Safety Standards

of the
Nuclear Safety Standards Commission (KTA)

KTA 1402 (2017-11)

Integrated Management System for the Safe Operation of Nuclear Power Plants

(Integriertes Managementsystem zum sicheren Betrieb von Kernkraftwerken)

The previous version of this safety standard was issued in 2012-11

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 May 17, 2018. 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).

All questions regarding this English translation should please be directed to the KTA office:

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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 objective to specify safety-related requirements, compliance of which provides the necessary precautions in accordance with the state of the art in science and technology against damage arising from the construction and operation of the facility (Sec. 7 para. 2 subpara. 3 Atomic Energy Act - AtG) in order to achieve the fundamental safety functions specified in the Atomic Energy Act and the Radiological Protection Ordinance (StrlSchV) and further detailed in the Safety Requirements for Nuclear Power Plants as well as in the Interpretations of the Safety Requirements for Nuclear Power Plants.

(2) According to Sec.7c para. 2 AtG the license holder is required to implement and utilize a management system, that allocates the appropriate priority to nuclear safety.

According to Requirement 1 “Organisational Requirements” of the Safety Requirements for Nuclear Power Plants (SiAnf), the company and plant management has the responsibility to ensure the safe operation of their nuclear power plants.

As detailed in SiAnf, Requirement 1, para. 1

a) an integrated, process-oriented management system (IMS) shall be implemented and continuously improved,
b) the company policies and goals, associated with attaining a high safety level and strengthening the safety culture, shall be specified and communicated,
c) basic principles of the organisational and operational structure shall be specified and
d) necessary resources shall be provided.

Furthermore, according to SiAnf, Requirement 1, para. 2, the safe operation of the plant shall be ensured, respecting the legislative, administrative and safety requirements.

(3) Essential to achieving these requirements is the establishment of clearly defined management structures by which it is ensured that all activities having a direct influence on the safe operation of nuclear power plants

a) are recorded and described,
b) are executed in a mutually coordinated fashion, and
c) are continuously checked and improved.

(4) It is the purpose of the present safety standard to specify the requirements for the management system including the requirements for safe operation.

(5) Specific requirements regarding well defined partial aspects are specified in separate safety standards. Thus, the requirements regarding ageing management are specified in safety standard KTA 1403, regarding product-related quality assurance in KTA 1401, regarding documentation in KTA 1404, and regarding the operating manual in KTA 1201, the testing manual in KTA 1202 and the accident management manual in KTA 1203.

1 Scope

(1) This safety standard applies to the planning, execution, checking and improvement of activities that have a direct or indirect influence on the safe operation of stationary nuclear power plants with light-water reactors.

(2) This safety standard specifies those requirements for the integrated management system that are relevant to ensuring and continuously improving safety – even when pursuing other goals and requirements. However, although this safety standard requires that these other pursuits – such as economics, quality, environmental, occupational health and safety protection – are integrated into the management system, this safety standard does not specify individual goals and requirements for these other aspects.

(3) This safety standard does not specify any direct requirements regarding safety culture. However, safety culture shall normally be furthered and supported by the management system.

Note:

Safety culture is furthered and supported by the management system in that, as specified under Sections 3 ff., it is required of this system that it

a) supports a mutual understanding of the key aspects of safety culture within the corporation,
b) provides the means with which the corporation supports individuals and groups to perform their tasks safely and successfully taking the interactions between man, technology and organizational aspects into account,
c) strengthens the basic attitude for learning and questioning at all levels of the corporation, and
d) provides the means by which the corporation continuously supports the development and improvement of safety culture.

(4) This safety standard considers the integrated management system as being an instrument that helps the corporation at all management levels to fulfill its responsibility for the safe operation of the nuclear power plant. The principle objective of the integrated management system is to ensure a continuous improvement process and a continuously learning organization. Accordingly, the primary recipient of the requirements specified in this safety standard for the integrated management system is the operating utility, which is expected to apply these requirements as basis for the development, introduction and application of a management system as well as for the internal reviews. An external review of the integrated management system should take this aspect into account. External reviews should not adversely affect the own initiative of the operating utility and their speedy application of improvement measures to the management system.

(5) Basically, the requirements regarding quality assurance measures for the processes specified under Section 5 are all presented in this safety standard. Any additional standards that must be taken into consideration are referenced.

2 Definitions

(1) Modifications

The term modifications comprises permanent and temporary changes to civil structures, to systems and components, software, operational limit values and conditions, or to organizational specifications. Exempted are replacements and reconstructions, provided, these do not have any effect on the respective nominal condition.

(2) Plant management

Plant management comprises those persons that manage and direct the plant at its topmost level. The plant management consists at least of the power plant director.

(3) Safe operation

Safe operation (of the power plant) includes the nuclear safety of the power plant as well the protection of persons within the plant and its environs from the harmful effects of ionizing radiation.

(4) Main person on standby

The main person on standby is a plant employee who is authorized as stand-in for the power plant director in the case of a simultaneous absence of the power plant director and his personal representative.

(5) Indicators

Indicators are characteristic values for surveilling and controlling the plant goals and for observing and surveilling the process performance and process results. These indicators show the degree to which the plant goals and process goals are achieved.

(6) Core competence

Core competence is the competence necessary for planning, performing, directing and surveilling all activities that are required for safe operation of a nuclear power plant.

(7) Power plant director

The power plant director is a plant employee who is ultimately responsible for safe operation of the power plant, in particular for the fulfillment of the requirements under the Atomic Energy Act and nuclear licenses. He is also responsible for the cooperation between all organizational units.

(8) Management system

A management system comprises all specifications, standardizations and organizational means provided for within the organization, that are required to plan all tasks relevant for the success of the organization, to execute them under controlled conditions and to survey and improve the extent to which the organizational goals are achieved.

N o t e :

In the present safety standard, the term management system always refers to a process-oriented integrated management system.

(9) Organizational congruence principle

The organizational congruence principle implies that duties, responsibility and authority are normally concurrent (congruent). Thus, an assignment of duties normally includes the assignment of the responsibility for performing these duties. In order to carry out the assigned duties, the corresponding authorizations (the authorizations for making decisions and for issuing instructions) are normally also assigned.

(10) Process

A process is the entirety of interrelated and interacting activities. A process converts inputs into results.

(11) Process goals

Process goals are concretely defined values either concerning the resulting conditions expected to later be achieved or concerning the required proper execution of the processes.

(12) Safety culture

Safety culture is determined by a safety-oriented attitude, responsibility and conduct of all staff required for ensuring the safety of the plant. For this purpose, safety culture comprises the assembly of characteristics and attitudes in a company and of individuals which establishes that, as an overriding priority, nuclear safety receives the attention required by their significance. Safety culture concerns both the organisation and the individual.

(13) Corporation

Corporation refers to an entity supported by an incorporation of any legal form (AG – Aktiengesellschaft; GmbH – Gesellschaft mit beschränkter Haftung; OHG – Offene Handelsgesellschaft; or other) which is the operating utility of a nuclear power plant and is in legal possession of the license required in accordance with Sec. 7 AtG. The corporation comprises the personnel, material means and legal rights including all organizational means required for the operation of the nuclear power plant. The corporation also comprises any participating, governing or otherwise connected enterprises (concerns) or parts of such enterprises that are recorded in the documentation of the management system of the operating utility as performing tasks and carrying responsibilities relevant to the safe operation of the nuclear power plant.

(14) Corporate management

Corporate management consists of a person or group of persons at the topmost level of the corporation who attend to leading and directing the corporation and who carry the responsibility for radiological protection in accordance with StrlSchV.

N o t e :

In case of a legal person or a semi-autonomous partnership, the corporate management is the board of directors, or the company manager or another body of this corporation entitled as representative by law, statutes or contract.

(15) Corporate perspective

Corporate perspective comprises the aspects essential to the company such as safety, economic efficiency, quality, occupational health and safety protection, or the environment.

(16) Corporate policy

Corporate policy comprises the superordinate intentions and the orientation of the corporation. The corporate management uses corporate policy to define the basic values, the self-conception within the corporation and the basic behavior codex.

(17) Corporate goal (power plant goal)

Corporate goal is the specified basic orientation of the corporation (of the power plant).

(18) Improvement measures

Improvement measures may be corrective measures or preventive measures. Corrective measures and preventive measures, as defined in accordance with DIN EN ISO 9000, differ from each other thus: Corrective measures are measures taken after detection of defects or other unwanted situations to remove their cause and, therefore, serve to prevent a renewed occurrence of the defect or situation. Preventive measures on the other hand are measures taken in advance to remove the cause of possible defects or other unwanted situations with the intention of preventing an occurrence of the defect or situation in the first place.

3 Management System

3.1 Basic Requirements

The management system shall comprise all activities with relevance to safe operation. In this context, safe operation shall always have the highest priority.

3.2 Primary Objectives

The primary objectives of the management system are

a) to ensure safety,

b) to continuously improve safety,

c) to promote and improve the safety culture.

3.3 Interactions with Interested Parties

Interested Parties shall normally be identified and an appropriate strategy for an effective communication and information exchange regarding safety relevant issues shall normally be established.

3.4 Process Orientation

(1) All activities within the corporation or the power plant that have any relevance to the operation of the power plant shall be identified.

(2) Those activities that have a direct or indirect influence on safe operation shall be described in a procedural form. These descriptions shall take

a) the dangers and risks involved when performing the respective activities, as well as

b) the safety-related internal and external requirements

into account.

