Safety Standards

of the
Nuclear Safety Standards Commission (KTA)

KTA 1403 (2022-11)

Ageing-Management in Nuclear Power Plants

(Alterungsmanagement in Kernkraftwerken)

The previous versions of this safety standard were issued in 2010-11 and 2017-11.

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

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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) on July 25, 2023. 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, 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 AtG, the Radiation Protection Act (StrlSchG) and the Radiation Protection Ordinance (StrlSchV) as well as further detailed in the Safety Requirements for Nuclear Power Plants (SiAnf) and the Interpretations of the SiAnf.

(2) Based on the “Safety Requirements for Nuclear Power Plants” (SiAnf) and the “Interpretations of the Safety Requirements for Nuclear Power Plants” the present safety standard specifies the requirements for the procedures of ageing-management in operating nuclear power plants with light water reactors.

(3) A sustained assurance of quality taking the actually required quality condition into account is important to the safety and availability of the respective nuclear facility. Since technical systems are subject to time and operation dependent ageing phenomena that will lead to an alteration of the quality state, it is necessary to install ageing-management. The ageing management also covers all aspects of ageing caused by changed operational conditions during long-lasting shutdowns.

1 Scope

(1) This safety standard applies to the procedures of ageing-management regarding the safety-related Technical Facilities – including the respective auxiliary and operating media – that are specified in the licensing documents and operating instructions of light water reactors still in operation. Special emphasis is placed on physical ageing under consideration of newer findings with respect to ageing processes.

N o t e :

Requirements for the handling of long-term stored radioactive substances are specified in KTA 3604 Sec. 8.3.

(2) This safety standard applies, furthermore, to the procedures of ageing-management regarding the basic qualification and maintenance of competence and know-how of the personnel and, also, to the documentation and the data from information and operation management systems.

(3) The scope of this safety standard does not extend to the repercussions of any conceptual developments.

2 Definitions

(1) Ageing, physical

Physical ageing comprises time dependent or operation-related modifications of originally given characteristics. They are caused by, e.g., embrittlement, fatigue, corrosion, wear-and-tear or by a combination of these factors.

N o t e s :

(1) The causes depend on the condition of the material used, on the occurrence of events (e.g., loadings) and on the ambient conditions. The operation-related relevant damage mechanisms will depend on the specifics of the plant, of the systems and components. In this respect, physical ageing also comprises mechanical, electrical, chemical and biological damage mechanisms.

(2) The ageing phenomena already known during assembly of the plant and the newer findings regarding ageing phenomena gained from laboratory research or by improved examination procedures shall be treated equally.

(2) Ageing-management in nuclear power plants

Ageing-management in nuclear power plants comprises the entirety of measures taken to control any ageing phenomena that could be detrimental to the safety of a nuclear power plant.

N o t e :

The term “ageing-management” is used in subsequent sections of this safety standard as short for “ageing-management in nuclear power plants”.

(3) Feature, functional

Functional feature refers to any characteristic quality that is required to enable performing a specific task in accordance with the design.

(4) Damage mechanisms

In this safety standard, damage mechanisms refer to any ageing-related physical, chemical and biological processes that could be detrimental to the integrity or functionality of a component.

(5) Damage mechanisms, relevant

Damage mechanisms are considered as being relevant if they can influence a required functional feature of Technical Facilities during their term of operation to an impermissible extent.

(6) Technical Facility

In this safety standard, the term Technical Facility refers summarily to mechanical components and systems, to electrical and instrumentation and control equipment and components as well as to te structural components (buildings, partial structures, structural systems and components).

N o t e :

The term “Technical Facilities” as used in this safety standard corresponds to the term “Systems, Structures and Components (SSC)” frequently used in corresponding English publications.

3 General Principles

(1) This safety standard specifies requirements for ageing-management that encompass the technical and organizational measures with respect to an early detection of ageing phenomena relevant to the safety of nuclear power plants and to maintaining the actually required quality condition.

(2) The operating practice regarding aspects of ageing-management shall take into account the legislative basis and the applicable legal standards (Atomic Energy Act (AtG), Nuclear Safety Officer and Reporting Ordinance (AtSMV), Safety Requirements for Nuclear Power Plants, Interpretations of the Safety Requirements for Nuclear Power Plants, guidelines and recommendations by the Reactor Safety Commission, KTA safety standards, DIN standards and other conventional standards) as well as plant specific requirements.

