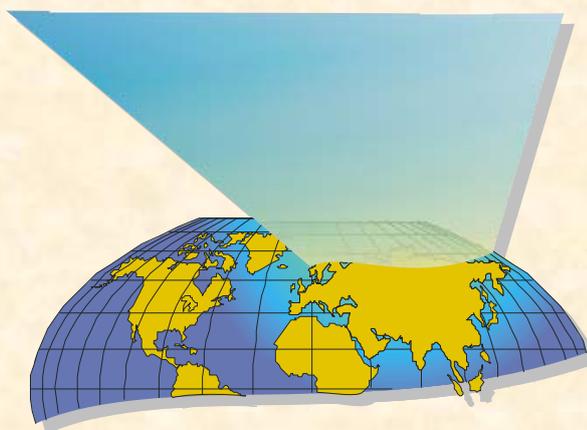


**FEDERAL SERVICE for HYDROMETEOROLOGY and
ENVIRONMENTAL MONITORING**



**On the progress of implementation
of the Russian National AMAP Plan (III stage)
by Roshydromet in 2006-2008**

2008

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1. Implementation of the Russian National Amap Plan Projects (III stage) by Roshydromet in 2006-2007

In 2006-2007 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 2006 and 2007 were carried out in the western Arctic and included activity in the sea areas (Central Arctic Basin, and on the coast (Spitsbergen archipelago, Franz Josef Land archipelago, area of Bolshezemelskaya tundra).

As a whole of seven Arctic expeditions were carried out by Roshydromet in 2006 and 2007 during them was conducted sampling of different environmental compartmentd for the measuring content 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-2006" and "North Pole-2007" expeditions

Within the framework of voyages RV "Academic Fedorov" in the Central Arctic Basin, samples of snow cover, sea water, sea ice and sea bottom sediments have been collected at 28 oceanographic stations for determination of the pollutants contents. 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.

The works werer accomplished by the SSC AARI and the Nothr-West Branch of SI "NPO "Typhoon".

1.1.2. "Spitsbergen 2006" and "Spitsbergen 2007" Expeditions

In 2006 and in 2007, the ecological monitoring of the area of the Barentsburg miners' settlement, coal mine Grumant and settlement Piramida 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 by the North-West Branch of the SI "NPO " "Typhoon" in the framework of the Program of Roshydromet on the organization and development of scientific studies on the archipelago for 2002-2007.

Annually works were carried out in two stages: in the spring and in the summer seasons.

The work program included: geoecological sampling of atmospheric air and atmospheric aerosol, snow cover, soils, soil water and terrestrial vegetation in the settlement territory of the Barentsburg and coal mine of the Grumant, and in the sanitary-protection zone of the settlement and in the baseline areas; sampling of sea ice, seawater, seawater suspended matter and bottom sediments in the Grónfjord and Isfjord Bays area adjoining the settlement; collecting of samples of freshwater ice, surface water and bottom sediments of potable water Lake of the Bienda-stemmev and Grøndalselva river. The layout of ecological sampling points included: in the spring season - 25 ground, 11 marine and 2 lake-based sampling sites, in the summer period - 26 ground, 11 marine, 1 lake-based and 1 river-based sampling sites.

The samples of sea and surface land water, sea and freshwater ice, 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-derivates), 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, volatile organic compounds (VOC) and gaseous composition components: NO₂, SO₂, H₂S, CO, etc., were measured. The concentrations of the HM, OH, NAH, PAH and individual phenols were determined in the samples of soils. The concentrations of the OH, PAH, OCs, PCB и HM were estimated in the samples of terrestrial vegetation.

The work was accomplished by the the North-West Branch of the SI "NPO" "Typhoon".

1.1.3. "NAR-2006" and "NAR-2007" Expeditions

The work carried out in the framework of the "NAR 2006" and the "NAR 2007 " expedition continued the activities undertaken in 1998-2005 Region of works covered the areas of the Toravei, Varandei, Toboi, Myadsei, Inzyrei, Rossihina oil deposit fields.

The each 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 19 sampling points on land and at 30 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 works were accomplished by the the North-West Branch of the SI "NPO "Typhoon".

1.1.4. "Franz Josef Land 2007" expedition

During of the summer-fall seasons of 2007 sampling of the soil and technical liquers specimens in the Graham Bel, Gofman and Land of Alexandral islands of the Franz Josef Land Archipelago. As a total for the analysis were collected 635 samples of soils and 30 samples of technical liquers. Soil samples were investigated for the levels of HM, total OH, volatile aromatic hydrocarbons and PCB. The samples of technical liquers were examined for the levels of PCB.

The works in the part of chemical analysis was accomplished by the the North-West Branch of the SI "NPO "Typhoon".

