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ПРОГРАММА ОРГАНИЗАЦИИ ОБЪЕДИНЕННЫХ НАЦИЙ ПО ОКРУЖАЮЩЕЙ СРЕДЕ
UNEP

Terminal Evaluation of the UNEP GEF project "Persistent Toxic Substances (PTS), Food Security and Indigenous Peoples of the Russian North"

Project Number GF/4030-01-01

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CONTENTS

ABBREVIATIONS

AMAP	Secretariat of the Arctic Monitoring and Assessment Programme
DDT	Dichloro-diphenyl-trichloroethane
DGEF	Division of GEF Coordination (UNEP)
EMEP	European Monitoring and Evaluation Programme
EOU	Evaluation and Oversight Unit (UNEP)
EU	European Union
GEF	Global Environment Facility
HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
HM	Heavy Metals
MSC-E	Meteorological Synthesising Centre-East
OCs	Organochlorinated compounds
OCN	Octafluoronaphthalene
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated biphenyl
PCDD/Fs	Polychlorinated dibenzo-p-dioxins and dibenzofurans (Dioxins)
PTS	Persistent Toxic Substances
QA/QC	Quality Assurance/Quality Control
RAIPON	Russian Federation and Russian Association of Indigenous Peoples of the North
RCMA	Regional Centre for Arctic Monitoring
UNEP	United Nations Environment Programme

EXECUTIVE SUMMARY

The project on "Persistent Toxic Substances (PTS), Food Security and Indigenous Peoples of the Russian North" was designed as an integral component in a range of activities addressing identified information needs concerning environmental contamination in Arctic Russia, its effects on indigenous peoples, and the development of proposals for actions to improve the situation in the region. The project was designed as the key component in an overall strategy, in which a number of international projects and programmes, including those of the Secretariat of the Arctic Monitoring and Assessment Programme (AMAP), that supported this project by providing data and information.

The overall goal of the project was to reduce the contamination of the Arctic environment by Persistent Toxic Substances.

The main objectives were stated as:

1. Assisting indigenous peoples in developing appropriate remedial actions to reduce the health risks resulting from the contamination of their environment and traditional food sources.
2. Enhancing the position of the Russian Federation in international negotiations to reduce the use of PTS, and to empower indigenous peoples to participate actively and fully in these negotiations.
3. Enabling the Russian Federation and Russian Association of Indigenous Peoples of the North (RAIPON) to increase their involvement in the work of the eight-nation Arctic Council to reduce emissions of PTS.

The expected outcomes from this global assessment project included:

1. Recommendations to federal and local authorities, indigenous peoples and the international community on measures to reduce exposure of indigenous peoples to PTS, including identification of priority areas where actions are needed.
2. Assessment of the significance of aquatic food chains as a pathway of exposure of indigenous peoples to PTS.
3. Assessment of the relative importance of local and distant sources, and the role of atmospheric and riverine transport of PTS.

The project had nine components:

1) Co-ordination, management, and support to the project
2) Assessment of local pollution sources in the vicinities of selected indigenous communities
3) Assessment of distant sources and fluxes of PTS to Arctic Russia
4) Study of biomagnification in Arctic food chains
5) Dietary survey of selected indigenous communities
6) Monitoring of PTS levels in humans
7) Assessment of role of pollution on health and development of recommendations
8) Capacity building
9) Dissemination.

The final project report describes, in sufficient details, the problems of pollution sources in all four project areas.

One very important issue is missing – in all the selected regions, and this situation is probably the same across the northern part of Russia, a sufficient and effective waste management system does not exist up to now. Disposal of municipal and other wastes, including open burning of them, (witnessed in field observations) can be a source of serious long-term problems. **Secondly** – a detailed inventory of the contamination connected with former and present military bases is also lacking and represents a very serious potential problem in the evaluated project areas.

Other important potential sources of problems are household and occupational sources of exposure. This aspect was studied in detail and provided a new perspective to the evaluation of potential sources of contamination, which is very relevant given the current local situation.

The accumulating knowledge over the last decade about health effects associated with persistent organic pollutants in indigenous people of the North has caused much public concern about their traditional food which is considered to be the major pathway of human exposures to highly toxic organo-chlorines and metals. However, other exposure sources and pathways of PTS were generally ignored.

