Safety Standards

of the
Nuclear Safety Standards Commission (KTA)

KTA 3604 (2020-12)

Storage, Handling and Plant-internal Transport of Radioactive Substances in Nuclear Power Plants (with the Exception of Fuel Assemblies)

(Lagerung, Handhabung und innerbetrieblicher Transport radioaktiver Stoffe – mit Ausnahme von Brennelementen – in Kernkraftwerken)

Previous versions of this Safety Standard were issued 1983-06 and 2005-11

If there is any doubt regarding the information contained in this translation, the German wording shall apply.

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KTA SAFETY STANDARD

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PLEASE NOTE: Only the original German version of this safety standard represents the joint resolution of the 35-member Nuclear Safety Standards Commission (Kerntechnischer Ausschuss, KTA). The German version was made public in the Federal Gazette (Bundesanzeiger) of January 20th, 2021. Copies of the German versions of the KTA safety standards may be mail-ordered through the Wolters Kluwer Deutschland GmbH (info@wolterskluwer.de). Downloads of the English translations are available at the KTA website (http://www.kta-gs.de).

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Comments by the editor:

Taking into account the meaning and usage of auxiliary verbs in the German language, in this translation the following agreements are effective:

shall	indicates a mandatory requirement,
shall basically	is used in the case of mandatory requirements to which specific exceptions (and only those!) are permitted. It is a requirement of the KTA that these exceptions - other than those in the case of **shall normally** - are specified in the text of the Safety Standard,
shall normally	indicates a requirement to which exceptions are allowed. However, the exceptions used, shall be substantiated during the licensing procedure,
should	indicates a recommendation or an example of good practice,
may	indicates an acceptable or permissible method within the scope of this Safety Standard.

Basic Principles

(1) The safety standards of the Nuclear Safety Standards Commission (KTA) have the task of specifying those safety-related requirements which shall be met with regard to precautions to be taken in accordance with the state of science and technology against damage arising from the construction and operation of the plant (Sec. 7 para. 2 subpara. 3 Atomic Energy Act - AtG) in order to attain the protective goals specified in the Atomic Energy Act (AtG), in the Radiological Protection Law (StrlSchG) as well as the Radiological Protection Ordinance (StrlSchV) and further detailed in the Safety Requirements for Nuclear Power Plants (SiAnf) as well as in the Interpretations on the Safety Requirements for Nuclear Power Plants (Interpretations of SiAnf).

(2) The licensing requirements pursuant to Sec. 7 AtG regarding the construction and operation of the plant are fulfilled by the facilities intended for the retaining of solid, liquid and gaseous substances in the planned enclosures, for the handling and the controlled transportation of the radioactive substances within the plant as well as for the transfer of radioactive substances via the planned paths. Safety standards of the series KTA 3600 specify the safety requirements for these facilities.

(3) The present safety standard contains requirements serving the purpose of fulfilling the protective goals of StrlSchG pertaining to the technical facilities and additional administrative measures regarding storage, handling as well as plant-internal transportation of radioactive substances with the exception of fuel assemblies, as well as to the design of the civil structures and installations.

(4) Requirements with respect to fire protection are specified in the three parts of safety standard KTA 2101.

(5) Products to be released from the plant are subject to the conditions derived from the legal regulations for the transportation of hazardous materials as well as from the currently applicable acceptance criteria of the receiving party.

(6) Requirements regarding the accounting system for radioactive waste are specified in Sec. 2 AtEV.

(7) Requirements with respect to the interim storage of radioactive waste with a negligible heat generation are specified in the similarly titled ESK-Ordinance (revised version of June 10, 2013).

1 Scope

(1) This safety standard applies to the storage, handling as well as plant-internal transportation and transfer of

a) radioactive substances intended for waste management, e.g.,
   aa) solid radioactive waste,
   ab) liquid radioactive waste in as far as they do not fall under the scope of safety standard KTA 3603,
   ac) radioactive substances intended for clearance pursuant to Secs. 31 through 42 StrlSchV

as well as

b) radioactive components and component parts planned to be dismantled and re-installed with the exception of fuel assemblies and activated components in the reactor pressure vessel,

c) radioactively contaminated tools and equipment,

d) radioactivity sources

on the site of nuclear power plants with light-water reactors whereby the path leading to the transfer, reuse or waste management is comprised of partial processes.

(2) Radioactive substances intended for waste management however, for which the paths for utilization or waste management have not yet been specified, shall be subject to the same requirements as waste.

2 Definitions

(1) Waste, radioactive

Radioactive waste are radioactive substances that shall be disposed of in an orderly way.

(2) Waste container

Container for receiving waste products (e.g., barrel, concrete container, cast-iron container, container).

(3) Waste product

Waste product is the processed radioactive waste without packaging and waste container.

(4) Liquid radioactive waste

Liquid radioactive waste that shall be disposed of include the following liquids

a) contaminated consumable liquids (e.g., oils, hydraulic fluids, cleaning agents and solvents, acids and lye)

and

b) radioactive concentrates in liquid form from the facilities for the handling and treatment of radioactively contaminated water (e.g., evaporator concentrates, filter residues from a mechanical filtration, used up ion-exchanger resin).

(5) Package

A package – for the purpose of the present safety standard – is the unit of container and radioactive substance, independent of the processing condition of the substance.

(6) Hot workshop

A hot workshop is a workshop specified to be used for working on radioactive parts that possess a license pursuant to Sec. 12 StrlSchG for their handling and treatment.

(7) Mobile conditioning facilities

Mobile conditioning facilities are closed process-oriented systems with defined interfaces. They are used for the discontinuous, i.e. campaign-oriented processing of raw waste or intermediary products that thus become waste products suited for intermediate or final storage. Such facilities are individually assembled for the respective conditioning campaign in a nuclear power plant and will be removed after conclusion of the campaign.

(8) Storing

Storing is the short- or longer-term storage of radioactive substances independent of the place of work activity. For the purpose of the present safety standard, a differentiation is made between short-term storing (usually less than or equal to 12 months) and longer-term storing (longer than 12 months)

a) In case of short-term storing the storage of radioactive substances is <u>not</u> the focus of the partial process but rather part of another partial process.

b) In case of longer-term storing the storage of radioactive substances is the primary goal of a partial process.

Note:

German practice has it that various terms are used synonymously to “storing” to better describe the objective of storing, e.g., to buffer, to stow, to make available, to prepare for transportation, to keep in a safe place, to let decay, to put into interim storage. For the purpose of the present safety standard, the term “storing” is restricted to meaning short-term and longer-term storage.

(9) Radioactive sources

Radioactive sources are – for the purpose of the present safety standard – sealed or unsealed radioactive substances pursuant to Sec. 5 StrlSchG, that are used for different purposes of testing in the nuclear power plant.

(10) Process / partial process

The process of waste management of radioactive substances is the sum of all partial processes and constitutes the entire path from the generating of the radioactive substance to the waste management objective. For the purpose of the present safety standard, a partial process is the objective-oriented treatment of radioactive substances directed toward the waste management objective, whereby storing is one of the individual partial processes.

Note:

Partial processes are, e.g., handling, putting into interim storage, storage, treatment and transportation of radioactive substances.

(11) Collection

Collection is the selective removal of those substances not required anymore in the individual work process, possibly directly at the location where and time when the substances accumulate.

(12) Sorting

Sorting is the selective separation of substance streams according to the criteria of their later use, processing and respective waste management objective.

(13) Interim storage locations for solid radioactive substances

Interim storage locations for solid radioactive substances ("interim storage locations" for short in the present safety standard) are compartments, or areas in compartments, where the containers with collected solid radioactive waste and the radioactive components and component parts as well as radioactively contaminated tools and equipment are stored until further handling and treatment.

(14) Packaging

Packaging is the insertion of a radioactive substance or a waste product into a container.

Note:

In Traffic Law, packaging is defined as the creation of a package.

3 Handling and Storage of Solid Radioactive Substances Intended for Waste management

Note:

To explain the text of the present safety standard, the handling and treatment of solid radioactive substances is visualized schematically in **Figure 3-1**.

3.1 Collection

(1) Any unsealed solid radioactive substance shall be collected. Collection should be carried out such that, under consideration of the necessary operating procedures and planned ways of waste management, the later sorting efforts are minimized.

(2) Substances intended for clearance pursuant to Secs. 31 through 42 StrlSchV shall be collected and stored separately to avoid contamination.

(3) Containers for the storage of solid waste shall enclose this waste such that any release is prevented under normal-operational loads.

Note:

Suitable containers can be, e.g., plastic bags, buckets, pots, barrels.

(4) The openings of the containers for the containment of solid waste shall be designed such that, even during filling of the containers, contamination is prevented as far as possible.

(5) The containers for storing solid waste shall be dimensioned and designed such that the collected waste can be introduced to further processing with the lowest possible number of handling steps.

(6) The containers for storing solid waste shall normally be located close to the place where these waste are created or accumulate.

(7) The containers for the containment of solid radioactive substances shall be visibly marked as such.

Note:

The marking can consist, e.g., of a sign saying, "Radioactive Waste".

(8) The dose rate emitted from the collected waste shall be monitored. If it becomes necessary, suitable radiation protection measures shall be provided (e.g., transfer to an interim storage location, setting up of shielding, cordoning off) and current dose rate values shall be posted.

(9) The collection of combustible substances shall be carried out observing the required fire protection measures specified in safety standard KTA 2101.3 (e.g., encapsulating the fire load within metallic collection containers).

(10) As soon as operating procedures allow, filled up containers for storing solid waste shall be removed and, if necessary, replaced by empty ones.

(11) Unless the content of filled up solid waste containers is immediately subjected to further handling and treatment, the containers shall be marked on the surface of the container with respect to the type of solid waste, the dose rate and the date the dose rate was measured.

3.2 Interim Storage Location for Solid Radioactive Waste

(1) The solid radioactive waste or the radioactive components and component parts collected in containers as well as radioactively contaminated tools and equipment shall be stored at an interim storage location until their further handling and treatment.

(2) Interim storage locations shall, basically, be located in a controlled area. Interim storage locations shall be connected to an air conditioning facility that, during specified normal operation, is suited for the controlled discharge or retention of radioactive substances. Filled in suitable containers, the waste may, temporarily, also be stored in the supervised area, provided, the containers are designed such that radioactive substances cannot be inadvertently released.

(3) The useable storage area in the interim storage locations shall be dimensioned such that they are sufficient for storing the increased volume of solid waste briefly occurring during specified normal operation.

(4) The interim storage locations shall normally be conveniently located with regard to delivery and processing of the collected solid waste.

(5) The load capacity of the interim storage location floor shall be designed for a load per unit area of at least 10 kN/m² and, additionally for temporary shielding, for a load per unit length of at least 10 kN/m for a maximum length of 5 meters at the least favorable location.

(6) Interim storage locations shall be provided with the necessary auxiliary equipment for the storage and transportation (e.g., storage racks, lifting equipment, forklifts) that would help to keep the radiation exposure of the personnel as low as possible.

(7) A remote-controlled loading and unloading of interim storage locations shall be monitored by optical and, if necessary, additional acoustical means.

(8) Interim storage locations shall normally be designed and furnished such that they can be easily decontaminated.

(9) The dose rate in interim storage locations shall be monitored.

