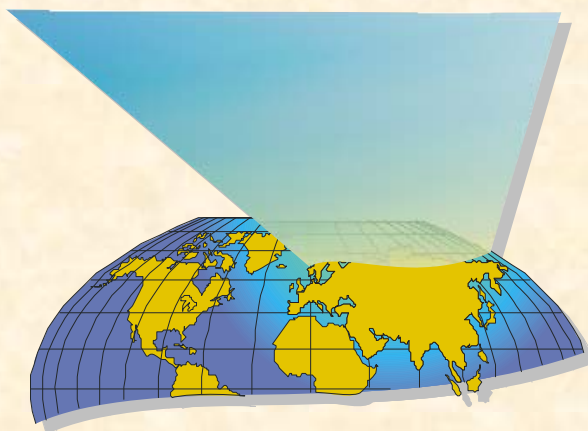


**FEDERAL SERVICE for HYDROMETEOROLOGY and  
ENVIRONMENTAL MONITORING**



**On the progress of implementation  
of the Russian National AMAP Plan Projects (III stage)  
by Roshydromet in 2005**

**2006**

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## **1. IMPLEMENTATION OF THE RUSSIAN NATIONAL AMAP PLAN PROJECTS (III STAGE) BY ROSHYDROMET IN 2005**

In 2005 in the framework of the Russian National Plan and special projects, the research institutions of Roshydromet organized:

- complex studies during the seasonal expeditions;
- stationary systematic observations of atmospheric air pollution in the largest cities of the Russian Arctic (Murmansk, Monchegorsk, Vorkuta, Nikel, Amderma, Norilsk and Salekhard);
- observations of the levels of pollutants over the Roshydromet network points;

### **1.1. Expedition studies**

The expedition studies in 2005 were carried out in the western Arctic and included activity in the sea areas (Central Arctic Basin, Barents, Greenland, Pechora) and on the coast (Spitsbergen archipelago, area of Bolshezemelskaya tundra).

A total of three Arctic expeditions were carried out by Roshydromet in 2005 that conducted sampling of different environmental media for the levels of pollutants.

The scope of work and the characteristics of the information set obtained from the results of each expedition are given in Table 1. The same table contains explanation of abbreviations of the names of contaminant groups used below.

#### **1.1.1. “North Pole-2005” Expedition**

Within the framework of voyage RV "Academic Fedorov" in the Central Arctic Basin with the purpose of landing to ice of drifting station “ North Pole-34 ”, samples of snow cover, sea water, sea ice and sea bottom sediments have been collected at 35 oceanographic stations for determination of the pollutants contents in Barents sea, in the Central part of the Arctic Basin and in Kara sea. In the samples of sea water standard hydrochemical indicators (hydrogen index, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, redox potential, total alkalinity, nutrients, suspended matter) and the levels of pollutants were determined. Main ions (K, Na, Ca, Mg), oil hydrocarbons (OH), polycyclic aromatic hydrocarbons (PAH), organochlorines (OCs) including polychlorobiphenyls (PCB), heavy metals (HM) were determined in the samples of sea ice and snow cover. Nutrients and the levels of pollutants were determined in the samples of bottom sediments.

Expedition was carried out during the period from July, 15 to September, 10 in 2005.

The work was accomplished by the SSC AARI and the RC “Monitoring of the Arctic”.

### 1.1.2. “Spitsbergen 2005” Expedition

In 2005, the ecological monitoring of the area of the Barentsburg miners' settlement in Spitsbergen archipelago was carried out. The aim of the work was to specify the ecological situation with respect to pollution of environmental compartments. The surveys were performed in the framework of the Program of Roshydromet on the organization and development of scientific studies on the archipelago for 2002-2005, which is part of the “Comprehensive program for optimization and increase of efficiency of activity of the Russian organizations on the Spitsbergen archipelago” approved on January 14, 1999 by the Chairman of the Interagency Commission on Spitsbergen under the Ministry for Economical Development of the RF.

Works were carried out in the period from 26.08.05 for 08.09.05.

The work program included: geoecological sampling of atmospheric air and atmospheric aerosol, soils, soil water and terrestrial vegetation in the settlement territory of the Barentsburg, and in the sanitary-protection zone of the settlement and in the baseline areas; seawater, seawater suspended matter and bottom sediments in the Groenfjord area adjoining the settlement; surface water and bottom sediments of potable water Lake Bienda-stemmev and Grendalselva river.