Higher potential risks of exposure of the indigenous population to PTS come from sources other than local foods. Contamination from fishing, hunting, and shot (plummet) casting can hardly be regarded as sources of significant lead exposure in surveyed populations. Smoking is likely to remain one of the most significant sources of cadmium intake in indigenous people; in addition to household use of toxicants; and frequent consumption of alcohol (mainly homemade ones). A specific source of PTS contamination stems from the fact that the indigenous people frequently use, for economic reasons, discarded (second-hand) industrial barrels and plastic containers to produce and to store liquids including homemade alcohols.

The results of the study of bioaccumulation and health effects are very important for future preventive strategies. It is necessary to educate people, how 'natural' food and traditional dietary procedures can be dangerous under conditions where there is environmental pollution.

The project findings and results reflect the present local situation in the evaluated regions. All region-specific priorities for environmental health are correctly presented. For interpretation of the health effects, and evaluation of causality between the causes of environmental pollution and the observable effects, a more detailed study of newer research projects connected with the broader study group (such as the EU project PCB-Risks) is strongly recommended.

Key messages from the project delivered to public and local authorities during the dissemination phase of the project were that, in total, PTS impact on the indigenous peoples of the Russian North, particularly of HCB, HCH and, in some cases, DDT and PCB, are one of the highest compared to the other Arctic regions. The highest exposures and associated health risks are documented for the coastal areas of Chukotka, where the traditional diet of the indigenous population is largely based on marine mammals and fish.

Many dissemination activities were undertaken based on the project reports. The results obtained in the course of the Project implementation are prepared for substantiating other projects

financed from regional, federal and international sources including UNEP, IPS, INTAS, Barents Health Program, Children of Russia (sub-program Children of the North).

The results of this project will be incorporated into the Russian National implementation plan to the Stockholm Convention.

All the methods of sampling and analytical procedures used in this project, including the QA/QC system, are fully acceptable by international standards.

INTRODUCTION AND BACKGROUND

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The project was executed by the Secretariat of the Arctic Monitoring and Assessment Programme, in collaboration with the RAIPON under the overall responsibility of the Executive Secretary, AMAP Secretariat and the vice-president, RAIPON. The UNEP/GEF Co-ordination Office, in association with the AMAP Secretariat and RAIPON were responsible for monitoring the implementation of activities.

A Steering Group was established to provide overall direction, suggest corrective actions if necessary, and approve technical and financial reports for the project. The Steering Group was to include representatives from RAIPON, the AMAP Secretariat, organizations and countries providing financial support and the Russian Federal Executing Agencies participating in the project's implementation.

The initial project duration was 35 months starting February 2001, which was later revised and extended to be completed in November 2005.

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SCOPE, OBJECTIVE AND METHODS

This terminal evaluation was conducted as an in-depth evaluation using a participatory approach whereby the UNEP/DGEF Task Manager, key representatives of the executing agencies and other relevant staff were kept informed and regularly consulted throughout the evaluation.. The draft report was circulated to the UNEP/DGEF Task Manager, key representatives of the executing agencies and the UNEP/EOU. .

The findings of the evaluation were based on the following:

1. A desk review of project documents including:
   (a) The project documents, outputs, monitoring reports (such as progress reports to UNEP and GEF annual Project Implementation Review reports) and relevant correspondence.
   (b) Review of specific products including laboratory reports and assessments, reports and publications, targeted information products and deliberations of the meetings of the Arctic Council and recommendations related to wider adoption of the findings of the assessments prepared by the project.
   (c) Notes from the Steering Group meetings.
   (d) Other PTS related material produced by the AMAP Secretariat
   (e) Relevant material published on web-sites maintained by the AMAP Secretariat and ICC.

2. Interviews and meetings with the Project Coordinator Yuri Sychev, Russian Polar Programme, Lars-Otto Riersen, the Executive Secretary of AMAP, Pavel Sulyandziga, the Vice-President of RAIPON, Prof. Dr. Valery Chashchin, Director of NPHR Centre, St. Petersburg, Dr. Maxim Chashchin, NPHR Centre, St. Petersburg, Agvan Movsesyan, Head of Department, Directorate of Natural Resources and Environmental Protection, Naryan-Mar; Dr. Galina Arteeva, Deputy Director, Nenenskyj Hospital, Naryan-Mar; Dr. Alexej Konoplev, Head of the Centre for Environmental Chemistry, Typhoon, Obninsk.