(10) Interim storage locations shall be cordoned off and marked as being an interim storage location. It shall normally be possible to lock up the interim storage location. In addition to the information required pursuant to Sec. 85 para. (1) StrlSchV, the marking shall normally also list the following points:

a) identification of the compartment,

b) dose rate at the door or at the cordon,

c) if necessary, notice regarding contamination,

d) point in time of the measurements.

3.3 Handling and Treatment

(1) After collection or storage, it shall be checked whether a further handling and treatment of the radioactive substances is required. The objectives can be:

a) preparation for conditioning,

b) longer-term storage in the nuclear power plant,

c) transfer into an interim storage facility or a federal repository,

d) clearance pursuant to Secs. 31 through 42 StrlSchV.

(2) The handling and treatment methods shall be pursuant to the requirements of the product control regarding storage in a federal repository, with the requirements regarding interim storage or with the requirements regarding clearance pursuant to Secs. 31 through 42 StrlSchV.

(3) The handling and treatment of radioactive waste may be carried out with stationary or mobile facilities. As far as applicable, these facilities shall meet the following requirements:

a) sufficient size of the set-up location,

b) supply of operating media (e.g., electrical power, water, pressurized air),

c) integration into the wastewater and vent air systems,

d) radiological requirements (e.g., dose rate limit),

e) acceptance and function tests prior to commissioning.

Note:

Requirements that are independent of the set-up location of the mobile handling and treatment facilities may be specified in an individual handling license pursuant to Sec. 12 StrlSchG.

(4) The facilities for sorting, shredding, densifying, compacting, drying, embedding into matrices, packaging, etc., shall be operated inside a controlled area. The spatial and logistical framework regarding the delivery and removal transportation of waste, and the allocation of waste and waste products shall be specified taking the radiation exposure of the personnel into consideration.

(5) Controlled area compartments in which these facilities are operated shall be connected to an air conditioning facility.

(6) A localized exhaust shall be provided if radioactivity can be inadvertently released to the room air during handling and treatment of waste, especially during densifying, compacting and drying.

(7) With regard to the characteristics of the waste products relevant to a final or intermediate storage, the corresponding process parameters (e.g., pressure, temperature, condensate volume) shall be documented over the course of the handling and treatment process.

(8) The design and operation of drying facilities shall take the fire and explosion hazards into account.

(9) The compartment and the facilities for packaging shall normally be designed such that they can be easily decontaminated.

(10) During packaging of solid waste, care shall be taken that none of the specified limit values for the following are exceeded:

a) radioactivity inventory at the time of transfer to the receiving party,

b) mass of a filled container, and

c) dose rate at the specified distances.

(11) Before and during work in compartments where solid waste is handled and treated, the radioactivity concentration in the room air and the dose rate shall be measured. The radioactivity concentration may be measured by collecting dust specimens and, subsequently, evaluating them in a laboratory.

(12) If it is to be expected that gases, heat or corrosive substances develop in the solid waste, then either the packaging shall be delayed until an inadmissible damage or distortion of the container can be excluded, or pressure relieving measures (e.g., sintered metal filters) shall be provided, or suitable container types shall be used.

(13) The handling and treatment of radioactive substances intended for clearance pursuant to Secs. 31 through 42 StrlSchV by abrasive procedures (e.g., high-pressure water jetting, and dry ice or sand blasting) and by chemical pickling shall be carried out in controlled areas. Decay storage, allocation storage for the release measurement, and the release measurement itself may be carried out in supervised areas.

(14) In the case of radioactive substances that are intended for clearance pursuant to Secs. 31 through 42 StrlSchV only after a decay storage, the expected duration of the storage shall be determined and specified.

3.4 Storage

(1) Solid waste shall be stored in an on-site waste storage facility until their further handling and treatment, or until their transfer to an external interim storage facility or to a federal repository.

(2) Waste storage facilities shall be designed or equipped such that the waste can be stored according to their respective categories.

Note:

The categories are specified according to respective operational aspects with possible criteria being, e.g., the dose rate at the surface, the activity content, the storing duration or the decay behavior.

(3) Waste storage facilities shall be designed and equipped such that the storing and removal from storage of each waste category is possible and unhindered with the planned transport equipment.

(4) Within the framework of general planning of a nuclear power plant, waste storage facilities shall be conveniently located with regard to delivery and removal transportation of the waste.

(5) The regular loading and unloading of a waste storage facility for solid waste shall normally be carried out by remote-controlled means if the entire waste storage facility must be categorized as exclusion area.

(6) The remote-controlled means for loading and unloading of waste storage facilities shall be monitored by optical and, if necessary, additional acoustical means.

(7) If waste storage facilities are not loaded by remote-controlled means they shall be designed such that they can be partitioned off using mobile shield walls.

(8) The load capacity of the waste storage facility flooring shall be designed for a loading from the items to be stored and from the means of transportation involved. If shielding measures are required in operationally accessible waste storage facilities, the design shall take an additional load per unit length of at least 10 kN/m for a maximum length of 5 meters at the least favorable location into account.

(9) Floors, walls and the furnishings of waste storage facilities shall normally be designed such that they can be easily decontaminated. The floor screed and the coating of the flooring in the waste storage facility shall be sufficiently resistant to pressure and abrasion.

(10) Waste storage facilities shall be protected against inward water seepage.

(11) Waste storage facilities shall normally contain only such furnishings, components or equipment that are required in carrying out the storing, handling and transportation tasks or that are required for fire protection of the storage facility.

(12) Waste storage facilities shall be connected to an air conditioning facility unless it can be ensured that, due to the packaging of the waste, a release of radioactive substances can be ruled out.

(13) General planning shall ensure that maintenance tasks within waste storage facilities can be kept at a minimum.

(14) The solid waste stored in a waste storage facility shall be secured against tilting and rolling.

(15) Waste storage facilities shall be kept locked. Only authorized personnel may be allowed to access these facilities.

(16) The design of the containers for longer-term storage of solid radioactive waste, and their materials (possibly, corrosion protection) shall, for the specified duration of storage, be such that the manageability of the packages is not impaired and that any release of radioactive substances is prevented.

(17) The containers to be stored in the waste storage facility shall be clearly, durably and visibly marked. In addition to the information required for the waste pursuant to Appendix Part B of AtEV, the marking shall also list the following points:

a) date of having been placed into storage,

b) storage position, and

c) name of the person responsible regarding this information.

Note:

Usual practice is a numeric marking in connection with a written account.

(18) Written accounts shall be kept on all procedures relating to storage and removal from storage.

Note:

Insofar as requirements ensue from the electronic record system pursuant to Sec. 2 AtEV, these shall be taken into account.

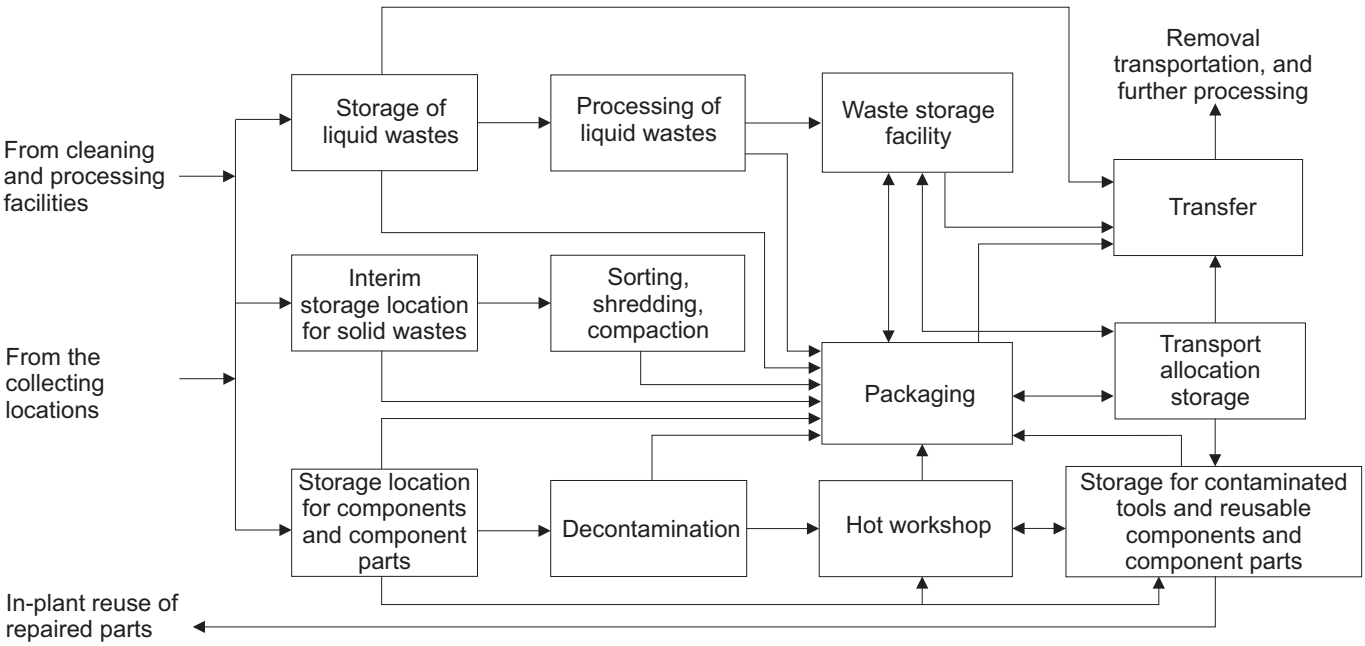

Figure 3-1: Schematic flow diagram of handling, of storage and transfer
(In an actual facility, not all of the shown stations and connections need to be realized.)

4 Handling and Storage of Liquid Radioactive Substances Intended for Waste management

Note:
To explain the text of the present safety standard, the handling and treatment of liquid radioactive substances is visualized schematically in **Figure 3-1**.

4.1 Collecting

(1) Liquid radioactive waste, at the time of their production shall without delay, be transferred separated by their waste type into the respective containers.

(2) The following types of liquid waste shall normally be stored separated from each other:

a) evaporator concentrates,

b) filter residues and ion-exchanger,

c) waste oil,

d) organic solvents, and

e) other liquid radioactive waste.

(3) Substances that are intended for clearance pursuant to Secs. 31 through 42 StrlSchV shall be collected and stored separately from radioactive waste in order to prevent any decontamination.

4.2 Collection and Storage Containers

(1) The selected materials – also for the linings, membranes and seals – shall withstand the operating loads (e.g., from mechanical, thermal and chemical loads as well as from ionizing radiation). In the case of materials sensitive to aging, the temporal behaviour shall be accounted for.

(2) The containers shall be designed and constructed with a view to their ability to be decontaminated (e.g., choice of materials, accessibility).

(3) The containers shall be designed and constructed or equipped such that, outside of the container compartments, at least their fluid levels are detectable and the maximum permissible fluid levels are displayed.

(4) Containers used for collecting liquid radioactive waste that are not located in container compartments and are designed and constructed as specified under paragraph (1) of Section 4.4 shall be located in drain pans such that any liquid leakage possibly occurring during filling can be retained. Monitoring equipment shall be installed if the drain pan cannot take up the full volume of the container.

(5) The capacity of the containers shall be dimensioned such that it is sufficient even for the normal operationally briefly occurring increased volume of liquid radioactive waste. **Table 4-1** lists the minimum required number of the different containers and their overall volumes taking this requirement into account.