(3) The operating utility of the nuclear power plant shall install a systematic and knowledge-based ageing-management that shall be organized, documented, assessed and updated. Hereby, the following requirements shall be translated into practice:

a) The extent of ageing-related observations shall be established and documented. The observations shall include:
   aa) ageing of the auxiliary and operating media of the Technical Facilities, as well as
   bb) relevant ageing influences on the data from information and operation-management systems including documentation.
b) The procedures of ageing-management shall ensure that safety-related relevant damage mechanisms are identified.

c) The causes and/or sequential effects of these damage mechanisms shall be mitigated by proper measures.

d) The development of the state of the art science and technology in national and international publications regarding ageing-related findings shall be pursued and assessed.

e) The measures taken with respect to ageing-management and the respective results shall be documented and assessed. In regular intervals, reports shall be written summarizing these measures and results. Ageing-management shall be continuously optimized based on the performed assessments. Impermissible deviations from the required quality condition shall be eliminated.

f) The ageing-management shall be translated into practice in a process-oriented way and shall be integrated into the operational procedures. It shall be part of an integral management system. The processes involved (e.g., servicing, maintenance), the intertwined activities as well as the mutual interactions shall be identified, directed and controlled. This overall process shall be designed in accordance with the principles of a PDCA-cycle (PLAN-DO-CHECK-ACT-cycle, cf. **Figure 1**).

N o t e :

The process orientation and relevant aspects of a PDCA-cycle are dealt with, e.g., in safety standard KTA 1402 “Integrated Management Systems for the Safe Operation of Nuclear Power Plants” and in IAEA SSG-48.

g) The ageing-management shall be performed on the basis of a structured knowledge base. This knowledge base shall contain sufficient information on the respective design concept, on the ageing-related requirements in standards, on the design and manufacture as well as operating history of the Technical Facilities, on the potential relevant damage mechanisms and, with respect to the relevant damage mechanisms, the designated and possible monitoring, examination and mitigation measures including assessment of the results.

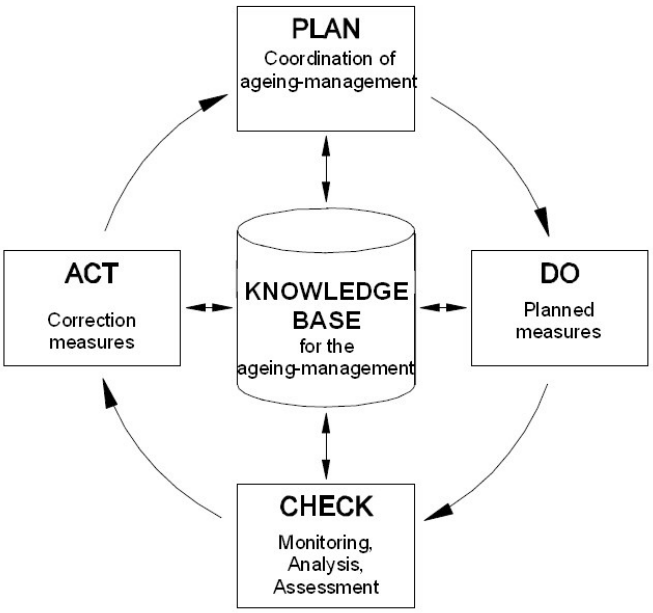

Figure 1: PDCA-cycle of ageing-management

(4) In case certain ageing effects are detected on safety irrelevant Technical Facilities that are applicable to similar Technical Facilities considered within ageing-management, these findings shall normally, e.g., within the framework of the internal experience feedback, be integrated into the ageing-management.

4 Ageing-Management Procedure Regarding Technical Facilities Including Auxiliary and Operating Media

4.1 Ageing of Mechanical Systems and Components

4.1.1 Extent of ageing-related observation and group assignment

(1) All safety-related mechanical components shall be taken into consideration.

(2) These mechanical components shall be assigned as belonging to Group M1 or Group M2 in accordance with their graded safety relevance.

(3) Group M1:

a) Group M1 shall comprise all components and component parts whose failures are specified as being impermissible.

b) Based on plant specific conditions, additional components shall be integrated into the extent of ageing-related observation of Group M1 if, during full power operation or during mitigation of design basis accidents, a failure of these components is not covered by plant design.

N o t e :

Group M1 comprises, among others, those components and component parts to which the scopes of the safety standard series KTA 3201 or KTA 3211 apply and the failures of which are specified as being impermissible.

E.g., the reactor coolant pipes, the main steam pipes and the feed water pipes belong to this group in as far as rupture preclusion is required for these components.

(4) Group M2:

All safety-related mechanical components not assigned to Group M1 shall be assigned to Group M2.

