

RULEBOOK

FOR ESTABLISHING PROGRAMME OF SYSTEMATIC ENVIRONMENTAL RADIOACTIVITY EXAMINATION

("Off. Gazette RS", no. 100/2010)

Article 1

This Rulebook shall establish the Programme of systematic environmental radioactivity examination, printed out with these Rulebook and which makes an integral part hereof.

Article 2

The Programme under Article 1 hereof sets forth the locations, time intervals, types and methods of systematic environmental radioactivity examination.

Article 3

This Rulebook, after the Government approval, shall be published in the "Official Gazette of the Republic of Serbia" and come into force eighth days after its publishing.

THE PROGRAMME OF SYSTEMATIC ENVIRONMENTAL RADIOACTIVITY EXAMINATION

Systematic examination of radionuclides content in the environment (hereinafter referred to as: radioactivity monitoring) is done to determine the presence of radionuclides in the environment and to assess the exposure level of the population to ionising radiation.

Examination of the external radiation levels and radionuclides contents in the environment is done by measuring the ambient gamma dose rate equivalent in the air, ambient gamma dose equivalent in the air, total alpha and total beta activity, and radionuclide activity in the environmental samples.

The measurement of ambient gamma dose rate equivalent in the air is done by a calibrated device, which can continually record daily changes in ambient gamma dose rate equivalent in the air (from 50 nSv/h to 15 mSv/h), and whose measuring uncertainty is less than 10%.

The measurement of ambient gamma dose equivalent in the air is done by calibrated thermoluminescent (hereinafter referred to as: TL) dosimeters.

The measurement of radionuclide activity in the environmental samples is done by gamma spectrometry method and specific methods for certain radionuclides in line with accredited methods according to the recommendations of the International Atomic Energy Agency.

Gamma spectrometry measurement of radionuclide activity in a sample is done by measuring within an energy range from 50 keV to 2700 keV, by calibrated, computerised gamma spectrometer with low-background shielded semiconductor detector.

The measurement of total alpha and total beta activity in the environmental samples is done by calibrated low-background alpha and beta counters.

The specific methods for determining radionuclides content include activity measurements by properly calibrated alpha, beta and gamma-ray counters and corresponding calibrated spectrometers, of the samples previously prepared by radiochemical or other standard method.

Radioactivity monitoring in the environment of the Republic of Serbia includes:

- 1) Systematic examination of the radioactivity in normal circumstances;
- 2) Examination of the radioactivity on suspicion of an emergency, and in the course of an emergency.

I SYSTEMATIC EXAMINATION OF THE RADIOACTIVITY UNDER NORMAL CIRCUMSTANCES

Programme of systematic examination of the radioactivity under normal circumstances includes the following measurements:

- 1) Examination of external radiation levels;
- 2) Examination of radionuclides content in the air;
- 3) Examination of radionuclides content in solid and liquid precipitation;
- 4) Examination of radionuclides contents in surface waters;
- 5) Examination of radionuclides contents in drinking water;
- 6) Examination of radionuclides contents in food;

7) Examination the level of exposure to naturally-occurring ionising radiation in residential and work environments,

8) Examination of radionuclides content at locations affected by depleted uranium.

The overview of the number of samples and the examination types are given as Appendix I to this Programme.

1. Examination of external radiation levels

Measurement of ambient gamma dose rate equivalents in the air

Ambient gamma dose rate equivalent in the air is measured daily, throughout 24 h a day, at the height of 1 m above an uncultivated grassy area in Beograd, Kladovo, Vinča, Palić, Novi Sad, Zlatibor, Niš, Vranje and Kosovska Mitrovica.

Measuring devices for measurements of ambient gamma dose rate equivalent in the air are parts of the system for early warning of emergency.

Measurement of ambient gamma dose equivalent in the air

The measurement of ambient gamma dose equivalent in the air is done by TL dosimeters, placed at 1 m height above an uncultivated grassy area with the replacement and reading period once every three months.

Ambient gamma dose equivalents in the air are measured in Beograd, Vinča, Kladovo, Prahovo, Golubac, Palić, Novi Sad, Sremska Mitrovica, Obrenovac, Užice, Kraljevo, Kragujevac, Zaječar, Niš, Lazarevac and Pirot.

2. Examination of radionuclides content in the air

The samples for examination of the radionuclides content in the air (hereinafter referred to as: aerosol samples) are collected continually in the course of 24 hours, every day, by pumping at least 300 m³/h of air through filter paper of known efficiency at 1m height above an uncultivated grassy area.

