

Safety Standards

of the

Nuclear Safety Standards Commission (KTA)

KTA 2101.2 (2015-11)

**Fire Protection in Nuclear Power Plants
Part 2: Fire Protection of Civil Structures**

(Brandschutz in Kernkraftwerken
Teil 2: Brandschutz an baulichen Anlagen)

The previous version of this safety
standard was issued in 2000-12

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

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Fire Protection in Nuclear Power Plants Part 2: Fire Protection of Civil Structures

KTA 2101.2

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PLEASE NOTE: Only the original German version of the present 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 BANz) of January 8, 2016.

Copies of the German versions of KTA safety standards may be mail-ordered through Wolters Kluwer Deutschland GmbH (info@wolterskluwer.de). Downloads of the English translations are available at the KTA website: www.kta-gs.de

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Comments by the Editor:

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

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

Basic Principles

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

(2) The Safety Requirements for Nuclear Power Plants (SiAnf), Appendix 3 "Internal and external events as well as external hazards", states among others that protective measures against fires inside the nuclear power plant must be provided. The basic requirements regarding fire protection measures are detailed in the safety standard KTA 2101.1. The fire protection of civil structures (also called "building structures" or "structural components") is detailed in the present safety standard and the fire protection of mechanical and electrical components in safety standard KTA 2101.3. All three parts of the safety standard series KTA 2101 must be considered in the planning and execution of fire protection measures.

Note:

The additionally relevant safety standards of the KTA are specified in safety standard KTA 2101.1.

(3) The present safety standard is prepared based on the assumption that the building codes, fire protection laws and fire protection regulations of the individual German states (Länder), the German Workplace Ordinance, the German Accident Prevention Regulations (UVV) of the trade unions and other public law regulations are complied with. If the specifics of the nuclear power plant require deviations from laws, ordinances or other public law regulations or from the German Accident Prevention Regulations, then, in each individual case, the particular procedures specified in these regulations regarding deviations and exemptions must be followed.

1 Scope

This safety standard applies to nuclear power plants with light water reactors.

Note:

Further scope-related specifications are detailed in safety standard KTA 2101.1.

2 Definitions

Notes:

(1) Applicable definitions are specified in safety standard KTA 2101.1.

(2) In specifying requirements for the structural material classes as well as for the fire resistance time, the present safety standard uses the terminology introduced by the building inspectorate (cf. DIBt-BRL "List of Building Regulations").

3 Design of Structural Fire Protection Measures

3.1 Certification Procedure

(1) It shall be proven that the structural fire protection measures will withstand the fire effects determined in accordance with safety standard KTA 2101.1, Sec. 3.2.3, without losing their fire protection function (e.g., stability, room isolation).

Note:

A simplified procedure specific to nuclear power plants that is used for determining the required fire resistance time of structural fire protection measures is presented in the informative Appendix A. The fire resistance classes for the intended structural elements can be deduced from these fire resistance times.

(2) In case the requirements specific to nuclear power plants go beyond requirements specified by the building inspectorate, the respective proofs may be provided analytically, experimentally, by analogy or by plausibility considerations.

(3) In the case of an analytical proof it is permissible to use simplified analysis procedures.

Note:

Analysis procedures are specified, e.g., in the fire protection sections of the Eurocodes that comply with the building inspectorate regulations.

(4) Experimental proofs shall be presented for special structural elements that, in addition to requirements regarding fire resistance, must also fulfill requirements specific to nuclear power plants.

(5) Any analogy consideration shall be based on referential results of experimental or analytical proofs that were performed for comparable constructions (e.g., type of construction, building materials, dimensions) and for comparable loadings (e.g., temperature effects, operational loading, additional loading regarding design basis accidents).

(6) Plausibility considerations may be presented to prove that structural measures designed for other load cases can also be considered for ensuring safety in the event of fire.

3.2 Fire Events under Consideration of Additional Requirements and of Combinations with Other Events

(1) If additional design requirements as specified in safety standard KTA 2101.1, Sec. 3.4.1 para. (4), must be considered (e.g., regarding radiation protection, gas leak tightness, lower temperature increases on the far side of the fire) then the determination of the fire resistance of the components shall be based also on these requirements. The proof guidelines and proof criteria established by the building inspectorate shall be applied analogously under consideration of the above requirements. It is admissible to use the certification procedures specified under Section 3.1 in these cases.

(2) Structural fire protection measures, the function of which must be ensured for the event combinations specified in safety standard KTA 2101.1, Sec. 3.3, shall be designed accordingly.

(3) Those structural fire protection measures, the fire protection function of which must be ensured even after an earthquake, shall be designed for the earthquake effects determined as specified in KTA 2201.1, provided that the intensity of the design-basis earthquake is higher than VI (EMS-98 - European Macroseismic Scale). The proofs regarding fire and earthquake may be performed independently of each other.

