

Safety Standards

of the

Nuclear Safety Standards Commission (KTA)

KTA 1503.3 (2022-11)

**Monitoring the Discharge of Radioactive Gases and
Airborne Radioactive Particulates**

**Part 3: Monitoring the Non-Stack Discharge of Radio-
active Matter**

(Überwachung der Ableitung gasförmiger und an
Schwebstoffen gebundener radioaktiver Stoffe)

Teil 3: Überwachung der nicht mit der Kaminfortluft
abgeleiteten radioaktiven Stoffe)

The previous version of this safety
standard were issued in 1999-06, 2013-11 and 2017-11

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

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Monitoring the Discharge of Radioactive Gases and Airborne Radioactive Particulates Part 3: Monitoring the Non-Stack Discharge of Radioactive Matter

KTA 1503.3

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PLEASE NOTE: Only the original German version of this safety standard represents the joint resolution of the 35-member Nuclear Safety Standards Commission (Kerntechnischer Ausschuss, KTA). The German version was made public in the Federal Gazette (Bundesanzeiger) on July 25, 2023. Copies of the German versions of the KTA safety standards may be mail-ordered through the Wolters Kluwer Deutschland GmbH (info@wolterskluwer.de). Downloads of the English translations are available at the KTA website (<http://www.kta-gs.de>).

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

(2) The stationary and the mobile radiation protection instrumentation serves, among others, in protecting the persons inside and outside of the facility from ionizing radiation, and in ascertaining the specified normal functioning order of the equipment

- a) for keeping solid, liquid and gaseous radioactive substances within the provided enclosures,
- b) for handling and the controlled conducting of the radioactive substances within the facility, and
- c) for monitoring the discharge of radioactive substances.

Concrete safety related requirements with regard to this instrumentation are specified in the safety standards of the series KTA 1500.

(3) The parts of safety standard KTA 1503 comprise the requirements regarding the technical equipment and additional organizational measures considered necessary with respect to monitoring emissions of gaseous radioactive substances and of radioactive substances bound to aerosols. These parts are, specifically:

Part 1: Monitoring the discharge of radioactive substances with the vent stack exhaust air during specified normal operation,

Part 2: Monitoring the discharge of radioactive substances with the vent stack exhaust air during design-basis accidents,

Part 3: Monitoring the non-stack discharge of radioactive substances.

(4) Monitoring the discharge of radioactive substances contributes to fulfilling the requirements specified under Sec. 8 StrlSchG, and Secs 99, 102 and 103 StrlSchV, in accordance of which it is required

- a) that any exposure or contamination of man and environment must be minimized even to levels below the respective limit values specified in StrlSchG by taking into consideration the state of the art and by taking into account all circumstances of the individual situations (Sec. 8, para. (2) StrlSchG),
- b) that no radioactive substances are discharged uncontrolled into the environment (Sec. 99, para. (4), StrlSchV), and
- c) that discharges are monitored and reported to the proper authority at least once a year specifying their kind and activity (Sec. 103, para. (1) StrlSchV).

The monitoring equipment must fulfill the requirements under Sec. 90 StrlSchV.

(5) In accordance with Sec. 107 StrlSchV, it is required that, in the event of design-basis accidents and emergencies, all necessary measures are initiated without delay in order to minimize the danger to life, health and material goods. In accordance with Sec. 106, para. 2 StrlSchV, it is required that, in preparation for an effective damage control and mitigation, the necessary auxiliary aids are kept in readiness. Basis for the decision to take these measures as well as for their type, extent and duration is, among others, the monitoring of the discharged activity performed with the radiation protection instrumentation.

(6) The present safety standard (KTA 1503.3) specifies the measures to be taken with respect to the equipment required for fulfilling the tasks under paras. (4) and (5) insofar as a discharge of radioactive substances occurs other than with the vent stack exhaust air. Thus, the present safety standard contributes to meeting the requirements in accordance with Sec. 8 para. (2) StrlSchG and Secs. 74, 90, para. 5, 99, para. 4, 103 para. 1, 107, 108 StrlSchV.

(7) By monitoring the activity of the discharged radioactive substances (emission monitoring) in connection, on the one hand, with dispersion calculations and, on the other, by direct measurements in the environment (immission monitoring), factual statements can be made about the radiological effects on the environment of the facility. Whereas, during specified normal operation, the essential data is acquired by emission monitoring – here the data derived from immission monitoring lie within the margin of fluctuation of the natural radiation –, it is the immission monitoring that becomes ever more important during design-basis accidents because it enables identifying the radiological effects.

(8) The equipment required for fulfilling these tasks are subdivided as

- a) stationary measuring and sampling equipment, and
- b) mobile measurement equipment deployed for determining the activity of cumulative samples.

1 Scope

(1) The present safety standard shall apply to the equipment for monitoring the non-stack discharge of gaseous radioactive substances and radioactive substances bound to aerosols from nuclear power plants with light water reactors during specified normal operation and during design-basis accidents.

(2) In order to achieve the monitoring objective, the basic requirements specified under Section 3 shall be fulfilled in every nuclear power plant with light water reactors. It is permissible to apply different technical means and administrative measures in order to meet these basic requirements; the technical means and administrative measures to be applied in power plants with pressurized water reactors (PWR) and boiling water reactors (BWR) as specified under Sections 4, 5, 6 and 7 are considered to be sufficient with respect to fulfilling the basic requirements specified under Section 3.

