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

REPORTING RADIOLOGICAL CONTROL OF THE ENVIRONS OF
NUCLEAR POWER PLANTS TO THE INSTITUTE OF RADIATION PROTECTION1
GENERAL

Limits have been set to releases of radioactive material from nuclear power plants as well as to radiation doses incurred by members of the critical group living in the vicinity of a nuclear facility and to collective doses. (Guide YVL 7.1). The radiological control of the environment conducted by the licensee include measurement of radioactive releases (YVL 7.6), onsite meteorological measurements (YVL 7.5), hydrological measurements, environmental monitoring (YVL 7.7) and calculation of radiation doses on the basis of these measurements (7.2).

2
SCOPE

This guide provides requirements for the reporting of the radiological control conducted in the environment of a lightwater-cooled nuclear power plant.

3
REPORTING REQUIREMENTS

An annual report covering the preceding calendar year shall be submitted to the Institute of Radiation Protection by April 1st of the following year. Additionally, the results of the first half of the year shall be reported by October 1st.

3.1
Reporting Releases of Radioactive Materials

Reports on radioactive releases shall be presented in the form of Appendix 1. The results of measurements shall be reported in three-month periods. The following background data shall be included in the report:

- the release limits specified in the operating license of the facility
- a description of discharge modes and paths, measuring equipment, methods of analysis, calibration procedure and sensitivity including calculation formulas, if essential changes have taken place as compared to previous reporting

- evaluation of measurement errors
- an account of abnormal releases

3.1.1

Reporting Releases of Radioactive Materials from Normal Operations

Atmospheric releases of radioactive materials are reported in the form of Tables 1 and 2 of Appendix 1. All release volumes and average release rates - with the various material groups specified - that are significant to calculation of radiation doses shall be provided as indicated by Table 1. Radionuclide composition shall also be determined and recorded in accordance with Table 2.

Radioactive releases in liquid effluents shall be reported in the form of Tables 3 and 4 of Appendix 1. All quantities of radioactive releases - with the various material groups specified - that are significant to calculation of radiation doses shall be provided as presented in Table 3. Additionally, release volumes and coolant flow rates are recorded. Radionuclide composition is also specified as in Table 4.

3.1.2

Reporting Abnormal Releases of Radioactive Materials

As a separate part of normal release reports, the following items are provided for

- releases in excess of the limit requiring remedial action. In addition to activity concentrations, reasons for exceeding the limit and the repairs performed shall be accounted for.
- scheduled temporary releases. In addition to activity concentrations, reasons for releases and time of beginning and termination of the release.

A special report in accordance with Guide YVL 1.5 shall be prepared on releases exceeding the limit requiring authority action. The report shall specify the quantities of releases, reasons for them, actions required by the authorities and their impact.

Data on abnormal releases shall be included in normal reporting tables.

3.2 Reporting Dispersion Data

Results of meteorological measurements shall be reported in the form of the table presented in Appendix 2. Estimated dispersion factors, by means of which dose calculation are performed, shall be given as well. Atmospheric dispersion of gaseous effluents is described in Guide YVL 7.3.

Information on dispersion condition prevailing at the time of abnormal releases shall be provided as well.

Aquatic dispersion of liquid effluents is presented in Guide YVL 7.4. Hydrological data necessary for calculation of radiation doses shall be enclosed with the report.

3.3 Reporting Dose Calculations

Doses to the critical group and collective doses caused by the nuclear power plant shall be calculated

- prior to commissioning as well as when filing applications for a construction permit and operating license
- during plant operation on the basis of measured quantities of released radioactive materials, measured dispersion conditions and the various environmental parameters.

Rules for performing dose calculations are provided in greater detail in Guide YVL 7.2.

Radiation doses incurred during operation shall also be calculated using data obtained through measurements of radiation levels and activity concentrations in the environment to the extent it is feasible. These doses are reported together with the results of measurements.

The surveys shall cover doses to the critical group and collective doses caused by external radiation from transports and by radioactive material in gaseous and liquid effluents.

As to the critical group, external whole body dose, internal whole body dose and doses to the various organs shall be calculated.

Collective doses to whole body and thyroid shall be calculated.

The results of dose calculations are reported in the form of Appendix 3. They are presented in six-month periods. The following background data shall be included in the report:

- limits to critical group doses and collective doses
- calculation formulas and parameters and rules for combining radiation doses, if changes have taken place in this since previous reports
- an evaluation of the effect of uncertainty factors; such are conservative assumptions and safety margins on one hand and ignored dispersion pathways on the other

In addition, the radiation doses caused by abnormal releases shall be reported as well in accordance with sub-section 3.1.2.