(6) Containers for concentrates shall, in particular, be equipped with

a) circulation equipment,

b) specimen removal connections,

c) level indicators and alarm equipment,

d) safety device against overfilling,

e) interlocking of the filing and the release nozzles,

f) gas exhaust equipment,

g) overrun device into another storage container, and

h) connections for flushing.

In the case of mechanical agitators, the penetrations of the rotating parts shall be located above the highest possible fluid level.

Type of Waste	***Minimum Number / Overall Volume (m^3) of the Containers***		
	PWR	BWR	
		Condensate polishing with powdered resin	Condensate polishing with bead resin
Evaporator residues		2 / 30	2 / 200
Filter residues, low level	3 / 100	2 / 120	2 / 60
Filter residues, intermediate level		2 / 30	2 / 30
Ion exchanger resin	2 / 16	contained in filter residues	2 / 20 [2)]
Waste oil [1)]	1 / 0.2	1 / 1	
Organic solvents [1)]	1 / 0.2	1 / 0.2	

[1)] mobile container; the specified container capacity is applicable, provided, regular waste management is possible.

[2)] Taking the decay tank in the condensate demineralizing system into account, the entire resin filling of the ion exchanger can be removed. There is no operational limit to the working life of this type of ion exchanger.

Table 4-1: Minimum values for the number of containers and their capacity for different liquid radioactive waste in a nuclear power plant with an electric power of 1300 MW

(7) The number of connecting nozzles on the containers below the fluid level shall be limited to the number required for process-technological reasons.

(8) It shall be possible to completely empty the containers.

(9) The normal-operational emptying of stationary containers shall normally not be possible by gravitational flow.

(10) Mobile containers shall be designed and constructed such that an easy and contamination-free handling and emptying of these containers is possible.

(11) All mobile containers provided shall be marked indicating for which type of the radioactive liquids specified under paragraph (2) of Section 4.1 they are intended.

(12) It shall be possible to lock mobile containers.

(13) Filled-up mobile containers shall immediately be brought away for further storage or handling and, if necessary, be replaced by empty containers.

(14) Filled-up mobile containers shall be clearly, durably and visibly marked. On the basis of this marking it shall be possible to ascertain the following information:

a) type of liquid, and radioactivity of the major contributing radionuclides,

b) amount of the liquid,

c) dose rate at the surface of the container as well as at a distance of 1 meter from the surface at the point in time the container was put into storage,

d) beginning date of storage,

e) name of the person responsible with regard to this information.

(15) Stationary containers shall have a separate exhaust from that of the room air. This gas vent system shall be equipped to hold back radioactive substances.

4.3 Valves, Pumps and Pipelines

(1) Valves, pumps and pipelines shall normally, if necessary offer the possibility to arrange additional shielding around them without this shielding becoming a major impediment or restriction to other handling processes.

(2) The liquids may only be conveyed in abrasion- and corrosion-resistant stationary pipelines with smooth inner surfaces. The pipelines of the transfer systems for filling the transportation vessels do not have to be stationary.

(3) Components for the conveyance of radioactive liquids shall normally be physically separated from conveyance systems for non-radioactive liquids, provided, the latter are not required for the operation of the former components.

(4) Systems shall be controlled such that an inadvertent transfer of radioactive liquid waste into other systems is prevented.

(5) It shall be possible to flush and completely empty the pipelines. Dead flow zones shall normally be avoided.

(6) Valves, pumps and pipelines shall be designed such that precipitations and crystallizations from radioactive liquids are prevented from settling.

(7) Valves that handle suspensions of solid substances shall normally have smooth transitions; their function shall be ensured even for a high content of solid substances.

4.4 Compartments for Containers

(1) Containerized liquid radioactive waste may only be stored in compartments provided for this purpose. These compartments shall be located inside a controlled area.

(2) Records shall be kept on the stored liquid radioactive waste. These records shall also contain information regarding the storage location.

(3) Container compartments shall be equipped with sufficiently inclined leak tight drain pans that are dimensioned to be able to hold the content of the largest container. Corresponding monitoring equipment shall signal any accumulation of liquids in the drain pans. Containers that are separated by shield walls may be stored together in a single drain pan.

(4) The emptying of the drain pans by gravitational flow is not admissible.

(5) Only one stationary container may be located in a container compartment intended for evaporator concentrates, filter residues and ion-exchanger resins.

(6) Pumps shall be provided that make it possible to pump the liquids accumulated in drain pans into other suitable containers.

(7) The containers shall be spatially arranged such that they can be subjected to visual examination, even if monitoring equipment is provided.

(8) Container compartments shall be dimensioned such that there is sufficient freedom of movement for performing maintenance tasks.

(9) Container compartments shall be connected to an air conditioning facility that is suited for a controlled release or retention for radioactive substances during specified normal operation.

(10) Only necessary pipelines and valves or equipment shall normally be installed in container compartments that are needed in the individual compartments for the safe storage or transfer procedures.

(11) Walls and floors of the container compartments shall normally be designed such that they can be easily decontaminated.

4.5 Handling and Treatment

(1) The handling and treatment of liquid radioactive waste shall be carried out with stationary conditioning facilities or, in the case of individual conditioning campaigns, with specially installed mobile facilities. The handling and treatment goals may be:

a) preparation for the conditioning,

b) longer-term storage in the nuclear power plant,

c) transfer into an interim storage facility or federal repository, or

d) clearance pursuant to Secs. 31 through 42 StrlSchV.

(2) The methods for handling and treatment shall be tuned to the requirements of product control in the federal repository, to the requirements of interim storage or to the requirements regarding clearance pursuant to Secs. 31 through 42 StrlSchV.

(3) The following requirements apply to handling and treatment in stationary or mobile facilities:

a) sufficient size of the set-up location,

b) supply of operating media (e.g., power, water, pressurized air) in conformance with the needs,

c) integration into the wastewater and vent air systems,

d) radiological requirements (e.g., limitation of the dose rate), and

e) acceptance and function tests prior to commissioning.

Note:
Requirements that are independent of the set-up location of the mobile handling and treatment facilities may be specified in an individual handling license pursuant to Sec. 12 StrlSchG.

(4) Facilities for the drying, solidifying, dehydrating, embedding into matrices, centrifuging, decanting, etc., of liquid radioactive waste shall be operated inside a controlled area. The spatial and logistical framework regarding the waste delivery and removal transportation, the allocation of the waste and waste products shall be specified taking the radiation exposure of the personnel into consideration.

(5) A localized exhaust shall be provided if activity can be inadvertently released to the room air during handling and treatment of waste, especially during drying.

(6) With regard to the characteristics of the waste products relevant to their final or intermediate storage, the corresponding process parameters (e.g., pressure, temperature, condensate volume) shall be documented over the course of the process.

(7) The design and operation of treatment facilities shall take the fire and explosion hazards onto account.

(8) The facilities and equipment for conditioning shall be designed such that they can be decontaminated. The walls and flooring of the compartments that house these facilities and equipment shall normally be such that they can be easily decontaminated.

(9) Before and during work in compartments in which liquid radioactive waste are handled and treated, the activity concentration in the room air and the dose rate shall be monitored.

(10) If it is to be expected that gases, heat or corrosive substances develop in the waste products from the handling and treatment of liquid radioactive waste, then either the waste shall

not be packaged before an impermissible damage to, or distortion of, the container can be precluded, or pressure relieving measures (e.g., sintered metal filters) shall be provided, or suitable container types shall be used.

(11) During the packaging of liquid or solidified waste, care shall be taken that

a) the activity inventory at the time of transfer to the receiving party,

b) the mass of a filled container, and

c) the dose rate at the required distances

do not exceed specified limit values.

(12) The handling and treatment as well as the decay storage for obtaining clearance pursuant to Secs. 31 through 42 StrlSchV for the liquid radioactive substances shall normally be carried in controlled areas.

(13) In the case of radioactive substances that are intended for clearance pursuant to Secs. 31 through 42 StrlSchV only after a decay storage, the expected duration of decay storage shall be determined and specified.

5 Handling and Storage of Contaminated Tools, Reusable Radioactive Components and Component Parts

Note:

In this section, the radioactive components and component parts concerned are the ones that are dismantled and removed for repair, inspection or examination and that are replaced by equivalent or new ones and that are then interim-stored after having been cleaned (decontaminated) and repaired for future reuse. This includes equipment that are used inside controlled areas. To explain the text of the present safety standard, the handling and treatment of radioactive components and component parts is visualized schematically in **Figure 3-1**.

5.1 Interim Storage Location for Components and Component Parts

(1) At least one interim storage location shall be provided for storing components and component parts to be subjected to further handling and treatment. Interim storage locations and set-down areas may be provided as temporary installations.

(2) Set-down areas shall not interfere with traffic routes and shall be designed such that any unnecessary radiation exposure of the personnel and inadvertent spreading of contamination is avoided.

(3) Interim storage locations shall be dimensioned such that they will be sufficiently large for storing the increased number of radioactively contaminated components and component parts briefly occurring during specified normal operation.

(4) The set-down areas for components and component parts within the interim storage locations shall be designed such that the required transport and work procedures are not impeded.

(5) The stored components and component parts shall be clearly, durably and visibly marked. On the basis of this marking it shall be possible to ascertain the following information:

a) type of the stored component or component part,

b) local dose rate at the surface of the packaging at the point in time of being placed into storage,

c) notice regarding contamination,

d) date of being placed into storage, and

e) name of the person responsible with regard to this information.

(6) The whereabouts of the components and component parts shall be documented. The information specified under paragraph (5) shall be included in these records.

(7) The interim storage locations are, additionally, subject to the requirements under paragraphs (2) and (5) through (10) of Section 3.2.

5.2 Decontamination

(1) A special decontamination compartment shall be available in which components and component parts can be decontaminated. It shall be equipped to meet the requirements regarding effectiveness and method of the decontamination.

(2) The usable surface area of the decontamination compartment shall be sufficient for setting up the necessary decontamination equipment, for performing the decontamination tasks on the dismantled and removed components and component parts specified under Section 1, and for set-down areas.

(3) The decontamination compartment shall be chosen and designed with special regard to transportation, handling, to secondary waste and accessibility. It shall be located within a controlled area and, in particular, be conveniently located with regard to the hot workshop.

(4) The floor of the decontamination compartment shall be designed for a load per unit area of at least 10 kN/m² and, additionally, for a load per unit length of at least 10 kN/m for a maximum length of 5 meters at the least favorable location.

(5) The floors, walls and ceilings of the decontamination compartment shall, and the furnishings shall normally, be such that they can be easily decontaminated.

(6) The decontamination compartment shall be connected to an air conditioning facility that is suited for a controlled release and retention of radioactive substances during specified normal operation. Localized exhausts shall be provided regarding radioactive fumes and aerosols at the workplaces such that, generally, the carrying of respiratory protective equipment will not be required during decontamination activities. The radioactive fumes and aerosols shall, if necessary (e.g. sand blasting boxes), be led through air filters of at least group ISO ePM_1 greater than or equal 50 % (average efficiency) in accordance with DIN EN ISO 16890-1 before they are led into the vent air duct.

(7) The local dose rate and the radioactivity concentration of the room air in the decontamination compartment shall be monitored at the start and in the course of the work task by stationary or mobile measurement devices.

(8) During decontamination, protection equipment (e.g., remote-controlled devices, glove boxes, shielding walls, foil tents) shall, if necessary, be used if they would help to reduce or prevent radiation exposure of the personnel and inadvertent spreading of contamination.

