RADIATION SAFETY DIRECTORATE

Pursuant to Article 26-e, paragraph 1, item 10 of the Law on Ionising Radiation Protection and Radiation Safety (Official Gazette of the Republic of Macedonia No. 48/02 and 135/07), the Director of the Radiation Safety Directorate hereby adopts a

RULEBOOK ON THE MAXIMUM PERMITTED LEVELS OF EMITTING RADIOACTIVE SUBSTANCES INTO THE ENVIRONMENT, THE MANNER OF PERFORMING MONITORING, KEEPING RECORDS AND SUBMITTING REPORTS

I. General provisions

Article 1

This Rulebook shall prescribe the maximum permitted levels of emitting radioactive substances (hereinafter referred to as: radioactive substances) into the environment, the manner of performing monitoring, keeping records and submitting reports

Article 2

If the nature of the activity performed with sources of ionising radiation results in inevitable emission of radioactive substances in the air, surface water, the sewerage system or elsewhere in the environment, the legal entity shall provide that the amount of emitted radioactive substances is at reasonably low levels and in all cases below the maximum permitted levels established with the provisions of this Rulebook.

If the nature of the activity in accordance with the regulations on ionising radiation protection and radiation safety results in emission, in the workplace environment, of waste or other liquid natural radioactive substances through the sewerage system or in the form of gas or aerosols in the air, the legal entity shall provide that the amount of emitted natural radioactive substances is at reasonably low levels and in all cases below the maximum permitted levels established with the provisions of this Rulebook

Article 3

The legal person and/or legal entity shall perform the following before emitting solid, liquid and/or gaseous radioactive substances, waste materials or other natural radioactive substances from work activities into the environment:

- determine the characteristics and the activity of the substance to be emitted, as well as any potential sites and methods of emission;
- determine all possible channels of exposure to ionising radiation of the general public caused by the emitted radioactive substances;
- assess the doses of projected emissions of radioactive substances to which an individual might be exposed, and
- submit the abovementioned information to the Radiation Safety Directorate.

II. Maximum permitted levels of emitting radioactive substances into the environment

Article 4

In case of emitting radioactive substances in solid, liquid and gaseous form originating from an activity with sources of ionising radiation, the following reference levels shall not be exceeded:

- an effective dose of 10 μSv per annum for an individual, and

- a collective effective dose of 1 person-Sv per annum.

In case of emissions of waste materials and other natural radioactive substances originating from work activities, the dose limit for individuals shall apply, established in accordance with the regulations on ionising radiation protection and radiation safety.

Article 5

Radioactive and other substances containing radionuclides or other radionuclide-contaminated objects may be emitted into the environment if:

1. During the emission of radioactive and other substances containing radionuclides or other radionuclide-contaminated objects used in an activity with ionising radiation sources , the sum of the ratios of medium activities per unit mass of certain radionuclides from the substance that is being emitted and the activity levels per unit mass, given in Table 1 of Appendix 1, which is a constituent part of this Rulebook, as well as the sum of the ratios of the medium activity of certain radionuclides emitted per unit area and the activity levels per unit area of the corresponding radionuclides, given in Table 2 of Appendix 1 of this Rulebook, shall not exceed 1;

2. During the emission of waste water in surface waters, the sum of the products of medium activities per unit volume of certain emitted radionuclides and the dose conversion factor h(g)j,ing for introducing a radionuclide "j" by means of ingestion for individuals aged above 18, established in accordance with the regulations on ionising radiation protection and radiation safety, per each cubic metre of emitted water shall not exceed 10-4 Sv/m^3;

3. During the emission of waste water in the sewerage system, the sum of the products of medium activities per unit volume of certain radionuclides emitted into the environment and the dose conversion factor h(g)j,ing for introducing a radionuclide "j" by means of ingestion for individuals aged above 18, established in accordance with the regulations on ionising radiation protection and radiation safety, per each cubic metre of emitted water shall not exceed 10-2 Sv/m^3;

4. During the emission of radioactive substances into the atmosphere, the sum of the products of medium activities per unit volume of certain emitted radionuclides and the dose conversion factor h(g)j,ing for introducing a radionuclide "j" by means of inhalation for individuals aged above 18, established in accordance with the regulations on ionising radiation protection and radiation safety, per each cubic metre of emitted gaseous radioactive substances shall not exceed 10-7 Sv/m^3;

