THE STUDY OF RADIONUCLIDE DISTRIBUTION LAW IN THE AREA OF "GUM ADASY" OGED AND IN OIL EXTRACTING LAYERS

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ABSTACT

It is for many years that Institute of Radiation Problems, ANAS has already begun fundamental studies of radiation state and radionuclide content of the fields in oil-gas extracting centers. Core laboratories were established, strong expert group was trained and they were provided with modern measuring devices in order to realize these works, to organize perfectly the results obtained.

1.INTROCTION

It is for long years that oil and gas are being extracted from the area of "Gum adasy" oil and gas extracting agency (OGED). This area includes 3000 ha zone, "Bahar", "Hovsan" and "Gum adasy" oil fields. The wells of "Bahar" oil field are situated on offshore platforms but the wells of "Gum adasy" oil field situate on onshore platforms or on its surrounding small islands and the wells of "Hovsan" oil field are onshore. Oil is extracted from different layers and depths in these wells and these layers and the study of both radionuclide distribution law and radionuclide content revive interest [1,2].

First of all crude oil is separated from water, mechanical mixtures and salts existing in oil by mechanical-thermal method. The separated crude oil only 1 per cent content of which composes water is sent to reservoirs of refineries, from there to thermal refining. The chemical and mechanical blends of natural radio-nuclides found in the layers solved in crude oil extracted from the Earth crust separate in each of these sequential technological processes. The surroundings of oil and gas extracted wells, local areas where bottom sediments accumulate and the areas where layer waters are flowed to mainly expose to technological pollution. Drilling of new oil wells, closing of the wells lost their productivity naturally impose new areas in the area of OGED to pollution by radio-nuclides and cause their number to increase.

Radiation background of these zones should be regularly kept under control and the migration of the radio-nuclides creating this background should be studied in order to provide radiation safety of population from the aspect of protecting environment.

2.THE METHOD APPLIED IN THIS WORK [4-7]:

Radiation state of the zones was studied by SRP-88, DRGZ-02, DRG-05M and MKS-1402 M standard dosimeters. These devices are used to measure γ-radiation of soils, rocks and water, indirectly radioactivity. Their sensitivity varies in the range of 3881 $m^2/(s^{-1}xmg^{-1})$ but flow of γ-rays in the range of $10x3x10^4s^{-1}$. Special background of the device doesn't exceed $10s^{-1}$. Gap is ±10%. This device is very firm and reliable for all outside works. Measurements must be conducted in the following way [1]:

1. First of all total area is studied by SRP-88, DRGZ-02, DRG-05M and MKS-1402 M dosimeters. Dose rate of the ray being in higher background level is measured beginning from natural background level by these dosimeters. Measurements are repeated for three times by every $1m^2$.
2. If exposure dose rate exceeds D=15 mkR/hour in the areas with more pollution, then the radionuclide content of the samples taken from these areas are analysed and at the same their β– activity is determined.
3. The activity of nuclides creating α and γ-rays in soil and water samples is defined in spectrometric "PROGRESS-BQ" complex device. Range of definition of this device varies between 200-800 keV according to radiant energy.

3. RESULTS

Exposure dose rate of γ-rays created by radioactive nuclides accumulated for years in local areas during oil extraction and its preliminary treatment in the area of "Gum adasy" OGED was measured and was revealed that radiation background of most areas vary in the range of 4-8 mkR/h. Radiation state in all production areas, vacant soil plots, the surfaces of platforms, water ponds and soils polluted by oil and old parts excluded from technological processes situated in this zone were studied by researchers of Institute of Radiation Problems, ANAS and samples were taken from soil, water and residues for radionuclide analysis of local areas with high radiation background. As a result of study it was determined that it was mainly local polluted areas where oil had been extracted, transported and treated preliminarily and thermally which cover very small fields. Spectrum of these areas is very big and it includes oil wells, old oil reservoirs, old transport pipelines, separators, compressor stations, water and oil pumping plants, mechanical precipitators and areas where bottom sediments have accumulated. The studies revealed that radio-ecological problem exists mainly in the areas where radiation background is much higher that the normal one and oil is extracted and in these areas radiation background sometimes reaches 100-200 μR/h or more than that. Exposure dose rate of γ-rays in such small areas can be observed only in zones where more radio-nuclides have accumulated. This dose rate can't be observed 1 meter far from there, that's while moving away from the source dose rate decreases disproportionately to squared distance ($\dot{D}_{e\phi\phi\kappa} \sim 1/p^2$).

The results of sample analysis taken from the areas with high exposure dose rate in the field of "Gum adasy" OGED are given in Table 1.

The highest radiation background was surveyed in the areas around Department of complex treatment of oil, that's radiation background in this area varies in the range of 20-200 mkR/h and this exceeds the norm for oil-gas extracting fields [4] for 0.6-6.1 times.

According to the results of samples' analysis taken from local areas of oil-gas extracting departments with high radiation background, ^{226}Ra, ^{232}Th and ^{40}K natural radio-nuclides mainly create radiation background in the area of "Gum adasy" OGED. As it is shown in Table 1 effective activity of these radio-nuclides exceeds norm for many times [4] (370 Bk/kg). Effective activity of radio-nuclides in the samples taken from the mazut tanks' surroundings exceeds for 4.2 times the allowed effective activity norm for oil-gas extracting fields.

