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

PROGRAMMES FOR MONITORING RADIOACTIVITY IN THE ENVIRONMENT OF NUCLEAR POWER PLANTS

1
GENERAL

The purpose of the environmental radiation monitoring prior to the commissioning of the nuclear power plant is to reveal the background radiation levels of the environment and the concentrations of radioactive substances in the environment and the variations therein.

During the operation of the plant, the purpose of the environmental radiation monitoring is to reveal the radiation doses that the plant may be inducing in the environment. The programme shall be closely connected to dose calculations that are carried out on the basis of measured amounts of released radioactive materials, measured dispersion conditions and various environmental parameters.

2
SCOPE OF APPLICATION

This guide presents general principles for the environmental radiation monitoring programme of a light water reactor plant. The whole-body measurements that are conducted for the population of the environment are agreed upon separately.

3

REALIZATION OF THE ENVIRONMENTAL RADIATION MONITORING PROGRAMME

Appendix 1 gives the requirement level for the measurements and analyses of the environmental radiation monitoring programme. The programme shall come into effect not later than one year before the first planned fuel charge of the plant. The programme presented in this guide may be expanded, if the special conditions of the environment make it necessary. Similarly, the programme may be supplemented on the basis of the results obtained from release control, for instance if some unexpected radionuclides come up in release measurements. After the first three years of plant operation, the programme may be reduced if the measurement results and dose estimates indicate that some object of monitoring has very little significance.

The objective of the radiation monitoring programme is to detect radiation doses of at least the same order of magnitude as the guide dose limits for the critical group given in Guide YVL 7.1. Appendix 2 presents the measurement sensitivities required of the measuring equipment.

Estimation of the radiation doses received by the population of the environment, based on measurements, is part of the environmental radiation monitoring programme. The licensee shall estimate local radiation doses up to the distance of ca 10 km and compare these observations with the radiation doses calculated on the basis of measured releases, measured dispersion conditions and various environmental parameters.

Guide YVL 7.8 deals with the reporting of the results of the environmental radiation monitoring and related radiation dose estimates. Also the results of the monitoring programme carried out prior to the commissioning of the plant shall be reported before the issuance of the operating license.

4

REFERENCES, LITERATURE

Principles of Environmental Monitoring Related
to the Handling of Radioactive Materials, ICRP
Publication 7, 1965

Environmental Radioactivity Surveillance Guide
ORP/SID 72-2, U.S. Environmental Protection
Agency, 1972

Programs for Monitoring Radioactivity in the
Environs of Nuclear Power Plants, Regulatory
Guide 4.1, Revision 1, U.S. Nuclear Regulatory
Commission, 1971

Table 1 Requirement level for the measurements and analyses of the environmental radiation monitoring programme

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 one radiation exposure rate meter at the plant site towards the main wind direction from the release point	Continuous measurement and recording	
	About 10 dosimeter stations evenly located in the most important direction from the plant at a distance of 1...10 km	4/a...annually	Gamma dose, 4/a...annually
2. Airborne radioactive particulates and iodine	3...5 air sample collectors which can collect the airborne radioactive particulates and iodine (also iodine in the form of organic compounds) located up to 5 km from the plant	Continuous collection, filters replaced 2/month	Gamma emitters, 2/month ^{89}Sr and ^{90}Sr , 4/a
3. Deposition	3...5 rain water collectors located up to 10 km from the plant and in the next big population centre	Continuous collection	Gamma emitters and ^3H , ^{89}Sr and ^{90}Sr , 4/a
4. a) Soil	a) A soil sample is drawn from the area of the assumed maximum deposition to find out the accumulation of especially the long-lived radionuclides	1...2/a	Gamma emitters and ^{89}Sr and ^{90}Sr , 1...2/a
b) Indicator organisms	b) 1...2 indicator species that strongly enrich many radionuclides are collected		
5. Grazing grass	Collective samples representing milk producing farms located 1) at a distance of less than 5 km 2) at a distance of 5...10 km from the plant	2/growing season	Gamma emitters and ^{89}Sr and ^{90}Sr , 2/growing season
6. Milk	Samples representing farms located 1) at a distance of less than 5 km 2) at a distance of 5...10 km 3) at a distance of more than 10 km from the plant	Grazing season 2/month, other times 1/month	^{131}I from each sample ^{89}Sr , ^{90}Sr and ^{137}Cs 4/a

Table 1 (cont)

Object to be monitored	Number of measuring equipment or samples and places of measurement and sampling	Sampling frequency	Analysis and frequency
7. Garden and agricultural produce	At a distance of 1...10 km from the plant 2...3 most grown or produced species representing various plant types accumulating radioactive substances in different ways (depending on the location; also other garden and agricultural products may have to be monitored).	1/harvest	Gamma emitters and ^{89}Sr and ^{90}Sr , 1/harvest
8. Drinking water	From fresh water of the plant and water (surface and ground) used in the surrounding area at a distance of 1...10 km	4/a	Gamma emitters and ^3H , ^{89}Sr and ^{90}Sr , 4/a
9. Discharge water body	At 2...4 places in the direction of the main dispersion or in the areas of higher concentrations at 1...2 depths depending on water depth	4/a	Gamma emitters and ^3H , ^{89}Sr and ^{90}Sr , 4/a
10. a) Sediments/ sedimenting matter b) Indicator organisms	a) Sampling/continuous collection of sedimenting matter at 2...4 places in the discharge area + 1 reference point B) Collection of 2...3 indicator species that strongly enrich many radionuclides and/or indicate the accumulation of long-lived radionuclides in the water environment	a) 1...2/a/continuous collection taking place in two-week periods b) 1...2/a	Gamma emitters and ^{89}Sr and ^{90}Sr , 1...2/a
11. Fish	2..4 species in household use from the discharge area; if possible, the species should represent stationary predatory fishes, plankton eaters and migratory fishes prevalent in the area	4/a	Gamma emitters and ^{89}Sr and ^{90}Sr , 4/a

Table 1 Measurement sensitivities required in the environmental radiation monitoring programme

Equipment or radionuclide analysis	Required sensitivity
External radiation radiation exposure rate meter dosimeters	10 % change to normal values 40 mrem/a extra dose
Air gamma emitters ^{89}Sr ^{90}Sr	370 $\mu\text{Bq}/\text{m}^3$ 190 $\mu\text{Bq}/\text{m}^3$ 37 $\mu\text{Bq}/\text{m}^3$
Water gamma emitters ^3H ^{89}Sr ^{90}Sr	370 Bq/m^3 7400 Bq/m^3 190 Bq/m^3 37 Bq/m^3
Milk ^{89}Sr ^{90}Sr ^{131}I ^{137}Cs	190 mBq/l 37 mBq/l 37 mBq/l 370 mBq/l
Other samples gamma emitters ^{89}Sr ^{90}Sr	3.7 Bq/kg 1.9 Bq/kg 370 mBq/kg