5. During the disposal of solid radioactive substances in the environment, the maximum permitted levels established in item 1 of this Article shall apply, whereas the disposal shall be performed in a manner that the rate of the ambient dose equivalent does not exceed 0,1 μSv/h at a distance of 1m from the surface of the substance disposed in relation to the natural rate at a given point and the total rate of the ambient dose equivalent shall not exceed 0,4 μSv/h; and

6. During the emission of gaseous radioactive substances derived from incineration in

combustion plants, the maximum permitted levels established in item 4 of this Article shall apply, whereas the ashes generated in the process shall fulfil the maximum permitted levels established in item 1 of this Article or the maximum permitted levels established in item 5 of this Article, if the ashes are being disposed at dumping grounds.

The levels referred to in paragraph 1 of this Article shall not apply to the emission of radioactive substances into the environment which do not fulfil the optimisation principle in accordance with the regulations on ionising radiation protection and radiation safety.

Article 6

The emission of waste or other natural liquid radioactive substances in the sewerage system or radioactive gases or aerosols in the air originating from work activities shall not exceed the values given in Appendix 2, which is a constituent part of this Rulebook.

In cases where the values referred to in paragraph 1 of this Article are exceeded, an assessment of the dose shall be made in order to determine whether the provisions of Article 4 paragraph 2 of this Rulebook have been met.

In the case of more than one radionuclide, the sum of the ratios of the determined activity concentration and the values given in Appendix 2 of this Rulebook shall not exceed 1.

The values referred to in paragraph 1 of this Article shall not apply to the emission of waste or other natural radioactive substances into the environment which do not fulfil the optimisation principle in accordance with the regulations on ionising radiation protection and radiation safety.

III. Manner of performing monitoring, keeping records and submitting reports

Article 7

The legal person and/or entity shall perform monitoring of the emission of radioactive substances into the environment in order to provide that the emissions are within the limits of the maximum permitted levels established with the provisions of this Rulebook.

The emission monitoring referred to in paragraph 1 of this Article shall be performed by means of monitoring, measuring, calculating and recording the values and parameters of the emissions of radioactive substances in the vicinity of the workplace, especially the total activity and activities per unit volume of emitted radioactive substances.

Monitoring shall be performed at all workplaces where there are sources of ionising radiation which can cause radioactive contamination through controlled emission of radioactive substances and wherever there is a possibility of leakage of considerable amounts of radioactive substances, as well as at all workplaces where activities are performed or waste is generated, in accordance with the regulations on ionising radiation protection and radiation safety.

Article 8

The legal person and/or legal entity shall keep records of the monitoring results and of the doses and/or dose rates calculated; it shall inform the Radiation Safety Directorate of the type of radioactive substance, the activity, amount and site of emission thereof, the date, duration and

method of the emission of radioactive substances into the environment, as well as of the estimated dose of exposure to ionising radiation of an individual and the manner of estimation, within 60 days before the emission of radioactive substances at the latest.

The legal person and/or legal entity shall inform without delay the Radiation Safety Directorate of any unexpected and/or incidental emission of radioactive substances into the environment.

Article 9

Constituent parts of this Rulebook shall be Appendix 1, consisting of Table 1: Activity levels per unit mass and Table 2: Activity levels per unit area, and Appendix 2, consisting of Table 1: Activity values of radionuclides per unit time in emissions into the sewerage system and Table 2: Activity values of radionuclides per unit time in emissions into the air.

IV. Transitional and final provisions

Article 10

On the day of entry into force of this Rulebook, Articles 31, 32 and 33 of the Rulebook on the manner of collecting, recording, processing, storage, final placement and emission of waste radioactive substances into the environment (Official Gazette of SFRY No. 40/86) shall cease to apply.

Article 11

This Rulebook shall enter into force on the eighth day from the date of its publication in the Official Gazette of the Republic of Macedonia.