The samples of sea and surface land water, bottom sediments collected during the surveys were investigated for the levels of organochlorines (OCs) including polychlorobiphenyls (PCB), polycyclic aromatic hydrocarbons (PAH), oil hydrocarbons including total oil hydrocarbons (OH) and composition of the fraction of non-polar aliphatic hydrocarbons (NAH); individual phenols (alkyl-, chlorine- and nitro- derivatives), heavy metals (HM) and arsenic, detergents and nutrients. The samples of atmospheric aerosols were examined for the levels of HM, OCs, PCB and PAH, and in the air samples, the determinations of volatile organic compounds (VOC) and gaseous composition components: NO<sub>2</sub>, SO<sub>2</sub>, H<sub>2</sub>S, CO, etc., were made. The concentration of the HM, OH, NAH, PAH and individual phenols were determined in the samples of soils. The concentration of the OH, PAH, OCs, PCB и HM were determined in the samples of terrestrial vegetation.

The work was accomplished by the RC “Monitoring of the Arctic”.

### 1.1.3. “NAR-2005” Expedition

The work carried out in the framework of the “NAR 2005” expedition continued the activities undertaken in 1998-2004. The expedition period is 12.08.05-26.08.05. Region of works covered the area of Toravei, Varandei, Toboi, Inzyrei, Rossihina oil deposit fields.

The expedition work program envisaged:

- monitoring of pollution of atmospheric air, water and bottom sediments of land water bodies, soils and terrestrial vegetation;
- visual and instrumental (aerial photography and video surveys) observations of disturbance of soil-vegetation cover.

Observations and sampling for chemical-analytical and other laboratory examinations were performed at 17 sampling points on land and at 28 sampling points in the area of tundra lakes.

The samples of water, bottom sediments and soils were examined for the levels of HM, total OH, non-polar aliphatic hydrocarbons, volatile aromatic hydrocarbons, PAHs, detergents and individual phenols (alkyl-, chlorine- and nitro- derivatives). Standard

hydrochemical indicators were also determined in the water samples. The samples of terrestrial vegetation were examined for the levels of HM and OH.

The work was accomplished by the RC "Monitoring of the Arctic".

**Table 1. Scope of work and characteristics of the information set obtained (planned) based on the results of Roshydromet expeditions in 2005**

Study object / type of observations	Number of stations	Number of samples	Parameters under control
<b>"North Pole-2005" Expedition</b>			
Sea water	21	29	DET, OH, PHE, NAH, PAH, HM, OCs, PCB, SC, H/Chem
Snow cover	5	5	HM, OCs, PCB, OH, PAH, MI
Sea ice	5	5	HM, OCs, PCB, OH, PAH, MI
Sea bottom sediments	4	4	Nutrients, PCB, OH, PHE, NAH, PAH, HM, OCs, PCB
<b>"Spitsbergen 2005" Expedition</b>			
Seawater	12	13	DET, OH, PHE, NAH, PAH, HM, OCs, PCB, H/Chem
Sea water suspended matter	10	10	HM, OCs, PCB, PAH
Sea bottom sediments	13	13	HM, OCs, PCB, OH, NAH, PAH, PHE, DET, nutrients
Surface land water	2	4	DET, OH, PHE, NAH, PAH, HM, OCs, PCB, VAH H/Chem
Bottom sediments of fresh water bodies	2	2	HM, OCs, PCB, OH, PAH, VAH, PHE, DET, nutrients, GMC
Soils	25	50	HM, OCs, PCB, OH, NAH, VAH, PAH, GMC
Soil water	7	7	HM, OCs, PCB, OH, NAH, VAH, PAH, PHE, DET, H/Chem
Terrestrial vegetation	25	50	HM, OCs, PCB, PAH
Atmospheric aerosol	9	9	HM, OCs, PCB, PAH
Atmospheric air	9	9	VOC, NO <sub>2</sub> , SO <sub>2</sub> , H <sub>2</sub> S, CO, PHE
<b>"NAR 2005" Expedition</b>			
Surface land water	28	28	DET, OH, PHE, NAH, VAH, PAH, HM, H/Chem
Bottom sediments	28	28	OH, PHE, NAH, VAH, PAH, PCB, HM, nutrients
Soils	17	17	HM*, PHE, OCs, PCB, OH, NAH, VAH, PAH, nutrients, GMC
Terrestrial vegetation	9	9	HM