N o t e :

The assignment of a component to Group M2 may become necessary, e.g., for reasons of radiation protection, of fire protection or of an increased hazard potential.

(5) Any mechanical Technical Facility not assigned to either Group M1 or Group M2 shall be considered as being outside the scope of this safety standard.

4.1.2 Identification of relevant damage mechanisms

(1) The potential relevant damage mechanisms shall be compiled within the framework of the Basis Report (cf. Section 6) for all safety-related mechanical components.

N o t e :

The potential damage mechanisms also include the damage mechanisms that were taken into account during the design of the installation.

(2) The relevance of these potential damage mechanisms as compiled in the Basis Report shall be determined individually for each specified component.

(3) The recurrent in-service inspections, the maintenance and the monitoring performed concurrently with plant operation shall be conceptually so devised as to deliver data the assessment of which shall enable early detection of potential relevant damage mechanisms on safety-related Technical Facilities.

4.1.3 Procedure with respect to maintaining the actually required quality condition

4.1.3.1 General requirements

(1) Component-specific measures shall be specified under consideration of the group assignment and of the influencing

effects with respect to maintaining the actually required quality condition.

(2) The specification of these component-specific measures requires the following:

a) sufficient knowledge of the specifically required and the actual quality condition of the component or system (meeting the requirements of the design, of the materials and manufacture),

b) sufficient knowledge of the operation-to-date including the influencing effects during commissioning,

c) sufficient knowledge of potential relevant damage mechanisms and their prevention,

d) examination procedures to ensure protection against relevant damage mechanisms (design, operation-to-date),

e) fracture-strength related assessment of postulated and actually detected flaws (determination of crack propagation and of the critical discontinuity size and load parameters),

f) information from the operational surveillance of the causes and effects of potential operation-related relevant damage mechanisms,

g) consideration of the current state of knowledge.

(3) The actual quality and the required quality shall be compared to prove that the quality requirements are met.

4.1.3.2 Procedure regarding Group M1

A coherent overall concept of independent measures shall be prepared for the Technical Facilities in Group M1. It shall be shown by these measures that the quality required to uphold the design specifications is ensured for the entire operating period. This requires that

a) the causes of potential operation-related relevant damage mechanisms (e.g., water chemistry, mechanical and thermal loadings) are determined,

b) the effects of potential operation-related relevant damage mechanisms are monitored (e.g., by in-service inspections or operational surveillance measures) at representative locations and are assessed,

c) the state of operation-related knowledge from other plants (e.g., results of the in-service inspections or the operational surveillance measures) is taken into consideration,

d) the state of knowledge concerning potential relevant damage mechanisms is kept up to date with regard to the development of the respective state of science and technology.

4.1.3.3 Procedure regarding Group M2

The procedure regarding Group M2 shall be based on preventive maintenance. This requires that

a) the effects of potential operation-related relevant damage mechanisms are monitored (e.g., by in-service inspections or operational surveillance measures) at representative locations and assessed,

b) the state of operation-related knowledge even from other plants (e.g., results of the in-service inspections or the operational surveillance measures, laboratory investigations) is taken into consideration,

c) the state of knowledge concerning potential relevant damage mechanisms is kept up to date with regard to the respective state of science and technology, and

d) ageing-related failures due to common cause failures are prevented.

N o t e :

An individual random failure is permissible.

4.1.4 Assessment of the effectiveness

(1) The effectiveness of the existing and of possibly taken additional measures for detecting and mitigating relevant damage mechanisms shall be assessed in regular intervals. The length of these intervals shall be chosen in accordance with the expected ageing behavior. This assessment may be based on a comparison of the specified and the actual conditions or on trend analyses.

(2) The comparison between the specified and the actual conditions shall be based on, e.g.:

a) initial condition during commissioning,

b) expected value in case of continuous development,

c) assessed results,

d) requirements in standards.

(3) The trend analyses shall be based on, e.g.:

a) statistical evaluation of failures, damages or findings,

b) projections of the developments into the future (prognoses),

c) adherence to an anticipated value in case of continuing development.

(4) If the assessment of the effectiveness shows that the measures taken did not suffice, these measures shall be optimized or supplemented.

4.2 Ageing of Technical Facilities of the Electrical and Instrumentation and Control Equipment

4.2.1 Extent of ageing-related observation

(1) All safety-related Technical Facilities of the electrical and instrumentation and control equipment shall be included in the procedures of ageing-management.

N o t e :

These comprise, among others, the fire alarm equipment and the lightning protection facility.

(2) The functional features of these Technical Facilities that are required to enable them to perform their safety-related functions shall be specified.