3. Interviews with Indigenous Peoples organizations, intended users for the project outputs and other stakeholders in the regions involved with this project included Pavel Sulyandziga, the Vice-President of RAIPON and Dr. Larisa Abryutina, RAIPON.

OVERVIEW OF PERSONAL VISITS

19-21/03/2006 – Moscow, Obninsk – Polar Programme, RAIPON, TAYPHOON
22-24/03/2006 – Naryan-Mar – local authorities
24-26/03/2006 – St. Petersburg, NPHR Centre

30/03-02/04/2006 – Oslo, Norway - AMAP

PROJECT PERFORMANCE AND IMPACT

The project had nine components:

1) Co-ordination, management, and support to the project

Project was focused on the Russian North which is populated by a variety of indigenous peoples with different cultures and traditional lifestyles. Careful consideration has been made in selecting a sampling strategy that will ensure that the results have optimal regional and demographic significance. Based on the available resources and considering the availability of compatible information from other activities, the four areas were selected:

i) Kola Peninsula
ii) Lower basin of the Pechora River
iii) Taimyr Peninsula, including lower reaches of the Yenisey River
iv) Chukotka Peninsula

A common and generally acceptable scheme was used - the exposed and non-exposed groups from different indigenous populations with distinct dietary characteristics and living in geographically different areas (affected by different primary sources of contaminants) were included in the project.

Core activities specified in the project design were implemented. These included systems for project co-ordination, administration and management of activities, organization of steering and co-ordination group meetings, translation of project outputs, dissemination of information on the project, progress reporting, publication of project reports and dissemination of key results etc.

Project co-ordination and management arrangements included a project manager, an indigenous peoples co-ordinator based at RAIPON, Moscow, and indigenous peoples co-ordinators for the regional activities of the project based in regional branches of RAIPON.

Additionally, the project provided the supporting information and data that are required for assessment of long-range PTS transport that are not linked to any one specific region, e.g. emission inventories and meteorological input data for modelling work, and data handling activities etc.

The progress of the Project was periodically assessed via four Steering Group Meetings and six Coordination Meetings (2 per year for 3 years).

General project management and coordination was conducted by the **Project Steering Committee (SC)**, which consisted of one representative from the Implementing Agency (UNEP), Executing Agencies (RAIPON and AMAP Secretariat), each of the international

organizations, countries, NGOs, financial institutions and foundations participating in the project financing. Other countries and institutions that provided other types of contributions and whose involvement could be useful for the project implementation, had a right to obtain the SC observer status.

The Secretariat of the Arctic Monitoring and Assessment Programme (AMAP) was designated as the international project coordinator and, with assistance of **the Russian Association of Indigenous Peoples of the North (RAIPON)**, providing functions of operations execution, coordination and administration of the project. In addition, RAIPON participated in the project activities concerning assessments of local pollution sources, food consumption and traditional diets, pollution levels in indigenous population and their effects, impacts of socio-economic and demographic conditions on lifestyle and health of indigenous population, and information dissemination.

All progress reports were regularly reviewed by the Steering Committee to inform their management decisions.

2) **Assessment of local pollution sources in the vicinities of selected indigenous communities**

This part of project was focused on an inventory of PTS sources in the areas where indigenous peoples live. The component was implemented with the active participation of local environmental protection authorities responsible for pollution control in the areas concerned, and was reliant upon the baseline activities carried out by the State Committee of the Russian Federation for Environmental Protection with additional funding from the project budget.

The project made use of some previous projects and activities such as the "Multilateral Cooperative Project on phase-out of PCB use, and management of PCB-contaminated wastes in the Russian Federation" and work was coordinated with the GEF-supported activity "Support to the National Plan of Actions for the Protection of the Arctic Marine Environment from Anthropogenic Pollution in the Russian Federation". This enhanced cost-effectiveness.

Project reports clearly presented the findings stemming from the GEF project. The project reports described the key aspects of the lives of indigenous peoples. Specific, extreme living conditions (fogs, strong winds, long winters), traditional lifestyle and culture, food, and sensitive connection with and dependence on the environment strongly influenced these populations. These aspects are very important for adequate understanding of the problems which were addressed in this project. Conflicts with modern culture and lifestyles are evident. However, during the Soviet and Post-Soviet periods, the lifestyle of northern indigenous peoples has undergone radical changes. The current situation can be described as the preservation of the traditional lifestyles under certain constraints imposed by modern conditions. Indigenous populations form only a very small part of total population of Northern Russian regions.