No. 03-1718/2

9 December 2009

Director,

Skopje

PhD **Rumen Stamenov**

APPENDIX 1

Table 1: Activity levels per unit mass

Nuclide	Activity levels per unit mass [Bq/g]
H-3	$8,6 \cdot 10^{2}$
Be-7	6,9
C-14	$6,3 \cdot 10^{1}$
F-18	$1,3 \cdot 10^{1}$
Na-22	$1,3 \cdot 10^{-1}$
Na-24	$2,1 \cdot 10^{-1}$
Si-31	$1,2 \cdot 10^{2}$
P-32	$9,8 \cdot 10^{1}$
P-33	$2,3 \cdot 10^{2}$
S-35	$5,7 \cdot 10^{1}$
C1-36	$1,6 \cdot 10^{1}$
C1-3S	$7,3 \cdot 10^{-1}$
K-40	1,5
K-42	4,0
K-43	$7,3 \cdot 10^{-1}$
Ca-45	$4,0 \cdot 10^{1}$
Ca-47	$3,2 \cdot 10^{-1}$
Sc-46	$1,5 \cdot 10^{-1}$
Sc-47	5,2
Sc-48	$1,3 \cdot 10^{-1}$
V-48	$1,1 \cdot 10^{-1}$
Cr-51	$1,2 \cdot 10^{2}$
Mn-51	1,3
Mn-52	$1,0 \cdot 10^{-1}$
Mn-52m	$4,9 \cdot 10^{-1}$
Mn-53	$4,5 \cdot 10^{2}$
Mn-54	$3,8 \cdot 10^{-1}$
Mn-5б	$6,6 \cdot 10^{-1}$
Fe-52	$4,5 \cdot 10^{-1}$
Fe-55	$4,7 \cdot 10^{1}$

Nuclide	Activity levels per unit mass [Bq/g]
Fe-59	$2,6 \cdot 10^{-1}$
Co-55	$4,2 \cdot 10^{-1}$
Co-5б	$8,3 \cdot 10^{-2}$
Co-57	4,4
Co-58	$3,3 \cdot 10^{-1}$
Co-58m	$2,3 \cdot 10^{2}$
Co-60	$9,9 \cdot 10^{-2}$
Co-60m	$3,4 \cdot 10^{2}$
Co-61	$3,5 \cdot 10^{1}$
Co-62m	$4,1 \cdot 10^{-1}$
Ni-59	$2,9 \cdot 10^{2}$
Ni-63	$1,2 \cdot 10^{2}$
Ni-65	2,0
Cu-64	6,8
Zn-65	$5,2 \cdot 10^{-1}$
Zn-69	$1,6 \cdot 10^{2}$
Zn-69m	2,7
Ga-72	$3,6 \cdot 10^{-1}$
Ge-71	$1,0 \cdot 10^{4}$
As-73	$1,7 \cdot 10^{2}$
As-74	$4,5 \cdot 10^{-1}$
As-76	1,4
As-77	$6,7 \cdot 10^{1}$
Se-75	1,1
Br-82	$1,9 \cdot 10^{-1}$
Rb-86	3,3
Sr-85	$6,6 \cdot 10^{-1}$
Sr-85m	$1,1 \cdot 10^{1}$
Sr-87m	4,5
Sr-89	$2,8 \cdot 10^{1}$
Sr-90 +	1,1
Sr-91	1,7
Sr-92	$7,8 \cdot 10^{-1}$
Y-90	$1,4 \cdot 10^{2}$
Y-91	$2,5 \cdot l0^{1}$

Nuclide	Activity levels per unit mass [Bq/g]
Y-91m	2,4
Y-92	4,5
Y-93	$1,4 \cdot 10^{1}$
Zr-93 +	$6,0 \cdot 10^{1}$
Zr-95	$2,9 \cdot 10^{-1}$
Zr-97 +	$3,1 \cdot 10^{-1}$
Nb-93m	$1,1 \cdot 10^{2}$
Nb-94	$1,4 \cdot 10^{-1}$
Nb-95	$4,2 \cdot 10^{-1}$
Nb-97	1,8
Nb-98	$4,6 \cdot 10^{-1}$
Mo-90	1,8
Mo-93	$1,3 \cdot 10^{1}$
Mo-99	2,0
Mo-101	$7,4 \cdot 10^{-1}$
Tc-96	$1,5 \cdot 10^{-1}$
Tc-96m	$1,9 \cdot 10^{1}$
Tc-97	$2,0 \cdot 10^{2}$
Tc-97m	$7,5 \cdot 10^{1}$
Tc-99	$2,1 \cdot 10^{1}$
Tc-99m	$5,3 \cdot 10^{1}$
Ru-97	2,2
Ru-103	$7,1 \cdot 10^{-1}$
Ru-105	1,6
Ru-106 +	2,5
Rh-103m	$1,0 \cdot 10^{4}$
Rh-105	7,7
Pd-103	$1 \cdot 10^{3}$
Pd-109	$8,5 \cdot 10^{1}$
Ag-105	$6,9 \cdot 10^{-1}$
Ag-108m +	$1,4 \cdot 10^{-1}$
Ag-110m	$1,1 \cdot 10^{1}$
Ag-111	$1,5 \cdot 10^{1}$
Cd-109	$1,4 \cdot 10^{1}$
Cd-115	1,4