(3) For the duration of their operating period, the safety-related Technical Facilities of the electrical and instrumentation and control equipment may not be impermissibly influenced by relevant damage mechanisms. An influence is considered as being impermissible if the Technical Facility, in the event of required operation for which it was designed, cannot fulfill its specified normal function to such extent that the minimum number of facilities required for the mitigation of this event is not anymore available.

N o t e :

The main goal of ageing-management measures is to prevent a common cause failure due to ageing processes, especially, in the event of required operation. Ageing processes are characterized by being long term processes that usually will not lead to a random simultaneous unavailability of redundant facilities.

4.2.2 Identifying relevant damage mechanisms

(1) For all safety-related Technical Facilities of the electrical and instrumentation and control equipment, the relevant damage mechanisms shall be determined that may be detrimental to the required functional features specified under Section 4.2.1 para. 2.

(2) When determining the relevancy of the relevant damage mechanisms to be compiled in the Basis Report under Section 6 the following data shall be taken into consideration:

a) the sensitivity of the materials or components of those safety-related Technical Facilities of the electrical and instrumentation and control equipment that are subject to assessment, and

b) the intensity, frequency and duration of the influential events during specified normal operation and within the respective Technical Facilities of the electrical and instrumentation and control equipment (e.g., self-heating).

4.2.3 Procedure for the mitigation of relevant damage mechanisms

(1) It shall be ensured that the functional features to be determined in accordance with Section 4.2.1 para. 2 are completely maintained by ageing-management procedures taking the actual situation with regard to type, extent and interval into account.

(2) In the case of Technical Facilities of the electrical and instrumentation and control equipment that are examined with respect to the actual situation, proof shall be provided by type approval and suitability tests and by the measures of

a) in-service inspections,

b) preventive maintenance, and

c) repairs

in combination with the corresponding experience feedback that all required functional features are maintained. An examination with respect to the actual situation shall take all aspects into account that pertain to the design-specific function in the event of required operation.

N o t e :

If the examination is performed with respect to the actual situation, the relation to reality is given. An event of required operation for which a Technical Facility of the electrical and instrumentation and control equipment is designed and during which it must fulfill the required functional features will present no different or higher loadings for the Technical Facility than during in-service inspection. Therefore, the system of in-service inspections, preventive maintenance and repair is well suited for the detection and, with the consequent use of experience feedback, for the mitigation of damages from ageing mechanisms.

(3) If the measures specified under para. 2 do not extend to certain events of required operation (e.g., loss-of-coolant accident, earthquake, aircraft crash and blast pressure wave) then a supplemental proof shall be provided with respect to the functional features required in these events of required operation showing that the operating and environmental conditions at the assigned location have no impermissibly detrimental effects on these characteristics. This proof may be performed analytically.

(4) If it can be proven in accordance with paras. 2 or 3 that there will be no ageing-related impairment of the required functional features, no further measures shall be required.

(5) In the case of Technical Facilities of the electrical and instrumentation and control equipment for which it cannot be proven in accordance with paras. 2 or 3 that the functional features are maintained, an analysis founded on the structured knowledge base (cf. Section 3 para. 3 item g) shall be performed with respect to possible ageing-related effects from relevant damage mechanisms. This analysis shall take the operational and environmental conditions at the assigned locations of these Technical Facilities into account.

(6) The analytical proofs in accordance with para. 5 shall be comprehensibly documented and assessed.

(7) If the analysis in accordance with para. 5 in the event of required operation of a safety-related Technical Facility of the electrical and instrumentation and control equipment leads to the result that an unavailability cannot be precluded, then, corresponding to their safety-related significance and under consideration of the operational and environmental conditions, measures for the mitigation of the relevant damage mechanisms determined in accordance with Section 4.2.2 shall be specified. Such measures may be, e.g.:

a) supplemental in-service inspections,

b) supplemental preventive maintenance,

c) special or substitute examinations,

d) design modification of the Technical Facilities of the electrical and instrumentation and control equipment (e.g., modification of the sealant material),

e) plant-related modifications (e.g., environmental conditions, mode of operation),

f) deployment of other equipment.

(8) When specifying these measures, the knowledge base shall normally be expanded by including experience feedback from the operation and maintenance of plant-internal facilities and from other plants.

(9) The measures for the mitigation of relevant damage mechanisms shall be specified for the type of the equipment, for the type of the equipment system or for the individual level of the component. With regard to ageing-management, the summary treatment of comparable equipment and components is permissible.