For evaluation of the project results, it is important to know that the main types of traditional activities, performed by northern indigenous peoples until now, are deer-breeding, hunting, fishing and sea-hunting, which are also very sensitive to potential environmental contamination. Reindeer breeding is still the main type of economic activity for most indigenous peoples of the Arctic. One of the main uses of reindeer is to provide people with food and clothing. Meat, blood, marrow, entrails and other tissues are consumed both fresh and processed. The skin is used for clothing, shoes, lodgings and accessories. Similarly, in the case of fish - sea-hunting is

another traditional activity of indigenous peoples of coastal areas of the Arctic and Pacific Oceans. The targets of this hunting are whales, walruses, seals and ringed seals, which provide the indigenous communities with meat, fat and skins. Meat and fat, both fresh, processed, and preserved in traditional ways, were traditionally their main food. Fishing has always been one of the most important traditional activities of the northern indigenous peoples. Fish remains the most important food product for the people and their dogs.

During and after the 2nd World War a massive industrial development of the Northern areas began, including intensive exploration and development of mineral deposits, which resulted in the reduction of both pastures, and hunting and fishing grounds. During the post-Soviet period there was another radical change in the State policy. It should be noted that, although both hunting and fishing were traditional activities, the indigenous peoples were usually pushed out of rich grounds by the incoming populations and had to move to more remote and less well-resourced locations. The new incoming hunters had the advantage of pre-established contacts with the town markets, allowing them to sell furs for higher prices. The traditional activities are in crisis for economic reasons. The main negative consequence of the transition to the market economy and subsequent financial and economic crises was the increasing reduction of social activity among the indigenous population. The lack of money, collapse of the traditional economy, and the loss of familiar values together led to the expansion of mass alcohol consumption amongst the indigenous population.

A key characteristic of the Northern regions of the Russian Federation is the combination of two diametrically opposite types of economies in a very vulnerable and fragile environment. One is the traditional indigenous lifestyle integrated to the environment, and the other is the contemporary industrial economy leading towards the destruction of the environment. Very frequently the mineral deposits coincide with reindeer pastures, hunting and fishing grounds and other areas of traditional nature management.

In the history of Russia, the Far North always played the role of the supplier of raw materials to the central part of the country. Originally, these raw materials were furs, now they are silver, gold, diamonds, wood, coal, oil, gas and others. Raw materials from the Northern regions provide prosperity for other regions to the detriment of their own. A third characteristic is the absence of real self-administration and the lack of power of indigenous peoples to influence or control the industrial development of natural resources or at least to obtain real compensation for the disturbance of their traditional lands.

The Northern regions of Russia are also subject to a policy of secrecy and restricted access established during the Soviet period, when military and industrial development of the North, by the prisoners of numerous work camps, began. The Arctic was classified as a restricted region and remained a closed area with the frontier regime. Therefore, the development of the Arctic was regulated by confidential resolutions and directives of the party authorities and the government. For this reason it was always difficult, or even impossible, to obtain information on the environment, and generally, the information pertaining to the contamination of these sites is missing.

These factors resulted in the radical change in the activities of the indigenous population and irreversible transformations. It is very alarming that the pollution of the environment unavoidably leads to the pollution of the natural foods of the indigenous population, which constitutes an important element for physical survival and in the preservation of their culture. It is not

surprising that the pollution and environmental degradation, together with the extreme Northern climate, leads to increases in morbidity and mortality.

The indigenous peoples of Arctic, regardless of their specific ethnicity, present many common features not only in social and cultural domains, but also in anthropo-biological respects. They show commonalities in a number of psycho-physiological characteristics e.g. unique specific metabolic pathways. This suggests that these special characteristics are the "standard" formed over many centuries under the influence of the adverse geographical and climatic conditions of the Far North. This "standard" seems to be permanent for the Northern indigenous peoples and differs to the acclimatization reactions observed by the new, in-coming population. It is also noticeable that the variability and the range of individual variation for many traits have decreased as compared to those who live in more moderate climates. The loss of minimal and maximal features contributes to the stabilization of morphological and functional complex in the extreme conditions of Northern regions. Apparently, these features are very important in the adaptive responses of Northern indigenous populations to the evolving natural and social environment. The project report briefly summaries some studies, which confirm explore this in detail.