Note:

The concrete design of an individual process is strongly dependent on the given organization of the respective nuclear power plant.

(3) Process goals, process inputs, process flow and process output as well as the criteria for the process assessment (such as indicators) shall be specified. Interfaces between the processes shall be identified and regulated.

(4) The organizational units and the functions (e.g., of the appointed person, of the on-site supervisor or of the shift supervisor) involved in the process flow shall be identified and specified for each individual step of the process. Insofar as activities with relevance to safe operation are performed by external companies (in particular, manufacturers, suppliers, other contractors, other nuclear power plants, operating utilities), the respective interfaces shall be regulated.

(5) All processes shall be well ordered and presented systematically structured in the form of a process model.

Note:

The processes may, for instance, be structured as

a) management and leadership processes,

b) core (or key) processes, and

c) supporting processes.

(6) Whenever processes make use of information processing systems (integrated operation management systems), for instance during fault diagnosis and remedy, maintenance or system unlocks, they shall be introduced with the appropriate quality assurance. Taking their safety relevance into account, they shall be regularly and systematically reviewed and appropriately adjusted.

3.5 Integrated Approach

(1) The processes shall be designed taking the requirements resulting from different corporate perspectives into account, and they shall be conducted using an integrated approach.

Note:

The integrated approach shall normally ensure that in the case of competing requirements and goals, those relevant to nuclear safety and radiological protection are assigned the correct priority in accordance with their respective relevance.

(2) The operating utility shall normally determine and integrate the applicable requirements from statutory and sub-statutory regulations (e.g., regarding environmental protection, occupational health and safety protection) into the management system.

(3) In this context requirements from the areas quality assurance, risk management, plant security, safety oriented leadership and aspects of human-machine interaction shall normally be taken into account.

3.6 Plan-Do-Check-Act Cycle

With regard to a continuous improvement, the plan-do-check-act cycle (PDCA cycle) shall be applied to all relevant operational activities, to partial and entire processes and to the management system as a whole.

Note:

The systematic approach to be applied in this context comprises the planning, analysis and description of operational procedures, the implementation of specified guidelines, checking the effectiveness on the basis of definite criteria and, as far as necessary, the corrections directed at optimizing these procedures.

3.7 Opportunities and Risks

Within the integrated approach of the management system opportunities and risks shall be assessed, in order to develop corresponding strategies, objectives and measures.

3.8 Documentation of the Management System

(1) The management system shall be documented. The documentation of the management system shall include:

a) Corporate and power plant policy,

b) Corporate and power plant goals,

c) Conceptual description of the management system specific to the power plant,

d) Process documents (e.g., the process descriptions and related instructions for ensuring the effectiveness of planning, execution and supervision; the process model, indicators,

e) Records regarding process results, and

f) Records regarding the results from surveillance measures (i.e., reviews, audits).

Notes:

(1) The present safety standard does not contain specifics for the structure of the documentation regarding items a), b), c), e) and f).

(2) Not all instruction-type documents referenced in the process documents as applicable need to be archived, necessarily, within the documentation of the management system.

(2) The process documents should all have a uniform structure and each contain the elements specified in **Appendix A**.

(3) The process documents shall all be consistent with the additionally applicable documents referenced therein. The process documents shall be reviewed in regular intervals to ensure that they are kept up-to-date.

(4) A systematic procedure shall be specified, that controls the structure, scope, independent assessment and handling of the documentation.

4 Responsibilities of the Managements

4.1 Responsibilities of Corporate Management

4.1.1 Basics

Corporate management is responsible for ensuring safe operation. In this context, corporate management

a) shall ensure that a management system as specified in the present safety standard is installed, maintained and reviewed and shall promote a continuous improvement of the management system,

b) shall establish a clear corporate policy that emphasizes self-commitment of the corporation with regard to high safety standards and to strengthening safety culture,

c) shall ensure that corporate policy and corporate goals are communicated and that they are implemented by plant management,

d) shall establish the basic structural and procedural organization,

e) shall ensure the availability of sufficient resources, and

f) shall review in regular intervals whether the management system is still effective.

4.1.2 Corporate policy

(1) Corporate policy shall include specifications regarding the orientation of the corporation. These specifications shall address, in particular,

a) a safe and economic operation,

b) a high safety culture,

c) the protection of the employees and of the environment,

d) the personnel development for a sustained core competence and for the expansion of competence,

e) the basics regarding personnel management,

f) the constant search for improvements,

g) the cooperation with external organizations and with the general public, and

h) the demands and expectations regarding executives and other employees.

(2) The corporate goals shall be defined based on the corporate policy.

4.1.3 Structural organization

(1) Corporate management shall ensure that the basics of a structural organization are specified such that all tasks usually performed in a power plant including those regarding controls and surveillance are performed reliably and effectively.

(2) The form of the organizational structure shall be specified such that it is free of contradictions

(3) Corporate management shall appoint the power plant director who will be responsible for safe operation. Corporate management shall ensure that the controls and responsibilities for all safety-related processes are assigned to the competent organizational units of the power plant.

(4) Clear boundaries shall be established between the decision-making authorizations of corporate management and those of the power plant director.

(5) Corporate management shall appoint the nuclear safety commissioner, the radiation protection commissioner, the IT security commissioner and the plant security commissioner. These commissioners shall be granted access and reporting rights directly to corporate management.

4.1.4 Procedural organization

Corporate management shall ensure that a process-oriented procedural organization regarding safe operation is specified and implemented in the power plant.

4.1.5 Provision of resources

(1) Corporate management shall provide the resources necessary for achieve the corporate goals. These resources are, in particular,

a) sufficient personnel for operating the power plant and maintaining the core competence, and

b) sufficient means for maintaining and improving the technical, organizational and administrative safety level of the power plant.

(2) With regard to core competence, sufficient advanced planning shall be applied concerning qualification and number of available personnel.

4.2 Responsibilities of Plant Management

4.2.1 Basics

(1) Plant management shall ensure that the power plant is operated safely and that the safety-related and statutory and regulatory requirements are observed.

(2) Within this framework, plant management is responsible for implementing the corporate requirements regarding the management system. Plant management shall develop a management system for the power plant and shall develop, implement, apply, review and continuously improve this system. In this context, plant management shall

a) concretize and communicate corporate policy and corporate goals in the form of power plant goals and behavior patterns insofar as required for safe operation. With regard to achieving and maintaining a high safety culture, the behavior patterns shall normally address, in particular, the following aspects:

   aa) the top priority of safety,

   ab) the exemplary function of executives,

   ac) the safety orientation of any decision making process,

   ad) the safety-oriented basic attitude of all employees, and

   ae) the constant search for improvements.

b) specify and implement the structural and procedural organization of the power plant based on the specifications by corporate management,

c) determine the necessary resources and shall deploy them such that safe operation is ensured and, also, that the management system can be developed, implemented, assessed and continuously be improved,

d) evaluate the effectiveness of the management system in regular intervals and, if necessary, initiate suitable measures (i.e., management review), and

e) conduct - in regular intervals according to section 6.2.2 - a self-assessment of the safety culture and an independent assessment of the safety culture and implement improvement measures, in order to maintain a high safety culture and to continuously improve it.

(3) Plant management shall ensure that the executives actively apply the management system as a management tool.

(4) Plant management shall create a culture within the power plant regarding the continuous improvement of the management system, with the personnel being committed and actively engaged in the improvement process.

N o t e :

Management tools serving this purpose are, among others, employee and feedback conferences as well as a plant-internal suggestion system.

(5) Plant management shall ensure that suitable methods regarding the decision making processes are specified and trained. These methods shall be such that it is ensured that all decisions of major significance are comprehensibly documented.

(6) Plant management shall ensure that the required testing and surveillance are performed by others than the ones performing the respective tasks.

4.2.2 Power plant goals and process goals

(1) The power plant goals shall be developed and shall be concretized and communicated in the form of individual targets or guidelines for the respective process, department or employee and shall be implemented by suitable measures.

(2) The external and internal requirements shall be determined and used as basis for developing these goals.

(3) The goals shall be specific, measurable, practicable (i.e., achievable), relevant and attached to specific points in time. They shall be documented.

(4) In the case of competing goals, plant management shall ensure that the priority of each individual goal is specified. Any conflicting goals, possibly as a result of deriving power plant goals from corporate goals, shall also be taken into consideration. The identification and resolution of conflicting goals shall be carried out systematically and shall be comprehensibly documented.

4.2.3 Structural organization

(1) The structural organization shall be designed such that the power plant director can properly attend to his overall responsibility for safe operation.

(2) Insofar as corporate management performs operative tasks at the power plant level within its responsibilities as radiation protection supervisor, these tasks shall be well differentiated from the tasks of the power plant director. When performing any tasks with a direct or indirect relation to safe operation, corporate management shall always involve the power plant director. The power plant director shall be allowed to freely decide upon all issues involving safe operation.

(3) An organization chart (organigram) shall be established, depicting all organizational units and authorized persons involved in safe operation, and showing the organizational structure and the chains of command.

(4) The duties, responsibilities and authorizations (i.e., the authorizations for making decisions and for issuing instructions) of the organizational units or their directors and representatives shall be specified free of contradictions and shall be unambiguously described. In this context, the chains of command shall be evident throughout. General guidelines shall be provided for solving possible cases of conflict. All duties, responsibilities and authorizations shall be specified such that the duties, responsibilities and authorizations are congruent with each other (principle of organizational congruency). To this end, the responsibility for performing the task and the corresponding authorizations (i.e., authorizations for making decisions and for issuing instructions) shall also be assigned whenever assigning a task.