N o t e :

A component of an electrical or instrumentation and control equipment is considered as being the smallest effective unit of the system that alone can still fulfill an active or passive function (e.g., transducer, actuator, motor, cable penetration, cable, junction box, circuit breaker, battery, component group of the instrumentation and control device).

4.2.4 Assessment of the effectiveness

(1) The effectiveness of the existing and other possibly taken measures for detecting and mitigating relevant damage mechanisms shall be assessed in regular intervals. The length of the intervals shall be chosen to correspond to the expected ageing behavior.

(2) This assessment may be based on comparisons between the specified and the actual conditions or on trend analyses.

(3) The comparison between the specified and the actual conditions shall be based on, e.g.:

a) a specific initial condition (e.g., that of commissioning) as reference value for potential changes,

b) expected value based on a continuous development,

c) comparison with an assessed finding, or

d) comparison with requirements in standards.

(4) The trend analyses shall be based on, e.g., a statistical assessment of failures, damages or findings.

(5) If the assessment of the effectiveness shows that the measures taken are not sufficient, these measures shall be optimized or supplemented.

4.3 Ageing of Structural Facilities

4.3.1 Classification of structural facilities

(1) Within the framework of ageing-management the structural facilities shall be classified as follows:

a) buildings or partial buildings (B),

b) structural systems (S), and

c) structural components (T).

(2) Buildings and partial buildings are structural facilities that shall be identified in accordance with the Power Plant Identification Code.

(3) Structural systems are conglomerates of structural components that fulfill a mutual function. The following differentiation of structural systems shall apply:

a) supporting framework,

b) internals (e.g., steel platforms, crane rails),

c) anchorages,

d) roof sealings,

e) insulation against outside water pressure,

f) drain systems (e.g., roof drainage, drains),

g) decontamination coatings,

h) elements of the structural fire protection,

i) elements of the structural lightning protection,

k) internal seals (e.g., internal Brattberg frame, pipe transits),

l) façades (function: weather protection),

m) outside grounds (e.g., streets, paths, surfaces),

n) other coatings,

o) other space-enclosing structural components (e.g., non-load-bearing walls, doors, gates, windows), and

p) interior decoration (e.g., flooring, suspended ceilings without fire protection function).

N o t e :

The interfaces between structural, mechanical and electrical systems and structural components are specified for the individual power plant.

(4) Structural systems consist of structural component parts. These are required for the system to be able to meet its functional requirements.

E x a m p l e 1 :

The system “supporting structure” of a building consists of load-bearing structural parts such as, e.g., outside walls, roofing, inside walls, interior ceiling, support pillars, beams and foundations.

E x a m p l e 2 :

The system “elements of structural fire protection” of a building consists of, e.g., fire protection doors, cable transits, pipe transits, fire protection dampers, fire protection ceilings, system flooring and building joints.

E x a m p l e 3 :

The system “(structural) anchorages” consists of, e.g., dowel plates, anchor plates, cast-in channels.

4.3.2 Extent of ageing-related observation and classification

(1) Within the framework of ageing-management, all safety-related structural facilities shall be taken into consideration. The classification criteria for the buildings or partial buildings (B), structural systems (S), and structural components (T) are the respective safety requirements specified, e.g., in the licensing documents.

(2) In a first step, the safety-related buildings or partial buildings shall be classified as Group B1 or Group B2 as follows;

B1: Safety-related buildings or partial buildings in accordance with safety standard KTA 2201.1,

B2: Buildings or partial buildings that may prove to have detrimental effects on safety-related Technical Facilities.

N o t e :

In order to achieve a systematic classification of all buildings or partial buildings it is advisable to assign the other buildings or partial buildings to a Group B3.

(3) In a second step, the safety-related structural systems (S1) within the buildings or partial buildings of Groups B1 and B2 shall be identified:

S1: Safety-related structural systems.

N o t e :

In order to achieve a systematic classification of all structural systems it is advisable to assign those structural systems not relevant to safety to a Group S2.

(4) In a third step, the safety-related structural component parts (T1) within the safety-related structural systems of Group S1 shall be identified:

T1: Safety-related structural component parts.

N o t e :

(1) In order to achieve a systematic classification of all structural component parts it is advisable to assign those structural component parts not relevant to safety to a Group T2.

(2) The structural component parts of Group T2 do not contribute to the safety-related function of the Group S1 systems.

E x a m p l e :

A Group B1 building can contain structural component parts of the system “space-enclosing structural components” that, themselves, are not relevant to safety (e.g., non-load-bearing walls).

4.3.3 Identification of the relevant damage mechanisms

(1) The potential relevant damage mechanisms shall be compiled within the framework of the Basis Report (cf. Section 6) for all safety-related structural components.

