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Development of the Territorial Automated Network of Ambient Air Control in Towns of the Murmansk Region

Final Report

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Brief summary of the project

The purpose of the project is to improve the existing ways of air quality monitoring by implementation of an automatic monitoring system and by extending the range of monitored substances to match international standards.
The establishment of an automated air quality monitoring system will allow obtaining of reliable information on the state of ambient air pollution, which in its turn will facilitate making of proper administrative decisions on reduction of emissions to the air, prevention or reduction of adverse consequences of environmental changes.

This project provides installation of ambient air quality monitoring stations in 3 industrial areas

Total cost of the project is 16.3 million rubles.

During the initial contact with the initiators in August 2009, the following donors expressed interest in this project: NEFCO and NDEP.

The project does not have a direct commercial effect, but possible benefits can be gained from environmental fees for monitored pollution above admissible limits which will be revealed during the monitoring process.

Direct economic benefits:

- Fees for monitored pollution above admissible limits;
- Sale of knowledge through scientific articles, attending conferences.

Indirect economic benefits:

- Improvement of environmental conditions owing to the monitoring and prompt response to the atmosphere pollution and therefore, improvement of general health of the population.

List of abbreviations

ADTS – Automated Data Transmission Service
APC - Approximately Permissible Concentration
CATE - Closed Administrative-Territorial Entity
CEMS – continuous emission monitoring system
CMEP - Center of monitoring and environmental pollution
CPP – Cogeneration Power Plant
DHME - Department of Hydrometeorology and Monitoring of Environment
EVD - The Agency for International Business and Cooperation: a branch of the Ministry of Economic Affairs of the Netherlands
FL – Federal Law
GCOS – Global Climate Observing System
GD – Guiding Document
GOK – Mining and Concentration Complex
GOST – State Standard of the Russian Federation
HMC - Hydrometeorological Center
HMS – Hydrometeorological Station
HSS – Hardware and Software System
IEP – Investment Environmental Project
IMS - Ionosphere-magnetic service
ITC – Information Technology Center
IZA – Ambient Pollution Index
KAZ SAUL - Kandalakshsky Aluminum Plant of Siberian-Urals Aluminum Company[1]
LLC – Limited Liability Company
MIS - Measurement Instrumentation Service
MPC - Maximum Permissible Concentration
MSC – Mining and Smelting Company
MUGMS - Murmansk Department of Hydrometeorology and Monitoring of Environment[2]
NDEP - Northern Dimension Environmental Partnership[3]
NEFC - Nordic Environment Finance Corporation[4]
NP - Maximum frequency of MPC increase
OAO – Open Joint Stock Company
PM-10 - Suspended solids with a diameter less than 10 microns
SanPiN – Sanitary Regulations and Standards
SDW – Solid Domestic Waste
SHS - Sanitary-hygienic Standard
SI – Standard Index
SMS – State Monitoring System
SUAC – Siberian-Urals Aluminum Company
UHMS - Unified Hydrometeorological Service
US – Urban Settlement
WMO – World Meteorological Organization

[1] Russian: Кандалакшский алюминиевый завод Сибирско-Уральской алюминиевой компании – *Translator's note*.
[2] Russian: Мурманское управление по гидрометеорологии и мониторингу окружающей среды – *Translator's note*.
[3] Russian: Природоохранное партнерство Северное Измерение – *Translator's note*.
[4] Russian: Экологическая Финансовая Корпорация Северных Стран – *Translator's note*.

1 GENERAL PROVISIONS

1.1 Background

There are a lot of mining and smelting industries concentrated in the Murmansk Region due to the presence of natural resources. “Severonikel” («Североникель») and “Pechenganikel” («Печенганикель») factories, which enter the GMK “Norilsk Nikel” (ГМК «Норильский Никель») are located in the towns of Monchegorsk, Zapolyarnyi and Nikel, and Kandalakshsky Aluminum Plant (Кандалакшский алюминиевый завод) is in Kandalaksha. Ferrous metallurgy is represented by OAO “Olkon” («Олкон») (Olenegorsk) and OAO “Kovdorskiy GOK” («Ковдорский ГОК») (Kovdor).

The largest Russian apatite and nepheline concentrate producers for making of mineral fertilizers operate in the towns of Kirovsk and Apatity. All the above mentioned enterprises account for 70% of all emissions to the air. “Pechenganikel” («Печенганикель») factory, which enters “GMK Norilsk Nikel” (ГМК «Норильский Никель»), accounts for about 80% of the pollutant emissions, predominantly sulfur dioxide but also heavy metals and suspended solids PM-10. This plant is located In Nikel and Zapolyarnyi of the Murmansk region.

The problem of air pollution by PM is acute for Apatity and Kirovsk, where the producers of mineral fertilizers are located.
At the moment Murmansk Department of Hydrometeorology and Monitoring of Environment, which is empowered by the government to monitor the environmental pollution, monitors the content of total suspended solids in the ambient air of the settlements of the Murmansk region.

At the same time the particulate matters with a diameter less than 10 microns (the so-called PM-10) are not measured separately. Meanwhile, this problem is crucial, as the concentration of PM affects human health significantly, the solids easily get into respiratory tracts and cause respiratory and allergic diseases when exposed long-term. But it is impossible to control the pollution level on the above mentioned substances without having monitoring the PM.

The existing monitoring system in the Murmansk region is not fully automated, data is received extensively delayed, which makes identification of the pollutant source complicated.

According to the Council of the European Union, the following substances should be monitored: sulphur dioxide, nitrogen dioxide, particulate matters with a diameter of no less than 10 microns (the so-called PM-10), general suspended solids (dust), ozone, benzol, metals, aromatic hydrocarbons, including benzo(a)pyrene.
Two substances on this list (PM-10 and ozone) are currently not being monitored in Murmansk. According to the Council of the European Union, the following substances should be monitored: sulphur dioxide, nitrogen dioxide, suspended substances with a diameter of no less than 10 microns (the so-called PM-10), general suspended solids (dust), ozone, benzol, metals, aromatic hydrocarbons, including benzo(a)pyrene.

The purpose of the project:

The purpose of the project is to improve existing ways of monitoring by implementation of continuous Emission monitoring system (CEMS) and by extending the monitoring of substances to match international standards.
Establishment of a CEMS will allow obtaining reliable information on the state of ambient air pollution, which in its turn will facilitate making of proper administrative decisions on reduction

of pollutant emissions, prevention or reduction of adverse consequences of environmental changes.

Project objectives:

- To set up a system of continuous emission monitoring of the ambient air, installing automated gas analyzers in towns and settlements;
- To get reliable real time data on the ambient air pollution in towns and settlements of the Murmansk Region, necessary to prevent and mitigate the adverse effects of environmental changes, and make efficient managerial decisions; and
- To ensure the functioning of a central data system to improve the environmental management.

1.2 Economic benefits of IEP implementation

The project does not have a direct commercial benifit, but possible benefits can be gained from environmental fees for monitored pollution above admissible limits which will be revealed during monitoring process.

Direct economic benefits:

- Fees for monitored pollution above admissible limits;
- Sale of knowledge through scientific articles, attending conferences.

Indirect economic benefits:

- Improvement of environmental conditions due to the monitoring and prompt response to the atmosphere pollution and therefore, improvement of general health of the population.

1.3 Possibility to reproduce IEP

This project provides installation of ambient air quality monitoring station in 3 industrial areas

Further extension of the monitoring network in the future will provide a more complete picture of the ambient air conditions in the Murmansk region and therefore.

1.4 Participants and flow chart of IEP implementation

Project parties:

- Project initiator – Murmansk Department of Hydrometeorology and Monitoring of Environment (MUGMS);
- Project coordinator – Committee on Ecology and Management of natural resources of the Murmansk region;
- Equipment supply and installation subcontractors.

End consumers may include scientific and medical communities, policy makers, and policy planners at a local and national level, mass media and population in general. Data and information obtained through the monitoring programs should be brought to the attention of the users from scientific and medical communities in such form and within such time frame that would meet their specific needs.
Each person has a right to be informed about the state of environment. Thanks to the distribution of information on the ambient air quality among the population, we it is performed

the task of informing, educating and raising the level of awareness of the vital issues of environment and health. A well-informed and well-acquainted community may also be able to play a constructive role and render an effective assistance in solving of environmental improvement problem.

In this connection, it is recommended to carry out activities aimed at education of population and distribution of information which is significant for the community. It is also recommended to provide free international exchange and distribution of information on ambient air quality using such open and easily accessible medium for information transfer as Internet.

2 CHARACTERISTIC OF INITIATOR

2.1 Details и brief characteristic of initiator facility

State Institution “Murmansk Department of Hydrometeorology and Monitoring of Environment”

- Location – North-West Federal District, the Murmansk region, city of Murmansk
- Address: - 183789, Murmansk, Shmidta str., 23
  Tel/Fax: (815–2)47–24-06.
- Internet: www.kolgimet.ru The chief of Federal Agency “Murmansk UGMS” – Anatoliy Vasil’evich Semenov

In the territory of the Murmansk region MUGMS include:

- Hydro meteorological center
- Center of monitoring and environmental pollution
- Department of ionosphere-magnetic service
- Service of automatic data distribution
- Center of automated processing of hydrometeorological information
- Service for repair and calibration of hydrometeorological survey instruments
- Regional hydrometeorological observatory Barentsburg (Shpitsbergen Archipelago)
- Aeronautical meteorological station of the international airport of Murmansk
- State monitoring network includes:

- 32 hydrometeorological stations
- 54 hydrometeorological points
- 18 statutory checkpoints for ambient air control (SCAAC)
- 59 checkpoints of rivers and lakes pollution monitoring
- Research vessel “Viktor Buynitskiy”
- Research vessel “Professor Molchanov”
- Expeditionary boats “Captain Evtyukov” and “Briz”

Organizational chart of MUGMS is presented in Appendix 1.

History of the enterprise

November 14, 1936 – by the USSR Government Decree the Head Department of hydrometeorological service (HDHMS) attached to the Council of People's Commissars of the USSR is formed.

December 1932 – Formation of weather bureau in Murmansk – the ancestor of hydro meteorological centre of Murmansk.

1934 – Department of the Unified Northern Seas hydrometeorological service is established in Murmansk, which is transformed to the Department of Unified Northern Seas and Murmansk district hydrometeorological service in 1935.

1936 – Formation of Murmansk geophysical observatory of Murmansk UGMS.

1937 - Northern Seas and Murmansk district UGMS is newly reorganized to the Murmansk Branch of hydrometeorological service and subordinated to the Leningrad UGMS.