(5) In case that tasks specified in the personnel organization of the operating manual (see KTA 1201, chapter 6.2), the respective duties shall be properly delegated to the hierarchically subordinate position. Duties may only be delegated if the delegation recipients have the required qualification and expertise. Responsibilities may not be delegated. Likewise, no duties may be delegated that are directly associated with exercising responsibilities of the radiation protection commissioner, plant security commissioner, or nuclear safety commissioner.

(6) The directors of the organizational units including their representatives shall be specified by name. The management system commissioner shall be granted access and reporting rights directly to corporate management.

(7) The management system commissioner shall be provided with sufficient support by the corporation in order to be able to perform his duties.

(8) Any guideline concerning representatives shall clearly transfer the duties, responsibilities and authorizations (i.e., instruction and decision making authorization) to the respective representative (including the main person on standby and the on-call persons). This is to ensure that, in case of absence of the person primarily holding this position, the transferred duties can be completed. The representative shall fulfill the same qualification requirements as the person represented.

(9) When defining the organizational units it shall be taken into consideration that the respective directors of the organizational units must be able to properly fulfill their managerial functions. The directive width and the directive depth shall be specified to be in accordance with the associated duties.

(10) Insofar as duties, responsibilities and authorizations concerning safe operation are fulfilled by organizational units of the corporation outside of power plant organization (e.g., corporate headquarters), these shall be depicted in the structural organization of the power plant. In this context, the requirements specified under paras. (1) through (9) shall apply.

(11) Insofar as duties concerning safe operation are outsourced, it shall be ensured that the organizational unit responsible for the task has the corresponding technical competence to evaluate and control the outsourced tasks.

(12) The complete structural organization as specified under paras. (1) through (11) shall be depicted in the Personnel Organization of the operating manual.

(13) In case the primary organization (line organization) is supplemented by a secondary organization (e.g., a flexible, inter-departmentally structured organization for projects), the latter and its interfaces to the primary organization shall be described in a consistent way and shall be unambiguously specified.

(14) The duties, responsibilities and authorizations (i.e., instruction and decision making authorizations) for

a) the shift supervisors, their representatives and the reactor operators, and
b) all positions of otherwise active personnel – similar positions may be summarily presented –

shall be described in a consistent way and shall be unambiguously specified. In this context, the line of command shall be clearly structured. General guidelines shall be provided for solving possible cases of conflict. The duties, responsibilities and authorizations shall be specified in conformance with the principle of organizational congruency specified under para. (4).

(15) The structural organization shall be reviewed in regular intervals with special emphasis on the requirements specified in this section.

Note:

The requirements regarding modifications of the organization are specified under Section 5.5.

4.2.4 Procedural organization

(1) Plant management shall implement and maintain a procedural organization that is in accordance with the requirements for a management system as specified under Section 3.

(2) Plant management shall ensure that the personnel involved in the individual processes are familiarized with these processes.

(3) Plant management shall ensure that the process documents are made available to all personnel involved in the individual processes.

Note:

The requirements regarding modifications of the organization are specified under Section 5.5.

4.2.5 Management of resources

4.2.5.1 Maintaining and developing personnel resources

(1) With special regard to maintaining core competency, sufficient personnel with the corresponding qualification shall be provided. In this context, the various commissioners required for safe operation shall be taken into account.

(2) Plant-internal personnel shall be provided in sufficient number and corresponding qualification to properly specify, surveil, evaluate and accept the tasks performed by external companies. Likewise, plant-internal personnel shall be provided in sufficient number and corresponding qualification to properly evaluate the quality of the products delivered and services rendered by manufacturers.

(3) In case duties are performed centrally by the corporation, a sufficient number of qualified personnel shall be provided there at the corporation. This also applies to the planning and execution of projects.

(4) In order to ensure that plant-internal personnel will continue to be available, both in sufficient number and qualification, an advanced personnel planning policy is required. In this context, all foreseeable personnel changes (e.g., retirements, expected personnel fluctuations, succession planning, general personnel development) shall be taken into account, and a personnel development planning shall be installed that is tuned to the respective requirements (e.g., initial training periods, overlap periods, additional training periods, maintenance of expertise, new requirements, future demands on technical expertise, long-term goals).

Note:

A five year term seems to be a sensible time period for the advanced personnel planning.

(5) The required number and qualification of the plant-internal personnel shall be determined, documented and reviewed in regular intervals and shall be updated if necessary.

(6) The number and qualification of contract personnel needed as support for the plant-internal personnel shall be determined in advance and the required means shall be appropriated.

4.2.5.2 Means for maintaining and developing technical, organizational and administrative equipment and measures

Means shall be appropriated for the maintenance and further development of technical, organizational and administrative equipment and measures regarding safe operation. In particular, these means pertain to

a) provision of work conditions that are in compliance with ergonomic principles,
b) support of plant operation and surveillance,
c) early-on detection of wear and ageing of the components and removal of these effects by a preventive, condition-oriented as well as damage-related maintenance, and
d) application of technical, organizational and administrative measures that result from experience feedback in other technical facilities or from a specifically nuclear experience feedback. In this context, findings according to the state of the art in science and technology shall be included.

4.3 Management System Commissioner

(1) The management system commissioner shall support plant management in the development, implementation, assessment and continuous improvement of the management system. In this context, the management system commissioner shall support plant management in

a) concretizing corporate policy and power plant goals,
b) converting power plant goals into targets or requirements for processes, divisions and employees,
c) reviewing the effectiveness of the management system in regular intervals,
d) reporting on the effectiveness of the management system in regular intervals,
e) internally communicating the results and state of development of the management system, and
f) developing and surveilling the schooling measures regarding the management system.

(2) The management system commissioner shall be responsible for performing the following:

a) Preparation of, and participation in conducting the annual management reviews as well as their documentation. In this context, the results from the surveillance and assessment as specified under Section 6.2 shall be evaluated.
b) Participating in the planning and coordination of the surveillance measures specified under Section 6.2.
c) Communicating with the process supervisors in regular intervals regarding the effectiveness and improvement potentials of the processes.
d) Determining improvement potentials of the management system and communicating these to plant management.
e) Surveilling the implementation of the specified measures regarding the fulfillment of plant goals and the improvement of the management system; this includes coordinating the resolving of conflicting cases and periodically communicating with plant management.
f) Participating in the corporation-wide experience feedback regarding the management system.
g) Observing the state of the art in science and technology regarding the design of management systems in nuclear power plants.

4.4 Process Supervisor

(1) A process supervisor shall be appointed for every individual process; their duties are to surveil that specified process requirements are met, to develop improvement suggestions and to support implementing the improvement measures. The process supervisors shall inform the management system commissioner about their surveillance and their suggestions of improvement measures.

(2) The respective process supervisor shall specify the methods required for surveilling the effectiveness of the respective process and whether the process specifications and process goals are being achieved.

(3) The duties, powers and responsibilities of the respective process supervisor shall be documented.

4.5 Management Review

(1) A management review shall be performed at least once a year regarding the assessment of the management system with respect to its suitability, effectiveness and efficiency.

(2) The management review shall also take the results from the requirements specified under Sections 6 and 7 into account.

(3) Any feedback received from external organizations shall be evaluated.

(4) Management review shall normally include information from the experience feedback specified under Section 5.13.

(5) The objective of management review shall be to evaluate and, as far a necessary, adapt the plant policy and plant goals.

(6) Regarding implementation of improvement measure, the respective priorities with regard to their significance for safe operation shall be specified. Implementation of the improvement measures shall be surveilled and their effectiveness evaluated.

(7) The results of the management reviews shall be documented. The significant results shall be communicated to the employees and to plant management.

5 Requirements Regarding Safe Operation

Notes:

(1) The requirements specified in this safety standard for individual processes are structured to reflect the process models that are currently established in the power plants and that can be found in the corresponding requirements of IAEA Guidelines. All processes thus chosen pertain to safe operation.

(2) The different levels of detail are based on the following considerations:

a) Wherever German nuclear standards and guidelines did not contain respective requirements, the requirements from applicable international standards were adopted as far as necessary or were adapted on the basis of common practice in Germen power plants.

b) Wherever German nuclear standards and guidelines did contain respective requirements which, however, were identified as requiring modifications, the applicable requirements were included together with the appropriately modified requirements.

c) With regard to applicable requirements in existing standards and guidelines, these were only supplemented by requirements pertaining to the procedural sequence.

5.1 Power Plant Operation

(1) The nuclear power plant shall be operated safely under consideration of the applicable licenses and provisions as well as of the written plant-internal instructions.

(2) Those persons in the control room or the remote shut-down station performing functions of monitoring the plant and of issuing orders regarding switching operations shall have the expertise of shift supervisor, of shift supervisor representative or of reactor operator in accordance with guideline Technical Expertise.

(3) It shall be ensured that the shift personnel perform their tasks in accordance with written instructions, whether this concerns specified normal operation, design basis accidents, plant-internal emergencies, inspection rounds and, insofar as applicable, special operation modes (e.g., power plant experiments). This also applies to the monitoring of power plant parameters as well as to the observance of limit values and limit conditions, to the assessment of detected deviations, to the initiation of correcting measures (e.g., switching operations) and to informing the responsible organizational unit. In this context, the effectiveness of all switching operations shall be monitored and communicated.

(4) Any decisions of special significance to power plant operation shall be comprehensibly documented.