Nuclide	Activity levels per unit mass [Bq/g]
Cd-115m	$1{,}4 \cdot 10^{1}$
In-111	1,4
In-113m	5,6
In-114m	3,0
In-115m	9,9
Sn-113	1,4
Sn-125	1,1
Sb-122	$9{,}6 \cdot 10^{-1}$
Sb-124	$1{,}6 \cdot 10^{-1}$
Sb-125	$6{,}6 \cdot 10^{-1}$
Te-123m	3,5
Te-125m	$7{,}1 \cdot 10^{1}$
Te-127	$1{,}5 \cdot 10^{2}$
Te-127m	$1{,}3 \cdot 10^{1}$
Te-129	$2{,}5 \cdot 10^{1}$
Te-129m	5,2
Te-131	3,6
Te-131m	$3{,}6 \cdot 10^{-1}$
Te-132	$1{,}8 \cdot 10^{-1}$
Te-133	1,3
Te-133m	$5{,}1 \cdot 10^{-1}$
Te-134	$7{,}3 \cdot 10^{-1}$
I-123	$1{,}1 \cdot 10^{1}$
I-125	7,4
I-126	$7{,}7 \cdot 10^{-1}$
I-129	$4{,}5 \cdot 10^{-1}$
I-130	$5{,}7 \cdot 10^{-1}$
I-131	1,0
I-132	$5{,}2 \cdot 10^{-1}$
I-133	1,2
I-134	$4{,}4 \cdot 10^{-1}$
I-135	$6{,}9 \cdot 10^{-1}$
Cs-129	2,4
Cs-131	$1{,}0 \cdot 10^{3}$
Cs-132	$5{,}2 \cdot 10^{-1}$

Nuclide	Activity levels per unit mass [Bq/g]
Cs-134	$1{,}8 \cdot 10^{-1}$
Cs-134m	$3{,}3 \cdot 10^{2}$
Cs-135	$4{,}3 \cdot 10^{1}$
Cs-136	$1{,}5 \cdot 10^{-1}$
Cs-137 +	$3{,}8 \cdot 10^{-1}$
Cs-138	$4{,}8 \cdot 10^{-1}$
Ba-131	$8{,}6 \cdot 10^{-1}$
Ba-140 +	$1{,}7 \cdot 10^{-1}$
La-140	$2{,}0 \cdot 10^{-1}$
Ce-139	3,4
Ce-141	7,0
Ce-143	2,4
Ce-144 +	3,8
Pr-142	$1{,}2 \cdot 10^{1}$
Pr-143	$1{,}5 \cdot 10^{2}$
Nd-147	3,3
Nd-149	4,6
Pт-147	$6{,}0 \cdot 10^{1}$
Pт-149	$4{,}4 \cdot 10^{1}$
Sт-151	$1{,}6 \cdot 10^{2}$
Sт-153	$2{,}2 \cdot 10^{1}$
Eu-152	$2{,}1 \cdot 10^{-1}$
Eu-152т	3,9
Eu-154	$1{,}9 \cdot 10^{-1}$
Eu-155	9,0
Gd-153	9,8
Gd-159	$2{,}7 \cdot 10^{1}$
Tb-160	$3{,}0 \cdot 10^{-1}$
Dy-165	$7{,}3 \cdot 10^{1}$
Dy-166	$1{,}6 \cdot 10^{1}$
Ho-166	$2{,}6 \cdot 10^{1}$
Er-169	$2{,}0 \cdot 10^{2}$
Er-171	5,2
Tm-170	$2{,}4 \cdot 10^{1}$
Tm-171	$1{,}5 \cdot 10^{2}$