August 29, 1938 – By order No. 259 on the Head Department of hydrometeorological service of the USSR attached to the Council of People's Commissars of the USSR “For the improvement of hydrometeorological service of defence, commercial and fishing navigation in the Barents Sea, aviation and other sectors of the national economy on Cola Peninsula” the Murmansk Branch of Hydrometeorological service is assigned to “serve” all the sectors of

national economy and defence on Cola Peninsula and Barents Sea in respect of hydrometeorology", receives from the Leningrad department of meteorological service the possession of the network of meteorological, hydrological and marine stations on Cola Peninsula, Murmansk marine observatory and ship hydrometeorological stations, operating on the Barents Sea", - Murmansk Branch of Hydrometeorological service is granted a status of an independent territorial body of the USSR Hydrometeorological service.
July 1941 – Head department of hydrometeorological service joins the USSR Armed Forces, and Murmansk department of hydrometeorological service joins the Northern Fleet.
1941-1945 – Organization of metrological observations in Nivankyl (June 25, 1941), their discontinuation in August 1941, resumption in November 1944 after liberation of the territory; formation of meteorological station in Pechenga (November 1944) and Nikel (January 1945).
1946 – Release of the Head Department of Hydrometeorological service from the Ministry of Defence newly to the control of USSR Government. Restoration of "civil" functions of the Murmansk Department of Hydrometeorological service. From 1946 to the present the formation of hydrometeorological stations Kashkarantsy, Chavanga, Dalnie Zelentsy (1946); Kanevka (1948), Ura-Guba (1949), Alakurtti (1950-1991), Kanozero (1950-1987), Kovdor, Kolmyavr (1951-1987), Murmashi, Yaniskoski (1954), Pereval (1956-1994), Head of river Lotta (1959); Zarechensk (1963); Tumannaya (1967); Kislogoubskaya tidal powerplant (1969-1987).
March 14, 1979 – Murmansk Department of hydrometeorological service is transformed to Murmansk Territorial Department of hydrometeorology and environment control.
January 26, 1988 - Murmansk Territorial Department of hydrometeorology and environment control is transformed to Murmansk Territorial Department of hydrometeorology.
March 2004, 1992 – Murmansk Territorial Department of hydrometeorology is transformed to Murmansk Territorial Department of hydrometeorology and monitoring of environment.
July 29, 2004 – According to the order of Federal Service for Hydrometeorology and Environmental Monitoring No. 106 "On reorganization of territorial bodies of the Russian Service for Hydrometeorology and Environmental Monitoring" the Murmansk Territorial Department of hydrometeorology and monitoring of environment is transformed to the State Institution Murmansk Department of Hydrometeorology and Monitoring of Environment.

2.2 Legal status of facility

The State Institution Murmansk Department of Hydrometeorology and Monitoring of Environment performs state duties and provides services to the population and organizations under the license with registration number P/2005/0015/100/Л dated February 18, 2005.

The license applies to the activities in hydrometeorology and related areas, including:

- determination of meteorological, climatic, aero logical, hydrological, oenological, heliogeophysical and agrometeorological environmental characteristics;
- determination of the environment pollution (including radioactive) level (ambient air, soils, surface waters and marine environment, including by hydrobiological factors);
- preparation and delivery to the consumers of forecasting, analytical and estimated information on the environment state and pollution (including radioactive);
- creation and maintenance of data banks in the sphere of hydrometeorology and related areas.

2.3 Current state of production and sales of products, prospects of facility development

2.3.1 Current status

Federal Service for Hydrometeorology and Environmental Monitoring (RosGidroMet) is a link in the unified global system of the environment state and pollution monitoring (atmosphere, land and sea surface waters, near-Earth space environment), operates applying the unified standards, methods and principles, approved by the World Meteorological Organization (WMO), performs organization and management of the activities in the sphere of environment state and pollution monitoring, including general and specific environmental forecasting, as well as the active influences (antiavalanche and antihail services); provides unity of standards and methods of observation, analysis and forecasting. RosGidroMet is engaged in research activities in the Arctic and Antarctic Regions, World ocean and near-Earth space environment. At the moment it is under the supervision of the Ministry of Natural Resources of the Russian Federation.

The area of responsibility of the Murmansk MUGMS is presented in Appendix 2.

2.3.2 Characteristic of the environmental monitoring system (service) of facility

Murmansk center of monitoring and environmental pollution (CMEP), which is an operating and subdivision of the State Institution Murmansk UGMS, performs systematic observations of the state of the abiotic pollution: ambient air, atmospheric precipitations, snow cover, natural waters and bottom silts of rivers, lakes and seas.

In its activity the enterprise is governed by the Charter of the State Institution Murmansk UGMS, approved by the order No. 123 dated August 23, 2004 “On approval of the restated Charter of the State Institution Murmansk Department of Hydrometeorology and Monitoring of Environment”.
CMEP is formed by the order of MUGMS dated August 9, 1980 No. 138 pursuant to the order of the State Committee for Hydrometeorology of the USSR dated June 9, 1980 No. 181 on the base of the Division of environmental pollution observation and control.

Another accreditation for technical expertise and independence was successfully performed and analytical laboratory (center) accreditation certificate No. POCC RU.0001.511022, which is valid until 2010 was obtained in Murmansk Center of monitoring and environmental pollution in May 2005.

According to the Provision on the accredited Murmansk center of monitoring and environmental pollution, the Center includes:

- surface and sea waters monitoring laboratory;
- regional laboratory of atmosphere and radiation monitoring;

CMEP has network laboratories of environment pollution monitoring in the towns of Apatity, Kandalaksha, Monchegorsk and Nikel.
CMEP performs services on a contractual basis as follows:

- complex analysis of the state of ambient air, natural waters, bottom silts, atmospheric precipitations, snow cover by hydrochemical and hydrobiological factors;
- specialized surveys of environment state;
- calculation of background concentration of pollutants in ambient air, surface and sea water;

- route observations for sampling of ambient air for study of the air pollution state in particular districts of the settlements;
- sampling and analysis of surface, sea and waste waters by hydrochemical and hydrobiological factors.

Table 2-1 List of stationary checkpoints

Settlement	Stationary point #, (Adress)
Murmansk	№ 1 (metaostation, , Prigorodnaya street, 39A)
	№ 8 (улPapanina street, 32A)
	№ 12 (Lobova street, 26)
	№ 15 (Beringa street, 1Б)
	№ 17 (Skalnaya street, 9A)
	№ 18 (Verkhne-Rostinskoye highway, 51)
Kola	№ 1 (meteo-site)
Apatity	№ 2 (Rjsmonavtov street, 19A)
	№ 3 (Zhemchuzhnaya street, 9Б)
Kirovsk	№ 4 (Khibinogorskaya street)
Kandalaksha	№ 1 (Pervomayskaya street, 32)
	№ 2 (Shevchuka street,18)
Monchegorsk	№ 2 (Metallurgov street, 26A)
	№ 3 (Lenin street,24A)
Olenegorsk	№ 1 (Stroitelnaya str., 43A)
Nikel	№ 5 (Mira str., 25)
	№ 6 (Oktyabrskaya str., 6)
Zapolyarnyi	№1 (Yasnyi pereulok, 2A)
Total settlments	**9**
Total checkpoints	**18**

Provision of finance status of initiator (MUGMS) is not possible as far as this organization is the regional department of the Rosgidromet. This organization receives funding out of funds of federal budget (p. 8.1 “Regional departments of Rosgidromet are the state organizations and under the State’s supervision. Funding of territorial departments is realized out of funds of federal budget” Rosgidromet Order # 59 dated 25/03/2009). However, this is not the obstacle for submitting of this project for review to funding organizations for co-funding option.

3 DESCRIPTION OF INVESTMENT ENVIRONMENTAL PROJECT

3.1 Description of IEP

In order to have more complete and credible picture of the state of ambient air pollution it is necessary to organize the continuous emission monitoring system with installation of the automatic gas analyzers in the selected towns and settlements.
A primary task is the installation of the of automatic gas analyzers in 3 industrial areas

- In the area impacted by OAO “Kolskaya GMK”. Specific pollutants: sulfur dioxide, formalin, nitrogen oxides;
- In the area impacted by OAO “KAZ SAUL”. Specific pollutants: carbon oxide, hydrogen fluoride;
- In the area impacted by OAO “Apatit”, OAO “OLKON”, OAO “Kovdorskiy GOK” Specific pollutants - particulate matters (dust).

The CEMS may be used in the caution and warning systems when the pollution level drastically increases. Such systems operate jointly with mass media to inform the population of the current level of ambient air quality, and, if necessary, to provide recommendations on decrease of ambient overpollution or minimization of exposure.

Ambient air quality monitoring also allows obtaining valuable initial data for sanitary and hygienic researches, which are vital when identifying the relationship between health effects and concentration of pollutants in the ambient air. Generally to assess the exposure both monitoring and modeling for identification of sources, to which mitigation measures should be applied, as well as for the implementation of efficient programme for the ambient air quality management for a human health protection, is required.

3.2 Justification of selected technology and its description

3.2.1 Processes that make the basis of IEP

Basic project stages include equipment procurement (gas analyzers), installation, calibration, creation of computer-aided hardware and software complexes with central data collection on the location of Murmansk UGMS and support of operation of the entire system.
The parameters, which are planned to be monitored, are as follows: sulfur dioxide, nitrogen dioxide, formalin, carbon oxide, hydrogen fluoride and dust (PM10). The list of abovementioned substances is developed according to the main peculiar pollutants of the industrial enterprises of those districts, where monitoring is planned to be performed (see paragraph 3.3 for details).

Change of sulfur dioxide concentration
Currently, a proven set of automatic monitoring methods has been formed. Ultraviolet fluorescence for the automatic determination of SO_2 concentration is used most extensively. By ultraviolet irradiation with wave length 212 Nm in the collected air sample the excitation of SO_2 molecules to the unstable energy state with the higher energy level occurs. Reverse transition from the instability to the stable state conditions the secondary fluorescence

radiation, intensity of which is directly proportional to SO_2 concentration in the sample. The accuracy of data, received through the automatic SO_2 analyzers, depends on the range of factors through the whole chain of measurements. These include the accuracy of calibration standards, stability of analyzers' operation and possible sample loss in the measurement chain.

Change of nitrogen dioxide concentration

Chemiluminescent analyzer is a common reference method of application of automatic analyzers, as defined in the EU directive on the ambient air quality standards by SO_2 content. Some of the models of this device are mass-produced and commonly used. Such analyzers provide acquisition of data with high resolution on a real time basis.

However to obtain accurate and reliable measurement results it's necessary to have high level of technical maintenance and repair of this equipment, as well as provide prompt support and assistance in quality assurance. Accuracy of the measurements, made by the automatic analyzers, depends on the range of factors typical for the whole chain of measurements. These include the accuracy of calibration standards, operational stability and sensitivity of the analyzer as well as possible losses in the sample collection system.
Operational tests indicated that taking into account all the represented factors in conditions of duly organized monitoring stations network NO_2 concentration error is ± 10%. Respective assessments of random error is within ± 3,5 parts/bln.

Change of formalin concentration

It is planned to use photometrical method in the project.
This method is based on the interaction of formalin with chromotrope acid in the sulfate medium and subsequent photometric measurement of optical dense of the colored resultant.

Change of methanol over formalin is based on their preliminary differential oxidation by potassium permanganate in the sulfate medium (methanol is oxidized to formalin, and formalin – to carbon dioxide) and subsequent reaction of the formed formalin with chromotrope acid.