3.4

Reporting Results of Environmental Monitoring

Requirements for performance and scope of environmental monitoring are set forth in Guide YVL 7.7. Reporting shall cover results of radiation and activity measurements, dose estimates based on them and investigations of abnormal observations. The following background information shall be included in the report:

- a description of measuring equipment sampling areas and methods, analysis methods, calibrations and sensitivity and related calculation formulas, if essential changes have taken place as compared to previous reports
- an evaluation of measurement error and calculational uncertainty factors
- reference values, meaning values measured as part of the preliminary programme or outside the sphere of influence of the nuclear power plant

The results are reported quarterly or less often if the analysis is performed less often. The principal rule is that if monitoring is continuous or measurements are made more often than 4 times a year, maximum, minimum and average values are reported. In case measurements are performed less often than 4 times a year, the sampling time or interval is given together with the results of measurements.

Appendix 4 provides a list of required data and additional information to be obtained through exposure and activity measurements for each monitoring object. When reporting, the results measured in each measuring or sampling location or area shall be specified. When indicator organisms, such as plants and fish, are monitored, the results shall be reported for each species. Error evaluations shall be included in the results.

On the basis of these measurements, the licensee is required to give an estimate of radiation doses to the extent it is feasible. It may be difficult to distinguish between radiation from radioactive materials released from a nuclear power plant and natural background radiation or radiation caused by fall-outs as a result of nuclear tests. Therefore it is necessary to have, in addition to calculation models and parameters, reference values that are obtained prior to commissioning of the facility or, if they are variable, through measurements made outside the sphere of influence of the facility. If the licensee does not have such data, it must simply report the total dose received from all sources of radiation.

Abnormal observations are reported on a sample-by-sample basis also when the frequency measurements is higher than 4 times per year. The presence of ^{131}I in milk is always regarded as abnormal.

When investigating abnormal observations, the licensee should make an attempt to determine the doses received through the various exposure pathways and report external and internal whole body dose as well as doses to the critical organs. If possible, the results should be compared to the dose calculations performed on the basis of measured releases of radioactive materials, measured dispersion conditions and the various environmental parameters.

4

RECOMMENDATIONS. LITTERATURE

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.

Table 1 Releases of Radioactive Materials in
 Gaseous Effluents
 Elevation of Release:

Type of Release	Calendar Quarter	Error %
Fission and Activation Gases		
Total Release (Bq)		
Average release rate (Bq/s)		
Iodines		
Total release (Bq)		
Average release rate (Bq/s)		
Particulates with half- lives ≥ 8 days		
Total release (Bq)		
Average release rate (Bq/s)		
Gross alpha radioactivity (Bq)		
Tritium		
Total release (Bq)		
Average release rate (Bq/s)		
Carbon-14		
Total release (Bq)		
Average release rate (Bq/s)		

Table 2 Radionuclide Composition of Releases of Radioactive Material in Gaseous Effluents

Elevation

Radionuclide	Quantities of Releases by Calendar Quarter (Bq)
Fission and activation gases ^{85m}Kr ^{85}Kr ^{87}Kr ^{88}Kr ^{131m}Xe ^{133m}Xe ^{133}Xe ^{135m}Xe ^{135}Xe ^{137}Xe ^{138}Xe Others Unidentified Total	
Iodines ^{131}I ^{132}I ^{133}I ^{135}I Total	
Particulates ^{89}Sr ^{90}Sr ^{95}Zr ^{95}Nb ^{103}Ru ^{106}Ru ^{134}Cs ^{137}Cs ^{140}Ba ^{140}La Others Unidentified Total	

Table 3 Releases of Radioactive Materials in
Liquid Effluents

Type of Release	Calendar Quarter	Error %
Fission and activation products Total (Bq)		
Tritium Total (Bq)		
Dissolved and entrained gases Total (Bq)		
Gross alpha radioactivity Total (Bq)		
Volume of releases (m ³)		

1) Not including tritium, gases and alpha

Table 4 Radionuclide Composition of Releases of Radioactive Materials in Liquid Effluents