(5) Start-up and shut-down operations, power operation and refueling shall be performed in such a way that fuel rod damage is avoided as far as possible and that the specified limit values and conditions of the deployed fuel assemblies are not exceeded during their entire operating life.

(6) Power changes shall only be performed in a planned, carefully controlled way in order to ensure that the reactor is operated within the range of specified limit values and conditions and that the intended reaction is achieved.

(7) Special operation modes (e.g., power plant experiments) shall only be performed within a planned procedure that is properly approved in accordance with applicable guidelines (e.g., shift instructions). During planning, the safety-related significance of these special operation modes shall be evaluated. Quality assurance for the planned procedure and the corresponding approval procedure shall be conducted according to the requirements specified for the development, assessment and approval of power plant operation (operating manual – BHB, testing manual – PHB, etc.).

(8) The management and communication behavior in the control room shall be specified such that all actions can be safely performed.

(9) The minimum required number of personnel in the shift groups and minimum required number of staff in the control room including their required qualification (e.g., shift supervisor) shall be specified for power operation as well as for the cold-subcritical power plant such that sufficient personnel is available for all operating conditions and for executing all duties required to be performed by the staff personnel (e.g., emergency protection, fire protection, major inspection, refueling). Procedures shall be specified to handle cases where the available staff falls below the specified minimum number.

(10) All information essential to plant operation (e.g., modifications of the operating manual, new shift instructions) shall be communicated to the shift personnel through a formalized communication system. The shift personnel shall comprehensibly confirm the receipt of this information. Type and extent of the documents to be kept available in the control room area shall be specified and shall be checked in regular intervals.

(11) Shift instructions shall be checked in regular intervals regarding their relevance and validity and, if considered mandatory, shall be transferred to the operating manual. The number of shift instructions shall be kept as low as absolutely necessary.

(12) It is required to keep a shift log into which at least the following information shall be entered:

a) essential modifications of the operation mode,

b) unusual events,

c) any unavailability of parts of the safety system and of components,

d) any maintenance tasks performed by the shift personnel on safety-related systems and components insofar as the tasks were performed outside of the task permission procedure specified in the Maintenance Regulation of the operating manual.

e) essential analysis values insofar as these are not otherwise available in the control room (e.g., in the form of printed records),

f) alarm signals, and

g) regarding change-of-shift: point in time of the shift-handover including the power plant condition and the operating condition of important systems and components as well as of simulations insofar as these are not otherwise available in the control room in the form of separate lists.

No later than the next workday, a member of the shift supervisor line management shall take careful notice of the shift log and shall document this act.

(13) The procedure for the change-of-shift shall be specified. Change-of-shift shall be performed on the basis of written operation records (e.g., data on the plant condition, on the status of initiated or planned activities as well as on all modifications and events relevant to plant operation).

(14) The shift supervisors and their superiors shall ensure that the tasks performed in the control room are safety oriented and can be performed in an as calm environment as possible.

(15) The keys for the entranceways to the exclusion areas and the redundancy compartments, for the safety-related hand-operated valves and for the cabinets of the reactor protection system shall be safe-guarded on the basis of written instructions with clearly specified authorizations. The admissibility for issuing the keys on the basis of the power plant condition, the authorization of the respective person, and the completeness of the keys upon change-of-shift shall be subject to surveillance. Issuing and returning of the keys shall be documented with the date, time of day and name of the authorized person.

(16) Plant walkthroughs shall be performed in regular intervals. These walkthroughs shall be used to record and surveil specified power plant parameters. Any detected peculiarities, deviations and conspicuous items shall be reported to the shift supervisor. Furthermore, attention shall be paid to general operative conditions (e.g., orderliness and cleanliness, unnecessary fire loads).

(17) The emergency shutdown station shall be visited in regular intervals in order to ensure that it is accessible and in proper condition with regard to operational readiness and operability. This includes the documents, communication equipment and alarm systems required for plant operation.

5.2 Maintenance

5.2.1 Maintenance policy

(1) Maintenance measures, together with the point in time they are to be performed, shall be specified for all systems, components and facilities in order to help prevent safety-related systems and components from failing and to enable early detection of their possible ageing.

(2) The maintenance measures for systems, components and facilities that are essential to safe operation shall be specified within a maintenance schedule. These maintenance measures shall be performed only on the basis of written instructions (e.g., maintenance instruction, work assignment sheet).

(3) Based on current findings (e.g., from the surveillance of highly stressed technical facilities, from results gained by diagnoses, from failure statistics and operation experience), the maintenance schedule shall be reviewed in regular intervals with regard to the extent and type of the listed tests and, insofar as necessary, shall be modified.

5.2.2 Planning of a major inspection

(1) A major inspection shall be planned in a quality assured way with special emphasis on ensuring that all inspection activities are safely performed and that unforeseen circumstances are reacted to in a flexible way.

(2) All activities planned to be performed during the major inspection (i.e., work assignment, work description, tests and inspections) shall be centrally registered in a major inspection plan. This shall ensure that the tasks to be performed in work redundancies and in operational redundancies are clearly specified with regard to the power plant conditions and that they are coordinated with each other. Insofar as necessary, their effect on safe operation shall be evaluated.

(3) Overall planning shall include establishing a realistic time schedule.

(4) Any modifications of the planning shall be entered in the major inspection plan.

(5) The major inspection plan and its modifications shall be checked by a second qualified and authorized person.

5.2.3 Failure alarms

N o t e :

In some power plants, failures and faults are registered in the form of failure and fault alarm signals and in other plants as work orders. In the present safety standard these alarms or work orders are collectively referred to as failure alarms.

(1) Failure alarms shall be issued in case of deviations from nominal conditions of technical and administrative facilities of the power plant (e.g., operating instructions, operating manual, testing systems, operation management system); the removal of these deviations shall be initiated according to their urgency, and their removal shall be surveilled.

(2) A central system shall be provided in the power plant in which the deviations from nominal conditions of technical and administrative facilities of the power plant are registered. Every employee shall be authorized to be able to initiate or issue failure alarms regarding these deviations.

N o t e :

Exempted from this procedure are those systems used outside of the classic failure reporting system (e.g., human factor analysis, almost-events, work activity observations).

(3) Each failure alarm shall be classified with regard to its safety relevance in order to be able to prioritize its urgency. In this context, it shall be checked whether the alarm requires reporting in accordance with ordinance AtSMV.

(4) The central system shall be designed to be able to notify the responsible persons and units of the pending failure alarm.

(5) The failure alarms shall, furthermore, be included and discussed in the systematic information exchange (e.g., morning conference) specified under Section 5.14, para. (3). In this context, one of the organizational units shall be unambiguously assigned with the technical clarification, and the subsequent activities shall be specified.

(6) The subsequent activities shall be surveilled until final removal of the cause of failure.

5.2.4 Planning and executing maintenance tasks

(1) All maintenance tasks shall be planned to ensure that they are performed on time and in a quality assured manner.

(2) Guidelines shall be established identifying the maintenance tasks that are required to be subjected to the work permission procedure.

(3) Within the work permission procedure the tasks shall be clearly described in such detail that the assigned personnel can execute the tasks without mistakes. All documents required for executing the tasks shall be specified (e.g., maintenance instructions, testing instructions, design-reviewed documents). A description of the measures regarding plant security and occupational health and safety protection shall be attached. The planned tasks and associated measures shall be checked and properly cleared before beginning work.

(4) The shift supervisor shall basically be responsible for clearing the individual tasks. During a major inspection, clearance of tasks within properly isolated systems may alternatively be issued by correspondingly authorized and qualified personnel (e.g., clearance office, major-inspection office).

(5) The respective authorizations for the intended work tasks shall be specified. These tasks shall be subjected to a technical clarification. In context of this clarification, the actual work activities, the associated measures to be taken regarding plant

security and occupational health and safety protection, and the required system isolations shall be checked and specified.

(6) The actual work activities shall be planned such that they can be performed with the required quality within the specified deadline.

(7) If the maintenance involves fabrication and construction measures (e.g. repair welding, re-finishing of parts, insertion of dowels) the product-related quality assurance requirements in accordance with safety standard KTA 1401 shall be taken into consideration. In particular, insofar as measurement and testing equipment is required, this equipment shall meet the requirements of safety standard KTA 1401, Sec. 10.

(8) When planning maintenance measures, the special requirements regarding radiation protection shall be taken into account already at an early stage.

(9) The function tests required within the framework of the respective tasks shall be clearly described.

(10) The tasks shall be performed in accordance with the detailed plans. If during task activities it becomes apparent that the task cannot be performed as planned, work shall be ceased and the plan shall be changed in cooperation with the associated responsible persons.

(11) The on-site supervisors shall have the expertise to assess whether the maintenance tasks were properly executed. Within the limits of their possibilities, the on-site supervisors shall assure themselves that in the work area of their supervision any measures relating to plant security and occupational health and safety protection performed by any units other than the shift personnel are properly performed and, also, that the measures they themselves ordered to be initiated are carried out. They shall, furthermore, introduce the personnel to the tasks to be performed and to the specified measures, and they shall make certain that these measures are complied with. They shall ensure that only approved auxiliary and operating materials (e.g., chemicals, adhesive tapes) are used. Insofar as measurement and testing equipment is required, this equipment shall meet the requirements of safety standard KTA 1401, Sec. 10.

(12) If in the course of maintenance activities faulty parts are found, these parts shall be marked accordingly, shall be separated to ensure that they are not reused and shall be stored until all facts have been clarified.