(2) The relevance of these damage mechanisms shall be determined individually for each structural component part taking the respective boundary conditions into account.

4.3.4 Determining the condition of the (safety-related) structural systems and component parts

(1) The condition of the (safety-related) structural systems and component parts as documented during assembly shall be updated within the framework of modification measures.

(2) Whenever new relevant damage mechanisms are made known, the condition of the structural systems and component parts shall be newly established and assessed with respect to their meeting the existing safety requirements.

4.3.5 Procedure for the mitigation of relevant damage mechanisms

(1) The measures including surveillance procedures for the mitigation of relevant damage mechanisms shall be specified for the individual level of the structural component part.

(2) These measures may be:

a) preventive maintenance,

b) in-service inspections,

c) special examinations,

d) repair tasks, and

e) structural modifications.

(3) The frequency and intensity of the examination measures shall be adjusted to the relevant damage mechanisms that can occur in the individual structural component parts and to the anticipated damage development.

(4) The point in time for performing the required repair tasks or structural modifications shall be chosen such that the anticipated damage development is taken into consideration.

(5) Any findings shall be documented.

4.3.6 Assessment of the effectiveness

(1) The effectiveness of the existing and other possibly taken measures for detecting and mitigating relevant damage mechanisms shall be assessed in regular intervals. The length of these intervals shall be chosen to correspond to the expected ageing behavior.

(5) If the assessment of the effectiveness shows that the measures do not suffice, these measures shall be supplemented with respect to the actual situation.

4.4 Ageing of auxiliary and operating media

4.4.1 Extent of ageing-related observation

(1) The ageing-management shall take those auxiliary and operating media into account that are introduced into safety-related Technical Facilities.

(2) Auxiliary and operating media comprise, e.g.:

a) lubricants (oil, grease) that are monitored for ageing processes in accordance with the selection criteria of mechanical, electrical and the instrumentation and control engineering,

b) insulating oil of safety-related transformers,

c) diesel fuel of the emergency diesel generators, and

d) other materials such as, e.g., refrigerants and control fluids.

4.4.2 Requirements for the auxiliary and operating media

(1) The requirements for the auxiliary and operating media shall be specified; they are dependent on the usage of the Technical Facilities and their requirements.

(2) Ageing-related requirements from specific standards and manufacturer guidelines shall be taken into consideration.

4.4.3 Procedure for auxiliary and operating media

(1) The state of knowledge regarding ageing-related influences on auxiliary and operating media shall be included in the ageing-management of the respective Technical Facility. Additional requirements for the auxiliary and operating media are specified below.

(2) All data and examinations regarding auxiliary and operating media shall be systematically recorded and documented. This includes, e.g.:

a) the data regarding procurement, quality, identification marking and deployment of the media, and

b) the results of laboratory investigations.

(3) These data and results shall be assessed with regard to their ageing relevance. If required, measures against ageing shall be initiated and re-examined and, if applicable, improved.

5 Procedures of the Ageing-Management Regarding Non-Technical Aspects

5.1 Personnel Qualification and Maintaining Their Competency and Know-How

Next to the technical and physical aspects of ageing-management, the personnel play a highly important role in ensuring the safety of a nuclear facility.

N o t e :

Respective requirements regarding, e.g.

a) resource management,

b) organization,

c) personnel qualification and maintenance of their competency,

d) operating experience and maintenance of know-how of the personnel, and

e) monitoring the effectiveness,

are dealt with in safety standard KTA 1402 “Integrated Management System for the Safe Operation of Nuclear Power Plants”.

5.2 Ageing of the Plant Documentation

5.2.1 General requirements

Requirements regarding the documentation in nuclear power plants are specified in Principles of Documentation and in KTA 1404.

5.2.2 Extent of ageing-related observation

The ageing-management in nuclear power plants shall be extended to the plant documentation that, within the framework of planning, assembly, commissioning, operation and decommissioning of a nuclear power plant, is created and archived with the goal

a) of demonstrating the existence and the fulfillment of legal prerequisites,

b) of describing the required condition of the plant and of describing the essential procedures during assembly and operation of the plant,

c) of enabling an assessment of the actual condition of the plant,

d) of presenting the information required for a safe operation of the plant, and

e) of enabling experience feedback.

5.2.3 Ageing aspects to be ensured against

(1) It shall be ensured that the documentation is kept up-to-date. This requires that organizational directives are established regarding the preparation and modification of documents.

N o t e :

The term documentation comprises all forms of a lasting data storage, be it in form of, e.g., electronic data or printed media.