The change in traditional dietary habits has greater impact on the health of indigenous population than it is usually believed. The distinct feature of nutrition in Arctic is the amount of proteins. According to the calculations, an adult Eskimo in early 20th century normally consumed daily 1.8-2.2 kg of meat of sea mammals. Meat and fat are the essential elements of the diet of the Northern indigenous peoples because, together with plants, they are main suppliers of energy, vitamins and microelements. This led to the formation of special metabolic mechanisms: lower levels of hormonal activity of the thyroid glands and pancreas and specific biochemical processes when the degradation of fat prevails over its synthesis and the main source of energy are proteins and not carbohydrates.

Lipid intake has undergone a radical transformation over the last decades with the aggressive obtrusion of "Soviet" cooking and more recent "westernization". As a result, the balance of lipids and sugars in blood serum of indigenous peoples was affected and, together with the general decrease in physical activity, lead to the development of various diseases especially atherosclerosis and insular diabetes.

The radical change of dietary habits started during the Soviet period when the nomadic routes in reindeer-breeding areas had been changed and traditional activities ceased. The difficulties for fishers and hunters inland and in the sea consisted of various restrictions introduced by the government and the reduction of populations of fish and animals. It was accompanied by spread of imported food products and greater orientation towards "ready-made" or "European" food.

This resulted in the reduction of meat, fat and local plants in Northern diets. It is not accidental that obesity and endocrine diseases increased and there is a high level of anaemia among pregnant women and children.

Introduction of the 'unusual' carbohydrates led to failure of their well established metabolic mechanisms for food assimilation. This particularly affected children in nurseries and schools. Carbohydrates and dairy products formed a significant part of their new diet. The menu in these institutions was compiled in-line with standard practices in the Central and Southern regions without taking into consideration the peculiarities of the metabolism of indigenous children. Until now, the staff of educational institutions do not believe that dairy and sugar can be not be readily

assimilated by indigenous children. Again, this is very important knowledge, because these specific features of metabolism can be a source of serious health problems connected with environmental pollution.

It should be also noted that until recently the long period of breast-feeding, sometimes until the child was 6-7 years old, was also important for the formation of the tolerance to the traditional diet. However the dietary habits of the Northern indigenous peoples have changed and some of the metabolic adaptations have become harmful under a new dietary regime. What used to protect their health now contributes to its destruction, provokes various diseases and developmental abnormalities, including the development of high mental functions.

Thus the traditional lifestyle and traditional diet can present a real threat to the indigenous populations of the Arctic zone. This can be easily proved if the range of traditional food products and traditional cooking of Northern indigenous populations is examined.

One of the common features of the indigenous peoples of the Arctic zone is that, traditionally, they share the same nutrition type (which is also one of the criteria to classify them as a separate group of indigenous peoples). The similarity and peculiarity of the traditional foods of Northern indigenous populations shows itself both in the food products they use and their cooking. Their diet mainly consists of animal products sometimes combined with wild plants that can be explained by their Northern location and traditional activities, such as hunting, fishing, reindeer-breeding and plant picking.

Until recently the Arctic indigenous peoples consumed only what they could find themselves in nature. The traditional diet of the Northern indigenous peoples is also characterized by the consumption of raw products and the restricted use of heat processing introduced in the European culture. Traditional ways of cooking were determined by lack of metal ware, ovens, salt and other practical factors. Because of the prolonged use of animal products the Northern indigenous peoples have developed the protein-fat nutrition type, which has become the genetically fixed pattern of metabolism ensuring aboriginals' health.

Until now the raw animal products most frequently are frozen while still fresh and then served sliced, chipped or cut into small pieces. Usually raw meat or fish is served with berries (bilberries, cowberries, cloudberries, crowberries, wild leek and other soured or frozen plants). Other popular dishes are meat and fish dried under the wind or smoked at the open fire in the traditional lodge. These traditional foods are complemented by poultry - partridges (all year long), geese, ducks (in summer) and also eggs. Apart from berries they also eat different parts of plants, wild roots, mushrooms and moss.

In order to ensure the applicability of recommendations, derived from the project's surveys involving limited groups of people, to the entire indigenous population of the arctic region of Russia, the sampling was stratified on the basis of geographical differences in locations of traditional populations within the Arctic. Tthe survey comprised various groups of indigenous pregnant women as well as groups of general indigenous populations residing in both in the westernmost (Kola Peninsula), easternmost (Chukotka Peninsula) and northernmost (Taimyr Peninsula) areas and also the largest ethnic group (Nenets of Pechora River Basin).