(13) After completion of the maintenance activities a function test shall be performed to demonstrate that the respective components and systems fulfill the requirements regarding functional availability. Completion of the activities shall be reported without delay.

(14) Any preventive maintenance during power operation (PMO) of the safety system may only be performed on partial systems or on components of standby systems.

(15) The points in time for the PMO measures shall be specified such that the reliability of the safety functions is not significantly affected. In this context, points in time of tests performed on the other redundancies shall be taken into consideration.

(16) When planning PMO measures, the prerequisites and conditions for operating the power plant as specified in the operating manual shall be taken into account. When planning PMO measures any deviations from the conditions and parameters of normal operation shall be avoided as far as possible.

(17) PMO measures shall be executed such that they have no impact on the availability of other equipment of the safety system. The required isolation of systems shall be performed such that, when necessary, a rapid normalization is possible.

(18) The durations and causes of any non-availabilities occurring in conjunction with PMO measures as well as the respective plant conditions shall be documented and assessed.

5.2.5 Safety measures

(1) Depending on the individual safety requirements, the safety measures including system isolation measures shall be planned and executed accordingly.

(2) Special procedures shall be specified for the planning and executing of safety measures.

Note:

In addition to system isolation measures, other safety measures include measures regarding, e.g., radiation protection, fire protection, permission for the internal inspection of vessels, occupational health and safety protection.

(3) With regard to system isolation and normalizing measures, their planning shall be subjected to independent monitoring.

(4) The shift supervisor shall basically be responsible for releasing systems for their isolation and only after having checked that all prerequisites such as the availability of the necessary equipment of the safety system for the respective power plant condition are fulfilled.

(5) During a major inspection, the release of systems for isolation and the normalization of components and partial systems within the systems released for isolation may alternatively be issued by correspondingly authorized and qualified personnel (e.g., clearance office, major-inspection office).

(6) The isolated plant components shall be properly marked both in the major control room and on-site and, as necessary, be secured against an inadvertent reenabling switching.

(7) Any modifications of the planning of system isolation measures shall be quality assured in the same way as a new system isolation.

(8) After a corresponding feedback as specified under Section 5.2.4, para (13) that the activities have been completed, the shift supervisor shall basically be responsible for initiating the normalizing procedure, i.e., restoring the system to operational readiness. The normalization within the systems released for isolation may alternatively be initiated by correspondingly authorized and qualified personnel (e.g., clearance office, major-inspection office).

5.2.6 Inservice inspections

(1) Inservice inspections shall be performed to verify the proper functioning, the integrity, the stability and the proper condition of the systems, components and equipment specified as being safety-related in the nuclear licensing procedure, and also of the equipment for monitoring the safety-related limit values.

(2) Safety-related systems, components and equipment as well as the availability parameters stated in the safety specification (cf. safety standard KTA 1201, Section 7.1, item g)) shall be subjected to inservice inspections at specified testing intervals.

(3) The extent and the objectives of the inservice inspections shall be evaluated in regular intervals and shall be adjusted to any new findings.

(4) As far as possible, the conditions of the inservice inspections should be representative of the operating conditions. The power plant condition shall be chosen accordingly.

(5) As far as possible, inservice inspections should be integrally performed and should overlap each other.

(6) If the inspection result lies outside of permissible deviations with possible repercussions on the conditions regarding power operation of the plant, the shift supervisor shall immediately determine whether this would also result in a reduction of the availability of the safety system. Additionally, a detailed assessment shall be performed by the proper technical department. The final measures shall be specified after the detailed assessment becomes available. Any deviations detected in the course of inservice inspections shall be documented.

(7) The measurement and testing equipment required for the inservice inspections shall meet the requirements of safety standard KTA 1401, Sec. 10.

5.3 Modification of the Power Plant and of Plant Operation

(1) It shall be ensured that the design, checking, monitoring and execution of any permanent and temporary modifications of the technical power plant equipment and of the written operating procedures are performed in conformance with design boundary conditions and under consideration of the applicable rules and standards.

(2) All modifications shall be performed following a specified procedure. This applies to temporary and permanent modifications of the power plant as well as to modifications of the documentation.

(3) If the modification involves fabrication and construction measures (e.g. welding, fabrication of parts, insertion of dowels) the product-related quality assurance requirements in accordance with safety standard KTA 1401 shall be taken into consideration. In particular, insofar as measurement and testing equipment is required, this equipment shall meet the requirements of safety standard KTA 1401, Sec. 10.

(4) The plant modifications shall be evaluated with regard to the following aspects:

a) relevance with respect to safety,

b) repercussions on the existing power plant design,

c) repercussions on the handling of design basis accidents and emergencies,

d) repercussions on power plant security,

e) fulfillment of statutory and regulatory requirements as well as the quality assurance requirements in accordance with the safety relevance of the modification,

f) occupational health and safety protection of the deployed personnel,

g) additional need for information, education and training,

h) acquisition of the required technical equipment, and

i) need for a special commissioning program.

(5) The planning and implementation of modifications shall take the following aspects into account:

a) specification of the responsibilities,

b) categorization of the modifications according to their safety relevance,

c) involvement of all organizational units concerned,

d) integration into the existing power plant concept and the existing documentation structure,

e) taking account of Section 5.2.4 in the case of modifications that are subject to the Maintenance Regulation of the operating manual,

f) checking the modifications and performing function tests before transfer to operation with the tests being performed under conditions as real as possible and showing that the respective components and systems have their full operational capability,

g) required training during and after performing the modifications,

h) assessment and updating of the plant-specific simulator as well as of the respective training documents, and

i) updating the power plant documentation.

(6) Temporary modifications shall be limited both in duration and number. They shall be clearly marked as such both onsite in the plant and in the documents on hand in the major control room or appropriate substitute measures shall be taken. A formal procedures shall be specified for the timely information of the associated personnel with regard to the temporary modifications and their effects on safe operation.

5.4 Commissioning after Modifications

(1) Commissioning tests shall be performed after implementing modifications in the power plant to verify that they function in accordance with the design requirements.

Note:

Whether or not a special commissioning program is necessary results from the assessment specified under Section 5.3, para. (4).

(2) The special commissioning program shall be established such that it is ensured that the power plant remains within its design limits during commissioning.

(3) The special commissioning program shall comprise all necessary tests required to verify that the power plant is in the condition required by the design documents on which the licensing was based and that the power plant can be operated within the operational limits and conditions. In particular, the following data shall be specified:

a) the goal of the commissioning procedure,

b) the commissioning phases and the acceptance criteria,

c) the conditions of the required systems,

d) the activities required to achieve these conditions,

e) the individual limit values to be observed, and

f) information on the required documentation and on the test protocols and test documents to be archived (commissioning documentation).

(4) The test results shall be assessed after every phase and before starting the next phase. The next phase may not be started before the results from the previous phase fulfill the respective prerequisites from a safety point of view.

(5) Commissioning shall be performed with a view to confirming or determining the operating parameters, the limit values and plant operation modes and, if necessary, to evaluate these data with respect to the specified design limits. Insofar as necessary, these data shall be included in the operation documents. All data shall be archived.

5.5 Modification of the Organization

(1) It shall be ensured that any organizational modification keeps up a structural and procedural organization that is free of contradictions and remains safety oriented.

(2) Modification of the organization that may affect safe operation shall be carefully planned and implemented by a systematic and comprehensible procedure in order to avoid any negative repercussions. In this context,

a) the improvements (goals) attempted by the organizational modifications shall be specified and documented,

b) the possible organizational alternatives shall be evaluated,

c) the possible effects of the organizational modifications on safe operation shall be analyzed and taken into account during planing and implementation and shall be checked after their implementation,

d) the execution and implementation of the organizational modifications shall be carefully planned and documented,

e) the accompanying measures shall be specified that are needed for an effective organizational modification (e.g., communication, training, preparation of documents), and

f) the functionality of the organization shall be checked during and after implementing the modification.

(3) After a suitable time period it shall be checked, whether the organizational modifications have achieved the intended goals.

5.6 Plant Monitoring

5.6.1 Reactor-physical monitoring

(1) Reactor-physical monitoring shall be performed to ensure that the reactivity is controlled under all operating conditions.

(2) Equipment and measures shall be provided which enable controlling the reactivity under all operating conditions. In particular, after loading or repositioning of fuel assemblies, reactor-physical tests shall be performed before and during start-up to verify that the reactor-physical characteristics of the core correspond to the values projected by the associated advance calculations.

(3) The reactor-physical characteristics shall be monitored throughout the fuel cycle, shall be analyzed with regard to trends and shall be evaluated with regard to a possible unusual behavior. Furthermore, by reactor-physical monitoring it shall be ensured that the actual core characteristics are in conformance with the design requirements and that the basic operating parameters are recorded and archived in a logical, uniform and retrievable way.

5.6.2 Chemical and radio-chemical monitoring

(1) Chemical and radio-chemical monitoring shall be performed to ensure a sustained integrity of structures, systems and equipment, to ensure an early detection of any sources of radioactivity, to allow the planning of radiological protection measures and to ensure early detection of any fuel rod defects.

(2) The radioactivity of the main coolant shall be monitored in regular intervals to ensure early detection of abnormal changes (e.g., due to fuel assembly defects) and, thus, to enable taking corresponding measures.

(3) An analysis program shall be established for the necessary chemical and radio-chemical monitoring measures which shall include all monitoring measures of the media in safety-relevant systems.