(9) After completion of the decontamination tasks, the dose rate or the residual contamination of the components or component parts shall be checked.

5.3 Hot Workshop

(1) A hot workshop shall be provided in which components or component parts can be worked on and repaired. It shall be located within a controlled area and be conveniently located with regard to the decontamination compartment.

(2) The usable surface area of the hot workshop shall be sufficient for setting up of the equipment necessary for working on the components and component parts, for performing the work tasks on the components and component parts, and for set-down areas.

(3) Protection equipment for reducing radiation exposure and contamination shall be kept in readiness (e.g., mobile shield walls, exhaust facilities and a shielded waste collection area).

(4) Equipment, the operation of which could lead to the release of dusts, aerosols and fumes, shall be provided with exhaust facilities that will effectively prevent a spreading of these substances such that, generally, the carrying of respiratory protective equipment will not be required during the work tasks. The hot workshop and the exhaust facilities shall be connected to an air conditioning facility that is suited for a controlled release and retention of radioactive substances during specified normal operation.

(5) The walls, floors and furnishings of the hot workshop shall normally be such that they can be easily decontaminated. Surfaces of the floors, walls and tables shall be abrasion and pressure resistant with regard to the expected mechanical loading.

(6) The floor of the hot workshop shall be designed for a load per unit area of at least 10 kN/m² and, additionally, for a load per unit length of at least 10 kN/m and a maximum length of 5 meters at the least favorable location.

(7) The local dose rate and the radioactivity concentration of the room air in the hot workshop shall be monitored during the course of the work task by stationary or mobile measurement devices.

5.4 Storage

(1) A separate storage location shall be provided for the contaminated tools, radioactive components and component parts that are intended for reuse.

(2) The storage location under paragraph (1) shall meet the requirements specified under paragraphs (4) through (6) of Section 5.1 and paragraphs (2) and (5) through (10) of Section 3.2.

(3) Deviating from paragraphs (1) and (2), the contaminated tools, radioactive components and component parts that are intended for reuse may also be stored in suitable containers in a supervised area, provided, these containers are of such design that radioactive substances cannot be inadvertently released from them.

6 Plant-internal Transportation and Transfer of Solid and Liquid Radioactive Waste and of Radioactive Components and Component Parts

6.1 Transport Paths

(1) Already during the design stage of a nuclear power plant, the transport paths shall be specified for such parts that require lifting equipment and vehicles for their transportation.

(2) The load capacity and the free cross section of the transport paths shall be dimensioned to suit the expected transports.

(3) The surfacing of the transport paths shall be sufficiently resistant to pressure and abrasion in accordance with the mechanical loading.

(4) The design of the transport paths shall be such that they are readily identifiable and accessible. Horizontal transports shall, as far as possible, be planned to be performed on the same level.

(5) There shall be no steps along the transport paths. Unavoidable level differences shall be bridged by low-incline ramps.

(6) It shall be ensured by structural and administrative means that the transportation procedures can be carried out unhindered and the component parts cannot be damaged.

6.2 Transport Equipment

(1) Transport procedures may only be carried out with correspondingly suited transport equipment.

(2) The transport equipment shall be simple and safe to operate.

(3) The transport equipment employed in a controlled area shall normally be such that they can be easily decontaminated.

(4) The transport vehicles for travel within controlled areas shall normally not be equipped with combustion engines.

(5) The transport equipment shall be equipped and dimensioned such that the transported items can be shielded if so required.

(6) All transport equipment shall be designed such that, in case of danger, the transport procedure can be quickly interrupted (e.g., mechanical brakes).

(7) The containers for transporting radioactive waste shall be designed to be able to withstand the loads from normal-operation transports as specified, including any regularly experienced disruptions, such that the radioactive substances remain enclosed.

6.3 Transport Procedure

(1) Operating instructions shall be provided for the transports in which the transport procedures are specified.

(2) Traffic regulations shall be specified for the transports on the nuclear power plant site that shall, generally, follow the Highway Code.

(3) The transported items shall be secured on the transport equipment against tilting, sliding and falling down.

(4) The transports shall be carried out such that inadvertent spreading of contamination is avoided as far as possible.

(5) If, in exceptional cases, transports of unshielded or insufficiently shielded highly radioactive parts are carried out, then any persons not directly involved with the transport shall be prevented from having access to the transport area.

(6) Once started transport procedures shall normally be completed without interruption. If unusual conditions make this impossible, then the transports shall be carried out sufficiently far enough that they present no avoidable hindrance to other work procedures and that the general safety is not impeded. Interrupted transports shall be reported to the radiological protection officer or to a person authorized by him and shall be completed as soon as possible.

6.4 Transfer of Radioactive Substances

Note:
The objective of a transfer is the transport into another nuclear facility. This transport is subject to the corresponding legal regulations to be observed by the transport carrier regarding transportation of dangerous goods. More extensive requirements for the transportation of radioactive substances, especially radioactive waste, are contained in other legal regulations (e.g., AtG, AtEV, or – in the case of international shipments – EGV 1013). All these regulations, together with the acceptance criteria of the receiving party, contribute to defining the extent of the required documentation as well as the correspondingly required administrative procedures.

(1) The transfer of radioactive substances requires the examination and the supervision by the radiological protection officer or by a qualified person authorized by him.

(2) Before the transfer of liquid radioactive waste that are to be transported in tank vehicles, the volume of the liquid radioactive waste to be disposed of shall be determined and the radioactivity of the major contributing radionuclides estimated on the basis of the records specified under paragraph (2) of Section 4.4 or of the measurement of a test specimen taken before filling the tank vehicle.

6.4.1 Transfer stations for liquid radioactive waste

(1) The transfer stations shall be located within a controlled area.

(2) Any accessible surface of the transfer stations shall normally be such that they can be easily decontaminated.

(3) The transfer stations shall be provided with possibilities for decontamination (e.g., supply connection for demineralized water and drain connection for the contaminated water).

(4) Transfer stations for non-packaged liquid radioactive waste shall, during the transfer and filling procedure, be secured against access from personnel not directly authorized to perform tasks related to the filling process.

(5) The filling devices of the tank vehicle for non-packaged liquid waste shall, during the transfer and filling procedure, basically, be positioned over a leak tight and drainable floor tub. Alternatively, the tank vehicle or the tank container can be equipped with corresponding drip-catching devices.

(6) The filling device for non-packaged liquid radioactive waste shall be equipped with a system that will reliably prevent an overfilling of the tank vehicle.

(7) The coupling elements from the transfer station to the tank vehicle shall be equipped with tightly closing valves that can be opened only after proper coupling has been achieved. The residual volume between these valves shall be minimized as far as technically possible minimum.

(8) Connection hoses or connection pipes of the transfer station shall be equipped with a drip-catching device. Connection hoses including their coupling elements and hose clips shall be dimensioned such that they can be tested at a pressure level twice the maximum permissible operating pressure.

(9) Equipment shall be provided that can be used to flush the connection hoses.

(10) Connection hoses including their coupling elements shall, prior to beginning the filling process, be subjected to a visual inspection, to a leak tightness test, to a pressure test at the maximum permissible operating pressure and to a function test.

(11) During filling procedures, the air possibly escaping from the transport containers shall be led directly to the vent air system.

6.4.2 Transport allocation storage

(1) Transport allocation storage serves as buffer storage of packages until their actual removal transportation. Location for this storage may be within a supervised area, a controlled area, in the open or inside buildings.

(2) In areas used for transport allocation storage, it is not admissible to handle non-packaged radioactive substances.

(3) The readied packages in the transport allocation storage shall be secured by suitable means (e.g., lead seals) against unnoticed opening.

(4) The areas allocated to the transport allocation storage shall be equipped with suitable handling equipment, lifting equipment, etc., to enable an easy transfer of the packages to the transport vehicle.

7 Handling and Storage of Radioactive Sources

7.1 Radioactive Sources

The requirements specified under Sections 7.2 through 7.4 shall apply to the following radioactive sources used for calibration purposes and function tests:

a) test sources and measurement standards for function testing and for calibrating radiation measurement equipment,

b) radiation sources for radiographic examinations,

c) unsealed radioactive sources such as:

   ca) solutions of embedded or non-embedded gamma ray emitting radionuclides of a known radioactivity concentration for calibrating gamma spectrometers, circuit water and wastewater monitoring equipment,

   cb) solutions of a known radioactivity concentration for the radiochemical determination of the separation efficiencies for identifying and determining radioactive nuclides (e.g., wastewater analyses),

   cc) gaseous radioactive sources for function testing of delay facilities and for calibrating measurement equipment for monitoring vent air (e.g., krypton 85, xenon 133).

7.2 Handling of Sealed Radioactive Sources

(1) The radioactive sources as well as their storage containers shall be marked pursuant to Sec. 85 StrlSchV. On the basis of this marking it shall be possible to ascertain the following information:

a) type of the radioactive substance (name of nuclide),

b) activity and point in time of when it was determined.

(2) The source may only be transported in containers specified for this transport.

(3) Any work on the leak-tight enclosure that could possibly damage the enclosure is not admissible.

(4) Any damage or loss shall immediately be reported to the radiological protection officer in charge.

7.3 Handling of Unsealed Radioactive Sources

(1) The storage containers for unsealed radioactive sources shall be marked pursuant to Sec. 85 StrlSchV. On the basis of this marking it shall be possible to ascertain the following information:

a) type of the radioactive substance (name of nuclide),

b) activity or activity concentration and point in time of when it was determined.

(2) The sources may only be transported in containers specified for this transport.

(3) When handling unsealed radioactive sources care shall be taken that an incorporation and contamination is prevented.

(4) If it is suspected that an incorporation occurred due to handling of unsealed radioactive sources, the radiological protection officer or a person authorized by him shall immediately be informed.

(5) All equipment used for transfer filling and for various handlings and treatments of unsealed radioactive sources where a contamination of this equipment has not been removed shall be marked accordingly if the possibility of a mix-up cannot be excluded.

7.4 Storage

(1) The storage locations for radioactive sources shall be located within a controlled area or in a supervised area and shall be marked accordingly.

(2) Storage locations and the storage containers for radioactive sources shall be designed such that they can be easily decontaminated.

(3) Compartments intended for the storage of unsealed radioactive sources the activity of which exceeds the clearance limit value shall be connected to an air-conditioning facility which, during specified normal operation, is suited for the controlled release or retention of radioactive substances, and the air supply and air exhaust of these compartments shall be such that spreading of contaminated air is avoided.

(4) Sealed or unsealed radioactive sources – when they are not being used or not involved in a work procedure – shall be stored in the containers provided for this purpose. The containers shall be marked accordingly.

(5) Storage compartments containing radioactive sources the radioactivity of which exceeds the clearance limit value shall be checked for contamination in regular time intervals and the local dose rate shall be monitored.

(6) Records shall be kept on the available, the incoming and outgoing radioactive sources and their whereabouts. On the basis of these records it shall be possible to ascertain the following information:

a) storage location,

b) type of the radioactive substance (nuclide name),

c) activity or activity concentration and point in time when it was determined,

d) type of the radioactive source (sealed or unsealed). In the case of unsealed radioactive sources, the chemical compositions shall, additionally, be recorded.