The aerosol samples collected within one month are put together at the month-end in aggregate monthly samples and are analyzed by gamma spectrometry not later than in the first half of the following month for the previous month.

The aerosol samples for examination of radionuclides content are collected in Beograd, Vinča, Subotica, Niš, Zlatibor, Zaječar and Vranje.

3. Examination of radionuclides content in solid and liquid precipitation

The samples of solid and liquid precipitation are collected continually in the course of one month at 1m height above the ground level by a sampler whose surface is at least 0,6 m². When collecting the samples, the amount of precipitation is recorded too.

The aggregate monthly samples of solid precipitation and liquid precipitation are analyzed by gamma spectrometry.

The precipitation samples are collected in Beograd, Vinča, Subotica, Novi Sad, Niš, Zaječar, Kragujevac, Zlatibor and Vranje.

4. Examination of radionuclides content in surface waters

The samples of surface waters for examination of radionuclides content are collected on the daily basis in the following rivers:

1. the Danube at Bezdan, Zemun, Vinča and Prahovo;
2. the Sava at Sremska Mitrovica and Beograd;
3. the Nišava at Pirot;
4. the Tisa at Kanjiža;
5. the Timok at Knjaževac;
6. the Drina at Loznica.

The samples of water at places under 1 and 2 are analyzed by gamma spectrometry as aggregate monthly samples.

The samples of water collected at places under 3 to 6 are analyzed by gamma spectrometry as aggregate three-monthly samples.

The water samples collected from the Danube (at Bezdan) and the Sava (at Sremska Mitrovica) are determined for ^3H i ^{90}Sr as the aggregate monthly samples.

In places under Paragraph 1, once every six months sediment samples are collected at the depth from 0 to 10 cm from the river bed.

The sediment samples are analyzed by gamma spectrometry. The sediment samples collected from the Danube (at Bezdan) and the Sava (at Sremska Mitrovica) are analyzed for the content of ^{90}Sr .

5. Examination of radionuclides content in drinking water

The samples of drinking water from a water supply system for the settlements with more than 100,000 inhabitants are collected on the daily basis, and total alpha and total beta activity and gamma spectrometric examination is done in the aggregate monthly samples.

Radionuclides content in drinking water from a water supply system using water from the Danube and the Sava, the upstream basins of which contain nuclear facilities are analyzed also for the content of ^{90}Sr and ^3H in the aggregate three-monthly samples.

6. Examination of radionuclides content in foodstuff and feedingstuff

Radionuclides content in foodstuff is examined in the samples of meat, milk, dairy products, cereals, vegetables and fruit.

The food samples under Paragraph 1 hereof are collected in Beograd, Subotica, Novi Sad, Niš, Užice, Zaječar and Vranje.

Milk samples are collected on the daily basis from the purchasing dairy company network in places under Paragraph 2 hereof, and aggregate samples from each of the places are analysed separately.

Foodstuff samples are collected from the primary production and radionuclides content is examined according to ripening and breeding (for meat).

In particular, composite diet samples are collected from children foodstuff in social institutions (kindergartens, four samples per year) in Beograd, Novi Sad and Niš.

Foodstuff samples are analyzed by gamma spectrometry and by specific determination of ^{90}Sr content.

Examination of radionuclides content in feedingstuff includes fresh bulk feed, dry bulk feed and mixed fodder for feeding various types and categories of animals.

Feed samples are analyzed by gamma spectrometry.

7. Examination of the level of exposure to naturally-occurring ionising radiation in residential and work environments

Examination of the exposure level in residential environments is done by measuring the radon concentration in the air.

The measurement is done in the present and newly built structures (flats, schools, kindergartens) in Beograd, Subotica, Novi Sad, Niš, Užice, Zaječar and Vranje.

Measurements are done once per year in at least 50 structures in total.

8. Examination of radionuclides content at locations affected by depleted uranium

Examination of radionuclides content at locations affected by depleted uranium includes examination of soil, plants and drinking water.

The samples of soil and plants are collected at sites Borovac, Bratosele, Reljan and Pljačkovica.

Water samples are collected from the local wells or water supply system at the sites Borovac, Bratosele, Reljan and Pljačkovica.

All samples are analyzed by gamma spectrometry for radionuclides content, and in drinking water samples total alpha and total beta activity are measured.