**Notes:**

H/Chem	- standard hydrochemical indicators (hydrogen index, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, redox potential, total alkalinity, nutrients, suspended matter)
HM	- heavy metals (Fe, Mn, Ni, Co, Cd, Pb, Zn, Cu, Sn, Cr, Hg, As)
OCs	- organochlorines (pentachlorobenzene, $\alpha$ - HCH, hexachlorobenzene, $\beta$ - HCH, $\gamma$ - HCH, heptachlor, aldrine, octachlorostyrene, heptachlorepoxyde, trans-chlordane, 2,4 - DDE, cis-chlordane, trans-nonachlor, 4,4 - DDE, 2,4 - DDD, 4,4 - DDD, cis-nonachlor, 2,4 - DDT, 4,4 - DDT, fotomirex, mirex)
PCBs	- polychlorinated biphenils (#28, #52, #101, #105, #118, #138, #153, #156, #180, sum of PCB)
OH	- oil hydrocarbons
PAH	- polycyclic aromatic hydrocarbons (naphthalene, acenaphthylene, biphenyl, 2-methylnaphthalene, 1-methylnaphthalene, fluorine, acenaphthene, phenanthrene, anthracene, 2,6-dimethylnaphthalene, fluoranthene, 2,3,5-trimethylnaphthalene, 1-methylphenanthrene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(e)pyrene, perylene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, indeno(123cd)pyrene, benzo(g,h,i)perylene)
VAH	- volatile aromatic hydrocarbons (benzene, toluene, orto-, para- and meta-xylene)
NAH	- non-polar aliphatic (C <sub>15</sub> -C <sub>31</sub> )
VOC	- volatile organic compounds
PHE	- phenols
DET	- detergents
nutrients	- nutrients (nitrates, nitrites, ammonium, total nitrogen, phosphates, total phosphorus, dissolved silicates)
SC	- suspension concentration
SP	- solid particles
GMC	- granulometric composition
MI	- main ions (K, Na, Ca, Mg)

## 1.2. Stationary systematic observations of pollution of the atmospheric air and atmospheric precipitation

In 2005, the observations of the level of atmospheric air pollution in the cities of the Arctic zone were carried out at stationary posts in Murmansk, Nickel, Monchegorsk, Salekhard and Norilsk. Sampling was made daily (4 times a day) in equal 6 h time intervals at 1.00, 7.00, 13.00 and 19.00 hours Moscow time to the filters and adsorbing tubes. The following indicators were determined:

- in Norilsk - levels of dust, sulphur dioxide, carbone oxide, nitrogen dioxide, nitrogen oxide, formaldehyde, hydrogen sulphide, phenol, chlor, benzo(a)pyrene, heavy metals;
- in Murmansk - levels of dust, sulphur dioxide, carbone oxide, nitrogen dioxide, nitrogen oxide, formaldehyde, mercury, benzo(a)pyrene, heavy metals;
- in Monchegorsk - levels of dust, sulphur dioxide, carbone oxide, nitrogen dioxide, nitrogen oxide, formaldehyde, benzo(a)pyrene, heavy metals.

It should be noted that in connection with a difficult financial situation it was not possible for Roshydromet in 2005 to extend the scope of the observed parameters.

Monitoring of sulphur and nitrogen compounds in the air and atmospheric precipitation was continued, and besides, acidification of atmospheric precipitation was measured at the stations of atmospheric pollution control Yaniskosky (Kola peninsula) and Pinega (Arkhangelsk region) in the EMEP framework.

In 2005, observations were continued at the station of carbon dioxide monitoring system - Teriberka. Frequency of sampling under the programme was 4 times a month. Air samples were analyzed at the Voeykov Main Geophysical Observatory.

It should be noted that operational obtaining of data on CO<sub>2</sub> concentrations at Teriberka station is very difficult due to a considerable lack of finances, which reduces the operational character of data obtaining.

In 2005, observations of the chemical composition of atmospheric precipitation were carried out at 5 stations of the Arctic network of stationary observations, situated in the area of Krasnoshchelye settlement (Kola peninsula), Naryan-Mar (Pechora River), Dikson Island, Turuhansk (Yenisey River) and Kusyur settlement (Lena River). The work program envisages monthly collection of the integral sample of precipitation.

Since 1999 a joint Project with the NPO "Taifun" connected with using automated instruments of air sampling for the levels of pollutants is realized in Amderma settlement. Now the organizations of Roshydromet solve the problem of installing the sampling equipment for the levels of organic compounds of mercury.

## 1.3. Radiation monitoring in the Russian Arctic

In 2005, observations in the framework of planned work for control of radioactive contamination of environmental compartments were continued at 34 sites of the State System of Radiation Monitoring in the Russian Arctic.

At all stations daily monitoring of the exposure dose strength of gamma emission and daily sampling of radioactive fallout from the atmosphere are carried out to determine total beta-activity.

At the sites in Arkhangelsk, Naryan-Mar, Salekhard, Murmansk, Dikson island, Zhelaniya cape, Kheis island and Kandalaksha sampling of aerosoles in the surface atmospheric

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layer and atmospheric precipitation was performed for a specific radioisotopic analysis, including determination of tritium. The analysis is being conducted at the laboratories of NPO "Taifun" and territorial administrations of Roshydromet in St.Petersburg and Yakutsk.