As far as the assessment of distant sources and fluxes of PTS to Arctic Russia, the objective was to assess transport of PTS from distant sources to areas of Northern Russia inhabited by

indigenous peoples. Measurement of concentrations of PTS at background air monitoring stations was provided as in-kind baseline contributions from the AMAP, bilateral and national monitoring activities. A limited number of special monitoring stations provide data on long-range transport, including data required for model validation/verification work.

Modelling work was required to assess the atmospheric transport of PTS from long-range sources and was undertaken by the Meteorological Synthesising Centre-East (MSC-E) in Moscow and the EMEP modelling centre for heavy metals and persistent organic pollutants, ensuring that, in addition to work directly associated with the GEF project, activities under EMEP (in the European part of the Russian North) were provided as a UN/ECE contribution to the project. Meteorological data needed for modelling of long-range atmospheric transport included data provided by the Russian Federal Service for Hydrometeorology and Environmental Monitoring as part of its in-kind baseline contribution.

Riverine fluxes of PTS were monitored in the Pechora and Yenisey Rivers. The last downstream sampling sites of the Russian Federations national freshwater monitoring network, sampling on four occasions during a year, were used. Hydrological data for the rivers concerned were provided by the Russian Federal Service for Hydrometeorology and Environmental Monitoring as part of the in-kind contribution.

The project focused on the evaluation of potential sources of contamination as an important issue for decision-making and the ensuing management of these problems.

For the study of the exposure of humans to PTS from the point of human intake, the chain "source – pathway – biological availability" was applied. Contaminant sources can be conditionally separated into three groups - distant sources located long distances from receptors, local sources located in the vicinities of the indigenous communities and contact sources that originate from intentional or non-intentional use by recipients in everyday household and occupational life. Parts of the selected regions were evaluated as target regions for long-range atmospheric transport pathways.

Due to the character of atmospheric circulation in the Northern Hemisphere emission sources located in the Northern Hemisphere, particularly in Europe and Asia, play a dominating role in contamination of the Arctic. The global character of PTS and spatial distribution of emission sources requires that evaluation of the long-range airborne transport to the Arctic region is made on the hemispheric/global scale with the use of a multi- compartment approach. To meet these requirements appropriate modelling tools had to be elaborated and the application of one from the MSC East from Moscow proved to be an excellent decision for the purposes of this project.

The assessment included the evaluation of concentration and deposition levels as well as source-receptor relationships for selected areas and for the Arctic as a whole. It is also important to know for evaluation of the project's results that the climate of the Russian Arctic regions is characterized by lack of solar radiation in wintertime, which leads to very low temperatures. In contrast, summer solar radiation flux is significant, but temperatures are not high because most of incoming solar energy is dissipated on snow or ice melting.

Emission sources of Hg, PCBs and γ-HCH for modelling purposes were divided into several groups according to their geographical location. The key criterion for the selection of a specific region as an aggregate of emission sources was the possible influence of emissions from this

region on the Russian North. The number of the selected regions was different for different pollutants. The selections made by the project were very relevant and logical.

The assessment was completed using EMEP data and models. To evaluate levels of contamination of the Arctic region by global pollutants (Hg, PCBs, γ-HCH) due to long-range transport a hemispherical approach was applied. For this purpose hemispheric multi-compartment transport models MSCE-Hg-Hem and MSCE-POP have been developed at EMEP/MSC-E. This Evaluator has had extremely good first-hand experiences with the application of this model and fully respects the model results described in the project report.

The results from this component of the project show that the most significant contributors to anthropogenic mercury deposition are sources located in South-eastern Asia, Europe and Russia. The most significant contributions to the natural component of annual deposition to the Arctic are from the Pacific and Atlantic Oceans, and from Asia. The major contribution is made by North-western Europe (about 40%). Other significant contributors are Russia (19%), the Americas (17%), South-eastern Europe (16%). For PCB-28 and PCB-118 North-western Europe and Russia are main contributors. However, for PCB-180, the main contributors are North-western Europe and the Americas. In the case of γ-HCH the modelling results indicate contributions of different emission sources to the contamination of the Arctic region. Western Europe is the largest contributor to this region (about 40%), then come India (19%), the Americas (17%), China (10%) and Russia (6%). The share of all other sources amounts to 8%. This is a very important summary of potential long-range transport pathways and sources, which lead to the long-term contamination of the north part of Russia. However, local sources of contamination are more serious in this evaluator's opinion.