II RADIOACTIVITY EXAMINATION ON SUSPICION OF AN EMERGENCY AND IN THE COURSE OF AN EMERGENCY

If the Agency, based on the information received from the system for early warning of emergency, direct from a nuclear or radiation facility operator, or through international cooperation, establishes that an emergency has occurred that may cause an additional exposure of the population and the environment of the Republic of Serbia, then an additional number of locations will be determined, as well as the measurement frequency, and the authorized institutions will be required to perform such measurements.

III REPORT ON COMPLETED SYSTEMATIC ENVIRONMENTAL RADIOACTIVITY MONITORING

Legal entities which perform radioactivity monitoring shall deliver to the Agency the Report on environmental radioactivity monitoring not later than 31 May of the current year for the previous year, while in case of an accident or at the demand of Agency they shall deliver the report forthwith.

Appendix I.

Overview of the number of samples and the types of examination

Table 1. Overview of the number of samples and the types of examination for radionuclides content in the environmental samples

Type of sample	Type of examination	No. of sites	Annual measuring frequency per site	No. of tested samples per site	Total annual number of examinations
External radiation level	Ambient gamma dose rate equivalent	9	continually	-	-
	Ambient gamma dose equivalent	16	4	1	64
Air	Gamma spectrometric analysis of radionuclides content	7	12	1	84
Solid and liquid precipitation	Gamma spectrometric analysis of radionuclides content	9	12	1	108
Surface water	Gamma	6	12	1	88

		spectrometric analysis of radionuclides content	4	4	1	
		Contents of 90Sr & 3H	2	12	1	24
River sediment		Gamma spectrometric analysis of radionuclides content	10	2	1	20
		Content of 90Sr	2	2	1	4
Drinking water		Determination of total alpha and beta activity	7	12	1	84
		Gamma spectrometric analysis of radionuclides content	7	12	1	84
		Contents of 90Sr & 3H	2	4	1	8
Foodstuff	Milk	Gamma spectrometric analysis of radionuclides content	7	12	1	84
		Content of 90Sr	7	12	1	84
	Dairy products	Gamma spectrometric analysis of radionuclides content	7	2	1	14
		Content of 90Sr	7	2	1	14
	Meat	Gamma spectrometric analysis of radionuclides content	7	2	1	14
		Content of 90Sr	7	2	1	14
	Cereals	Gamma spectrometric analysis of radionuclides content	7	2	1	14
		Content of 90Sr	7	2	1	14
	Vegetables	Gamma	7	2	3	42

		spectrometric analysis of radionuclides content				
		Content of 90Sr	7	2	3	42
	Fruit	Gamma spectrometric analysis of radionuclides content	7	2	2	28
		Content of 90Sr	7	2	2	28
	Children meal	Gamma spectrometric analysis of radionuclides content	3	4	1	12
		Content of 90Sr	3	4	1	12
Feeding Stuff	Fresh bulk feed	Gamma spectrometric analysis of radionuclides content	7	2	1	14
	Dry bulk feed	Gamma spectrometric analysis of radionuclides content	7	2	1	14
	Mixed fodder	Gamma spectrometric analysis of radionuclides content	7	2	1	14

Table 2. Examination the level of exposure to naturally-occurring ionising radiation in residential and work environments

Location	Type of structure	Annual examination frequency	Number of structures	Total annual number of examinations
Beograd	Residential building	1	15	15
	Kindergarten	1	3	3
	School	1	3	3
Subotica	Residential building	1	5	5
	Kindergarten	1	2	2
	School	1	1	1

Novi Sad	Residential building	1	5	5
	Kindergarten	1	2	2
	School	1	1	1
Niš	Residential building	1	5	5
	Kindergarten	1	2	2
	School	1	1	1
Užice	Residential building	1	5	5
	Kindergarten	1	2	2
	School	1	1	1
Zaječar	Residential building	1	5	5
	Kindergarten	1	2	2
	School	1	1	1
Vranje	Residential building	1	5	5
	Kindergarten	1	2	2
	School	1	1	1

Table 3. Examination of radionuclides content in locations affected by depleted uranium

Type of sample	Type of examination	No. of site	Annual measuring frequency per site	No. of tested samples per site	Total annual number of examinations
Soil	Gamma spectrometric analysis of radionuclides content	4	1	5	20
Drinking water	Determination of total alpha & beta activity	4	1	2	8
	Gamma spectrometric analysis of radionuclides content	4	1	2	8
Plants	Gamma spectrometric analysis of radionuclides content	4	1	3	12