Nuclide	Activity levels per unit mass [Bq/g]
Yb-175	$1{,}1 \cdot 10^{1}$
Lu-177	$1{,}5 \cdot 10^{1}$
Hf-181	$6{,}8 \cdot 10^{-1}$
Ta-182	$2{,}5 \cdot 10^{-1}$
W-181	$3{,}5 \cdot 10^{1}$
W-185	$1{,}2 \cdot 10^{2}$
W-187	1,5
Re-186	$3{,}6 \cdot 10^{1}$
Re-188	$1{,}8 \cdot 10^{1}$
Os-185	$4{,}9 \cdot 10^{-1}$
Os-191	$1{,}0 \cdot 10^{1}$
Os-191m	$5{,}0 \cdot 10^{2}$
Os-193	$1{,}1 \cdot 10^{1}$
Ir-190	$1{,}2 \cdot 10^{-1}$
Ir-192	$4{,}4 \cdot 10^{-1}$
Ir-194	8,9
Pt-191	2,0
Pt-193m	$1{,}1 \cdot 10^{2}$
Pt-197	$6{,}9 \cdot 10^{1}$
Pt-197m	$3{,}4 \cdot 10^{1}$
Au-198	1,1
Au-199	6,9
Hg-197	$1{,}8 \cdot 10^{1}$
Hg-197m	$1{,}2 \cdot 10^{1}$
Hg-203	1,8
Tl-200	$4{,}7 \cdot 10^{-1}$
Tl-201	$1{,}1 \cdot 10^{-1}$
Tl-202	$8{,}5 \cdot 10^{-1}$
Tl-204	$1{,}3 \cdot 10^{1}$
Pb-203	2,0
Pb-210 +	$8{,}6 \cdot 10^{-3}$
Pb-212 +	1,0
Bi-206	$1{,}1 \cdot 10^{-1}$
Bi-207	$1{,}5 \cdot 10^{-1}$
Bi-210	$1{,}9 \cdot 10^{1}$

Nuclide	Activity levels per unit mass [Bq/g]
Bi-212 +	$9{,}4 \cdot 10^{-1}$
Po-203	$6{,}9 \cdot 10^{-1}$
Po-205	$7{,}7 \cdot 10^{-1}$
Po-207	$8{,}7 \cdot 10^{-1}$
Po-210	$2{,}5 \cdot 10^{-2}$
At-211	$4{,}2 \cdot 10^{1}$
Ra-223 +	$8{,}1 \cdot 10^{-1}$
Ra-224 +	$3{,}2 \cdot 10^{-1}$
Ra-225	$6{,}3 \cdot 10^{-1}$
Ra-226 +	$8{,}0 \cdot 10^{-3}$
Ra-227	8,6
Ra-228 +	$1{,}7 \cdot 10^{-2}$
Ac-227	$2{,}4 \cdot 10^{-2}$
Ac-228	1,3
Th-226 +	$5{,}9 \cdot 10^{1}$
Th-227	$4{,}5 \cdot 10^{-1}$
Th-228 +	$1{,}1 \cdot 10^{-1}$
Th-229 +	$4{,}2 \cdot 10^{-2}$
Th-230	$1{,}2 \cdot 10^{-1}$
Th-231	$1{,}3 \cdot 10^{2}$
Th-232	$1{,}4 \cdot 10^{2}$
Th-234	$1{,}9 \cdot 10^{1}$
Pa-230	$5{,}3 \cdot 10^{-1}$
Pa-231	$1{,}9 \cdot 10^{1}$
Pa-233	2,0
U-230 +	$3{,}8 \cdot 10^{-1}$
U-231	$1{,}1 \cdot 10^{1}$
U-232 +	$5{,}5 \cdot 10^{-2}$
U-233	$6{,}2 \cdot 10^{-1}$
U-234	$6{,}7 \cdot 10^{-1}$
U-235 +	$7{,}1 \cdot 10^{-1}$
U-236	$7{,}3 \cdot 10^{-1}$
U-237	4,5
U-238 +	$6{,}9 \cdot 10^{-1}$

