INSTITUTE OF RADIATION PROTECTION

GUIDE YVL 7.7

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

PROGRAMMES FOR MONITORING RADIOACTIVITY IN THE ENVIRONMENT OF NUCLEAR POWER PLANTS

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1 GENERAL

The radiation monitoring of the environment comprises those measurements of the radiation level and determinations of the concentrations of radioactive substances that are necessary for ascertaining and following the exposure to radiation that the population in the environment is subjected to.

2 SCOPE

This guide presents the general principles on environmental radiation monitoring that are applied in the supervision of nuclear power plant safety.

3 RADIATION MONITORING PROGRAMME

There shall be a radiation monitoring programme for the environment of each nuclear power plant site. The programme shall be approved by the Institute of Radiation Protection and it shall be started, as far as applicable, not later than one year before the planned commissioning of the first power plant unit at the plant site. The programme can be revised to better respond to the specific conditions or changes at the site or in the environment. Appendix 1 gives an example of an acceptable programme for monitoring radioactivity in the environment of a nuclear power plant. Appendix 2 presents guide values for the measurement sensitivities that relate to the programme. The measurement sensitivities are determined on the basis of the guide dose limits given in Guide YVL 7.1. The reporting of the results is dealt with in Guide YVL 7.8.

In addition, the environmental radiation monitoring programme may be supplemented with separate accounts requested by the Institute of Radiation Protection.

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Example of an acceptable programme for monitoring radioactivity in the environment of a nuclear power plant

Object to be monitored	Number of measuring equipment or samples and places of measurement and sampling	Sampling frequency	Analysis and frequency
1. External radiation	At least two radiation exposure rate meters at a distance of less than 1 km from the release point	Continuous measurement and recording	Display in the control room
	About 10 dosimeter stations evenly located in the most important directions from the plant at a distance of 1 - 10 km	4/a - annually	Gamma dose, 4/a - annually
	Supplementary monitoring is performed with spectrometric measurements	2 - 4/a, and at the dosimeter stations 1/a	Gamma dose, gamma spectrum, 2 - 4/a
2. Airborne radioactive particulates and iodine	3 - 5 air sample collectors which can collect airborne radioactive particulates and iodine (also iodine in the form of organic compounds) located up to 5 - 10 km from the power plant	Continuous collection, filters replaced 2/month	Gamma emitters, 2/month ^{89}Sr and ^{90}Sr, 4/a
	When necessary, supplementary monitoring is performed with a movable air sample collector	2 - 6/a	Gamma emitters, 2 - 6/a
3. Deposition	3 - 5 rain water collectors located up to 5 - 10 km from the power plant	Continuous collection	Gamma emitters, and ^{3}H, 12/a; ^{89}Sr and ^{90}Sr, 4/a

Object to be monitored	Number of measuring equipment or samples and places of measurement and sampling	Sampling frequency	Analysis and frequency
4. a) Soil	Soil samples are drawn from the area of the assumed maximum deposition to find out the accumulation of especially the long-lived radionuclides	a) once in about three years	Gamma emitters and ^{90}Sr
b) Indicator organisms	1 - 2 indicator species that strongly enrich many radionuclides are collected	b) 1 - 6/a	Gamma emitters and ^{89}Sr and ^{90}Sr, 1 - 6/a
5. Grazing grass	Collective sample representing milk producing farms located at a distance of 0 - 10 km from the power plant	2/growing season	Gamma emitters (especially ^{131}I) 2/growing season
6. Milk	a) Sample representative of milk producing farms located at a distance of 0 - 10 km from the power plant	1/week	^{131}I 1/week
	b) Sample representing the whole production of milk at a distance of less than 40 km from the power plant		^{89}Sr, ^{90}Sr and gamma emitters, 2/month
7. Garden produce	At a distance of 1 - 10 km from the power plant 2 - 3 species accumulating radioactive substances in different ways	1 - 2/a	Gamma emitters, 1 - 2/a
8. Grain	1 - 2 species at a distance of less than 20 km from the power plant	1/a	Gamma emitters, ^{89}Sr and ^{90}Sr

Object to be monitored	Number of measuring equipment or samples and places of measurement and sampling	Sampling frequency	Analysis and frequency
9. Meat	1 - 2 types at a distance of less than 40 km from the power plant. The samples shall represent both grazing season and fodder season.	2/a	Gamma emitters, 2/a
10. Drinking water	Representative sample from the power plant and the surrounding area	4/a	Gamma emitters and ^{3}H, ^{89}Sr and ^{90}Sr, 4/a
11. Discharge water body	Water sample in 4 - 5 places in the discharge area	3 - 6/a	Gamma emitters and ^{3}H, ^{89}Sr and ^{90}Sr, 3 - 6/a
12. a) Sediments	a) Sampling in several places in the discharge area	a) once in about three years	a) Gamma emitters, ^{90}Sr and $^{239,240}Pu$ depth distributions
b) Sedimenting matter	b) Continuous collection in 3 - 6 places in the discharge area	b) continuous collection	b) Gamma emittters, 2 - 6/a
c) Indicator organisms	c) Collection of 2 - 4 indicator species that strongly enrich many radionuclides and/or indicate the accumulation of radionuclides in the water environment	c) 1 - 2/a	c) Gamma emitters and ^{89}Sr and ^{90}Sr, 1 - 2/a

Object to be monitored	Number of measuring equipment or samples and places of measurement and sampling	Sampling frequency	Analysis and frequency
13. Fish	2 - 4 species with different behaviour modes that are in household use, collected from the discharge area	2/a	Gamma emitters 2/a

The measurement of radioactivity in man is annually performed for about 12 - 20 persons living at a distance of 1 - 10 km from the power plant.

Guide values for the measurement sensitivities in the environmental radiation monitoring programme and detection limits in the analyses

Equipment	Measurement sensitivity
External radiation	
radiation exposure rate meter	10 % change to normal values
dosimeters	10^{-4} Sv extra dose
Radionuclide analyses	**Detection limit**
Air	
gamma emitters	10^{-4} Bq/m^3
^{89}Sr	10^{-4} Bq/m^3
^{90}Sr	10^{-5} Bq/m^3
Drinking water	
gamma emitters	10^{2} Bq/m^3
^{3}H	10^{4} Bq/m^3
^{89}Sr	10^{2} Bq/m^3
^{90}Sr	10 Bq/m^3
Milk	
^{89}Sr	0.2 Bq/l
^{90}Sr	4×10^{-2} Bq/l
^{131}I	4×10^{-2} Bq/l
^{137}Cs	0.1 Bq/l
Fish, meat and grain	
gamma emitters	1 Bq/kg
^{90}Sr	4×10^{-2} Bq/kg
Other samples	
gamma emitters	2 Bq/kg
^{89}Sr	2 Bq/kg
^{90}Sr	0.4 Bq/kg

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