Measurement of dust concentration

Principle of method measurement is absorption by the dust meter monitor (electron) of beta ray, radiated by the radioactive source and particles gathered from the flow of surrounding air. Pulsation of clean filtration band is measured before each cycle of sampling by the dust meter, then the dust is gathered at the precision filtration spot during the certain period of time, and then pulsation of fouled filtration band is measured. Difference between two pulsation values is estimated by the dust meter and indicated as dust concentration in gram-mol/m^3.

Measurement of hydrogen fluoride concentration

Operating principle of the applied method is based on the phenomenon of absorption of optical radiation by molecules of the substance sampled in the near infrared.

3.2.2 Characteristic and demand in raw materials and resources involved in production

The project provides creation of the continuous ambient air monitoring system.
The system structure is as follows:

- Statutory checkpoints for monitoring of urban environment;
- Monitoring center, as a part of the hardware and software complex for organization of data and information exchange.

A) The checkpoints must be equipped with systems of communication with the main control room for data collection and control of device operation, autonomous power supply and unauthorized access alarm. The connections concentration data will be collected automatically on a real-time basis and transmitted to the central control room.
Analyzers' operation and calibration must be also controlled from the central control room. All analyzers must be put into the State Register of Measuring Equipment; measurement complex must undergo metrological certification after installation.
The example of a statutory checkpoint for ambient air control is illustrated in the figure 3-1.

Figure 3-1 Statutory checkpoint for ambient air control

The equipment, which is planned to be installed for the ambient air control at the statutory checkpoints, is listed above:

Table 3-1 The equipment planned to be installed under the project

№ п/п	Gas analyzer	Pollutant to detect	Required number
1.	C-105A	sulfur dioxide	3-4
2.	P-310A	nitrogen dioxide	2-3
3.	ФОРТ-301	Formalin	2
4.	К-100	carbon oxide	1-2
5.	GASFINDER	hydrogen fluoride	2
6.	Dust meter F-701-20	Dust	3-4

B) Monitoring Center in CMEP will have hardware and software complexes (HSC), incorporated into the local area network: communication, dispatch, geoinformation, modeling and archives. Hardware support is based on Pentium IBM-PC compatible computers. Software products are russified and they allow management of statutory checkpoints and analyzers operation, collect and process data, model and forecast on pollution behavior.
Hardware and software complexes (HSC) for data processing of a number of statutory checkpoints were formed in CMEP in 2008. However after installation of the new statutory checkpoints it will be necessary to connect them to the existing HSC or, if it is impossible:

- Update the existing HSC
- Create the new HSC

Creation of the automated system will allow:

- 24-hour automatic measurement of meteorological parameters of the atmosphere and concentration of pollutants in the ambient air;
- Transmission of the measurement results to the Monitoring center;
- Assessment of the ecological situation in the supervised areas on a real-time basis;
- Forecasting on pollution behavior depending on the meteorological parameters of the atmosphere;
- Creation of ecological data archives;
- Identification of atmospheric emission sources.

Project implementation will require outsourcing of contractors – procurement, installation and calibration of the equipment, connection and creation of hardware and software complexes.

3.2.3 Level of energy intensity of production

Project implementation is not related to energy-intensive processes. Power is mainly consumed by operation of the equipment, capacity of which is illustrated in the table above.

Table 3-2 Capacity of equipments, involved in the project

Gas analyzer	Consumed power
C-105A	Less than 100 W
P-310A	400 W
ФОРТ-301	Measuring unit: 48 W Calibration unit (CU): 300 W Processing unit: 30 W
K-100	50 W
GASFINDER	100 W
Dust meter F-701-20	50 W

3.2.4 Compliance with international standards

Implementation of this project will allow extension of the list of monitored parameters recommended by the Council of the European Union. Thus, air monitoring system in the specific parts of the region with be brought into proximity with the European one.

3.2.5 Level of approval of technology (tested in pilot plant environment, performed full-scale tests and etc.)

It is important to mention that 2 of the existing 15 statutory stations for ambient air control are already equipped with the automatic gas analyzers, operating in continuous mode in the settlements of Zapolyarny and Nikel.

Installation of the new statutory checkpoints commenced in 2009 and is continuing up to date in Murmansk (monitoring of nitrogen oxide and dioxide, carbon oxide and total hydrocarbons), Monchegorsk (monitoring of sulfur dioxide) and Apatity (monitoring of suspended solids).

That is why the project is not considered innovative for the Murmansk region.
However such solids as PM-10 have not been measured in the region before.
It is worth mentioning that the technology of monitoring of such parameters as PM-10 has been already applied in number of Russian cities (e.g. Moscow, Saint Petersburg).

3.3 Characteristic of the area, resources and infrastructure used for investment project implementation

3.3.1 Payout of the area of IEP implementation

Purchase and installation of automatic gas analyzer for detection of pollutants concentration in ambient air of 3 cities:

1) In the area impacted by OAO “Kolskaya GMK”

Gas analyzers will be installed in the settlement of Nikel and the towns of Zapolyarny and Monchegorsk.
Specific pollutants: sulfur dioxide, formalin, nitrogen oxides.

Figure 3-2 Map of OAO “Kolskaya GMK enterprises

2) In the area impacted by OAO “KAZ SAUL”

Specific pollutants: carbon oxide, hydrogen fluoride.

Figure 3-3 Map of KAZ SAUL allocation

3) In the area impacted by OAO “Apatit”, OAO “OLKON”, OAO “Kovdorskiy GOK”.

Specific pollutants - suspended solids (dust)

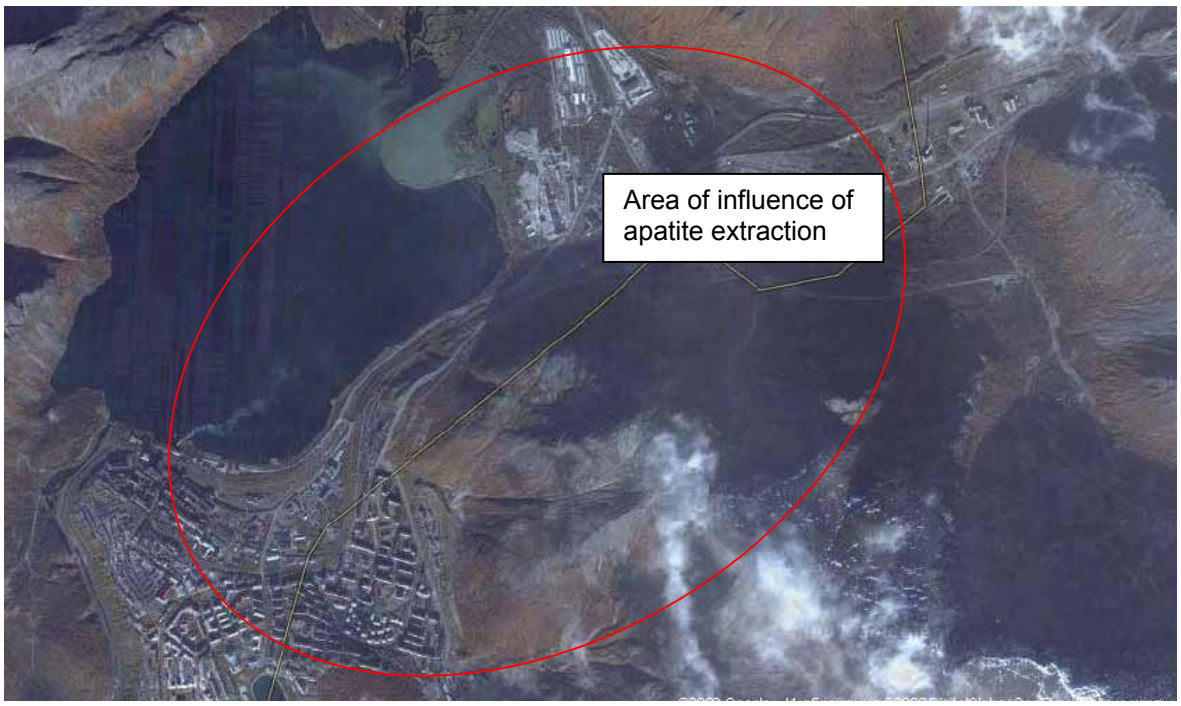


Figure 3-4 Map of the area of influence of OAO «Apatite»

Figure 3-5 Map of Kovdorskiy GOK allocation

Figure 3-6 Map of Olenegorsk deposit allocation

3.3.2 Specific requirements and conditions of connecting to existing networks of gas, water and heat supply

The equipment operates through power supply: it is designed for the line voltage 200 V, 50Hz.

3.4 Process risks

Main technological risks of the project implementation are associated with obtaining non-objective information on the state of air quality caused by an incorrect selection of the monitoring station location.

3.5 IEP implementation

If the project receives financing, its implementation period will last one year.

4 ENVIRONMENTAL IMPACT ASSESSMENT

4.1 Description of current state of environment at the area of IEP implementation

The Project will be implemented in Murmansk Region. The Murmansk Region is one of the largest and most developed regions of the European North of Russia. The region is located in the Kola Peninsula. Most of its territory lies within the Arctic Circle. With the area of 145 thousand sq. km, the region represents a unique combination of abundant natural landscape, cultural and historic environment and developed economy. Advantageous geographic locations, significant natural resource potential, ice-free sea port, and proximity of the borders with the EU countries are the key factors of social and economic regional development.

The Murmansk Region has significant advantages compared to other Russian regions. This happens mostly because of its geopolitical and geographic location. The Murmansk Region is the northern gate of Russia; it links Russia with the European countries and handles huge cargo flow from our country and back.

Various natural resources exist in the region. More than 60 major fields of various minerals have been discovered in the Kola Peninsula area. Currently, nearly thirty types of fossils are produced; the most precious minerals are phosphor ore, titanium iron, aluminum, copper, nickel, zirconium, and other rare metals. The reserves of mica, ceramic raw material and raw materials for construction, facing stone, semi-precious and ornamental stones are extensive.

Figure 4-1 Murmansk Region map

Superb oil and gas reservoirs have been discovered in the Barents Sea in the last ten years. Shtokman gas and condensate field, with the reserves of 3.0 trillion cubic meters (tcm) of gas, is one of them. Development of such a unique field will satisfy the gas needs of the entire North-West of Russia for many years.

The economy of the Murmansk Region is targeted to the natural resources. The region delivers 100% of the Russian production of apatite concentrate and 12% of iron ore concentrate, 14% of refined copper, 43% of nickel, 14% of the fish production.

Natural and climate conditions in Murmansk Region, as well as complex physical and geographic situation often cause natural disasters, the most typical of them are:

- storm winds with the speed of 30 m/s and more;
- heavy snow storms (with wind speed up to 20 m/s during 12-15 hours);
- snowfalls (with average daily amount of 40 mm);
- frost (with the ambient temperature less then 40 C during more then 3 days);
- heavy ice-covered ground (wire icing of more then 20 mm);
- avalanching in mountains;
- forest fires.