Nuclide	**Activity levels per unit mass [Bq/g]**
U-239	$1{,}0 \cdot 10^{2}$
U-240 +	4,5
Np-237 +	$3{,}1 \cdot 10^{-1}$
Np-239	3,8
Np-240	1,1
Pu-234	$1{,}0 \cdot 10^{2}$
Pu-235	$1{,}0 \cdot 10^{2}$
Pu-236	$3{,}1 \cdot 10^{-1}$
Pu-237	$1{,}4 \cdot 10^{1}$
Pu-238	$1{,}5 \cdot 10^{-1}$
Pu-239	$1{,}4 \cdot 10^{-1}$
Pu-240	$1{,}4 \cdot 10^{-1}$
Pu-241	3,4
Pu-242	$1{,}5 \cdot 10^{-1}$
Pu-243	$1{,}6 \cdot 10^{2}$
Pu-244	$1{,}5 \cdot 10^{-1}$
Am-241	$1{,}7 \cdot 10^{-1}$
Am-242	$1{,}3 \cdot 10^{2}$
Am-242m +	$1{,}2 \cdot 10^{-1}$
Am-243 +	$1{,}7 \cdot 10^{-1}$
Cm-242	1,2
Cm-243	$2{,}3 \cdot 10^{-1}$
Cm-244	$2{,}7 \cdot 10^{-1}$
Cm-245	$1{,}5 \cdot 10^{-1}$
Cm-246	$1{,}7 \cdot 10^{-1}$
Cm-247	$1{,}8 \cdot 10^{-1}$
Cm-248	$4{,}9 \cdot 10^{-2}$
Bk-249	$2{,}2 \cdot 10^{1}$
Cf-246	$1{,}3 \cdot 10^{1}$
Cf-248	$6{,}8 \cdot 10^{-1}$
Cf-249	$1{,}0 \cdot 10^{-1}$
Cf-250	$1{,}9 \cdot 10^{-1}$
Cf-251	$1{,}0 \cdot 10^{-1}$
Cf-252	$2{,}2 \cdot 10^{-1}$

Nuclide	Activity levels per unit mass [Bq/g]
Cf-253	2,7
Cf-254	$1,6 \cdot 10^{-1}$
Es-253	2,2
Es-254	$3,7 \cdot 10^{-1}$
Es-254m	$8,8 \cdot 10^{-1}$
Fm-254	$6,0 \cdot 10^{1}$
Fm-255	$1,8 \cdot 10^{1}$

Radionuclides marked with the sign "+" indicate that the activity levels per unit mass include their short-lived daughter nuclides.

Table 2: Activity levels per unit area

	Beta, gamma and low toxicity alpha emitters	Other alpha emitters
Activity levels per unit area (Bq/cm^2)	0,04	0,4

***** Low toxicity alpha emitters are: natural uranium, depleted uranium, natural thorium, uranium-235 or uranium-238, thorium-232, thorium-228 and thorium-230 when contained in ores or physical or chemical concentrates; or alpha emitters with a half-life of less than 10 days.

APPENDIX 2

Table 1: Activity levels of radionuclides per unit time in emissions into the sewerage system

Radionuclide or its radioactive daughter	**GBq/year**
^{238}U	8,3E+02
^{235}U	7,7E+02
^{234}U	7,7E+02
^{232}Th	4,8E+03
^{230}Th	4 3E+03
^{228}Th	4,9E+00
^{231}Pa	5,9E+01
^{228}Ra	4,2E+01
^{226}Ra	7 5E+01
^{227}Ac	2 6E+01
^{210}Pb	3,2E+01
^{210}Po	3,7E+01

Table 2: Activity levels of radionuclides per unit time in emissions into the air

Radionuclide or its radioactive daughter	**GBq/year**
^{238}U+	l,4E+02
^{235}U+	12E+02
^{234}U	1,1E+02
^{232}Th	1,4E+01
^{230}Th	2,8E+01
^{228}Th+	9,3E+00
^{231}Pa+	2,8E+00
^{228}Ra+	12E+02
^{226}Ra+	6 6E+01
^{227}Ac+	7,1E-01
^{222}Rn	l,5E+05
^{220}Rn	2,0E+03
^{210}Pb+	l,6E+02
^{210}Po	7,0E+01