8 Tests

8.1 Facilities for the Storage, Handling and the transfer of Radioactive Substances

8.1.1 General requirements

(1) Facilities for the storage, handling and transfer of radioactive substances shall be subjected to the following tests and examinations:

a) tests prior to construction,

b) accompanying checks,

c) inservice inspections.

(2) The results of the tests shall be recorded in reports, attestations and certificates. These test records shall contain all essential data about the tests performed. This information shall include at least:

a) unambiguous identification of the test object,

b) type of test and specification of the corresponding test instructions,

c) list of the documents made available for the individual test,

d) the individual tests performed and their results,

e) detected deficiencies and, if necessary, the imposed deadline for their removal and for the renewed test to be subsequently performed,

f) summarizing remarks whether or under what restrictions the test object corresponds to the requirements and can be correctly applied and operated as specified,

g) name and signature of the tester including the location and date of the test.

(3) The tester shall affix every individual document he or she has checked with a mark of approval and with a reference mark correlating the document to the corresponding test certificate.

(4) If any previously checked documents are modified then the changes shall be subjected to a renewed examination.

8.1.2 Tests prior to construction

(1) In accordance with specifications of the proper authority the following items shall, if applicable, be checked by an expert authorized by this authority:

a) whether the facilities required for storage, handling, and transfer are provided and suitable,

b) whether the facilities are designed in accordance with the applicable regulations, standards and guidelines and are sufficient with respect to the safety-related requirements,

c) whether the facilities can be subjected to the required in accordance with the test schedule as specified under paragraph (2) of Section 8.1.4.

(2) In this regard and if applicable, the design of the facilities shall be examined based on the following documents:

a) safety analysis report,

b) plant specifications,

c) procedural descriptions and diagrams,

d) transportation flow diagrams,

e) activity flow diagrams (volumes and activities),

f) component lists with the essential data,

g) valve lists,

h) lists of the measurement locations and interlocks,

i) component arrangement plans, and

k) pipeline arrangement plans.

Note:
Before construction of the buildings, the component and pipeline arrangement plans contain the location and arrangement of components, valves and pipelines upward of a nominal diameter of 50.

l) loading plans,

m) compartment lists with the expected local dose rates,

n) test schedule for inservice inspections and maintenance tasks,

o) building plans and layout drawings in which the radiological protection measures are marked (e.g., boundaries of supervised areas, set-down locations for dismantled radiating parts, transport paths for radioactive waste).

The extent and degree of detail of these documents shall be coordinated with the extent specified in the individual license.

Note:
In addition, cf. Guideline IWRS I.

8.1.3 Accompanying tests

8.1.3.1 Extent of the accompanying tests

The accompanying tests shall comprise:

a) design review,

b) material, construction and pressure tests, and

c) acceptance and function tests.

Type and extent of the tests shall be specified in a test schedule.

8.1.3.2 Design review

A design review shall be carried out for those storage, handling, and transfer facilities the failure of which could lead to a radioactivity release to the environment exceeding the licensed limit values for specified normal operation or to a radioactivity release that possibly could exceed limit values pursuant to the StrlSchG regarding radiation exposure of one or more persons; this design review shall be carried out in accordance with specifications by the proper authority and, if required, in cooperation with an expert authorized by this authority.

8.1.3.3 Material, construction and pressure tests

The fabrication and assembly of facilities or of parts of facilities for the storage, handling, and transfer of radioactive substances that are subjected to the design review specified under Section 8.1.3.2 shall be tested in the manufacturing plant or on the construction site. It shall be ascertained whether the facility parts are in conformance with the design reviewed documents. These tests shall be performed by qualified personnel of the operating utility or of the manufacturer and, if required in accordance with specifications by the proper authority, in cooperation with an expert authorized by this authority.

8.1.3.4 Acceptance and function tests

(1) Facilities or parts of facilities for the storage, handling, and transfer of radioactive substances that are subject to a design review as specified under Section 8.1.3.2 shall be subjected to acceptance and function tests before commissioning and after every repair. These tests shall be performed by qualified personnel of the operating utility or of the manufacturer and, if required in accordance with specifications by the proper authority, in cooperation with an expert authorized by this authority.

(2) Before the acceptance and function tests of design-reviewed facilities or facility parts can be performed, the results from the material, construction and pressure tests shall have been made available. The acceptance and function tests shall be performed, if applicable, based on the following documents:

a) test schedules,

b) plant specifications,

c) procedural descriptions and diagrams,

d) operating and maintenance instructions,

e) transportation flow diagrams,

f) component data sheets,

g) plans of measurement locations and interlocks,

h) valve lists,

i) component arrangement plans, and

k) pipeline arrangement plans.

(3) Within the framework of the acceptance and function tests it shall be ascertained whether the facilities have been constructed in accordance with the licensed documents and whether they can be safely operated and properly maintained.

8.1.4 Inservice inspections

(1) Inservice inspections shall be performed to ascertain whether the facilities for the storage, handling, and transfer of radioactive substances continue to meet the specified requirements.

(2) Type and extent of the inservice inspections, the inspection intervals and the testers shall be specified in a test schedule. If required in accordance with specifications by the proper authority, this test schedule shall be established in coordination with an expert authorized by this authority.

(3) The inservice inspections shall comprise:

a) examinations of the operating records of the tasks regarding operation, tests, maintenance and repair,

b) visual inspections and checks regarding proper functioning of the facility, its systems and its components with special attention paid to the safety equipment and safety measures required as specified under the present safety standard or the license, and

c) checking the test certificates and attestations for exchanged parts.

8.2 Mobile Conditioning Facilities

8.2.1 General requirements

(1) Mobile conditioning facilities shall be subjected to the following tests:

a) prior tests,

b) acceptance and function tests,

c) inservice inspections.

(2) The results of the tests shall be recorded in reports, attestations and certificates. These test records shall contain all essential data about the tests and examinations performed. This information shall include at least:

a) unambiguous identification of the test object,

b) type of test and specification of the corresponding test instructions,

c) list of the documents presented for the individual test or examination,

d) the individual tests performed and their results,

e) detected deficiencies and, if necessary, the imposed deadline for their removal and for the renewed test or examination to be subsequently performed,

f) summarizing remarks whether or under what restrictions the test object corresponds to the requirements and can be correctly applied and operated as specified,

g) name and signature of the tester including the location and date of the test.

(3) The tester shall affix every individual document he or she has reviewed with a mark of approval and with a reference mark correlating the document to the corresponding test certificate.

(4) If any previously reviewed documents are modified then the changes shall be subjected to a renewed examination.

8.2.2 Prior tests and examinations

(1) Prior to the delivery and installation of a mobile conditioning facility in a controlled area, it shall be checked whether

a) the planned-mobile conditioning facility is suited for safe and as-specified conditioning of the waste,

b) this facility has a valid license pursuant to the AtG or StrlSchG, and that the therein contained licensing provisions are complied with,

c) the planned set-up location of the mobile conditioning facility is suited with regard to all technical boundary conditions, e.g., spatial requirements, floor loading, operating media supply, influence of radiological conditions on neighboring areas and transport paths, logistics for the supplied waste and for the waste management of the conditioned waste, and whether the radiological protection of the personnel is ensured during their operating tasks.

(2) With regard to the tests specified under paragraph (1), the following documents shall be provided:

a) procedural sequence plan, test sequence plan or campaign-independent procedure qualification for the conditioning procedure,

b) specification regarding the wastewater, vent media and other substances transferred from the conditioning facility to the systems of the nuclear power plant,

c) component arrangement plans, floor loading plans, technical support documents regarding required interfaces, requirement data of the necessary operating media, description regarding operation and maintenance,

d) if applicable, individual handling license including all subordinate provisions

da) test schedules for inservice inspections, and

db) test schedules for commissioning and function tests.

8.2.3 Acceptance and function test

After installation of a mobile conditioning facility the facility shall be subjected to an acceptance and function test. It shall be checked whether

a) the technical condition, the spatial arrangement and the interconnection of facility components and their connection to the corresponding systems of the nuclear power plant correspond to the conditions on which the prior test was based,

b) all operating procedures proceed in a functionally correct and fault-free manner,

c) in the presence of corresponding triggering criteria, the safety related switching functions are correctly executed as specified (e.g., emergency shut-down, high-temperature shut-down, isolation of the systems, high-temperature alarm, break of the vacuum),

d) the functioning of all safety related switching functions is ensured in all of the individual operating procedures, and

e) the radiological protection of the personnel is ensured during operation and maintenance.

8.2.4 Inservice inspections

Note:

The inservice inspections of mobile conditioning facilities are performed with a special view to their meeting the specified requirements and are performed under the responsibility of the authorized licensee of the mobile conditioning facility.

If plant-independent handling licenses pursuant to Sec. 12 StrlSchG were issued for these facilities then the requirements regarding inservice inspections shall be as stated in these licenses.

8.3 Longer-term Stored Radioactive Substances

8.3.1 General requirements

(1) In the case of longer-term stored radioactive substances, it shall be determined whether there is a need for periodic inspections. Periodic inspections are not necessary if it can be ascertained that no impairment of the handleability nor release or inadvertent spreading of contamination due to corrosion processes can occur.

Note:

The overall process is schematically shown in **Figure A-1**.

(2) If periodic inspections shall be performed, an inspection concept shall be established. The inspection concept shall normally detail the minimum requirements specified below for periodic inspections of longer-term stored radioactive substances with the goal of an early detection of systematic negative changes.

(3) The inspection concept as well as the type and extent of the periodic inspections shall be specified and, under consideration of Sec. 8 StrlSchG, shall be coordinated with the proper authority.

(4) No periodic inspections under the present safety standard are required for those radioactive substances intended for clearance and for which, in the course of the clearance procedure pursuant to Secs. 31 through 42 StrlSchV, the clearance ability has been determined by an orientation measurement or by a decision measurement.

Note:

By determining the clearance ability, it is ensured that these substances no longer present a radiological danger that would require taking additional measures under the present safety standard.

8.3.2 Tools and components

The extent of tests performed on contaminated tools and reusable radioactive components as detailed under Section 5 shall be plant-internally specified.

8.3.3 Cast-iron and concrete containers

The characteristics of thick-walled cast-iron or concrete containers preclude the possibility of a loss of integrity. Therefore, these types of vessels do not need to be subjected to periodic inspections.

Note:

This does not extend to the inservice inspections necessary regarding, e.g., the licensing process under traffic law or the need to ensure the integrity of the sealing system.

8.3.4 Other items

The inspection concept regarding other longer-term stored radioactive substances (e.g., non-packaged components intended for waste management and other containments, e.g., boxes, big bags, plastic bags) shall be established in agreement with the proper authority.

8.3.5 Thin-walled sheet steel containers

Note:

Thin-walled sheet steel containers may have a circular or cubic shape (e.g., 200-liter barrel, or Konrad sheet steel container).

8.3.5.1 General requirements

(1) If packages are loaded into other containers, periodic inspections of the packages are only required if their handleability needs to be sustained throughout the storage time, e.g., because they need to be removed for further treatment. Otherwise and in the following, the outer container is considered to be the “package” to be inspected periodically, provided, it is a thin-walled sheet steel container.

(2) In case of existing storage situations, suitable measures shall be specified in agreement with the proper authority for an inspection concept based on a case-by-case analysis if the performance of periodic inspections under this section, e.g.,

a) would lead to unacceptably high radiation exposures,

b) would lead to unacceptably high number of handling processes,

c) is made impossible due to limited accessibility, or

d) is made impossible due to lack of space.