Almost all Murmansk region is located in an unfavorable climate zone, which causes certain issues in operation of industrial and transport organizations.

Heavy wind storms, snow storms, snowfalls are typical for the coastal area of Cola Peninsula all year.
This zone comprises all restricted admission territories, such as: Polyarny, Snezhnegorsk, Skalisty, Ostrovnoy, Zaozersk, Zapolyarny, as well as cities of Severomorks and Murmansk.

Air

The main cause of air pollution is industrial emissions of hazardous substances. Steel making factories and non-ferrous production plants contribute to air emissions at the rate of 60%.The main stationary sources of the emission in the Cola Peninsula are industrial enteprizes as: JSC "GMK "Pechenganikel" (Nikel and Zaplyarny), JSC "Severonikel Factory" (Monchegorsk), mining and concentration complex "OLKON" (Olenegorsk), JSC “Kandalakshsky Aluminum Plant” (Kandalaksh), JSC "Apatit" (Apatyty), power generation plants, boiler houses. Significant input in air pollution of city areas is done by automotive and railroad transport.

In atmosphare air emission of industrial enterprises are exposed by a complex of meteorological factors, which influence the existing level of the pollution. The dispersion of pollutants in Cola Peninsula mainly depends on active cyclonic activity with moderate or heavy winds. North-West of RF European part is categorized as favorable area for air pollution dispersion.

At anti-cyclonic season with weak winds and lowed inversions with gauzes in cities and industrial centers of Murmansk region increased level of pollution concentrations can be observed. High pollution (with maximum single concentrations of pollutants above 10 MPC) of the city air has not been observed. The most single concentrations of sulfur dioxide have been recorded in Nikel (3.5 MPC), nitrogen dioxide - in Murmansk (2 MPC) and carbon oxide in Monchegorsk (2.2 MPC).

The established standard for air quality assessment is MPC – maximum permissible concentration. Based on this standard other characteristics can be calculated: SI – standard Index – the maximum detected concentration of any pollutant in the city, divided by MPC.
NP - Maximum frequency of MPC increase %;
IZA - Ambient pollution index.

- The pollution level is considered to be increased if IZA is 5-6, SI $<$ 5, NP $<$ 20%;
- The pollution level is considered to be high if 7≤IZA≤13,5, SI$<$ 10, 20%$<$NP$<$ 50%;
- The pollution level is considered to be very high if IZA≥14, SI$>$10, NP$>$50%.

Based on the atmosphere pollution observation data the assessment of air pollution level in the settlements and towns of Murmansk Region was performed (Table 4-1).

This assessment allowed to determine the towns of Murmansk region, where mean year concentration of pollutants is ≥ MPC, the largest single pollution indices are introduced – PSI and the maximum frequency of exceedence of MPC by any substance in the town (tables 4-1).

Table 4-1, Indices of ambient air pollution in the area of Murmansk UGMS activities in 2008 (Source of information – Report on environment safety and rational use of natural resources of Murmansk region in 2008).

City	IZA (5)	Contaminants	SI	NP	Pollution level
Apatity	1,1	Suspended substances Sulfur dioxide Carbon oxide Nitrogen dioxide Benzopyrene	1,4 <0,1 1,2 0,4 1,1	2,0 - 1,6 - -	Low
Zapolyarniy	2,2	Suspended substances Sulfur dioxide Carbon oxide Nitrogen dioxide Formalin	0,8 3,2 0,4 0,4 0,7	- 10,0 - - -	Low
Kandalaksha	2,0	Suspended substances Carbon oxide Poorly soluble nonorganic fluorides Hydrogen fluoride Benzopyrene	1,6 0,7 0,5 1,5 2,1	7,4 - - 2,6 -	Low
Kirovsk	-	Suspended substances Sulfur dioxide Carbon oxide Nitrogen dioxide	0,8 0,1 0,8 0,4	- - - -	Low
Cola	3,0	Suspended substances Sulfur dioxide Carbon oxide Benzopyrene Formalin	0,6 0,4 1,4 0,7 0,5	- - 1,3 - -	Low
Monchegorsk	5,0	Suspended substances Sulfur dioxide Carbon oxide Benzopyrene Formalin	1,0 1,6 1,8 3,5 0,8	- 1,6 1,2 - -	High
Murmansk	4,0	Suspended substances Sulfur dioxide Carbon oxide Phenol Formalin	0,6 1,6 1,3 1,9 1,0	0 4,2 1,3 4,9 -	Low

Nikel	4,0	Suspended substances Sulfur dioxide Carbon oxide Formalin Benzopyrene	1,0 3,7 0,7 0,7 0,6	- 18,8 - - -	Low
Olenegorsk	-	Suspended substances Sulfur dioxide Carbon oxide Nitrogen dioxide	1,2 <0,1 0,8 0,7	1,4 - - -	Low

Taking into consideration these standard characteristics the air quality of air pollution was performed in Murmansk region. The cities where average pollutants concentration ≥1 PMC were defined.

Table 4-2 Indices of ambient air pollution of the towns of Murmansk region in 2008 (Source of information – Report on environment safety and rational use of natural resources of Murmansk region in 2008).

City	Ambient pollution index (IZA)	Standard index (SI)	Maximum frequency of MPC increase % (NP)	Average annual ≥1MPC
Zapolyarniy	2,2	3,2	10,0	1,0 MPC (sulfur dioxide) 1,0 MPC (formalin)
Cola	3,0	1,4	1,3	1,3 MPC
Monchegorsk	5,0	1,6	1,6	3,0 MPC (formalin) 1,2 MPC (benzopyrene)
Murmansk	4,0	1,9	4,9	1,7 MPC (formalin)
Nikel	3,0	3,7	18,8	1,1 MPC (sulfur dioxide) 1,7 MPC (formalin)
Olenegorsk	-	1,2	1,4	1,2 MPC (suspended substances)

In 2008 based on the observation data the content of pollutants in the ambient air, expressed in terms of API, is low. There were some occasional pollution detection on certain pollutants mainly in the 30-40 km zone of the main industries.

Wastes

Generation of hazardous wastes of 1-4 hazard class decreased by 36.9% in 2008 in comparison with 2007 and made 288,400 tons.
Use and processing of hazardous wastes decreased in comparison with the previous year and made 199,900 tons (69,300 from waste generation).
Quantity of waste burials increased by 14.6% in comparison with 2007 and made 197,700 tons.
Actual quantity of generation, use, processing and allocation of consumer and production wastes in Murmansk region in 2008.

Table 4-3 Actual quantity of generation, use, processing and allocation of consumer and production wastes in Murmansk region in 2008 (Source of information – Report on environment safety and rational use of natural resources of Murmansk region in 2008).

Types of waste	Generation, tons	Use, processing, tons	Burial, tons
1 class	63,3	98,2	0,000
2 class	91,3	31,1	0,000
3 class	85793,2	61625,7	2433,3
4 class	202448,8	138209,9	194297,0
5 class	203352400,6	51183969,9	152128494,4
Total waste	203640797,2	51383934,8	152325224,7

About 90,000 tons of waste per year is incinerated at the incineration plant of Murmansk. There are no landfills equipped according to the up-to-date environmental requirements in Murmansk region. There 19 so-called “authorized” landfills, 5 of them have 2 year remaining life; area occupied by the landfills is about 150 ha. There are over 40 unauthorized waste emplacement sites.

Waste regaining is ill-developed and concentrated mainly in Murmansk and Apatity.

Surface water

There are more than 127 thousand hydro objects on the Kola Peninsula including 20,6 thousand stream flows, 107 thousand water reservoirs including lakes of Imandra, Umbozero, Lovozero, reservoirs at Tuloma, Voronya, Teriberka rivers. The region is very rich with water resources.
Regular monitoring of water reservoirs quality is carried out by Murmansk UGMS with frequency of 6-12 times per year at 55 regional rivers, lakes, springs and reservoirs.

It is very specific for the natural waters to include metal ions such as cupper, iron and manganese. High concentrations of metals when no water discharge form industrial enterprises takes place can be observed in low-water season when feeding is primarily done by ground waters.

However industrial activity at Kola North leads to pollution of water reservoirs by sewage waters as well as by dust emissions coming to water with rainfall. High and extremely high water pollution levels by metals, sulfates, ditiophosphate, nitrogen and phosphorus compounds, organic substances are limited and can be observed in small water objects.

Rivers Nadui (Monchegorsk) and Kolos-yoki (Nikel) are classified as chronically polluted water objects due to they are exposed to direct water discharge from non-ferrous metallurgy companies without sufficient treatment.

Soil

The main factors causing soil pollution are industrial and domestic waste as well as emissions from the industrial enterprises (aerogenic pollution).
Settlements of Murmansk region occupy 0.4% of the territory of region, agricultural lands – 0.2%; 8,950 ha are occupied for plough-lands for forage grasses production in comparison with 17,411 ha in 1990.

In accordance with the effective normative-legal acts: Federal Low "About sanitary-epidemiological safety of population" dated 30.03.1999 No. 52-FL with addenda and amendments, art. 21; SanPiN 2.1.7.1287-03 "Sanitary-epidemiological requirements as to soil quality"; GN 2.1.7.2041-06 "Maximum permissible concentration (MPC) of chemical substances in soil"; GN 2.1.7.2042-06 "Guiding permissible concentration (GPC) of chemical substances in soil" – the control of observance of requirements of sanitary legislation as to soils, maintenance of territories of urban and country supplements, accomplishment of measures on prevention of soil pollution.

In year of 2008, the soil examinations were carried out on all administrative territories, including Severomorsk ZATO. As compared with 2007, specific weight of samples exceeded sanitary standard of the heavy metals' content in soil has been reduced.
The districts of region have been ranked taking into account K_{sum} – a summary index of soil pollution (Table 4-3). In accordance with the accomplished ranking, the territory of the Severomorsk ZATO takes the second place as to soil pollution grade.

Table 4-3 Ranking of region territories basing on soil pollution index (K_{sum})

Territory	Summary index of soil pollution Ksum
Kovdorskiy district	0,14
ZATO Polyarniy	1,23
Terskiy district	1,37
Apatity town	2,24
Kandalaksha town	2,27
Olenegorsk town	2,7
Kirovsk town	3,0
ZATO Skalistiy	3,02
Lovozerkiy district	3,62
ZATO Zaozersk	5,1
Monchegorsk town	6,0
the city of Murmansk	7,72
Kola District	10,32
ZATO Severomorsk	**32,8**
Pechengskiy district	45,92

The highest index of soil pollution has been registered in the industrial enterprises impact zone (Pechenega area, ZATO Severomorsk). In Murmansk the index of soil pollution mounts to 7.72; this is lower than the average rate in the region.

Demographic situation and population health

Demographic situation and population health in Murmansk region as well as in Russia in whole becomes worse and is determined by low birthrate and life expectancy, high death and sickness rate. For the year 2007 Region population decreased for 5902 people and by the 01.01.2008 it accounted 850 929 people (fig 4-2).

