

A photograph of a dolphin leaping from the water, creating a large splash. The dolphin's body is dark and sleek, and the water is a deep blue. The splash is white and foamy, with many droplets visible. The dolphin is in the center of the frame, moving from the bottom left towards the top right.

# The quantification of natural radioactive background levels of radioactivity in offshore bottom sediments of northeastern part of Sakhalin Island

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- Drilling in offshore zone entails the increasing of marine environment ionizing radiation due to higher content of natural radionuclides , especially Ra-226, Ra-228 and its decay products in reservoir water.
- According ecological examination, the content of Ra-226 and Th-232 in reservoir water may run up to 400 Bq/kg.

- Therefore during the complex ecological monitoring of gas and oil depletion areas it is necessary to carry out analysis and to register the level of  $\gamma$ -phone,  $\alpha$ - $\beta$ - $\gamma$ -activities components of the sea environment.

- The aim of our works was the estimation of natural radioactivity of bottom sediments, that is defined with natural radionuclides (NRN) of uranium and thorium series and K40. The investigation was held on the areas gas and oil deposits, where the drilling operations had started of the *Sakhalin-2* project. The reason for the investigation was the initial of the drilling process.

# Materials and methods

- The object of our investigation were bottom sediment samples that was collected on Piltoon-Astoch and Loonskoye oil fields.



- The collection of samples was held according standards: admixtures were removed from samples, samples were dried and homogenized carefully. Measurements of natural radionuclides specific activities were conducted with scintillating spectrometer “Progress” that is used in the system of radionuclide control. The measurements were made to a high degree of accuracy (ratio error no more than 30%).

# Results and discussion

- **The results of the radionuclides content determination in bottom sediments of the area of the research ( an average data of 2 or 3 examinations) are displayed in table 1.**

# The average content of of redionuclides in offshore Sakhalin bottom sediments depending on its granulometric composition, bk/kg

Year of research	Type of bottom sediments	Ra-226		Th-232		K-40	
		Approx. concentration	Interval	Approx. concentration	Interval	Approx. concentration	Interval
1997	Sanding silts	$12,0 \pm 1,5$	3,5 – 15,0	$19,8 \pm 4,2$	13,9 – 27,0	$608 \pm 37$	360 - 840
2002	Sanding silts	$14,6 \pm 4,6$	12,0 - 21,3	$21,1 \pm 6,1$	20,3 – 25,4	$542 \pm 115$	455 - 890
	Fine-grained sands	$14,6 \pm 4,6$	12,0 - 21,3	$16,1 \pm 6,1$	20,3 – 25,4	$650 \pm 120$	455 - 614



- The content of natural radionuclides Ra-226, Ra-228, Th-232, K-40 in bottom sediments of the shelf zone are caused by natural factors - geochemical peculiarities of the region.

- The following limits of natural radionuclides are based on the bottom sediments radioactive tracer analysis results: Ra-226 from 5,1 upto 21,3 Bk/kg; Th-232 from 4,4 upto 25,4 bk/kg; K-40 from 358 upto 661 bk/kg of the dry solid matter.

- We compared the new data with the background ionizing radiation that was registered in 1997 in the same oil fields before the start of their developing.

- The analysis of the data received showed that the average content of Ra226 and Th232 in bottom sediments, that consist of fine-grained sands, was  $7,9 \pm 3,3$  and  $5,6 \pm 3,0$  Bk/kg respectively. The admixture of oozy increased the activity of NRN in 1,5-2 times and reached  $11,3 \pm 4,0$  Bk/kg for both radionuclides. The content of K40 varied from  $470 \pm 90$  Bk/kg for sand up to  $650 \pm 120$  Bk/kg for mixture of mud and sand.

- The spectrometric result showed that the natural radionuclides concentration in the bottom sediments from Piltoon-Astoch oil field stayed at the same level that it was before the start of the gas and oil deposit's developing. Thus the oil production did not worsen the ionizing radiation in this area.

- **The comparison of this data with the one of the background studies on the northeast offshore of Sakhalin, that were held before the initial of the oil and gas deposit development, showed that the level of NRN in bottom sediments of Piltun-Astokhsky deposit remained on the same level for 2 years of development as in the year 1997. Thus the oil and gas development hasn't negative influence on the radiation situation in the area on the present stage.**