(4) With regard to maintaining the chemical parameters, automatic measurements of chemical data or laboratory analyses shall be provided, thus, enabling taking possibly necessary countermeasures.

(5) Before deploying any auxiliary and operating materials it shall be ensured that the equipment or system concerned will not be detrimentally affected.

5.6.3 Radiological monitoring

(1) Radiological monitoring shall be performed to ensure that the officially specified limit values are observed, that any unnecessary radiation exposure of personnel, population and environment is avoided and that, under consideration of the conditions of each individual case, the radiation exposure is kept as small as possible even below the limit values.

(2) A radiological protection program shall be established specifying the radiological monitoring inside and outside of the power plant. In this context, the required equipment and measures shall be provided.

(3) The discharge of radioactive substances shall be continuously monitored and documented.

(4) The personnel working inside the power plant shall be subjected to an anticipatory monitoring with regard to observance of their permissible annual and lifetime doses.

5.7 Protection Requirements and Security Measures

5.7.1 Fire protection

(1) It shall be ensured by preventive measures that fires are reliably prevented and that a nonetheless possible fire can be detected and localized early and reliably and that any sequential effects can be limited.

(2) The fire protection concept shall be developed in accordance with safety standard KTA 2101, Parts 1, 2 and 3 and shall be checked in regular intervals. In this context, the following aspects shall be taken into account:

a) application of the defense-in-depth concept,

b) analysis of the effects of technical modifications on the fire protection concept and, insofar as necessary, implementation of the corresponding corrections, and

c) inspection, servicing and checking of the fire protection systems and equipment in regular intervals.

(3) Fire protection shall take the aspects of radiological protection into account and, in this context, in particular the radiological protection of the fire protection personnel.

5.7.2 Plant security and IT-security

(1) Plant security measures shall be established to ensure that effective security measures will be taken against disruptive actions or any other interference by third parties.

(2) The plant security measures shall be planned, implemented and maintained on the basis of guidelines SEWD and SEWD-IT, thus ensuring the necessary protection against disruptive actions or any other interference by third parties.

(3) The plant security concept shall be checked in regular intervals. Likewise, the plant security systems and measures shall be checked in regular intervals.

5.8 Emergency Protection

(1) Measures regarding emergency protection shall ensure that in case of an emergency (i.e., a beyond-design-basis event sequence) any effects on the environment are prevented or effectively mitigated.

(2) In this context, with regard to restoring compliance with protective goals and to limiting the effects of violating a protective goal, sufficient personnel as well as administrative and technical measures shall be provided and shall be described in the emergency manual.

(3) An emergency organization shall be specified in writing. In particular, the authorizations for making decisions and for issuing instructions as well as the communication and reporting paths shall be clearly specified; furthermore, the cooperation with the proper authorities and external organizations shall be specified. The specified structure of the emergency organization may only be supplemental and shall not be in contradiction to the Personnel Organization of the operating manual.

(4) The power plant director or one of his representatives shall be the head of emergency organization.

(5) Criteria shall be specified for convening of the emergency organization and for issuing internal and external alarms.

(6) The measures of the plant-internal emergency protection shall be carefully planned. In this context, the possibility for the occurrence of a combination of nuclear and non-nuclear hazards such as fire, poisonous or suffocating gasses shall be taken into account.

(7) The technical know-how and technical equipment of external organizations may be used as support for the emergency organization. In this context, corresponding advance arrangements shall be made.

(8) The measures of plant-internal emergency protection shall be checked with regard to their feasibility, and their effectiveness shall be evaluated. This shall included evaluating their compatibility with the safety concept.

(9) All facilities, instruments, tools, protective gear, documents and communication systems that are needed in case of an emergency shall be accessible at all times. Regular servicing and inspections of the technical items shall be performed as far as possible and sensible in order to ensure their functional capability.

(10) A training program shall be established ensuring that the plant personnel and the personnel of the consulted external organizations have the required knowledge and abilities to cope with the tasks even under emergency conditions (emergency training program).

(11) With regard to maintaining the knowledge and abilities of the personnel and to testing the organizational procedures, the measures of the plant-internal emergency protection including the external lines of communication shall be practiced in exercises at least once a year. Insofar as possible, these exercises shall normally include use of the power plant simulator.

5.9 Personnel Qualification and Training

(1) The required qualification and knowledge required of the responsible personnel as well as of the personnel otherwise engaged shall be specified and maintained accordingly.

Note:

The required depth of knowledge is detailed in technical qualification guidelines.

(2) The qualification and knowledge required of responsible personnel as well as of the personnel or groups otherwise engaged in similar positions shall be specified for the persons in this position and shall be documented accordingly.

(3) Aside from the technical and administrative expertise, when filling vacancies, performing staff evaluations or choosing and advancing managerial staff, their methodical competence, leadership competence, social competence as well as safety oriented attitude of the persons in question shall also be taken into account.

(4) The qualification required of the personnel for the individual tasks shall be specified and verified.

(5) With regard to the establishment and maintenance of the personnel qualification and know-how, training programs (i.e., schoolings, training sessions, self-study courses) shall be developed and performed that are tailored to the specific needs of the organization and of the individual. The training program shall also focus on qualification, methodical competence and social competence. In addition, leadership skills shall be conveyed to the managerial personnel. The training program shall be carried out well coordinated with the requirements of plant operation.

(6) Procedures shall be established by which long-standing staff members will be enabled to pass on the special knowledge, skills and experience acquired during their professional life.

(7) All adequate equipment including a representative power plant simulator shall be used in the training of the personnel. Training equipment and methods shall be promptly updated to the current plant condition.

(8) The training program and actual training measures shall be designed such that each holder of a position becomes fully aware of the relevance and importance of the respective task in view of safe operation. The training program shall normally further the individual's attitude that due attention must be paid to safety concerns.

(9) Operating experience from the own power plant as well as any relevant experience from other power plants shall be incorporated into the training program. In this context, the causes of any events and the correcting measures taken shall be conveyed.

(10) The executives shall be responsible for determining the training requirements of their personnel.

(11) All personnel working in the power plant shall be generally trained in

a) radiation protection (if the task requires presence in the controlled-access area),

b) fire protection,

c) occupational health and safety protection, and

d) technical familiarity with the power plant.

(12) All training measures performed shall be documented specifically for each individual.

(13) The training program and the resulting measures (i.e., schoolings, training sessions, self-study courses) shall be evaluated with regard to their effectiveness and quality; if necessary, improvement measures shall be implemented.

(14) Training shall normally be performed by qualified and experienced personnel who have the corresponding teaching skills and who shall normally be acquainted with the work routine and practice at the place where the task is to be performed.

(15) The requirements regarding qualification, knowledge and training of external personnel shall be in conformance with the task-specific requirements of comparable activities by plant personnel.

5.10 Procurement of Deliveries and Services

(1) It shall be ensured that all deliveries and services rendered fulfill the quality requirements specified within the framework of construction and operation of the power plant.

Note:

The process for the procurement of deliveries and services is applied both to the internal procedures within the corporation as well as to the delivery of wares and rendering of services by external organizations (e.g., qualification, goods delivery and service rendering at the power plant). The requirements of the procedure applied outside of the power plant by the manufacturer or servicing organization is governed by safety standard KTA 1401. Safety standard KTA 1401 also applies to any fabrication performed within the power plant.

(2) Safety standard KTA 1401 shall be applied to all deliveries and services rendered.

(3) The procurement documents with regard to procurement of deliveries and services to be rendered shall specify and contain the following data:

a) quality characteristics and deployment conditions,

b) specifications to be met,

c) required documentation,

d) required licenses, verifications, permits,

e) requirements regarding traceability,

f) obligation of the contractor to provide information in case of modifications,

g) procedure in case of deviations in accordance with safety standard KTA 1401, Sec. 11.

(4) The responsibilities for the procurement of deliveries and services in the corporation shall be clearly established. The management system shall provide procedures and regulations, in order to fulfil the requirements for the procurement of deliveries and services, including the corresponding monitoring tasks. In this context it shall be ensured, that comprehension and knowledge about the product or service, that is being procured, is available within the organisation.

(5) All deliveries and the associated documentation shall be checked with regard to their conformance with the procurement documents and also with regard to transportation damages. The results of the receiving inspection shall be documented. Insofar as special receiving inspections and third-party participations are specified, these shall be initiated.

(6) Special surveillance shall be performed to ensure that the contractors fulfill the requirements specified under para. (3) regarding their deliveries and services rendered.

(7) All deliveries shall be systematically marked for identification. The procedure for the handling of deviations shall be specified.

(8) In order to avoid damage, loss, diminution of value or negligent use, it shall be specified for all deliveries how they shall be handled, transported, stored, maintained and processed. In this context, it shall be ensured that proper storage conditions exist (e.g., prevention of fires and water damages, access restriction for unauthorized persons, type of packaging). In order prevent a quality reduction of materials that age with prolonged storage, their storage life shall be restricted accordingly.

(9) The procedure for issuing materials from storage shall be specified. Materials may only be issued to authorized personnel. Only those materials may be issued

a) that can unambiguously be identified,

b) that fulfill the storage conditions and whose specified storage life has not been exceeded,

c) for which the procedural rules regarding auxiliary and operating media are fulfilled, and

d) that have passed the receiving inspection (cf. para. (4)).

(10) Suitable measures shall be specified and implemented by which it is ensured that the required quality is maintained in the period between issuing from storage and deployment in the power plant.