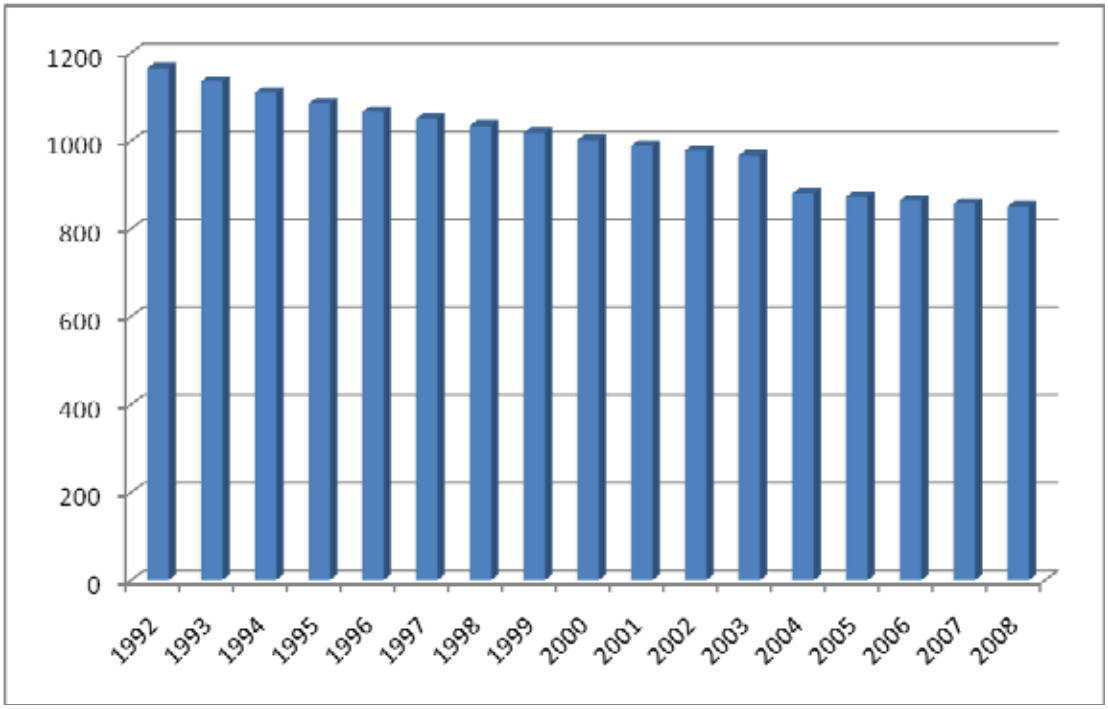


Figure 4-2 Population at the beginning of the year, in thousands

Children above 14 make 122,534 people (14.4%), persons over working age – 126,788 people (14.9%). There is a regressive type of age distribution formed and maintained in the region. Middle age of population in the region is 36.1 years.
Generally the Murmansk region has the same demographic modernization problems as other regions of the North-West Federal District:

- Decrease in population due to the high death rate and low birthrate;
- Ageing of population due to low birthrate and rising death rates at working age;
- High death rate at working age and subsequent large gap in male and female life expectancy, as well as decrease of general index of life expectancy

In the Murmansk region high death rate is primarily associated with premature mortality from circulatory diseases, high male mortality from the accidents, injuries and toxication, as well as high mortality from neoformations.

Basic reasons of population health level and demographic situation decrease still remain: social stratification and poverty, increase of unemployed people amount, unbalanced structure and quality of food, adverse working conditions of employees, negative ecological and natural climatic conditions.

According to data of Directorate of state population placement service in Murmansk region as of March 03, 2009 total unemployment accounted 14963 people (as of February 01, it was

13178 people). Level of the registered unemployment (to economically active population) amounted 3%.

Quantity of employees supposed to be fired in accordance with staff reduction, liquidation according to data of enterprises themselves amount 1998 people.

Quantity of employees being on unpaid vocation as of March 03 amounts 128 people. Those who are idle because of employer's fault – 305. As far as vacancies concern Severomorsk ZATO is in the third place in Murmansk region: in Murmansk (2944), Kola district (526), Severomorsk (368), Kandalaksha (240), Pechengskiy district (171).

4.2 Impact on health caused by pollutants which are going to be monitored

Sulfur dioxide

The impact of sulfur dioxide (SO_2) and related compounds on a human organism may have a number of chronic and acute health effects. In gas form SO_2 may cause irritation of respiratory system, and in case of short-time impact of high doses depending on the individual sensitivity the reversible effect on pulmonary function may be observed. Secondary product, H_2SO_4 generally affects respiratory function. Its compounds as polynuclear ammonium salts or sulfate organic substances have a mechanical effect on alveoles and being freely soluble chemical compounds they freely penetrate through respiratory system mucosa to the human organism. It was determined that aerosols of solid particles, generated at chemical interaction of gas molecules in the atmosphere (i.e. secondary contaminants) are associated with a lot of health effects, as described in the section on VCh10.

According to the SHS 2.1.61338-03 "Maximum Permissible Concentration (MPC) of pollutants in the ambient air of the settlements" maximum single concentration MPC for sulfur dioxide is 0.5 mg/m^3, mean daily MPC is 0.05 mg/m^3. Hazard class is 3.

Nitrogen Dioxide

Nitrogen dioxide (NO2) is one of the air pollutants that emerge during burning processes. Nitrogen oxide (NO) always emerges together with nitrogen dioxide; the combination of NO and NO2 is usually called nitrogen oxides (NO_x).

In this case we are referring to the impact of NO_2 on human health. At very high concentrations that can be met only during serious emergencies at production enterprises explosion to NO_2 can lead to immediate and grave lung damage. Health impacts can also happen at smaller concentration of this pollutant that occurs at times of increased pollution in cities. The gathered data states that exposure to this pollutant in the atmosphere can lead to acute and chronic health impacts especially in susceptible category of people such as asthmatics.

NO2 generally performs the functions of an oxidative agent that is able of destroying the wholeness of membranes and albumens. At high concentrations acute inflammatory processes in airways can emerge. Apart from this short-term exposure can result in proneness to higher risk of respiratory infections. In spite of the fact that research has been carried out in the field of exposure control there is no evidence of direct connection between the concentration grade or dose and the answer.

Maximum allowable concentration (MAC) in the air of urban areas, one-time for nitrogen dioxide is 0.02 mg/m^3, average daily MAC is 0,005 mg/m^3. 2^{nd} class of hazard.

Carbon Oxide

As a result of binding of carbon monoxide (CO) and hemoglobulin with formation of carboxyhaemoglobin (HbCO) the ability of blood to transport oxygen goes down and processes of CO binding with other blood albumens directly influence the change of functioning of such stressed organs as brain, cardiovascular system, skeletal muscles as well as fetal development. At peak concentrations when the normal CO concentration level in the atmosphere is by much exceeded people die. HbCO concentration level shall not exceed 2,5% to prevent acute fits of cardio ischemia for middle-aged and elderly people with diagnosed or latent coronary heart disease and development of fetal hypoxia for pregnant women.

Maximum allowable concentration (MAC) in the air of urban areas, one-time for carbon dioxide is 5 mg/m^3, average daily MAC is 3 mg/m^3. 4^{th} class of hazard.

Formaldehyde

Formaldehyde has common toxicity, irritates mucosa of upper airwasy, eyes and skin.

Maximum allowable concentration (MAC) in the air of urban areas:

average daily MAC is 0,003 mg/m^3, maximum one-time MAC is 0,035 mg/m^3, 2^{nd} class of hazard.

Dust (PM10)

Suspended solids PM-10 have impact on human health; particles get easily into airways and cause respiratory diseases and allergies.

Maximum allowable concentration (MAC) in the air of urban areas:

average daily MAC is 0,1 mg/m^3, maximum one-time MAC is 0,05 mg/m^3.

Hydrogen Fluoride
Hydrogen fluoride irritates airways, is a very strong dehydrating substance, causes slow-healing ulcers if it contacts the skin and carbonization in cases of long exposure. Average daily MAC in the atmosphere is 0,005 mg/m^3, maximum one-time MAC is 0,02 mg/m^3. 2nd class of hazard.

4.3 Requirements of environmental legislation

The legislative basis for environmental monitoring of Russian Federation is the Federal Law "On Environmental Protection" № 7-FZ, dated 10 January 2002. The main objective for the monitoring as indicated in the law is to ensure state needs including legal and physical persons in reliable information needed to prevent and (or) reduce adverse consequences of environmental changes.

The legal basis for the state environmental monitoring and its integral part, state air monitoring being carried out within state sanitary supervision, is approved by RF Government Act dated 23 August 2000 № 622 (Regulation on the State Sanitary Supervision).

The Regulation stipulates undertaking of State Sanitary Supervision by Federal Russian Service for Hydrometeorology and Environmental Monitoring, Ministry of Natural Resources with participation of other federal executive bodies and regional executive bodies RF.

Basic elements of State Sanitary Supervision ensuing for obtaining reliable information on human induced changes in environment conditions (primarily chemical and radioactive pollution) are state, industrial, regional and local monitoring networks.

The basic standard for air quality determination in urban areas is GN 2.1.6.1338-03 (revision dated 03 November 2005) adapted by the Act of the Chief State Sanitary Doctor of the Russian Federation, dated 30 May 2003 N 114. This standard defines maximum admissible concentrations of hazardous substances in the air of urban areas.

List of legal documents related to the project:

1. Federal law dated January 10, 2002 No. 7-FZ "On environmental protection";
2. Federal law dated May 4, 1999 No. 96-FZ "On atmosphere air protection";
3. RF Government Act No. 373 dated April 21, 2000 "On the approval of the provision on state registration of damaging impact on the atmosphere air and their sources";
4. RF Federal law dated July 19, 1998 No. 113-FZ "On the service for hydrometeorology";
5. RF Federal law dated April 27, 199. No. 4871-1 "On supporting of measurement unity";
6. RF Government Act "On the approval of the provision on state registration of damaging impact on the atmosphere air and their sources" dated April 21, 2000 No. 373;
7. RF Government Act "On the Federal Service for Hydrometeorology and Environmental Monitoring and the approval of the provision on the Federal Service for Hydrometeorology and Environmental Monitoring" dated July 23, 2004 No. 372;
8. RF Government Act "On norms of noxious elements and pollutants emissions into the atmosphere air and of dangerous physical impact on it" dated March 2, 2000 No. 183;
9. SanPiN 2.2.1/2.1.1.1200-03 Sanitary and protection zones and sanitary classification of enterprises, facilities and other objects;
10. SanPiN 2.1.6.1032-01 Hygienic requirements to support of the quality of the atmosphere air in urban areas;

11. GN 2.1.6.1338-03 Maximum allowable concentration (MAC) in the atmosphere air of urban areas;
12. GOST (State Standard) P 22.1.01-95 Safety in emergencies. Monitoring and forecasting. General provisions;
13. GOST (State Standard) 17.2.3.01-86. Nature protection. Atmosphere. Regulations on air quality control in urban areas;
14. GD 52.04.59-85. Nature protection. Atmosphere. Requirements to precision of industrial emission control, 1986;
15. GOST (State Standard) 17.2.4.06-90. Nature protection. Atmosphere. Methods of determination of the speed and loss of gas and dust flows going away from stationary pollution sources;
16. GOST (State Standard) 17.2.4.07-90. Nature protection. Atmosphere. Methods of determination of the pressure and temperature of gas and dust flows going away from stationary pollution sources;
17. Order of the Federal Service for Hydrometeorology and Environmental Monitoring dated November 13, 2001 No. 165 “On approval of the provision on Regional scientific and coordination project in the field of hydrometeorology and environmental monitoring in the European territory”;
18. RF Government Act dated January 15, 2001 No. 31 “ On approval of the provision on state control over atmosphere air protection”;
19. Order of the Ministry of Emergency Situations of RF dated March 15, 1999 No. 141 “On foundation of the Russian national centre for monitoring and forecasting of emergencies of natural and industrial character the Russian Ministry of Emergency Situations”;
20. GD 52.04.576-97 “Provision on systematic supervision of monitoring of the condition and pollution of the environment”, Moscow, 1997.