(3) Paragraph (2) shall be applied analogously to other containers used for storing packages.

(4) Periodic inspections shall basically be performed as visual inspections of the entire surface of the container. These inspections may be performed with or without aiding devices (e.g., mirror) or indirectly (e.g., camera). A periodic inspection of the entire surface including top cover and base is not required, provided,

a) the packages are in proper condition at the time when placed into storage and, during storage, are all sufficiently accessible that at least half of their outer surface can be visually examined. After no more than five test cycles (cf. **Tables 8-1** and **8-2**), however no later than ten years, a complete inspection of the containers (including top cover and base) of the pending inspection lot (i.e., containers to be actually inspected) shall be performed.

b) it is shown in a case-by-case analysis that systematically occurring changes will be discovered on time.

8.3.5.2 Inspection concept

(1) The periodic inspections shall be performed on all packages depending on the material and container properties (cf. paragraph (1) of Section 8.3.5.3) using any of the test procedures specified under Section 8.3.5.5 (e.g., rotation procedure, random sampling procedure, reference package procedure or a combination of these procedures).

(2) The test intervals and inspection lots are specified in **Tables 8-1** and **8-2** assuming favorable ambient conditions during storage, e.g.,

a) air-conditioned rooms, or

b) temperatures above the dew point, or

c) continuous airflow around the containers so that moisture can quickly dry up.

If none of these boundary conditions exist, an adjustment of the test intervals specified in **Tables 8-1** and **8-2** shall be considered. However, the shortest test interval shall be one year.

(3) In addition, during any handling processes, the visible surfaces of the handled packages shall normally be subjected to a visual inspection.

(4) The surfaces of all packages in a stack that are visible without further handling shall be subjected to an annual visual inspection. This inspection may be performed by a camera ride or a walk-down inspection. Alternatively, it is admissible to include knowledge gained from the handling processes under paragraph (3).

(5) In case operating history presents reasonable indications or factual data indicating that the inspection concept needs to be adjusted, then the inspection concept as well as the extent and frequency of the tests shall be reviewed.

	Packages with a positively evaluated behavior	Packages with a semi-positively evaluated behavior	Packages with a neutrally evaluated behavior	Packages with a negatively evaluated behavior
Material □	⊞	⊞	⊟	⊟
Container ○	⊕	⊖	⊕	⊖
Test interval in years	10[1)]	5[1)]	2[1)]	1
Inspection lot for rotation procedure	-	50 % of N	40 % of N	25 % of N
Inspection lot for random sampling procedure	50 % of S	50 % of S	40 % of S	case-by-case analysis
[1)] Test may be distributed over the test interval N: number of packages per inspection charge S: size of random sampling of an inspection charge – determined from **Table 8-3**				

Table 8 1: Extent of inspections (percentage of testing packages = size of the inspection lot) and test interval depending on the material characteristics of packages and the container characteristics with the rotation procedure and random sampling procedure

	Packages with a positively evaluated behavior	Packages with a semi-positively evaluated behavior	Packages with a neutrally evaluated behavior	Packages with a negatively evaluated behavior
Material □	⊞	⊞	⊟	⊟
Container ○	⊕	⊖	⊕	⊖
Test interval in years	1	1	1	1
Inspection lot	1 % of N	5 % of N	case-by-case analysis	
N: number of packages per inspection charge				

Table 8 2: Extent of tests and inspections (percentage of testing packages = size of the inspection lot) and test interval depending on the material characteristics of packages and the container characteristics with the reference packages procedure.

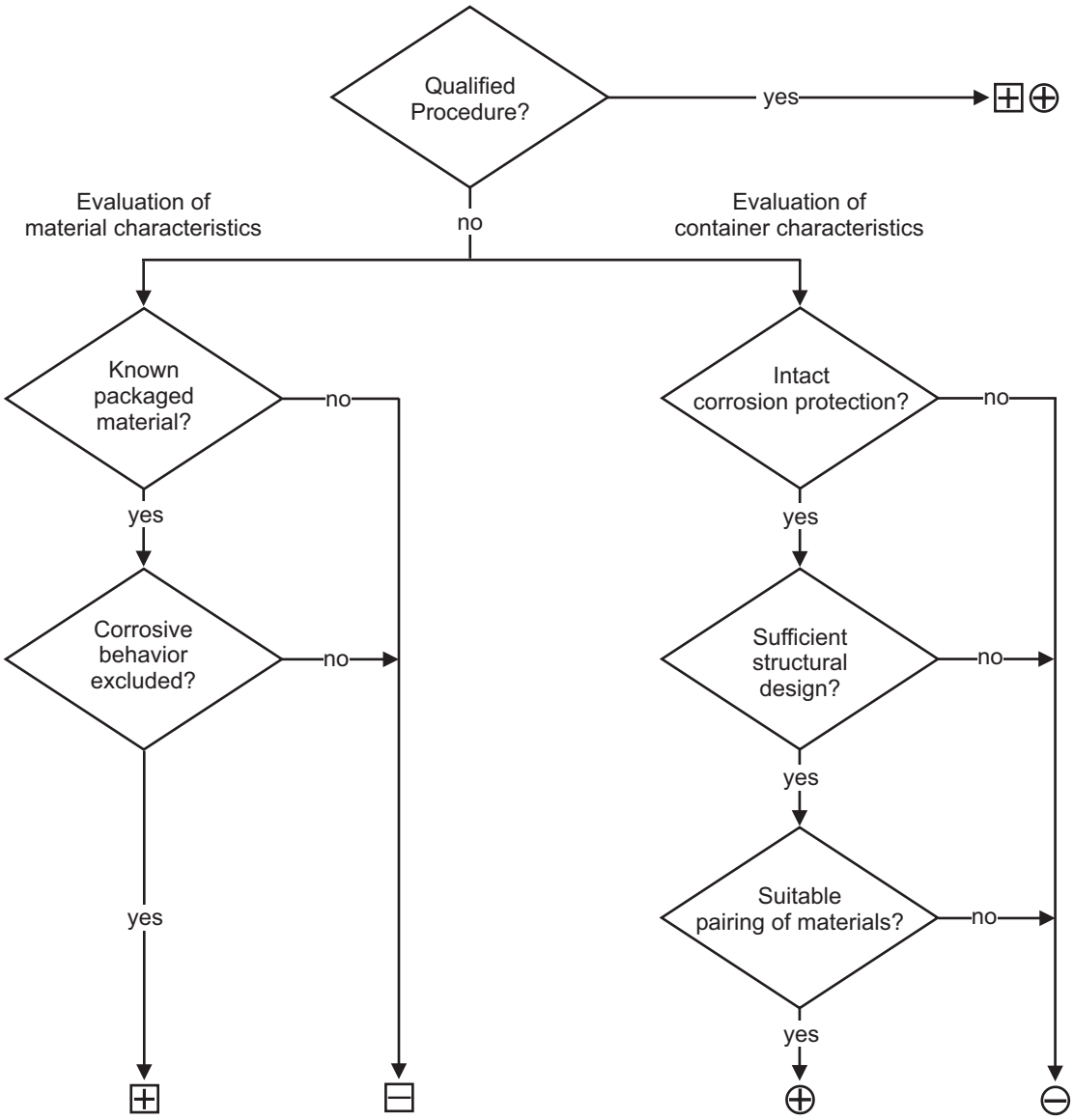

Figure 8-1: Determining the material characteristics of packages and the characteristics of thin-walled sheet steel containers

8.5.3.3 Evaluation of the material and container characteristics

(1) The material characteristics of the packages shall be evaluated in accordance with **Figure 8-1** regarding a favorable (⊞) or unfavorable (⊟) corrosion behavior. Likewise, the container characteristics of the package shall be evaluated in accordance with **Figure 8-1** regarding a favorable (⊕) or unfavorable (⊖) corrosion behavior.

The results for the individual package may be combinations such as:

(⊞ / ⊕), (⊞ / ⊖), (⊟ / ⊕), (⊟ / ⊖).

Related explanatory information is contained in **Tables A-1** and **A-2**.

(2) If the packages were manufactured using qualified procedures, then the material and container properties shall generally be evaluated as positive (i.e., ⊞ / ⊕).

(3) Especially packages the material characteristics of which were negatively evaluated and where the characteristics of the container were, likewise, negatively evaluated (i.e., ⊟ / ⊖), those packages should be qualified in timely manner.

8.5.3.4 Inspection charge

(1) With regard to periodic inspections, the packages shall be combined as various inspection charges. Possible forms for inspection charges are:

a) packages of similar material and similar material quality as well as type of container and similar container quality,

Notes:

1. E.g., a number of pressing drums each containing construction rubble.

2. Packages with negatively evaluated material characteristic (⊟) and negatively evaluated container characteristics (⊖) can even be aggregated into one inspection charge, provided, the materials and material characteristics as well as the container type and container characteristics are similar.

b) Packages with positively evaluated material characteristics and positively evaluated container characteristics (⊞ / ⊕), or

Note:

See example 7 of **Table A-2**.

c) Packages with positively evaluated material characteristics and a similar type of container and similar container quality, or

Note:

See example 6 of **Table A-2**.

d) Packages with positively evaluated container characteristics and a similar type of material and similar material quality.

Note:
See example 5 of **Table A-2**.

Additional examples are detailed in **Table A-2**.

(2) Packages with unknown radioactive substances or unknown characteristics of the materials (⊟) as well as packages that cannot be allocated to a specific inspection charge may be aggregated into one inspection charge.

(3) An inspection lot (i.e., packages to be actually inspected) shall be chosen from each inspection charge.

(4) The extent of tests and inspections shall be adjusted whenever the size of the inspection charge changes due to additions or disposals. The start of the periodic inspections shall be based on the year the first package of the inspection charge was placed into storage. The date of testing may be freely chosen within the calendar year of the tests of the inspection charge.

8.3.5.5 Inspection procedures

Inspection charges as specified under paragraph (2) of Section 8.3.5.4 shall be inspected following the rotation procedure. The rotation procedure shall also be primarily used for the inspection of those packages with known but negatively evaluated material characteristics and negatively evaluated container characteristics. All other inspection charges shall primarily be subjected to the random sampling procedure or the reference package procedure if so specified in **Tables 8-1** or **8-2**,

8.3.5.5.1 Rotation procedure

When applying the rotation procedure, for each inspection charge with a number, N, of packages, inspection lots (i.e., containers to be actually inspected) with the size of 25 % N, 40 % N or 50 % N shall be formed (cf. **Table 8-1**) and tested in one, two or five year intervals; thus, after four to ten years all containers will have been inspected.

8.3.5.5.2 Random sampling procedure

(1) For each inspection charge with a number, N, of packages with similar material and container characteristics, a random sample size, S, as specified in **Table 8-3** shall be determined for periodic inspection. The size of the inspection lot (i.e., packages to be actually inspected) shall be as specified in **Table 8-1.**

(2) The test intervals shall be determined on the basis of **Figure 8-1** and **Table 8-1**. Typical application examples are listed in **Table A-3**. In the case of multi-year test intervals, the random sample to be tested may be distributed over the years in an accordingly adjusted extent.

Note:
In the case of a multi-year test interval, the random sample to be tested may be distributed over the test interval. E.g., given a 5-year test interval, one fifth of the random sample can be inspected in an individual year.