Note:

The technical means and administrative measures required to meet the basic requirements specified under Section 3 are also applicable for determining the activity discharge in case of accidents that go beyond the design-basis accidents if this discharge would occur along the paths described in the present safety standard. If the monitoring of discharged radioactive substances cannot anymore be ensured with these technical means and administrative measures, the backup measurements carried out within the framework of environmental monitoring (immission monitoring) are used.

(3) Monitoring equipment and monitoring procedures for those serious events that would require plant-internal accident management measures are not within the scope of the present safety standard.

2 Definitions

(1) Discharge of radioactive substances

Discharge of radioactive substances is the intentional release of liquid radioactive substances bound to aerosols or of gaseous radioactive substances from the facility along paths provided for this purpose.

(2) Specified normal operation

Specified normal operation encompasses

- a) Operating processes for which the plant, assuming the able function of all systems (fault free condition), is intended and suited (normal operation);
- b) Operating processes which occur in the event of a plant component or system malfunction (fault condition) as far as safety related reasons do not oppose continued operation (abnormal operation);
- c) Maintenance procedures (inspection, servicing, repair).

(3) Detailed assessment of radioactive substances

The detailed assessment is a special form of monitoring consisting of identifying, and determining the activity of, the radionuclides or radionuclide groups discharged over a given time span. For detailed assessment measured value is used. The measurement uncertainty is indicated separately.

(4) Decision threshold

A decision threshold is a calculated value of a measurement parameter (e.g., activity, activity concentration, specific activity) for the comparison with a measured value in order to decide whether this measurement parameter has contributed to the measurement or has had a zero effect.

Note:

- (1) Decision thresholds are determined in accordance with DIN EN ISO 11929-1.
- (2) Application examples are given in report KTA-GS 82.

(5) Release of radioactive substances

Release of radioactive substances is the escape or leakage of radioactive substances from the intended enclosures into the facility or the environment.

(6) Calibration of a measurement equipment for radiation monitoring

The calibration of the measurement equipment for radiation monitoring is the determination of the relationship between the value defined by specific norms (e.g., activity of the calibration source) and the displayed value (e.g., count rate) of the measurement parameter.

(7) Mixture sample

A mixture sample is a mixture of individual samples or cumulative samples, or of parts of these samples, that were extracted within a specified time span.

(8) Detection limit

The detection limit is a calculated value for a measurement parameter (e.g., activity, activity concentration, specific activity) meant to be compared to a predetermined reference value to help decide whether or not the measurement procedure is suitable for a particular measurement task.

Note:

- (1) Detection limits are determined in accordance with DIN EN ISO 11929-1.
- (2) Application examples are given in report KTA-GS 82.

(9) Design-basis accident

A design-basis accident is a chain of events upon the occurrence of which the plant operation or the work task cannot be continued for safety-related reasons and which, with respect to

the plant operation, was considered in the plant design or for which, with respect to the work task, precautionary protective measures shall be provided.

(10) Monitoring

Monitoring is a collective term for the various types of a controlled determination of physical parameters; monitoring includes comparing the results with previously specified values.

Notes:

- (1) Monitoring is performed, e.g.,
 - a) by continuous measurements, or
 - b) by analyses of samples (e.g. in a laboratory), or
 - c) by a combination of selective measurement values,
 and is always carried out in conjunction with a comparison of the results with previously specified values of the physical parameters (e.g., licensed limit values, operational values).
- (2) To verify compliance with licensed limit values the upper limit of the probabilistically symmetric coverage interval is applied.

(11) Coverage interval

The coverage interval contains the area of potential true values of the measurand based on available information with a specified probability.

Note:

The limits of the probabilistically symmetric coverage interval are determined in accordance with DIN EN ISO 11929-1.

3 Determining the Discharge Paths, and Monitoring Concept

3.1 Criteria for Determining the Discharge Paths to be Monitored

(1) In order to be able to specify the required monitoring measures for the non-stack discharge of radioactive substances it is essential to know the possible additional discharge paths. All of those additional paths shall be taken into consideration by which, during specified normal operation or during design-basis accidents, gaseous radioactive substances and radioactive substances bound to aerosols could be discharged into the environment in such amounts that an emission monitoring cannot be waived.

(2) The possibility of a activity discharge does not need to be considered in those cases where the system under consideration is separated from the environment by at least two physical barriers or by one physical barrier and one pressure barrier, provided however, that even under design-basis accident conditions one physical barrier will remain intact.

(3) A detailed assessment of the activity discharged during specified normal operation is not required for those discharge paths for which it is determined that the activity discharge into the environment fulfills the criterion of insignificance. This criterion is considered fulfilled if the activity that can be discharged during specified normal operation over the time span of one week is less than one tenth of the activity resulting from the product of the vent stack exhaust air volume discharged in this time span and the detection limit specified in accordance with safety standard KTA 1503.1 Table 3-4 for the detailed assessment of the respective group of radionuclides.

3.2 Monitoring Concept

(1) For each of the paths that require monitoring in accordance with the criteria specified under Section 3.1, the specific activity or activity concentration in the medium of the respective system and the amount of the discharged medium shall be determined; the discharged activity shall then be calculated from these values.