Samples of surface water for determination of levels of 90-Sr and tritium were collected at the stations of radioactive contamination control, located in the mouth regions of the largest rivers of the Russian Arctic (Severnaya Dvina, Pechora, Mezen, Ob, Yenisey, Khatanga, Lena and Indigirka). Besides, the control for levels of 90-Sr in sea water was conducted in the White and Barents Seas in the most significant regions of the water area.

List of stations of radioactive contamination control and types of radiometric observations performed at these stations are presented in Table 2.

#### **1.4. Conclusion**

In conclusion it is necessary to stress that in spite of a complicated situation with the financing of the Arctic studies, Roshydromet in 2005 continued sufficiently large-scale expedition studies and observations of the state of environment components over the stationary network. The collected samples were passed to the base chemical laboratories of the Regional Center "Monitoring of the Arctic", NPO "Taifun" and the Institute for global climate and ecology, where they were analyzed.

It is necessary to stress that a considerable amount of comprehensive data on the state of the ecosystems in the specific regions of the Arctic land and local sea water areas was obtained in the framework of contract work with the interested investors. In this connection these data can be made available to the AMAP Secretariat only in the generalized form.

Data on these regions for the specific samples and specimens could be transferred to the Secretariat only on a compensatory financial basis with agreement of the investors.



Table 2. List of radiation control points and types of radiometric observations

Point of observation	Synoptic index	Geographical coordinates		Observation type			Conduct of radiometric observations in situ
		latitude	longitude	G	P	AFE	
<b>Coastal</b>							
1. Nikel M	22004	69° 25'	30° 11'	+	*		
2. Ura-guba M	22018	69° 17'	32° 48'	+	*		
3. Dalniye Zelentsy M	22037	69° 07'	36° 04'	*	*		
4. Cape Svyatoy Nos M	22140	68° 08'	39° 46'	+	*		r/m
5. Intsy N	22452	65° 58'	40° 13'	*	*		
6. Kanin Nos N	22165	68° 39'	43° 18'	+	*		r/m
7. Tobseda N	23105	68° 33'	52° 15'	*	*		
8. Khodovarikha N	23103	68° 56'	53° 46'	+	*		
9. Chernaya N	23118	68° 00'	57° 25'	*	*		
10. Varandey N	23112	69° 49'	58° 01'	+	*		
11. Korotaikha A	23121	68° 46'	61° 26'	*	*		
12. Mezen N	22471	65° 52'	44° 13'	+	+		
13. Kem-port N	22522	64° 59'	34° 48'	+	+		
14. Severodvinsk N	22546	64° 35'	39° 47'	+	*	*	
15. Unskiy Mayak N	22541	64° 50'	38° 24'	+	*		
16. Kego N (Arkhangelsk)	22555	64° 32'	40° 28'	+	+	+	
17. Zimnegorskiy Mayak N	22446	65° 28'	39° 44'	*			
18. Mud'yug N	22551	64° 51'	40° 17'	+	*		
19. Zhizhgin N	22438	65° 12'	36° 49'	+			
20. Amderma A	23022	69° 46'	61° 41'	+	+	0	
21. Tiksi T	21824	71° 40'	128° 50'	+	+	*	
22. Pevek P	25051	69° 42'	170° 15'	+	*	*	
23. Krasnoarmeyskiy P	25055	69° 33'	172° 02'	0	0		r/m
<b>Island</b>							
24. Barentsburg M (Spitsbergen Island)	22107	78° 04'	14° 15'	+	+	*	r/m
25. Morzhovets Island N (White Sea)	22361	66° 43'	42° 29'	+	+		r/m
26. Bugrino N (Kolguev Island)	22193	68° 48'	49° 20'	+	+		r/m
27. Uedineniya Island TM	20274	77° 30'	82° 14'	0	0	0	0
28. Vrangal Island P	21982	70° 59'	178° 29'	+	0	0	0
29. Karmaguly A (Novaya Zemlya Island)		-	-	+	*	*	
30. Cape Zhelaniya TM (Novaya Zemlya Island)	20353	76° 57'	68° 33'	0	0	0	0
<b>Observation points within a 100-km area of the Kola NPP</b>							
31. Apatity M	22213	67° 33'	33° 21'		+	+	
32. Pulozero M	22119	68° 21'	33° 18'		+	*	
33. Umba M	22324	66° 40'	34° 20'		+	*	
34. Zasheek M	22214	67° 24'	32° 33'		+	+	

**Note:**

G	- measurement of exposure dose capacity	M	- Murmansk HMSA
P	- plane-table	N	- Northern HMSA
AFE	- air-filtering equipment	A	- Amderma HMSA
+	- ongoing measurements	T	- Tiksi HMSA
*	- planned observations	TM	- Taimyr HMSA
0	- to resume earlier interrupted observations	P	- Pevek HMSA
		HMSA	- Hydrometeorological Service Administration