(3) For each of the inspections, the inspection lot (i.e., containers to be actually inspected) shall be randomly chosen from the inspection charge taking the material and container characteristics into account. It is admissible to adjust this inspection lot to account for aspects of the radiation protection and the handling.

(4) The forming of inspection charges and choice of packages to be actually examined (inspection lot) shall be carried out in coordination with the proper authority.

8.3.5.5.3 Reference packages procedure

(1) For each inspection charge with a number, N, reference packages shall be chosen that are representative for all packages of this inspection charge.

(2) The number of reference packages shall be determined on the basis of **Figure 8-1** and **Table 8-2**. Typical application examples are listed in **Table A-3**.

(3) The periodic inspections shall be performed annually on these reference packages.

(4) The forming of inspection charges and choice of reference packages shall be carried out in coordination with the proper authority.

Number, N, of packages of an inspection charge	***Size, S, of random sample***
1-29	N
30	29
31-33	30
≤ 36	32
≤ 39	34
≤ 44	36
≤ 49	38
≤ 55	40
≤ 63	42
≤ 72	44
≤ 80	46
≤ 100	48
≤ 120	50
≤ 150	52
≤ 200	54
≤ 300	56
≤ 600	58
> 600	59

Table 8 3: Determining the random sample size for the periodic inspections

8.3.6 Test results and experience feedback

(1) The results of the periodic inspections specified under Section 8.3.5.5 shall be documented. Minimum data to be documented are:

a) unambiguous identification of the test object,

b) type of inspection, listing the test instructions and the test results,

c) Name and signature of the tester and date of the test.

(2) In case of findings on the packages, these shall be evaluated with respect to their influence on the integrity of the respective container, and, as necessary, measures for their correction as well as time limits for their implementation shall be established (cf. **Table 8-4**). The implementation shall be documented.

Note:
Requirements regarding experience feedback and the systematic exchange of information are dealt with in safety standard safety standard KTA 1402.

Findings Category	*Evaluation*	*Measures*	*Exemplary Description of Findings and of their Detection*
A	No action required upon detection of the findings - Typical signs of usage as a result from normal handling tasks	- Documentation of the inspection - Returning test object to the inspection batch	- Superficial scratches on the outer corrosion protection leaving prime coat intact - deformations (dents) due to handling tasks that had no effects on the integrity of the container and have not led to damage of the corrosion protection - Typical indications of wear (e.g., flaking paint) at the attachment points, at the outer side of rolling hoops and the set-down surfaces caused by the handling tools used - External deposits from filling processes - Discolorations of the outside surface (e.g., due to thermal effects)
B	No immediate action required upon detection of the findings - Damages of the packages that go beyond normal signs of wear, however, that do not indicate an impairment of the integrity nor any systematic fault - Caused by mechanical forces effecting the packages	- Documentation of the inspection - Monitoring the development of the findings, or specifying repair measures including a date for their implementation - Possibly, placing the package into a larger drum - Determining the cause - Checking the stacking capability - Transferability check regarding other packages of the same inspection lot, and, if necessary, expanding the extent of tests and inspections - Transferability check regarding improvement of handling process	- Scratches on the corrosion protection down to the structural base material - Small area, point like superficial rust marks on the drum's wall, top cover or base - Slight arching of top cover, slight deformations or dents without rust
C	Immediate action required after detection of the findings - damage to packages not caused by external mechanical events other than handling processes - damages caused by ambient conditions, or during manufacturing of the packages, or a combination of various parameters (e.g., mechanical damage and unfavorable ambient conditions → chemical processes)	- Documentation of the inspection - Establishing the cause of the findings, checking for the possibility of a systematic fault - Transferability check regarding other packages of the same inspection charge, and expanding the extent of inspections - Transferring the content of the package to another container, reconditioning the content, possibly, placing the package into a larger drum	- Wall-penetrating rust of the container wall - Content of package has already begun to leak - Crack in the container wall - Rust damage and/or deformation of the package, possibly, with loss of integrity such that a normal handling with standard means of transport are not possible anymore (clearly visible arching of top cover, clearly visible deformations or dents without rust)

Table 8-4: Categorization of findings detected during the inspection of packages

9 Documentation

(1) All documents provided for the construction and operation of the facilities for storage, handling, transfer and transport of radioactive substances shall be compiled prior to the commissioning of the facilities. These documents shall reflect the actual state of the planned storage, handling.

(2) The documents shall reflect the technical and administrative measures required to meet the requirements specified under Sections 3 through 8. Special attention shall be paid to describing the planned procedures and the required radiological protection measures; these shall, if required for better clarity, also be described in corresponding drawings.

(3) The documents specified under paragraph (17) of Section 3.4, paragraph (2) of Section 4.4, paragraph (6) of Section 5.1, paragraph (2) of Section 5.4 and paragraph (6) of Section 7.4 shall be included in the documentation.

(4) The persons authorized with the planning or supervision of storage, handling, and transport procedures as well as for the transfer of radioactive substances shall have access to the documents required for properly performing these tasks.

(5) Radioactive waste shall be recorded taking the requirements pursuant to Sec. 2 AtEV into account.

Appendix A (informative)
Explanatory Notes Regarding Section 8.3

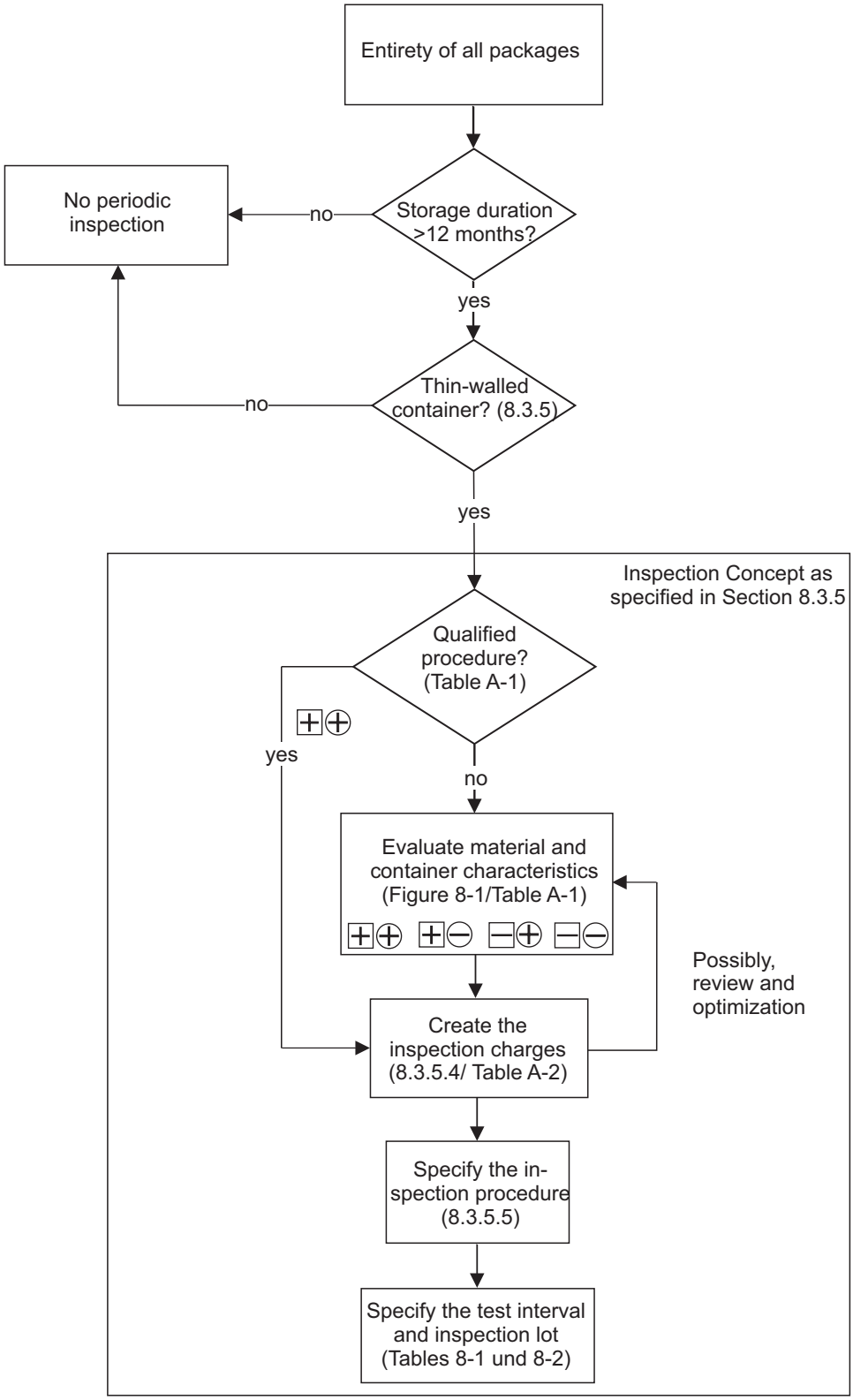

Figure A-1: Explanatory schematic for Section 8.3

(1) As shown in **Figure A-1**, the decision paths “yes/no” are followed for the groups “material” and “container” to determine whether favorable conditions (⊞ for the material and ⊕ for the container) or unfavorable conditions (⊟ for the material and ⊖ for the container) exist. In case no data is available the unfavorable conditions shall be assumed. Several combinations are possible: (⊞/⊕) (⊞/⊖) (⊟/⊕) (⊟/⊖).Practical examples are shown in **Table A-1**.

Question		**Answer**	
		yes	no
Qualified procedure?	Has the radioactive waste conditioned used a qualified procedure that today, in a similar or comparable form, is still considered adequate?	New procedure plan or test sequence plan or updated procedure	No new procedure plan or no test sequence plan, an outdated procedure, maybe missing certification of characteristics
Material Characteristics			
Is the material known?	Are material composition and quality known? Where the radioactive substances sorted?	Sorted, well known composition, only a single flow of substances	No sorting took place, various flows of substances, contents not or insufficiently known
Can corrosive behavior be excluded?	Can it be excluded that the container atmosphere has as corrosive behavior?	Dry waste products, no chemical or biological activity	High residual moisture, open liquid medium, chemical or biological reaction (gas-formation potential), aggressive contents
Container Characteristics			
Intact corrosion protection?	Is it ensured that the corrosion protection remains intact (even after the conditioning process)?	Strong corrosion protection, careful handling, no pointed or sharp objects	No corrosion protection, non-professional repairs; damage caused by conditioning or handling shall be assumed
Suitable structural design?	Is the structural design (wall thickness, rolling hoops) such that the container is highly resistant against wall-penetrating rusting	Large wall thickness (many mm), no corners, no edges where liquids might collect	Low wall thickness (less than 1.5 mm), corners, edges, beads or corrugations, e.g., rolling hoops
Suitable material pairing?	Is the material pairing of contained material and container uncritical?	Materials do not interact with each other, e.g., plastic bag, stainless steel as inner lining	Materials that easily interact, e.g., water and iron, aluminum and concrete

Table A-1: Definition of the characteristics cited in **Figure 8-1** and exemplary evaluation and decision criteria

(2) The packages are then aggregated into one inspection charge. Practical examples are shown in **Table A-2**.

