

In the event of any differences in interpretation of this guide, the Finnish version shall take precedence over this translation.

MEASURING RELEASES OF RADIOACTIVE MATERIALS FROM NUCLEAR POWER PLANTS

1

GENERAL

Measurements of releases of radioactive materials are needed to assure that nuclear power plants are operated within the permissible release limits. Also, they are used for calculation of radiation doses received by the public in the environment.

2

SCOPE

This guide provides requirements for monitoring routine and abnormal releases of radioactivity from light-water-cooled nuclear power plants.

3

MEASUREMENT AND ANALYSIS REQUIREMENTS

All effluent discharge paths of a nuclear power plant shall be monitored for radioactivity. The sensitivity of the equipment shall be such that release amounts which would result in a dose to a member of the critical group equal to the guide dose limit specified in Guide YVL 7.1 are measurable.

In the inspection of radiological measuring equipment conducted by the authorities, YVL Guides pertaining to nuclear power plant instrumentation systems are applied where appropriate.

Monitoring Effluents Released from Normal Operations

3.1.1

Radioactive Materials Released in Gaseous Effluents

Fission and Activation Gases

Continuous monitors measuring gross radioactivity shall be used. The sensitivity of measurements of fission and activation gases shall be such that release amounts which would result in annual exposures of 5 mrem to the whole body of a member of the critical groups are measurable. The calibration of continuous gross radioactivity monitoring systems shall be performed against suitable radionuclides. The calibration ratio of gross radioactivity is determined on the basis of radionuclide analyses.

If the releases are continuous, the principal radionuclides shall be analyzed

- once a month, as a minimum
- following refuelling, process change or other occurrences that could alter the mixture of radionuclides.

In the case of intermittent releases, an analysis shall be made of a representative sample of each release to determine the identity and quantity of the principal radionuclides.

The sensitivity of analysis for each of the principal radionuclide shall be such that concentrations of 3.7 MBq/m³ are measurable.

Iodines

A sample from releases shall be drawn continuously through an iodine filter. The sample shall be analyzed at least weekly for ¹³¹I. An analysis shall be made monthly or more often for ¹³²I, ¹³³I and ¹³⁵I.

The sensitivity of the analysis shall be such that release amounts of radioactive iodines which would result in annual exposures of 15 mrem to the thyroid of a member of the critical group are measurable.

Particulates

A sample of releases shall be drawn continuously through a particulate filter. The filters shall be changed and analyzed at least weekly for the principal gamma-emitting nuclides. When quantities of released radioactive materials are at low levels, precluding measurement of principal radionuclides, gross beta radioactivity measurements shall be made. A quarterly analysis for ⁸⁹Sr and ⁹⁰Sr and a monthly analysis for gross alpha radioactivity shall be made on composite samples.

The sensitivity of analysis for radioactive material in particulate form shall be such that release amounts which would result in annual exposures of 15 mrem to any organ of a member of the critical group are measurable.

Tritium

The release of tritium, when continuous, shall be determined monthly from representative samples.

A representative sample of each batch release shall be analyzed for tritium.

The sensitivity of analysis of released tritium shall be such that a concentration of 37 kBq/m^3 is measurable.

3.1.2

Radioactive Materials Released in Liquid Effluents

A representative sample of each release of liquid effluent shall be analyzed for gamma-emitting radionuclides. If this is not possible, gross radioactivity measurements shall be made and a weekly sample composited from all releases analyzed for the principal gamma-emitting radionuclides. A monthly sample composited from all releases shall be analyzed for tritium, dissolved and entrained gaseous radionuclides and gross alpha activity. A quarterly sample composited from all releases shall be analyzed for ^{89}Sr and ^{90}Sr .

The sensitivities of analyses shall be sufficient to permit the measurement of concentrations of 3.7 kBq/m^3 of gross radioactivity, 19 kBq/m^3 of gamma-emitting radionuclides, 370 kBq/m^3 of tritium, 370 kBq/m^3 of dissolved and entrained gaseous radionuclides, 370 kBq/m^3 of gross alpha radioactivity and 1.9 kBq/m^3 of ^{89}Sr and ^{90}Sr .

Continuous measurement of gross radioactivity shall be provided for liquid effluent releases prior to dilution. Requirements concerning the measuring equipment are presented under item 3.2.2.

3.2

Monitoring Abnormal Releases

3.2.1

Releases of Radioactive Materials in Gaseous Effluents

Attention shall be paid to the performance of the equipment used for continuous monitoring of fission and activation gases in higher concentrations as well. Another possibility is to employ a separate set of instruments. Recorders shall be located in the Control Room. The effluent monitor shall be set to alarm at $10 \times$ the guide release limit. Also, iodines and radioactive materials in particulate form shall be measured under such conditions using suitable measuring equipment.

3.2.2

Releases of Radioactive Material in Liquid Effluents

The discharge path leading to the coolant shall be continuously monitored for gross radioactivity. The output of the monitors shall be visible in the Control Room and recorded using e.g. a strip chart recorder. The monitoring system shall be set to alarm and to initiate automatic closure of the discharge valve when a pre-selected radioactivity limit is exceeded.

Provisions on the reporting of radioactive releases are presented in Guide YVL 7.8.

4

RECOMMENDATIONS, LITERATURE

Measuring, Evaluating and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, Regulatory Guide 1.21, Revision 1, U.S. Atomic Energy Commission, 1974

Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities, ANSI N13.1-1969, American National Standard Institute, 1969