International legal documents:

1. The Kyoto Protocol dated December 11, 1997;
2. Convention on Long-range Transboundary Air Pollution dated November 13, 1979;
3. International Agreement on Cooperation in the Field of Environmental Monitoring dated January 13, 1999.

4.4 Description of considered alternatives

Zero Option

The zero option of the project means a refusal from its implementation. The ambient air monitoring system currently existing in the Murmansk Region does not reflect the full picture concerning its actual state since measurements are not carried out continuously and the list of the measured components is not complete. Thus, it is possible to say that the current monitoring system in the Murmansk Region is ineffective.

It means that it is impossible to manage the ecological situation in the region without any reliable information on it.

4.5 Characteristic of sources and types of environmental impact

It is important to note that implementation of projects with such designation does not entail serious impact on the environment; the level of such impact is acceptable. The ecological value of implementation of such project cannot be compared with these minimal impacts which can be the consequences of construction works on the project. Therefore, in the first place, ecological and social consequences of implementation of such project shall be noted.

Environmental consequences of the project implementation

Implementation of such project is primarily directed to control over and subsequent prevention of the ambient air pollution and, therefore, improvement in the quality of life and health of the population of the Murmansk Region.

Implementation of the project also increases the level of ecological safety of the Murmansk Region in relation to emissions of industrial enterprises.

Creation of the air quality monitoring system enables the collection of reliable data and storing this in a central database which can than be used for ecological management.

The system would allow for control over effectiveness of the performed environmental actions of the city level as well as through "integration" of the air quality monitoring to the system of other mechanisms providing for execution of the environmental laws (ecological control, ecological examination, normalization).

The advantage of the automated system is that it is possible to carry out real-time forecasting of the atmosphere pollution in specified districts of the city and the region. This is a key factor for efficient ecological management. Up to date only the pollution level has been measured and due to the delay in processing, the possibility to take timely reactive measures didn’t exist. The real-time monitoring in its turn allows acting proactively in the struggle against air pollution.

Social consequences

Implementation of this project allows the project owner to receive objective, reliable, real-time and on-line information on the state of ambient air, to receive information on pollution sources as well as forecast the situation. Such system enables the detection of the reasons for pollution and an adequate response to complaints from the population.

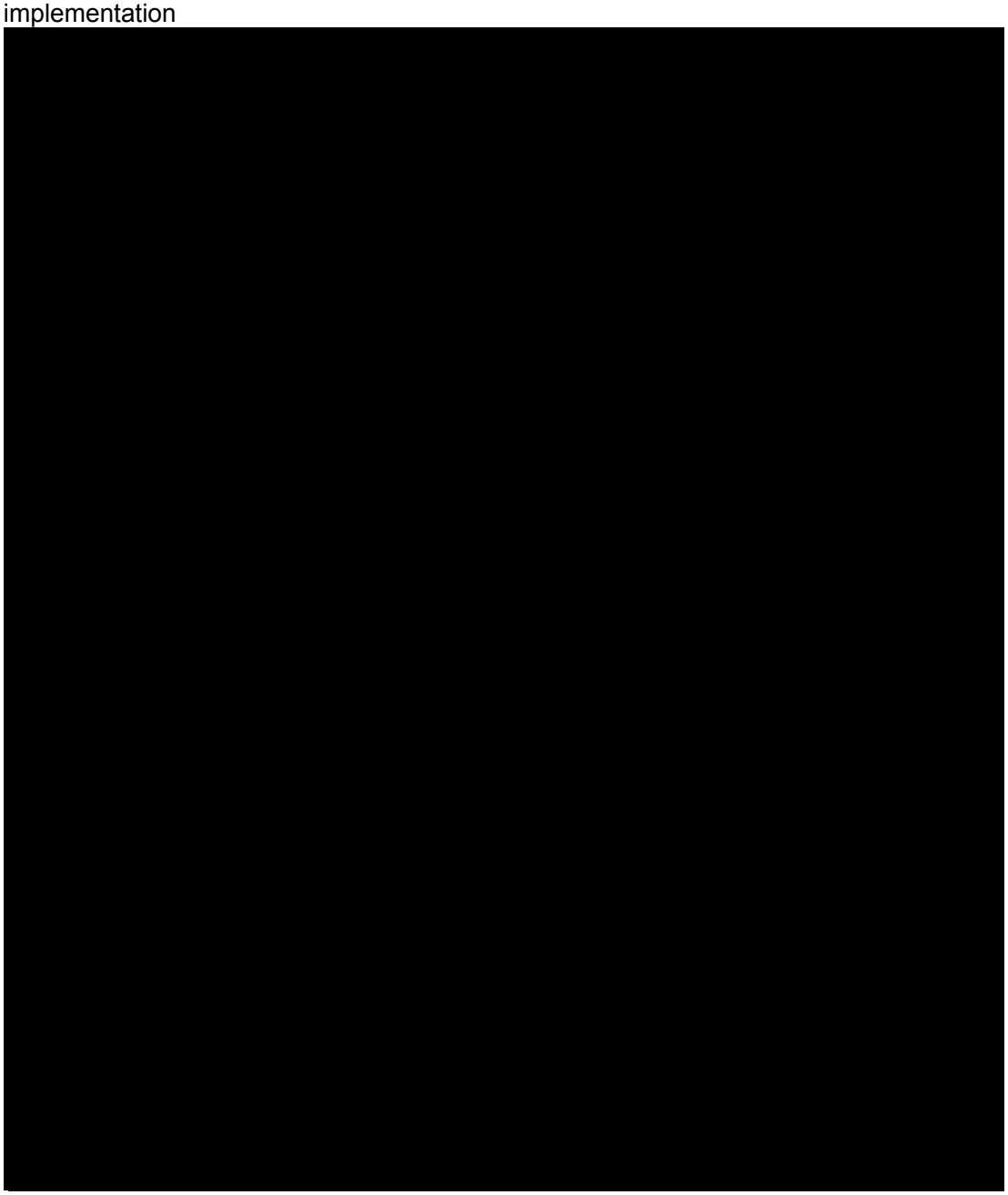
Creation of the air quality monitoring systems allows the project owner to process centralized, real-time and operative data-flows of information on the environmental conditions.

This data is highly needed by city organizations within the framework of their work on territorial planning, social and hygiene monitoring, when calculating environmental damage and working with complaints from the citizens.

Processing of the received data will also require creation of additional workplaces which will have a positive effect on the employment in this sector of the Murmansk Region.

However, temporary and local impact on the environment connected with construction works is inevitable in the course of construction of stationary points.
Possible impacts on the environment and the population on the basis of information obtained at the moment of evaluation are shown below:

Table 4-6 Possible impacts on environment and population arisen from project's implementation



In the course of the project's implementation negative impact on the environment and the population is inevitable. It shall be noted that main impact on the environment is expected during installation of new boxes for equipment since this process involves construction works.

In case of the equipment installation in the current boxes negative impact on the environment is not expected.
Description of negative impact on the environment and the population is summarized in the table below:

Table 4-7 Expected negative impact on environment and population

Production processes	Possible impact on:	Description
Construction and equipment of points		
Territory planning, asphalt work	Soil Vegetation	Works connected with land improvements may entail insignificant impact on soils (for example, deprivation of top soil (0-5 cm) as well as vegetation
Installation of boxes	Air	Air – emissions from construction equipment (short-term and insignificant according to their scale)

4.6 Measures for prevention of unfavorable environmental impacts of IEP implementation

Measures preventing adverse effect on the environment due to the project's implementation are shown in the table below:

Table 4-8. Measures preventing adverse effect on the environment due to the project's implementation

Production processes	Impact	Risk	Prevention /mitigation measures
Territory planning, asphalt work	• Fertile soil layer removal • Vegetation degradation	Low	Land improvements: planting of greenery, landscaping

4.7 Justification of necessity to perform additional engineering surveys

So as to determine the exact place for installation of the gas analyzers a detailed model investigation shall be carried out taking into account prevailing winds, location of pollution sources and location of infrastructure objects in the district.

4.8 Quality provision for air monitoring

Quality assurance and quality control are the most important elements of any ambient air monitoring system. Measures on quality assurance and quality control are included in the activity program aimed at correspondence between the performed measurements and the specific and accepted standards and purposes in relation to the quality as well as the specified degree of reliability. The essence of quality assurance and control is not in obtaining of data of maximum possible quality. It is unrealistic purpose which is impossible to achieve under actual conditions of limited resources. On account of quality assurance and control information obtained in practice is suitable for implementation of one or another task.

Primary purposes of quality assurance and control:

- Measurements shall be correct, accurate and reliable;
- Information received shall be representative for the ambient environment;
- Results shall be comparable and satisfy
- the requirements of uniformity of measurements;
- Measurement results shall be regular in time;
- Data completeness levels shall be high and their distribution shall be uniform;
- Separated resources shall be used optimally.

Telemetering systems of data transmission are often used for work of automated networks which allows to receive information from observation stations operationally and effectively in terms of expenses.
At the same time equipment designed for automated networks shall be checked by operators on a regular basis. Therefore, the most important components of any quality assurance and control system are regular and documented visits to observation stations, frequency of inspections of which depends on specific operation conditions of a network. Frequency of such visits is determined by the production necessity, geographical environment and availability of special permits for the personnel.

4.9 List of conditions for creation of a monitoring system

So as to achieve general purposes of monitoring it is necessary to provide for fulfilment of the following most important requirements to execution of measurements:

- Correctness and accuracy of measurements;
- Possibility of adaptation to metrological stations;
- Completeness of the collected data (scope of data) on a time scale;
- Space representativeness and coverage of the territory;
- Consistency of data received from separate points;
- Observations and in different time;
- International comparability and harmonization.

Considerations which shall be taken into account when creating small observation stations:

- Public security;
- Good overview of a station’s location place;
- Safety of the equipment and vandalism acts;
- Availability of community facilities;
- Construction permit;
- Local sources and drainages of atmospheric pollutants;
- Aerodynamic openness and protection.