Example	Description		Evaluation of the Inspection Charge		
	Material	**Container**	**Material**	**Container**	
1	Mixed waste, unsorted	Pressing drum [1]	⊟	⊖	Cf. paragraph (2) of Section 8.3.5.4, aggregation into one inspection charge only admissible for the rotation procedure. Containers are directly comparable but the characteristics of the contained material is not sufficiently known to be able to determine the corrosion behavior.
	Mixed waste, unsorted	Pressing drum	⊟	⊖	
2	Construction rubble, moist	Pressing drum	⊟	⊖	Cf. paragraph (2) of Section 8.3.5.4, aggregation into one inspection charge only admissible for the rotation procedure. Containers are directly comparable, however, no comparable or positive characteristics of the contained material regarding corrosion behavior (e.g., pH value, chloride content?).
	Containment sump sludge, moist	Pressing drum	⊟	⊖	
3	Construction rubble, moist	Pressing drum	⊟	⊖	Cf. paragraph (2) of Section 8.3.5.4, aggregation into one inspection charge only admissible for the rotation procedure. Contained materials are directly comparable, however, the characteristics of the containers are not sufficiently known to be able to determine the corrosion behavior.
		Used 200-liter drum [2]	⊟	⊖	
4	Filter cartridges, moist	Stainless steel drum	⊟	⊕	Cf. paragraph (2) of Section 8.3.5.4, aggregation into one inspection charge only admissible for the rotation procedure. Containers are directly comparable, however, no comparable or positive characteristics of the contained material regarding corrosion behavior (e.g., pH value, chloride content?).
	Containment sump sludge	Stainless steel drum	⊟	⊕	
5	Ion exchanger resins, moist	Stainless steel drum	⊟	⊕	Aggregation into one inspection charge is admissible. Containers are not directly comparable but positive, and the characteristics of the contained materials are comparable regarding corrosion behavior. Cf. paragraph (1) item d) of Section 8.3.5.4.
		new drum with intact corrosion protection	⊟	⊕	
6	Mixed waste, dry	Pressing drum	⊞	⊖	Aggregation into one inspection charge is admissible. Containers are directly comparable and the contained materials have positive characteristics regarding corrosion behavior. Cf. paragraph (1) item c) of Section 8.3.5.4.
	Construction rubble, dry	Pressing drum	⊞	⊖	
7	Evaporator concentrates, dry	400-liter stainless steel drum	⊞	⊕	Aggregation into one inspection charge is admissible. Containers and contained material have positive characteristics regarding corrosion behavior. Cf. paragraph (1) item b) of Section 8.3.5.4.
	Mixed waste, pressed, dry, ALP	new drum with intact corrosion protection	⊞	⊕	
	Metal scrap / construction rubble, dry, ALP	Type V container	⊞	⊕	

[1] Pressing drum without corrosion protection

[2] Drum with damaged corrosion protection

Table A-2: Examples for inspections charges combined from packages with similar material and container characteristics

(3) **Table 8-1** is then used for the rotation and random sampling procedures to specify the concrete test intervals and inspection lots: seen vertically, the determined favorable (⊞ or ⊕) or unfavorable (⊟ or ⊖) conditions deliver the 10-, 5-, 2- or 1-year test intervals of the inspection charge depending on the respective test and inspection procedure.

(4) In case of the rotation procedure, 50 % (⊞/⊖) shall be tested in 5-year intervals, 40 % (⊟/⊕) in 2-year intervals and 25 % (⊟/⊖) in 1-year intervals.

(5) In case of the random sampling procedure, the size of the random sample, S, is determined using **Table 8-3** and the size of the respective inspection lot (percentage of the random sample) using line 6 of **Table 8-1**.

(6) Waste with a positively or semi-positively evaluated behavior may be inspected using the reference packages procedure (cf. **Table 8-2**). The test interval is always one year and the size of the inspection lot is 1 % of the inspection charge in case of ⊞/⊕ and 5 % in case of ⊞/⊖ .

Material		**Container**	Evaluation		Test Interval [yrs]		Percentage
			Material	Container	Rotation	Random sampling	Reference packages
Qualified procedure			⊞	⊕	–	10	1 %
Mixed waste	unsorted	used drum without corrosion protection	⊟	⊖	1	case-by-case analysis	case-by-case analysis
	sorted, wet or moist	drum with intact corrosion protection	⊟	⊕	2	2	case-by-case analysis
	sorted, dry	used drum without corrosion protection	⊞	⊖	5	5	5
	pressed and dried as specified in ALP [1]	new drum with intact corrosion protection	⊞	⊕	-	10	1
Liquid waste	sawing muds or slurries of similar composition	used drum without corrosion protection, inside a tear-resistant thick plastic bag	⊟	⊕	2	2	case-by-case analysis
Evaporator concentrates	operationally predried, without certificate	used drum without corrosion protection	⊟	⊖	1	case-by-case analysis	case-by-case analysis
	operationally predried, same inspection charge	new drum with intact corrosion protection	⊟	⊕	2	2	case-by-case analysis
	operationally predried, with certificate	used drum without corrosion protection	⊞	⊖	5	5	5
	operationally predried, with certificate	new drum with intact corrosion protection	⊞	⊕	-	10	1
	dried as specified in ALP	used drum without corrosion protection	⊞	⊖	5	5	5
	dried as specified in ALP	new drum with intact corrosion protection	⊞	⊕	-	10	1
Construction rubble	fresh	used drum without corrosion protection	⊞	⊖	5	5	5
	fresh	new drum with intact corrosion protection	⊞	⊕	-	10	1
Steel scrap	well drained	used drum without corrosion protection	⊟	⊖	1	case-by-case analysis	case-by case analysis
	well drained	new drum with intact corrosion protection	⊟	⊕	2	2	case-by case analysis
	dried	used drum without corrosion protection	⊞	⊖	5	5	5
	dried	new drum with intact corrosion protection	⊞	⊕	-	10	1
Ashes	concreted	used drum without corrosion protection	⊟	⊖	1	case-by-case analysis	case-by-case analysis
	concreted	new drum with intact corrosion protection	⊟	⊕	2	2	case-by-case analysis
	dry	used drum without corrosion protection	⊞	⊖	5	5	5
	dry	new drum with intact corrosion protection	⊞	⊕	-	10	1

[1] ALP (German: **A**b**L**auf**P**lan - procedural sequence plan): Procedure in accordance with Sec. 3 AtEV, further detailed in “Guideline for the control of radioactive waste residuals” made public November 19, 2008 (BAnz 2008, no 197, p. 4777)

Table A-3: Application examples

Inspection charge contains N number of packaged items	**N = 50 Packaged Items**					
Material and container characteristics	⊞/⊕		⊞/⊖		⊟/⊕	
Inspection charges with similar characteristics	yes		yes		yes	no
Test interval [yrs.]	10	1	5	1	2	2
Test procedure	Random sampling	Reference packaged items	Random sampling	Reference packaged items	Random sampling	Rotation
Size of the inspection lot	50 % of S=40	1 % of N=50	50 % of S=40 (cf. Tab. 8.3)	5 % of N=50	40 % of S=40 (cf. Tab. 8.3)	40 % of N=50
Packaged items per test interval	20	1	20	(2,5) 3	16	20
Packaged items for annual test	2	1	4	3	8	10
Inspection charge contains N number of packaged items	**N = 500 Packaged Items**					
Material and container characteristics	⊞/⊕		⊞/⊖		⊟/⊕	
Inspection charges with similar characteristics	yes		yes		yes	no
Test interval [yrs.]	10	1	5	1	2	2
Test procedure	Random sampling	Reference packaged items	Random sampling	Reference packaged items	Random sampling	Rotation
Size of the inspection lot	50 % of S=58 (cf. Tab. 8.3)	1% of N=500	50 % of S=58	5 % of N=500	40 % of S=58 (cf. Tab. 8.3)	40 % of N=500
Packaged items per test interval	29	5	29	25	23	200
Packaged items for annual test	3[2)]	5[2)]	6[1)]	25[1)]	12	100

[1)] In the case of large inspection charges, the random choosing of packaged items for the random sampling procedure, due to the statistics involved and based on operating experience, allows picking a smaller inspection lot from the packaged items than would be necessary for the reference packaged item procedure

[2)] The small size of these inspection lots is based on a positive expectancy for a longer-term stability for these packaged items.

Table A-4: Example calculations for inspection charges with 50 and 500 packaged items

Appendix B

Regulations Referred to in the Present Safety Standard

(Regulations referred to in the present safety standard are valid only in the versions cited below. Regulations which are referred to within these regulations are valid only in the version that was valid when the latter regulations were established or issued.)

AtG		Act on the peaceful utilization of atomic energy and the protection against its hazards (Atomic Energy Act) in the version promulgated on July 15, 1985 (BGBl. I, p. 1565), most recently changed by article 239 of the ordinance dated June 19, 2020 (BGBl. I, p. 1328)
StrlSchG		Act on the protection against harmful effects of ionizing radiation (Radiation Protection Act – StrlSchG) of June 27, 2017 (BGBl. I 2017, No. 42, p. 1966), most recently changed by article 5 Sec. 1 of the act of October 23, 2020 (BGBl. I, p. 2232)
StrlSchV		Ordinance on the protection against harmful effects of ionizing radiation (Radiological Protection Ordinance – StrlSchV) of November 29, 2018 (BGBl. I 2018, p. 2034, 2036), most recently modified by Article 1 of the Ordinance of November 20, 2020 (BGBl. I, p. 2502)
AtEV		Ordinance on further modernizing the act on radiological protection of November 29, 2018 (BGBl. I 2018, Part 1 No. 41); Article 3 Ordinance on the requirements and procedures for disposal of radioactive waste (Nuclear Disposal Ordinance – AtEV)
SiAnf	(2015-03)	Safety requirements for nuclear power plants of November 22, 2012, revised version of March 3, 2015 (BAnz AT of March 30, 2015 B2)
SiAnf-Interpretations	(2015-03)	Interpretations of the safety requirements for nuclear power plants of November 22, 2012, revised version of March 3, 2015 (BAnz AT of March 30, 2015 B3)
GL Intermediate Storage	(2013-06)	ESK guidelines for the storage of radioactive waste with negligible heat generation Revised version of 10.06.2013 (ESK – Nuclear Waste Management Commission)
GL Controlling Radioactive Waste	(2008-11)	BMU-Guideline for the control of radioactive waste residuals and radioactive waste, made public November 19, 2008 (BAnz 2008, no 197, p. 4777)
GL IWRS I	(1978-07)	BMI-Guideline for the protection against radiation of personnel during the execution of maintenance work in nuclear power stations with light water reactors: Part I: The precautionary protective measures to be taken during the planning of the plant, of July 10, 1978 (GMBl. 1978, p. 418)
KTA 1402	(2017-11)	Integrated management systems for the safe operation of nuclear power plants
KTA 2101.1	(2015-11)	Fire protection in nuclear power plants; Part 1: Basic requirements
KTA 2101.2	(2015-11)	Fire protection in nuclear power plants; Part 2: Fire protection of structural components
KTA 2101.3	(2015-11)	Fire protection in nuclear power plants; Part 3: Fire protection of mechanical and electrical plant components
KTA 3603	(2017-11)	Facilities for treating radioactively contaminated water in nuclear power plants
DIN EN ISO 16890-1	(2017-08)	Air filters for general ventilation - Part 1: Technical specifications, requirements and classification system based upon particulate matter efficiency (ePM) (ISO 16890-1:2016); German version EN ISO 16890-1:2016