Table 1. Distribution of radiation background in the area

№	The place from where sample was taken and test record sheet	Exposure dose rate, mkR/h	Content and activity of radionuclides- A, Bk/kg			Effective activity, A_{eff}, Bk/kg
			^{40}K	^{232}Th	^{226}Ra	
1	Total area	5	122,9±34,4	7,8±2,75	18,74±3,95	39,40
2	The area polluted by oil	50	630,0±171,0	27,3±10,3	1232,0±135,0	1321,31
3	Residues on deposits and bottom sediments	65	316,0 ± 165	56,0 ± 17,0	2489,0 ± 266	2589,22
4	Wastes	115	319,0±162,0	670,2±85,2	1463,0±166,0	2368,08
5	Surroundings of mazut tank	130	1305,0±370,0	1860,0±214,0	3847,0±416,0	6394,53
6	Mazut ponds	200	1333±400	68.±26.2	5987±630	6189,39
$A_{eff}=A_{Ra}+1,31A_{Th}+0.085A_K$						

The analysis of soil samples taken from local areas with high radiation background in the area of "Gum adasy" OGED shows that these are mainly natural radio-nuclides such as ^{40}K, ^{232}Th and ^{226}Ra. Rocks derived from layers of different depths during oil-gas extraction process mainly contain these radio-nuclides and they separate with layer waters and accumulate in several places. Radionuclide analysis due to depth is shown in Table 2. As you see from the table absolute value of radio-nuclides' thickness changes chaotically not depending on the depth. Radio-nuclides' thickness in the water samples taken chosen according to their depths varies in the range of ^{226}Ra-3,14, ^{228}Ra-4,1, ^{40}K-3,14, Bk/L between 950-1070 meters, but in 4000-

4200 meters in the range of ^{226}Ra-2,7, ^{228}Ra-2,3, ^{40}K-4,21, Bk/L and this case doesn't correspond to any law. Despite of all these, radio-nuclides accumulate in local areas in big time space and create high radiation background on the base of natural background.

Table 2. The results of water samples taken from the layers of different depths in the area of "Gum adasy" OGED.

Number of the sample, №	Depth of the well, m	Radiation content, Bk/L		
		^{226}Ra	^{228}Ra	^{40}K
37	950-1070	3,14+-0,54	4,1+-0,9	3,24+-0,85
29	1988	0,86+-0,12	2,32+-0,21	2,14+-0,54
18	2522	5,14+-1,12	4,23+-1,56	3,21+-1,74
20	2000	0,46+-0,41	0,54+-0,13	0,46+-0,069
43	2100	3,14+-0,54	4,1+-0,9	3,44+-0,85
42	2300	3,14+-0,54	4,2+-0,9	3,14+-0,85
23	2400	0,6+-0,41	0,58+-0,13	0,46+-0,069
26	2600	0,54+-0,41	0,57+-0,13	0,36+-0,069
28	2700	0,56+-0,41	0,59+-0,13	0,66+-0,069
19	2800	0,46+-0,41	0,56+-0,13	0,56+-0,069
24	3000	2,14+-0,47	3,14+-0,17	1,68+-0,25
33	3000	2,54+-0,32	4,12+-0,86	3,32+-0,17
21	3600	2,7+-0,8	2,3+-0,7	4,21+-1,15
38	3700	3,41+-0,54	4,15+-0,9	3,24+-0,85
40	3800	3,54+-0,54	4,14+-0,9	3,14+-0,85
17	3900	2,7+-0,8	2,3+-0,7	4,21+-1,15
39	4000	3,25+-0,54	4,1+-0,9	3,14+-0,85
36	4200	3,7+-0,8	2,3+-0,7	4,32+-1,15
36	4200	2,7+-0,8	2,3+-0,7	4,31+-1,15
32	4250-4500	2,4+-0,8	1,7+-0,5	2,1+-0,7

4. RESULT

1. Average natural radiation background of production sectors in "Gum adasy" OGED and most areas is in the range of 4-8μR/h.
2. It was revealed that there exist local areas radiation background of which is about 200 mkR/h and effective activity of natural radionuclides is in "Gum adasy" OGED A_{eff}=6394,53Bk/kg..
3. Distribution of these areas in the zone is non-proportional and doesn't correspond to any regulation.

5. PROPOSALS

1. The areas with high radiation background where more radionuclides accumulated were separately circled, radiation safety signs were provided.
2. According to Safety Standards (SS (NRB)-99) and [4] normative documents, the results of radio-ecological investigation, radiation safety surveillance should be conducted in the areas and production sectors where radiation background exceeds 30-35 mkr/h and special effective activity exceeds 1500 Bk/kg.
3. Plot of lands with high radiation background should be digged in after decontamination.
4. The value of natural radiation background should be taken into consideration while evaluating plot of lands and their renting.

6. REFERENCES

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