5 FINANCIAL EFFICIENCY OF INVESTMENT ENVIRONMENTAL PROJECT

5.1 Value and structure of investment to IEP

In order to implement the project it s necessary to acquire and install the equipment for determination of contaminating agents in ambient air in cities.

1. The area impacted by OAO “Kolskaya GMK”. Specific pollutants: sulfur dioxide, formalin, nitrogen oxides.

Table 5-1 List of automatic gas analyzers in the area impacted by OAO “Kolskaya GMK”. (cost of automatic gas analyzers as for 15.10.2009 (Supplier – OPTEK, Russia)

№	Gas analyzer	Pollutant to detect	Required number	Cost, th.Rub.(1 gas analyzer)
1.	C-105A	sulfur dioxide	3-4	410,0
2.	P-310A	nitrogen dioxide	2-3	215,0
3.	ФОРТ-301	Formalin	2	1130,0

2. The area impacted by OAO “KAZ SAUL”. Specific pollutants: carbon oxide, hydrogen fluoride.

Table 5-2: List of automatic gas analyzers in the area impacted by OAO “KAZ SAUL” (cost of automatic gas analyzers as for 15.10.2009 supplier - OPTEK, Russia)

№	Gas analyzer	Pollutant to detect	Required number	Cost, th.Rub.(1 gas analyzer)
1.	K-100	carbon oxide	1-2	104,0
2.	GASFINDER	hydrogen fluoride	2	2250,0

3. The area impacted by OAO “Apatit”, OAO “OLKON”, OAO “Kovdorskiy GOK” Specific pollutants - suspended solids (dust)

Table 5-3: List of automatic gas analyzers in the area impacted by OAO “Apatit”, OAO “OLKON”, OAO “Kovdorskiy GOK” (cost of automatic gas analyzers as for 15.10.2009 supplier - OPTEK, Russia)

№	Gas analyzer	Pollutant to detect	Required number	Cost, th.Rub.(1 gas analyzer)
1.	Dust meter F-701-20	Dust	3-4	1350,0

Besides these computer-aided complexes with center of data collection on basis of Murmansk Administration for Hydrometeorological and Environmental Monitoring are to be developed. Preliminary cost – 1000 000-1500 000 Rub.

Overall estimate of the project is shown in table 5-4.

Table 5-4. Overall estimate of the project

Anticipated amount of financing required for arranging and undertaking continuous monitoring of air pollution will be RUR 16.3 roubles (including equipment expanses).
In the frame of official special-purpose program “Environmental protection, hygiene and safety of Murmansk region” for 2009-2010 using the funds of regional budget the financing of this project is planned at the *amount* of RUR 1.4 mln.

5.2 Expected income of the project implementation

The project does not have direct commercial benefit, but possible benefits can be gained from environmental fees for monitored pollution above admissible limits which will be revealed during monitoring process.

5.3 Evaluation of expenses for operation

Operational expenses are:

- Servicing, maintenance and repair of the equipment;
- Staff expenses and expenses connected with payment for services of subcontractors, including the matters of operation and management;
- Procedures for quality assurance and control, intercalibration and training of specialists;
- Data management, including its collection, analysis, archive keeping and accounting matters;
- Lease of land plots for observation stations, payment for electricity, consumables, spare parts, calibrating gas mixtures, transportation vehicles and other expense items.

5.4 IEP funding

It seems logical, given the amount of the investment, to opt for a co-financing mechanism whereby the Russian authorities provide for part of the required funds and one or more international financing institutes for the rest.
In August 2009 Royal Haskoning team conducted a number of interviews with representatives of the following organizations – potential donors of this project:

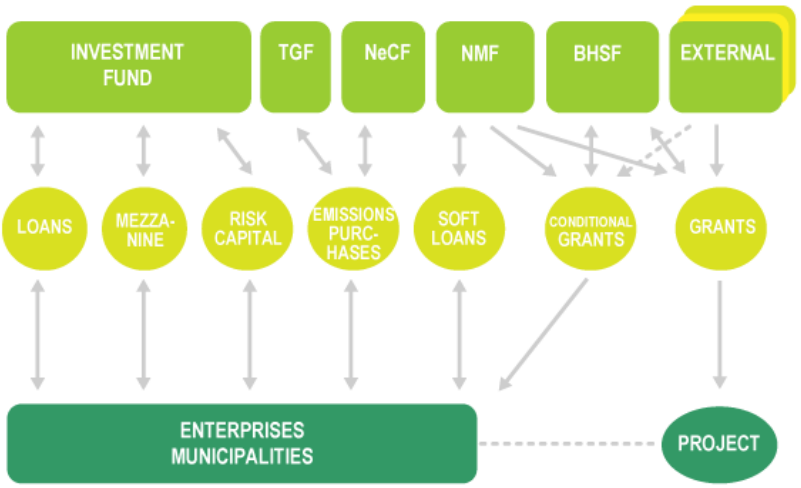
- European Bank of Reconstruction and Development
- International Finance Corporation
- EVD
- Council of the Barents Euro-Arctic Region (CBER)
- Northern Dimension Environmental Partnership (NDEP)
- NEFCO
- Committee of Nature Use and Environment of Murmansk region

The following donors expressed interest in this project: NEFCO and NDEP.

In the tables below is summarized information on these organizations

Table 5-1 Summary information on NEFCO

Name of funding agency	Nordic Environment Finance Corporation (NEFCO)
Logo of organization	
Name of contact person/ respondent	Henrik G Forsström, Senior Adviser
Contact details of respondent	Henrik G Forsström Senior Adviser NEFCO P.O. Box 249, FIN-00171 HELSINKI, FINLAND Office: Fabianinkatu 34 Telephone: +358 10 618 0638 Mobile: +358 400 888 541 (Russia +7 952 240 5405) Fax: + 358 9 630 976 E-mail: henrik.forsstrom@nefco.fi http://www.nefco.org
Programmatic priorities of funding agency	1. Water and sewerage
	2. Cleaner technologies in industry
	3. Waste
	4. Renewable Energy & Energy Efficiency
	5. Consultancy & Environmental services
	Others: NEFCO targets all forms of environmentally hazardous emissions and discharges, such as greenhouse gases and toxic pollutant.
Types of funds	1. NEFCO Investment Fund

administered by agency:	2. Nordic Environmental Development Fund (NMF) 3. Environmental Hotspots in the Barents Region (BHSF) 4. NEFCO Carbon Funds (TGF & NeCF) 5. Arctic Council Project Support Instrument (PSI) 6. Project Specific Funds Information on each of these funds can readily be obtained through: *http://www.nefco.org/nefco/financing/* NEFCO's funding resources (derived from http://www.nefco.org/introduction/funding_resources): 
Type of assistance (grant, loan, ….):	NEFCO offers loans, subordinated loans and soft credits to enterprises and municipalities, for projects which aim at reducing environmentally hazardous emissions and discharges, such as greenhouse gases and toxic pollutants, within NEFCO's area of operation (Russia, Ukraine and Belarus, and the Baltic countries). NEFCO administers several funds and facilities that in certain cases can provide grants or other funding (such as carbon financing for JI projects under the Kyoto Protocol) for development and implementation of projects of particular benefit to the environment. NEFCO works within a network of partners including other IFIs, international and national organisations (such as the Arctic Council, Barents Euro-Arctic Council and the NPA-Arctic), bilateral and multilateral donors (including the Nordic governments, the EU and the NDEP). NEFCO may also enter into partnerships with local enterprises which carry out environmental projects in countries where it operates. Each project financed by NEFCO must fulfil certain environmental criteria and the reductions in emissions and discharges must be quantifiable. Each project application is carefully analyzed by NEFCO's legal advisors, investment managers and environmental experts.
Objectives:	The basic mission of NEFCO is to promote cost-effective ways to reduce the environmental pollution emanating from regions adjacent to the Nordic countries.
Eligibility criteria/ conditions:	Each project to obtain funding from NEFCO must meet number of environmental criteria including reduction of emissions and discharges. Every project application is to be thoroughly reviewed by NEFCO lawyers, investment managers and experts on environment

Average amount of funding per approved project:	N/A - NEFCO works with small and medium-sized projects (sometimes through specialized facilities using intermediaries for smaller projects). NEFCO may provide up to 5 MEUR as an investment in a single project.
Information materials on fund:	Website www.nefco.org where information can be found and downloaded. Contact NEFCO's information department for paper copies and further information.
Contact person of found representative	Mr Amund Beitnes Investment Manager Telephone: +358 10 618 0658 Mobile: +358 50 311 3684 (Russia +7 921 165 9885) Fax: + 358 9 630 976 E-mail: amund.beitnes@nefco.fi
Tips:	NEFCO works within the framework of the Arctic Council and the Barents Euro-Arctic Council (BEAC). The Energy Efficiency Centers in NW Russia have long experience of working with NEFCO.

Table 5-2 Summary information on NDEP

Name of funding agency	Northern Dimension Environmental Partnership (NDEP)
Logo of organization	Northern Dimension Environmental Partnership
Name of contact person/ respondent	Jaakko Henttonen NDEP Manager
Contact details of respondent	EBRD, One Exchange Square London EC2A 2JN Tel. +44-2073387186 Fax +44-2073387486 Mobile +44-7802510609 Email: henttonj@ebrd.com
Programmatic priorities of funding agency	1. Waste water
	2. Energy efficiency and heating
	3. Solid waste
Types of funds administered by agency:	Grants
Type of assistance (grant, loan, ….):	Grants

Objectives:	The purpose of NDEP is to mobilise support for environmental and nuclear safety investments in the Northern Dimension Area by providing grants for concrete projects prepared by the IFIs. The grants are allocated from the NDEP Support Fund which pools significant contributions from partner governments.
Time frame of current round:	Continuous, though decisions of council on project proposals is either in November or December of each year.
Eligibility criteria/ conditions:	The following: 1. Impact on the environment; 2. Geographical location; 3. Co-financing required: they provide 10 – 20 % maximum of a project costs. So other funds to be provided by other agencies through e.g. loan.
Average amount of funding per approved project:	5 million Euro
Information materials on fund:	www.ndep.org and in Russian: http://www.ndep.org/RUS/index.asp For an overview of projects in pipeline: http://www.ndep.org/projects.asp?type=nh&cont=prjh&pageid=15&content=projectlist

It should be noted that during communications was discussed the potential possibility of donors to provide funding for this project. Specific requirements towards the project as well as funding terms will be the subject to the future interactions between the project initiator and donors.

5.5 Existing sources and conditions of IEP funding

The MUGMS is able to carry annual expenses for operation and maintenance of the project in amounts not more than 20% out of fands of federal budget.
The rest of financing is supposed to obtain from donors as well as from Russian financing sources of regional level in the frame of the regional departmental special-purpose program “Protection and hygiene of environment and provision of environmental safety in Murmansk region” for 2009 – 2010. In the frame of this program in 2009 from the regional budget was laid out RUR 4 M and in 2010 is planned to lay out RUR 2.5 M.