Radionuclide	Quantities by Calendar Quarter
Fission and activation products 1)	
¹⁴ C	
⁵¹ Cr	
⁵⁴ Mn	
⁵⁵ Fe	
⁵⁹ Fe	
⁵⁸ Fe	
⁶⁰ Co	
⁶³ Co	
⁶³ Ni	
⁶⁵ Zn	
⁸⁹ Sr	
⁹⁰ Sr	
⁹⁰ Y	
⁹¹ Y	
⁹⁵ Zr	
⁹⁵ Nb	
⁹⁹ Mo	
^{99m} Tc	
¹⁰³ Ru	
¹⁰⁶ Ru	
¹³¹ I	
¹³² I	
¹³³ I	
¹³⁵ I	
¹³⁴ Cs	
¹³⁷ Cs	
¹⁴⁰ Ba	
¹⁴⁰ La	
¹⁴¹ Ce	
Others	
Unidentified	
Total	
Dissolved and entrained gaseous radionuclides	
^{131m} Xe	
^{133m} Xe	
¹³³ Xe	
¹³⁵ Xe	
Total	

1) Not including tritium, gases or alpha

Table 1 Hours at Each Wind Speed and Direction

Stability Class:

Period of Record:

Wind Direction	Wind Speed (m/s) at Highest Level								Total	Average Speed (m/s)
	0 to 1	1 to 3	3 to 5	5 to 8	8 to 12	12 to 16	16 to 20	20 >20		
1 to 30										
31 to 60										
61 to 90										
91 to 120										
121 to 150										
151 to 180										
181 to 210										
211 to 240										
241 to 270										
271 to 300										
301 to 330										
331 to 360										
Total										

Periods of Calm (hours):

Missing Data (hours):

Provide tables for stability classes A,B,C,D,E,F and G.

Table 1 Doses to Member of Critical Group

Exposure pathway	Radiation Doses						
	External whole body dose	Internal whole body dose	Dose to skin	Dose to thyroid	Dose to bones	Dose to digestive system	Dose to lungs
Total							

Table 2 Collective doses

Exposure pathway	Collective doses (manrem)	
	Whole body dose	Dose to thyroid
Total		

Table 1

Reporting Results of Environmental Monitoring

1 (2)

Objects to be monitored	Results	Expression	Supplementary Information
1. External radiation	Exposure rate in continuous monitoring (C/kg h)	MMA	Type of dosimeter
	Exposure during reporting period (C/kg)	O	
2. Airborne radionuclides and iodines in particulate form	Concentrations of radionuclides detected in gamma spectrum (Bq/m ³) 89Sr and 90Sr (Bq/m ³)	MMA O, D	Type of filter
3. Deposition	Deposition of radionuclides detected in gamma spectrum (Bq/m ²) 3H, 89Sr and 90Sr (Bq/m ²)	O D (¹³⁷ Cs) O, D	Amount of precipitation
4.a) Soil b) Indicator organisms	a) Radionuclides detected in gamma spectrum (Bq/m ²) b) Concentrations (Bq/m ²) 89Sr and 90Sr (Bq/m ² , Bq/kg)	O D (¹³⁷ Cs) O, D	
5. Grazing grass	Concentrations of radionuclides detected in gamma spectrum (Bq/kg) 89Sr and 90Sr (Bq/kg)	O D (¹³⁷ Cs) O, D	
6. Milk	Concentrations (Bq/l/ of 89Sr, 90Sr, 131I and 137Cs	O, D	Amount of milk consumed which the sample represents. A separate account of the presence of 131I required.

Table 1

Objects to be monitored	Results	Expression	Supplementary Information
7. Garden and agricultural produce	Concentrations of radionuclides detected in gamma spectrum (Bq/kg) ^{89}Sr and ^{90}Sr (Bq/m ³)	O D (^{137}Cs) O, D	
8. Drinking water	Concentrations of radionuclides detected in gamma spectrum (Bq/m ³) ^3H , ^{89}Sr and ^{90}Sr (Bq/m ³)	O D (^{137}Cs) O, D	
9. Liquid Effluents	Concentrations of radionuclides detected in gamma spectrum (Bq/m ³) ^3H , ^{89}Sr and ^{90}Sr (Bq/m ³)	O D (^{137}Cs) O, D	
10.a) Sediments/ Sedimenting matter	Radionuclides detected in gamma spectrum (Bq/m ²)	O D (^{137}Cs)	
b) Indicator organisms	Concentrations (Bq/kg) ^{89}Sr and ^{90}Sr (Bq/m ² , Bq/kg)	O, D	Amount of sedimenting matter, number and total weight of indicator organisms
11. Fish	Concentrations of radionuclides detected in gamma spectrum (Bq/kg) ^{89}Sr and ^{90}Sr (Bq/kg)	O D (^{137}Cs) O, D	Number and total weight of the fish

- x) MMA = maximum, minimum and average values
O = one measurement value
D = if undetected, give detection limit