5.11 Handling of Fuel Assemblies and other Core Internals

(1) It shall be ensured that between delivery and removal from the plant the fuel assemblies and other core internals (e.g., control assemblies, flow restrictor assemblies) are safely handled, safely stored and safely deployed in the reactor.

(2) The fuel assemblies and the control assemblies shall be unambiguously marked for identification. All activities from storage to deployment shall be documented and closely followed. The deployment of the flow restrictor assemblies may be closely followed by using procedural step plans.

(3) Before beginning any handling of fuel assemblies or other core internals, the respective task shall be planned, checked and cleared. The planning shall take into consideration the requirements of the nuclear license and of the StrlSchV as well as the requirements in accordance with safety standards KTA 3101 Parts 1, 2 and 3, KTA 3107 and KTA 3602. Planning shall also take the mitigation of design basis accidents into account that might occur during these activities. Written procedural guidelines or instructions shall be provided for the execution of all handling activities. The lifting equipment and the load attaching points shall meet the requirements in accordance with safety standards KTA 3902, KTA 3903 and KTA 3905.

(4) Regarding the loading of the reactor core (including fuel reloading and repositioning), boundary conditions and physical parameters shall be specified (safety-related basic conditions) within which the core loading is permissible from a safety point of view. It shall be verified on the basis of the fuel loading plan for each fuel cycle that these requirements are met.

(5) Prior to the initial handling of a fuel assembly or other core internals in the power plant and before their initial deployment in the reactor core it shall have been verified that they are in conformance with the requirements of the nuclear license and with the specifications. The associated documentation (e.g., certificate of the final fabrication inspection, fabrication documents, receiving inspection, certification by the authorized expert) shall be at hand.

(6) Fuel assemblies and core internals shall be subjected to inspections before their deployment in the reactor core. It shall be ensured by random inspections prior to re-deployment that the fuel assemblies and other core internals are in proper condition.

(7) Handling of the fuel assemblies shall be performed in accordance with safety standards KTA 3107 and KTA 3602. The handling shall be performed following specified procedural step plans. After completion of the entire handling procedure, the condition achieved shall be checked.

(8) Fuel handling shall be performed in such a way that damages are prevented, cleanliness is ensured, introduction of debris and contaminants are prevented and radiation exposure of personnel is minimized.

(9) All handling activities shall be coordinated with the major control room. The fuel handling activities in the fuel pool and in the reactor pressure vessel may only be performed in close communication with the major control room.

(10) Fuel assemblies and core internals shall be stored only in the previously specified storage locations.

(11) The transport of fuel assemblies and core internals inside and outside of the power plant may be carried out only in certified shipping casks. A shipping cask provision plan shall be established by which it shall be ensured that all transport requirements are fulfilled. Possible impacts on the power plant from the handling of shipping casks shall be taken into account.

5.12 Handling of Radioactive Waste

(1) It shall be ensured by suitable operating procedures that the amount of radioactive waste is kept as small as possible both in radioactivity and in quantity.

(2) A waste concept regarding safe handling of radioactive waste shall be developed and implemented that shall be in accordance with guideline Radwaste Control. This concept shall specify the procedures for collecting, separating, conditioning, transport and storage of radioactive waste. The documentation and reporting regarding production and storage of radioactive waste shall be carried out in accordance with StrlSchV.

(3) The conditioning and intermediate storage of radioactive waste shall be performed and controlled in accordance with the requirements of a Safe Intermediate Storage and of a Final Storage (acceptance specification). All documents regarding waste production, waste classification as well as regarding

waste storage, waste conditioning and final storage shall be kept and stored.

5.13 Feedback of Experience

Plant-internal and plant-external experience shall be used to improve safe operation through learning, training and implementing procedures.

5.13.1 Basics

(1) A systematic exchange of information of safety-related operating experience shall be organized. The distribution of information, information feedback, and how information is to be processed and documented shall be specified. In this context, the plant-internal experience and the experience of other power plant operators shall be assessed and communicated.

(2) The plant-internal and plant-external operating experience shall be assessed from a technical standpoint by the particular organizational unit in charge and, from a general standpoint, by an independent organizational unit.

5.13.2 Plant-internal experience feedback

(1) Regarding the plant-internal experience feedback, operational procedures shall be installed to ensure a consistent mutual exchange of information with respect to operational events. These operational procedures shall specify the ways in which electronic, written or verbal information can be used for this exchange.

Note:

The plant-internal feedback of experience involves, e.g., the failure alarm procedure, daily work conferences as well as procedures for passing on information about almost-events.

(2) Further processing of these input data shall be specified in accordance with their safety relevance.

(3) Cause analyses shall be performed taking all aspects of man, technology, organization as well as their interaction into account. The procedures for performing these analyses shall be specified. In this context, criteria shall be specified regarding the participation of independent organizational units and regarding a further in-depth analysis. In-depth analyses shall be performed by an independent organizational unit.

(4) Modification measures shall be specified on the basis of the analysis results. The implementation of these measures shall be surveilled and their effectiveness evaluated through suitable methods.

(5) The causes determined from these analyses shall be subjected to a trend analysis in order to enable an early detection and prevention of a possibly occurring accumulation of these causes.

5.13.3 External experience feedback

(1) With regard to external experience feedback, the experience and findings made by other power plant operators and other institutions (e.g., authorities, authorized experts, manufacturers) shall be taken into consideration and the transferability for the own power plant evaluated. In this context, the following source of information shall be utilized:

a) reportable events,

b) operation experience as reported in national and international information systems,

c) exchange of the plant-internal experience with other power plants,

d) exchange of information in working groups,

e) exchange of information with manufacturers.

(2) In case the experience is transferrable to the own power plant, the measures required shall be specified and their implementation closely followed.

5.13.4 New findings

New scientific and technological findings shall be considered and evaluated within the framework of experience feedback.

5.14 Communication

(1) It shall be ensured that safety-relevant information is effectively communicated.

(2) In this context, communication paths from the executives to personnel and, vice versa, from the personnel to executives shall be established and practiced.

(3) A systematic exchange of information (e.g., early morning or work conferences, preparatory work conferences) shall be established and practiced between executives, personnel and the shifts for the passing-on of information that is necessary for the proper performance of safety-relevant tasks.

(4) The effectiveness of the communication paths shall be ensured by installing unambiguous lines of communication and by enabling a fast, open and effective information transfer.

(5) Reports on technical and organizational faults and on findings by the personnel at all levels of the corporation, both within and outside of line management shall normally be supported. The person having presented the report shall be informed within a reasonable period of time on the further processing of the respective report.

(6) The communication with external organizations (e.g., manufacturers, supervisory authorities, authorized experts, other nuclear power plants, operating utilities and the public) shall be ensured via defined and effective communication paths.

(7) An open and confidential atmosphere shall be established and furthered for the communication between plant operator and authorities. Informational data shall be exchanged following specified guidelines (e.g., notification and reporting procedure, regulatory meetings). In this context, the informational needs regarding the statutory tasks of the authorities shall be taken into account. In particular, the supervisory authority shall be informed without delay if the plant operator, based on scientific and technical findings, must put in question that the mitigation of design basis accidents can still be verified.

5.15 Preparation and Execution of Projects

(1) Any non-routine, time restricted, complex and inter-departmental task shall be organized and executed in a quality-assured and orderly manner.

(2) The respective project work order shall be unambiguously formulated and shall be issued by the responsible organizational unit.

(3) A steering committee shall be responsible for initiating, steering and ending a project. Managerial staff from the organizational units affected by the project shall be represented in the steering committee in order to be able to solve possible conflicts via structural-organizational responsibilities and authorizations. The specified structure of the project organization may not be in contradiction to the responsibilities specified in the Personnel Organization of the operating manual.

(4) The steering committee shall be responsible for concretizing the project, for installing the project management and the

personnel structure of the project and for providing the required resources.

(5) On the basis of a project plan, project management shall specify the detailed requirements, the physical procedure and time sequence as well as the controls and surveilling measures for the project. Project management shall report to the steering committee and, insofar as necessary, shall submit to them for their final decision any modifications or corrections of the original specifications.

5.16 Safety Reviews

(1) The safety aspects of a nuclear power plant shall be subjected to an integrated assessment in regular intervals.

(2) The periodic safety reviews shall be performed in accordance with the PSR guidelines (cf. Appendix B).

(3) Safety reviews shall only be performed after having been carefully planned and specified in writing

(4) The safety reviews shall be subjected to internal reviews by the plant operator that shall generally follow the PSR guidelines (cf. Appendix B). This review shall normally not be performed by persons that were directly involved in the particular part of the safety review under scrutiny.

(5) Improvement potentials detected in the safety reviews shall be identified and evaluated. The implementation of the improvement measures identified in the safety reviews in the power plant shall be continuously and closely followed. With regard to these implementations, the responsibilities, priorities and target dates shall be specified.

5.17 Documentation

(1) It shall be ensured that the entire documentation of the nuclear power plant is created, modified, recorded, archived and maintained in accordance with specified internal and external requirements.

(2) A systematic procedure shall be specified and described that details the structure, extent, independent assessment and handling of the documents from their creation to archiving and final destruction. In this context, safety standard KTA 1404 shall be taken into account.

6 Surveillance, Analysis, Assessment and Improvements

6.1 General

In order to ensure the effectiveness of the management system, the individual processes shall be supervised and steered and shall be continually improved. With regard to supervision and steering, a continuous monitoring of the processes shall be provided.