4 Location and Accessibility of Buildings

4.1 General Requirements

(1) Buildings shall be arranged taking operational and, additionally, the following requirements into consideration:

- the fire protective physical separation by the distances between buildings,
- the rapid and safe rescue of persons in the event of fire, and

c) the access points for the firefighting missions.

(2) The requirements in accordance with DIN 14090 shall basically be applied and additionally those specified under Sections 4.2 through 4.5.

4.2 Access Roads

(1) All surface areas on the plant site that are used for vehicular traffic shall basically be designed at least as a fire department staging area in accordance with DIN 14090. Exceptions are admissible in the case of remote vehicular surface areas (e.g., parking lots), provided, they are insignificant regarding accessing buildings or plant components. In case they have a reduced load-carrying capacity they shall be marked accordingly.

(2) Buildings with safety-related systems and plant components shall basically be accessible via two independent access roads that are at least 6 meters wide. Exceptions are admissible in the case of access roads to remote buildings that have a low fire load density (e.g., auxiliary service water pump building).

(3) In the case of plant-engineering related bottlenecks, the width of the access roads may be reduced to a minimum of 3.5 meters. However, the length of such bottlenecks shall be limited to a maximum of 40 meters.

4.3 Access Points

It can happen that access points dedicated to rescue and firefighting missions are locked for security reasons. It is, therefore, mandatory that these doors can be opened from the outside and can be arrested in the open position. The same applies to plant-internal access points of enclosed building areas.

Note:

Requirements regarding the blocking of entry points are detailed in Section 7.1.

4.4 Fire Department Staging Areas

The fire department staging areas in accordance with DIN 14090 may be part of the width of access roads, provided, a width of at least 5 meters next to the staging area remains available for the access road.

4.5 Free Movement Areas

(1) Regarding rescue and danger aversion missions, a free movement area of at least 7 meters by 40 meters shall be assigned in front of each of the necessary access points of the buildings. The distance between the free movement area and the respective access points shall normally not exceed 25 meters.

(2) The free movement areas in accordance with DIN 14 090 may be part of the width of access roads, provided, a width of at least 3 meters next to the free movement area remains available for the access road.

(3) Walk ways or other similar surfaces bordered by curb stones may be integrated up to a width of 2 meters into the free movement area.

5 Fire Compartments and Firefighting Sub-Compartments

5.1 Fire Compartments

If system-technological or usage-related requirements make it necessary for the size of a fire compartment to exceed the

size basically specified by building regulations, the required fire protection shall be ensured by compensatory measures (e.g., by creating firefighting sub-compartments (also called "firefighting sections") as specified under Section 5.2, by additional plant-engineering related fire protection measures, or by a combination of these measures).

Note:

This applies, e.g., to the reactor building and to the turbine building of boiling water reactors.

5.2 Firefighting Sub-Compartments

(1) The following areas shall be designed as firefighting sub-compartments:

- a) rooms for electronic data processing equipment and their conduit rooms,
- b) rooms for switch gear and their conduit rooms,
- c) rooms for electronic equipment and their conduit rooms,
- d) rooms for emergency power generation systems and their fuel depots, and for redundancies of the emergency power supply systems,
- e) rooms for redundant safety-related systems and plant components,
- f) rooms with storage vessels and facilities for lubrication oil, turbine oil and other combustible fluids,
- g) cable ducts and cable wells, insofar as they are not part of a room,
- h) cable floors,
- i) pool for new fuel assemblies,
- j) rooms for transformers with combustible fluids inside of buildings,
- k) rooms for the external oil supply (e.g., oil storage vessels including their auxiliary equipment). In the case of boiling water reactors, this room shall be located outside of the control rod drive room.
- l) rooms in which more than 3 m³ of activated charcoal are stored,
- m) rooms for fuel oil storage tanks,
- n) rooms for the conditioning of combustible waste material including the respective storage rooms.

(2) In addition, the following areas shall normally be constructed as firefighting sub-compartments:

- a) rooms for the fuel oil day tanks,
- b) storage rooms for closed containers for combustible radioactive substances,
- c) rooms in which up to 3 m³ of activated charcoal are stored.

(3) Walk-in pipe or cable ducts that are longer than 50 meters shall basically be subdivided into, as far as possible, equal-length firefighting sub-compartments. If the ducts do not contain any combustible materials or if they are equipped with a stationary fire extinguishing system, then a subdivision is required only if a duct is longer than 100 meters. When creating the subdivisions, personnel protection shall be taken into consideration.

(4) The control room together with its functional areas and the associated cable floor shall be constructed to be at least one firefighting sub-compartment. The document area and the personnel rest area shall be separated from the control room by fire resistant building elements out of non-combustible building materials. Any other rooms directly accessible from the control room shall normally be separated by fire resistant building elements out of non-combustible building