Table 1. Scope of work and characteristics of the information set obtained (planned) based on the results of Roshydromet expeditions in 2006 and in 2007

Study object / type of observations	Number of stations	Number of samples	Parameters under control
"North Pole-2006" and "North Pole-2007" Expeditions			
Sea water	11	22	DET, OH, PHE, NAH, PAH, HM, OCs, PCB, SC, H/Chem
Snow cover	20	20	HM, OCs, PCB, OH, PAH, MI
Sea ice	20	20	HM, OCs, PCB, OH, PAH, MI
Sea bottom sediments	3	3	Nutrients, PCB, OH, PHE, NAH, PAH, HM, OCs
"Spitsbergen 2006" and "Spitsbergen 2007" Expeditions			
Seawater	12	70	DET, OH, PHE, NAH, PAH, HM, OCs, PCB, H/Chem
Sea water suspended matter	10	32	HM, OCs, PCB, PAH
Sea ice	6	12	HM, OCs, PCB, OH, PAH, PHE, MI
Sea bottom sediments	13	26	HM, OCs, PCB, OH, NAH, PAH, PHE, DET, nutrients
Surface land water	2	8	DET, OH, PHE, NAH, PAH, HM, OCs, PCB, VAH, H/Chem
Freshwater ice	1	2	HM, OCs, PCB, OH, PAH, PHE, MI
Bottom sediments of fresh water bodies	2	4	HM, OCs, PCB, OH, PAH, VAH, PHE, DET, nutrients, GMC
Snow cover	26	52	HM, OCs, PCB, OH, PAH, VAH, PHE, MI, H/Chem
Soils	25	100	HM, OCs, PCB, OH, NAH, VAH, PAH, GMC
Soil water	7	14	HM, OCs, PCB, OH, NAH, VAH, PAH, PHE, DET, H/Chem
Terrestrial vegetation	25	50	HM, OCs, PCB, PAH
Atmospheric aerosol	9	36	HM, OCs, PCB, PAH
Atmospheric air	9	36	VOC, NO ₂ , SO ₂ , H ₂ S, CO, PHE
"NAR 2006" and "NAR 2007" Expeditions			
Surface land water	30	58	DET, OH, PHE, NAH, VAH, PAH, HM, H/Chem
Bottom sediments	30	58	OH, PHE, NAH, VAH, PAH, PCB, HM, nutrients
Soils	18	36	HM*, PHE, OCs, PCB, OH, NAH, VAH, PAH, nutrients, GMC
Terrestrial vegetation	9	18	HM
"Franz Josef Land 2007" expedition			
Soils	635	635	PCB, OH, VAH, HM
Technical liquers	30	30	PCB

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, α - HCH, hexachlorobenzene, β - HCH, γ - 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, tholuene, orto-, para- and meta-xylene)
NAH	- non-polar aliphatic (C ₁₅ -C ₃₁)
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 2006-2007, 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-hour 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.

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 2006-2007, 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 CO₂ concentrations at Teriberka station is very difficult due to a considerable lack of finances, which reduces the operational character of data obtaining.

In 2006-2007, 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 Kyusyur settlement (Lena River). The work program envisages monthly collection of the integral sample of precipitation.

Since 1999 a joint Project with the SI "NPO "Typhoon" connected with using automated instruments of air sampling for the indicating levels of pollutants is realized in Amderma settlement.

1.3. Radiation monitoring in the Russian Arctic

In 2006 and 2007, 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 settlements sampling of aerosoles in the surface atmospheric layer and atmospheric precipitation was performed for a specific radioisotopic analysis, including determination of tritium. The analysis is being conducted at the laboratories of the SI "NPO "Typhoon" 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.

2. Implementation of the Russian National AMAP Plan Projects (III stage) by Roshydromet in 2008

In 2008, the research institutions of Roshydromet plan to continue the following activities in the framework of the Russian National Plan and specialized projects:

- a complex of studies during the seasonal expeditions, including the drifting station and "Spitsbergen-2008" expeditions;
- stationary systematic observations of atmospheric air pollution in the largest towns of the Russian Arctic (Murmansk, Monchergorsk, Vorkuta, Nikel', Amderma, Norilsk and Salekhard);
- observations of the levels of pollutants at the Roshydromet network points;
- control of radioactive pollution of environmental components at the State Radiation Monitoring System points in the Russian Arctic.

During the expeditions "North Pole-35" drifting station and "Arktika-2008" it is planned to collect samples of the snow cover, seawater, sea ice and bottom sediments to investigate them for the concentration of pollutants by the same parameters as during the "North Pole-2006" and the "North Pole-2007" expeditions.

The "Spitsbergen-2008" expedition includes organization and implementation of baseline and local ecological monitoring of pollution of environmental components in the area of Barentsburg settlement and the adjoining area of Gronfjord Bay. The work will be performed in two stages: during the spring (May) and summer (August) periods. The work program includes geo-ecological sampling of atmospheric air and atmospheric aerosol, snow cover, soil, ground water and terrestrial vegetation in the territory of Barentsburg settlement, in the sanitary-protection zone and baseline regions; sea ice, seawater, marine suspended matter and bottom sediments in the Gronfjord Bay area adjoining the settlement; freshwater ice, surface water and bottom sediments of potable Lake Bienda-Stemmev and Grendalselva River. A diagram of the field ecological sampling points includes 15 land sampling sites, 15 marine, 4 lake and 2 river sampling stations. The composition of pollutants determined in the samples is similar to the "Spitsbergen-2006" and "Spitsbergen-2007" expeditions.

Conclusion

In conclusion it is necessary to stress that Roshydromet continued in 2006 - 2008 sufficiently large-scale expedition studies and observations of the state of environmental components over the stationary network.. The collected samples were passed to the base

chemical laboratories of the the North-West Branch of the SI “NPO ”Typhoon” 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	
Coastal							
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
Island							
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
Observation points within a 100-km area of the Kola NPP							
31. Apatity M	22213	67° 33'	33° 21'		+	+	
32. Pulozero M	22119	68° 21'	33° 18'		+	*	
33. Uмба 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