Note:

The requirements regarding management review are specified under Section 4.5.

6.2 Surveillance and Assessment

6.2.1 Process assessment

Regularly recurring assessments of the management system shall be performed based on self-assessments, reviews, audits, process monitoring and indicators, in particular in order to

a) ascertain that the process goals have been reached,

b) evaluate the effectiveness of the process,

c) ensure that the process specifications are fulfilled, and

d) detect possibilities for improvements.

6.2.1.1 Reviews

(1) Reviews should be performed to enable comparing the own system with that of other power plants at a national and international level and to optimize the processes by this exchange of expertise.

(2) Experts with the required expertise and experience regarding the subject to be reviewed should be invited to participate in the review.

6.2.1.2 Audits

(1) Audits shall be performed in order to determine in how far the

a) internal and external requirements specified for the processes can be fulfilled,

b) procedures and tasks can be performed and maintained as specified, and

c) processes can be improved.

(2) A general plan shall be established for the audits by which it is ensured that all processes are taken into account.

(3) Audits shall be performed regularly in appropriate intervals. The auditors shall be qualified, independent and not personally involved in the process being audited.

(4) When planning an audit, results from previous audits as well as other findings from process surveillance shall be taken into account.

6.2.1.3 Process monitoring

(1) All processes shall be monitored in order to enable an early detection of deviations from

a) the specified procedural sequences, and

b) the specified procedural results.

(2) Process monitoring shall comprise observing the procedural sequences as well as the activities undertaken in this context. Process monitoring shall be performed by the process supervisor, by the persons involved in the process and by executives at all hierarchal levels.

6.2.1.4 Indicators

(1) With regard to process assessments, indicators shall normally be introduced. These indicators shall serve in monitoring the degree of goal fulfillment by the individual processes or individual procedural steps and, insofar as sensibly possible, shall serve in assessing the performance of the process with regard to the specification. Indicators should also be introduced regarding assessment of the fulfillment of the power plant goals.

(2) Trend analyses shall be performed in regular intervals in order to enable an early detection and prevention of unwanted deviations with respect to reaching the power plant and process goals.

6.2.2 Process-independent assessment

(1) Plant management and executives shall normally perform process-independent assessments of the management system on the basis of, e.g., plant walk-throughs and work observations, in order to identify improvement possibilities regarding work behavior and safety culture.

(2) Self-assessments and independent assessments of the safety culture for the entire plant shall be conducted regularly under the participation of technical experts. The results of the assessments shall normally be made accessible within the organization of the plant for all employees on all levels.

Note:

For the assessment of the safety culture it is recommended to combine quantitative (such as employee surveys, indicators, etc.) and qualitative (such as interviews, observations, etc.) methods. The goal for the use of several methods for the evaluation of the safety culture is to balance strengths vs. weaknesses, so that the strengths of one method may offset the weaknesses of the other methods.

(3) In this context, plant management should also initiate carrying out national and international reviews.

6.3 Data Analysis

(1) With regard to demonstrating and assessing the suitability and effectiveness of the management system certain data shall be collected, recorded and analyzed with specified methods.

(2) Data analysis shall include data from the following sources:

a) surveillance and assessment (cf. Section 6.2),

b) surveillance of the power plant operation (cf. Section 5.1),

c) monitoring of specific physical, chemical, radio-chemical and radiological parameters (cf. Section 5.6), and

d) feedback of experience (cf. Section 5.13).

6.4 Improvements

In case of inadequate process results, of deviations in the process performance or of the need for improvements identified by the process-independent assessments, by the data analyses or by the management review, the corresponding improvement measures shall be specified.

7 Implementation of Improvement Measures

(1) The implementation of all improvement measures of the management system shall be centrally registered, documented and monitored.

Note:

The need for improvement measures may arise from checking the management system as specified under Section 6 or from findings generated by requirements specified under Section 5.

(2) The planning and implementation of improvement measures shall be closely monitored with regard to scheduling. The effectiveness of the improvement measures shall be checked with suitable methods.

(3) Guidelines shall be developed by which the coordination of the various improvement measures is governed and by which the priorities, resources, tasks and responsibilities are specified.

(4) The improvement measures shall be communicated.

Appendix A

Basic Elements for the Structure of a Process Document

- Table of contents
- Goal and objective of the process
- Name of the process supervisor
- Participating organizational units (including external organizations)
- Process-specific and additionally applicable documents
- Input (process initiator – customer), output (process result – supplier), interface to other processes
- Outline of the process
- Process visualization, e.g., process flowchart with a sequentially exact presentation of the individual procedural steps
- Placement of the individual process within the process landscape or within the process model
- Description of the procedural steps essential to reaching the process goal, including description of the basic principles and results of the individual procedural steps as well as who is responsible for the individual procedural step
- Description of the interfaces (transfer of data or materials according to specified requirements)
- Overview of the indicators together with the time period for their acquisition

Appendix B

Regulations and Literature 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 nuclear energy and the protection against its hazards (Atomic Energy Act – AtG) of December 23, 1959, in the new version promulgated on July 15, 1985 (BGBl. I 1985, p. 1565), last revised by Article 2 of the Law of July 20, 2017 (BGBl. I p. 2802)
StrlSchV		Ordinance on the protection from damage by ionizing radiation (Radiological Protection Ordinance – StrlSchV) of July 20, 2001 (BGBl. I, p. 1714; 2002 I, p. 1459), most recently changed according to Article 10 by Article 6 of the Act of January 27, 2017 (BGBl. I, p. 114, 1222)
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 1 of the Ordinance of June 8, 2010 (BGBl. I, p. 755)
SiAnf	(2015-03)	Safety Requirements for Nuclear Power Plants (SiAnf) of 22 November 2012 (BAnz AT 24.01.2013 B3), revised version of 3 March 2015 (BAnz AT 30.03.2015 B2).
Interpretations to SiAnf	(2015-03)	Interpretations of the "Safety Requirements for Nuclear Power Plants of 22 November 2012" (BAnz AT 24.01.2013 B3), revised version of 3 March 2015 (BAnz AT 30.03.2015 B2)
PSR Guidelines		Regulatory guidelines for performing periodical safety reviews (PSR) in nuclear power reactors of the Federal Republic of Germany
PSR Basics	(1997-08)	Basics regarding the periodical safety review of August 18, 1997 (BAnz 1997, No. 232a)
PSR Safety Status Analysis	(1997-08)	Safety status analysis of August 18, 1997 (BAnz 1997, No. 232a)
PSR Deterministic Safety Analysis	(1998-06)	Deterministic safety analysis of June 25, 1998 (BAnz 1998, No. 153)
PSR Probabilistic Safety Analysis	(2005-08)	Probabilistic safety analysis of August 30, 2005 (BAnz 2005, No. 207)
Guideline Technical Expertise	(2012-05)	Regulatory guideline on required technical expertise of personnel in nuclear power plants of May 24, 2012 (GMBl. 2011, No. 34, p. 611)
Guideline Radwaste Control	(2008-11)	Regulatory guideline for the control of residual radioactive material and radioactive waste of November 11, 2008 (BAnz 2008, No. 197, p. 4777)
Guideline SEWD	(1995-12)	Regulatory guideline for the protection of nuclear power plants with light-water reactors against disruptive actions or other third-party intervention of December 6, 1995 (GMBl. 1996, No. 2, p. 32) – *wording: unpublished*
Guideline SEWD IT	(2013-07)	Regulatory guideline for the protection of IT-systems in nuclear installations of safety categories I and II against disruptive actions or other third-party intervention (Guideline SEWD IT) of July 8, 2013 (GMBl. 2013, Nr. 36, S. 711) – *wording: unpublished*
KTA 1201	(2015-11)	Requirements for the operating manual
KTA 1202	(2017-11)	Requirements for the testing manual
KTA 1203	(2009-11)	Requirements for the emergency manual
KTA 1401	(2017-11)	General requirements regarding quality assurance
KTA 1403	(2017-11)	Ageing management in nuclear power plants
KTA 1404	(2013-06)	Documentation during the construction and operation of nuclear power plants

KTA 2101		Fire protection in nuclear power plants
KTA 2101.1	(2015-11)	Part 1: Basic requirements
KTA 2101.2	(2015-11)	Part 2: Fire protection of structural components
KTA 2101.3	(2015-11)	Part 3: Fire protection of mechanical and electrical components
KTA 3101		Design of reactor cores of pressurized water and boiling water reactors
KTA 3101.1	(2016-11)	Part 1: Principle of thermo-hydraulic design
KTA 3101.2	(2012-11)	Part 2: Neutron-physical requirements for design and operation of the reactor core and adjacent systems
KTA 3101.3	(2015-11)	Part 3: Mechanical and thermal design
KTA 3107	(2014-11)	Nuclear criticality safety requirements during refueling
KTA 3602	(2003-11)	Storage and handling of fuel assemblies and associated items in nuclear power plants with light water reactors
KTA 3902	(2012-11)	Design of lifting equipment in nuclear power plants
KTA 3903	(2012-11)	Inspection, testing and operation of lifting equipment in nuclear power plants
KTA 3905	(2012-11)	Load attaching points on loads in nuclear power plants
DIN EN ISO 9000	(2015-11)	Quality management systems - Fundamentals and vocabulary (ISO 9000:2015); German and English version EN ISO 9000:2015
DIN EN ISO 9001	(2015-11)	Quality management systems – Requirements (ISO 9001:2015); German and English version EN ISO 9001:2015