(2) The availability of the documentation shall be ensured. This pertains to providing a location for the documentation that is suitable to its usage and storage and pertains, as well, to the employment of data storage media enabling a sufficiently speedy and efficient access to the contents of the documents.

(3) It shall be ensured that the legibility of the documentation is such that its contents will be conveniently accessible to the user. Of particular importance in this respect are the physical condition of the documentation as well the availability of technical equipment for a suitable reproduction of the contents of the documents.

(4) It shall be ensured that, when transferring documents to other data media, the contents of the documents will remain unadulterated.

(5) The documentation’s availability and legibility shall normally be tested by suitable procedures (e.g., random visual tests and random testing the readability of data media).

(6) In the case that defects are detected in the documentation these shall be removed within a reasonable length of time that shall be in accordance with the respective document's significance regarding a safe plant operation.

5.3 Documentation of Data from the Information Systems and Operation Management Systems

5.3.1 General requirements

Information systems and operation management systems in nuclear power plants are used for supporting organizational processes and documenting data and procedures.

5.3.2 Extent of ageing-related observation

(1) The ageing-management in nuclear power plants shall be extended to those data processing systems that influence the condition of safety-related systems or that record their condition.

(2) Not part of the extent of ageing-related observation are data processing systems directly used for process surveillance and control.

Note:

Safety-related data processing systems are sufficiently treated in Section 4.2.

5.3.3 Requirements

(1) Depending on the requirements for the recording of data in nuclear power plants, the data stored by data processing systems shall remain available over long periods of time (cf. Section 5.2.1). In this respect, administrative regulations and procedures shall be established that will ensure that the relevant data bases are backed up, that the resulting data storage media are suitably handled and stored and that the relevant data storage media remain readable.

(2) The integrity of the data stored in data processing systems shall be ensured. In this respect, administrative regulations shall be established regarding the updating and maintenance of the data base.

6 Reporting System

(1) Within the framework of ageing-management, a plant specific Basis Report shall be drawn up. Furthermore, Status Reports shall be drawn up in yearly intervals.

Note:

The Basis Report and the Status Reports may be assembled from multiple subject-specific individual reports.

(2) The Basis Report shall normally comprise information regarding the following aspects:

a) description of the technical and administrative procedures,

b) structure of the knowledge base,

c) pursuing and evaluating ageing-related findings:

   ca) state of science and technology,

   cb) experience feedback,

d) ageing-management of the Technical Facilities including auxiliary and operating media:

   da) extent of ageing-related observation and classification,

   db) potential relevant damage mechanisms,

   dc) mitigating measures regarding these damage mechanisms,

   dd) monitoring the effectiveness,

e) ageing-management with regard to non-technical aspects:

   ea) personnel,

   eb) documentation,

   ec) information systems and operation management systems.

(3) A Status Report shall normally contain quantitative and qualitative information gathered within its respective reporting period on ageing-related activities and measures as well as findings and results from in-plant surveillance and from external sources. This includes, e.g., special examinations performed, insights gained from information notices and from modifications of standards. A Status Report shall contain a summarizing assessment of the effectiveness of ageing-management and of the quality or changed quality of the Technical Facilities. Any modifications of the ageing-management shall be documented.

(4) A Structure Condition Report shall, additionally, be drawn up. Within this report it shall be verified that all safety-related buildings, partial buildings, systems and structural component parts have been assessed with regard to their ageing condition. This Structure Condition Report shall be updated, at the latest, after ten years.

(5) The Basis Report and the Status Reports are integral part of the structured knowledge base for ageing-management (cf. Section 3 para. 3 item g).