The regional departmental special-purpose programme “Protection and hygiene of environment and provision of environmental safety in Murmansk region” for 2009 – 2010 was approved according to the Order of the Committee on natural resources and environmental protection of Murmansk region dated from 29.09.2008 № 459. Focal point - Svetlana Bulatova (tel: (8152) 21 00 32).
This program is implemented in the following lines:

- Provision of environmental safety of Murmansk region;
- State environmental monitoring;
- Development of nature protected areas;
- Environmental education;
- Search of clean water supply sources.

The program is aimed at environmental safety for population and environmental enhancement.

The main objective of this program is the provision of constitutional rights of Murmansk region's residents to have favorable environmental conditions.

6 CONCLUSIONS

6.1 Brief conclusions

The purpose of the project is improvement of the current monitoring methods of ambient air, extension of the lit of substances under control in accordance with the requirements of international standards. Creation of automated pollutant monitoring system allows to receive reliable information on the dirt load condition of ambient air, take correct administrative decisions reducing pollutant emissions, prevent or reduce unfavourable consequences of change in the state of environment.

This project provides for installation of monitoring stations for ambient air control in three areas impacted by industrial enterprises.

1) In the area impacted by OAO “Kolskaya GMK”. Specific pollutants: sulfur dioxide, formalin, nitrogen oxides;
2) In the area impacted by OAO “KAZ SAUL”. Specific pollutants: carbon oxide, hydrogen fluoride;
3) In the area impacted by OAO “Apatit”, OAO “OLKON”, OAO “Kovdorskiy GOK” Specific pollutants - suspended solids (dust).

The project does not have direct commercial effect. Possible profit can be gained from environmental fees for monitored pollution above admissible limits which will be revealed during monitoring process.

Direct economic benefits:

- Fees for monitored pollution above admissible limits;
- Sale of knowledge through scientific articles, attending conferences.

Indirect economic benefits:

- Improvement of the environmental conditions for the population on account of control and operative response to the atmospheric pollution and consequently improvement of general health of the population.

Environmental consequences of the project implementation
Implementation of such project is primarily directed to control over and subsequent prevention of the ambient air pollution and, therefore, improvement in the quality of life and health of the population of the Murmansk Region.

Implementation of the project also increases the level of ecological safety of the Murmansk Region in relation to emissions of industrial enterprises.

Creation of the air quality monitoring system enables the collection of reliable data and storing this in a central database which can than be used for ecological management.
The system would allow for control over effectiveness of the performed environmental actions of the city level as well as through "integration" of the air quality monitoring to the system of other mechanisms providing for execution of the environmental laws (ecological control, ecological examination, normalization).

The advantage of the automated system is that it is possible to carry out real-time forecasting of the atmosphere pollution in specified districts of the city and the region. This is a key factor for efficient ecological management. Up to date only the pollution level has been measured

and due to the delay in processing, the possibility to take timely reactive measures didn't exist. The real-time monitoring in its turn allows acting proactively in the struggle against air pollution.

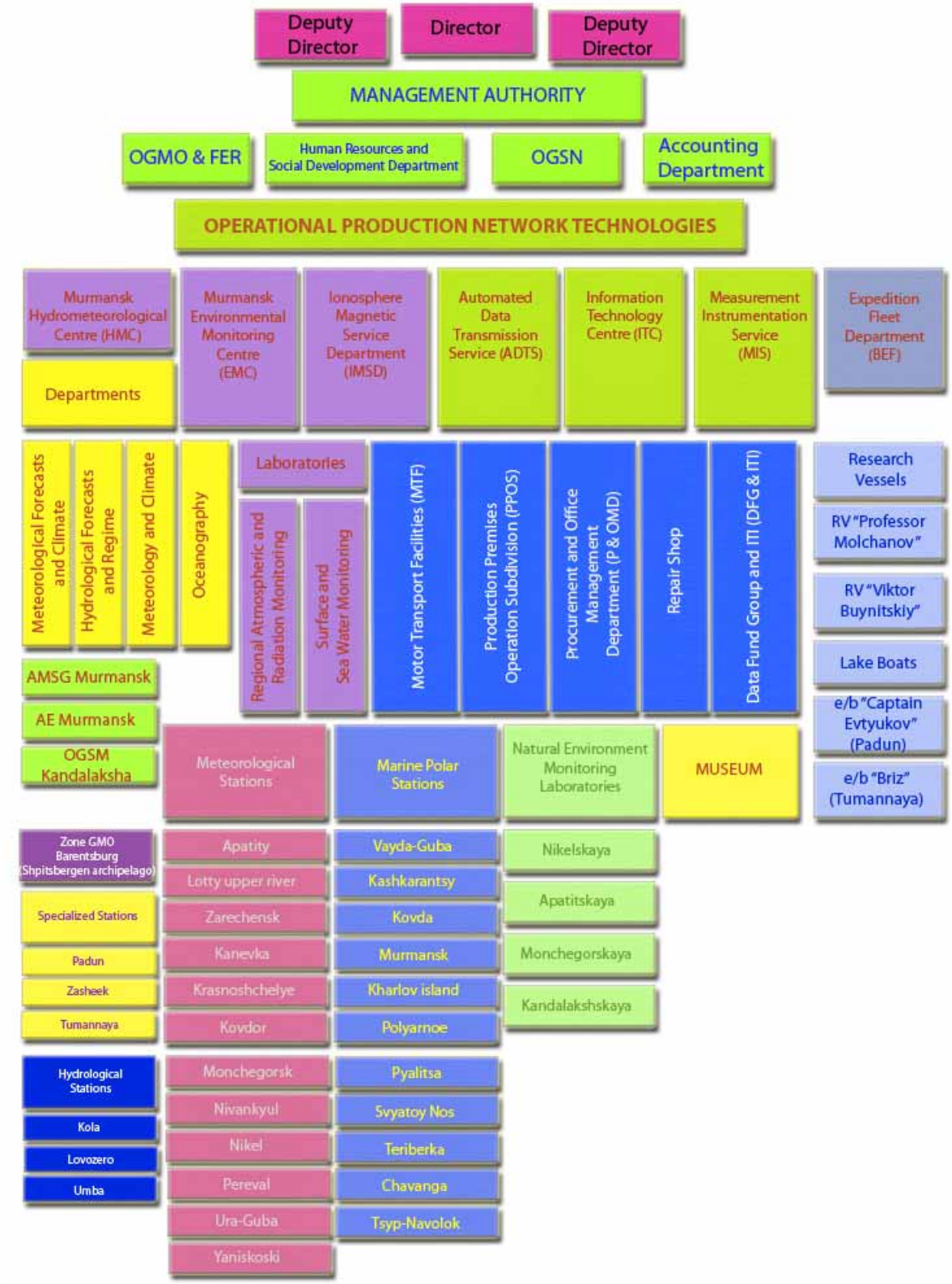
Social consequences
Implementation of this project allows the project owner to receive objective, reliable, real-time and on-line information on the state of ambient air, to receive information on pollution sources as well as forecast the situation. Such system enables the detection of the reasons for pollution and an adequate response to complaints from the population.
Creation of the air quality monitoring systems allows the project owner to process centralized, real-time and operative data-flows of information on the environmental conditions.
This data is highly needed by city organizations within the framework of their work on territorial planning, social and hygiene monitoring, when calculating environmental damage and working with complaints from the citizens.
Processing of the received data will also require creation of additional workplaces which will have a positive effect on the employment in this sector of the Murmansk Region.

During the initial contact with initiators, the following donors expressed interest in this project: NEFCO and NDEP.

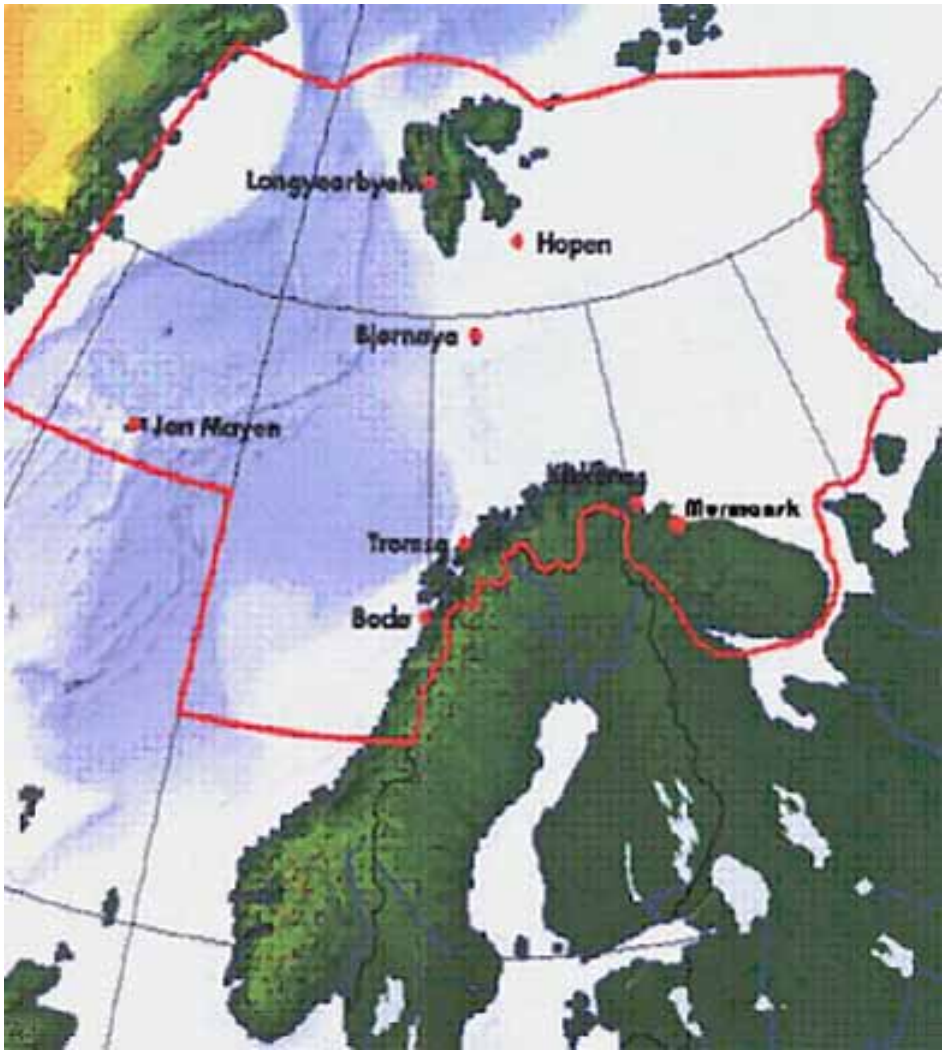
6.2 Major risks and uncertainties in connection with IEP implementation

Main technological risks of the project implementation are associated with obtaining non-objective information on the state of air quality caused by an incorrect selection of the monitoring station location.

Appendix No. 1 Organization Chart of Murmansk DHME



Appendix No. 2 Area of Responsibility of Murmansk DHME



Appendix No. 3 Statutory Checkpoint for Ambient Air Control in Apatity

Appendix No. 4 Equipment of the Statutory Checkpoint in Kirovsk