Appendix A

Regulations Referred to in this Safety Standard

Regulations referred to in this 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) Atomic Energy Act in the version promulgated on July 15, 1985 (BGBl. I, p. 1565), most recently changed by article 1 of the act dated December 4, 2022 (BGBl. I, p. 2153)
StrlSchG		Act on the Protection against the Harmful Effect of Ionising Radiation (Radiation Protection Act - StrlSchG) Radiation Protection Act of June 27, 2017 (BGBl. I, p. 1966), most recently changed by the promulgation of January 3, 2022 (BGBl. I, p. 15)
StrlSchV		Ordinance on the Protection against the Harmful Effects of Ionising Radiation (Radiation Protection Ordinance - StrlSchV) Radiation Protection Ordinance of November 29, 2018 (BGBl. I, p. 2034, 2036), most recently changed by article 1 of the ordinance dated October, 2021 (BGBl. I p. 4645)
AtSMV		Ordinance on the nuclear safety officer and on reporting of events (AtSMV) of October 14, 1992 (BGBl. I, p. 1766), most recently changed by article 18 of the ordinance dated November 29, 2018 (BGBl. I, p. 2034)
SiAnf	(2015-03)	Safety Requirements for Nuclear Power Plants (SiAnf) of November 22, 2012, amended version of March 3, 2015 (BAnz AT 30.03.2015 B2), most recently changed as promulgated by BMUV on February 25, 2022 (BAnz AT 15.03.2022 B3)
Interpretations of SiAnf	(2015-03)	Interpretations regarding the safety requirements for nuclear power plants of November 22, 2012, of November 29, 2013 (BAnz AT 10.12.2013 B4), changed on March 3, 2015 (Banz AT of March 30, 2015 B3)
Principles of Documentation	(1988-03)	Principles for the documentation of technical documents by the license applicant or licensee during assembly, operation and decommissioning of nuclear power plants, Länder-Commission for Nuclear Power (BAnz 1988, No. 56, March 22, 1988)
ESK-LL Intermediate Storage	(2013-06)	ESK-guidelines for the intermediate storage of radioactive waste with negligible heat generation
KTA 1402	(2017-11)	Integrated management systems for the safe operation of nuclear power plants
KTA 1404	(2022-11 Draft)	Documentation during the construction and operation of nuclear power plants
KTA 2201.1	(2011-11)	Design of nuclear power plants against seismic events; Part 1: Principles
KTA 3604	(2020-12)	Storage, handling and plant-internal transport of radioactive substances in nuclear power plants (with the exception of fuel assemblies)

Appendix B (informative)

Additional Related Standards

Guidelines on the Technical Qualification of Personnel	(2012-05)	Guideline relating to the qualification certification of nuclear power plant personnel; May 24, 2012 (GMBl. 2012, no. 34, p. 611)
	(2013-07)	Guideline relating to the programs aimed at maintaining the technical qualification of the responsible personnel in nuclear power plants of July 17, 2013 (GMBl. 2013, no. 36, p. 712)
	(2012-05)	Guideline relating to the contents of the qualification examination of the responsible shift personnel in nuclear power plants of May 24, 2012 (GMBl. 2012, no. 30, p. 905)
	(1994-02)	Guideline relating to the qualification certification of research reactor personnel of February 16, 1994 (GMBl. 1994, no. 11, p. 366)
	(2000-11)	Guidelines relating to assuring the necessary knowledge of the other personnel in nuclear power plants of November 30, 2000 (GMBl. 2001, no. 8, p. 153)
	(2014-02)	Guidelines relating to the technical knowledge of radiation protection officer in nuclear power plants and other facilities for the fission of nuclear fuel of February 20, 2014 (GMBl. 2014, no. 13, p. 289)
	(2006-04)	Guideline relating to the technical knowledge necessary in radiation protection (Technical Qualification Guideline as per StrlSchV) of June 21, 2004 (GMBl. 2004, no. 40/41, p. 799), changed April 19, 2006 (GMBl. 2006, no. 38, p. 735)
Guideline Maintenance	(1978-06)	Guideline for the procedure of planning and executing maintenance and modification task in nuclear power plants (GMBl. 1978, No. 22, p. 342)
Single Failure Concept	(1984-03)	Interpretation of the safety criteria for nuclear power plants; Single failure concept – Principles for applying the single failure criterion; Promulgation of May 14, 1984 (GMBl. 1984, No. 13, p. 208)
Basis-Safety	(1981-10)	Basis-safety for pressure-retaining components: Vessels, machines, pipes and valves (with the exception of: internal, load transmission components and pressure-retaining walls < DN 50); Appendix 2 of the RSK Guidelines for PWR, third issue of October 14, 1981 (BAnz 1982, No. 69a)
RSK Recommendation	(2004-07)	Mitigation of ageing processes in nuclear power plants; RSK Recommendation of July 22, 2004
KTA 1401	(2017-11)	General requirements regarding quality assurance
KTA 3201.4	(2016-11)	Components of the reactor coolant pressure boundary of light water reactors; Part 4: In-service inspections and operational monitoring
KTA 3706	(2000-06)	Switchgear facilities, transformers and distribution networks for the electrical power supply of the safety system in nuclear power plants
IAEA SSG-48	(2018-11)	„Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants“, Specific Safety Guide, International Atomic Energy Agency, 2018-11
IEEE STD. 1205-2014	(2014-05)	IEEE Guide for Assessing, Monitoring, and Mitigating Aging Effects on Electrical Equipment Used in Nuclear Power Generating Stations and Other Nuclear Facilities