The other part of the long-term transport of pollution assessment was focused on the description of the flows of large Arctic rivers, which represent one of the most significant pathways for contaminants to the Arctic. It is particularly relevant to PTS, since they can be potentially transported to the Arctic, due to watershed runoff, from the entire catchment areas of these rivers, including heavily industrialized regions. Riverine PTS transport is particularly important for two pilot areas which were selected for the project implementation – the lower part of the Pechora basin, and Eastern part of Taimyr Peninsula, located on the banks of the Yenisey river.

In general, PTS fluxes with the Pechora and Yenisey rivers correspond to seasonal river discharges. Highest fluxes usually, as expected, coincide with spring flood waves. Project results have shown that among chlorinated persistent organic pollutants, the highest fluxes are observed for PCBs, HCH, DDTs. Amounts of these contaminants transported by river flows to the areas inhabited by indigenous peoples can create risks for their health. Fluxes of other chlorinated organic pollutants are either below detection limits, or their values are not high enough to present considerable risk for the indigenous population.

HCH and DDT fluxes within the Yenisey River are formed by long-range transport. The lower part of the Pechora River may have local sources, which contribute to their fluxes. It is very important to recognise that DDE/DDT ratio indicates that increase of DDT flux may be caused by fresh contributions of this pesticide. This problem must be solved and managed as a part of the Russian National Implementation Plan.

Similarly, the fluxes of polynuclear aromatic hydrocarbons (PAHs) in both rivers are affected by local sources. Local contributions, mainly during the spring flood period, are also relevant in the

case of the fluxes of heavy metals (Pb, Cd and Hg) in the flow of Yenisey River. This can be explained by the influence of pollution from the Norilsk industrial complex.
The assessment of local pollution sources was very important for the determination of their role in general environmental pollution, contamination of traditional food products and, accordingly, their influence on human health. The estimated maximum distance from sites of indigenous peoples residence to local pollution sources under the inventory has been conditionally taken up to 100 km. Specific boundaries for inventory zones have been defined more exactly in each case considering local conditions (dominating winds, river flows, scale of regional sources, etc.). Taking into consideration that some of the pilot territories covered under the scope of the project are affected by pollution originating from big industrial complexes located in their vicinities, the scope of the objects under inventory included such towns as Apatity, Monchegorsk, Olenegorsk, Revda, Kirovsk (Murmansk Oblast) Naryan-Mar (NAO), Norilsk – TAO (Norilsk located in TAO is under administrative subordination to Krasnoyarsk Krai), Anadyr (ChAO).

The assessment produced by the project was based upon official data concerning PTS emissions received from the corresponding administrative territories, representatives of Russian Association of Indigenous People of the North (RAIPON) from regions, as well as expert estimates of PTS releases from usage of organic fuel. Expert calculations were necessary because the official statistical data do not include PTS emissions caused by burning of organic fuel. At the same time, this source of atmospheric PTS was essential for such PTS as heavy metals (HM), polycyclic aromatic hydrocarbons (PAHs) and dioxins. It should be also mentioned that in Russia, dioxin emissions have not been registered yet and, among all PAHs, only benz(a)pyrene emissions are registered.

The study comprised expert calculations for the following PTS emissions: lead, cadmium, mercury, benz(a)pyrene, benz(k)fluoranthene, indeno[1,2,3-c,d]pyrene and dioxins. Expert estimates of PTS emissions were prepared with the use of statistical data for consumption of various kinds of fuel as well as emission factors showing what amount of the substances would be released into the atmosphere by 1 ton of a specific fuel. PTS emission factors were determined either in accordance with Russian methodology or by adapting West-European figures to Russian technologies.

The statistical data were received from the State statistics offices of the corresponding administrative territories of the Russian Federation, from environmental protection authorities, or from the reports of the State Committee for Statistics of the Russian Federation (Goskomstat).

Regional Brunches (Committees) of the RF Ministry of Natural Resources executed the initial collecting and processing of data and information. The inventory of pollution sources is based upon the following sources of information:

- State Statistical Report forms on emissions of gaseous pollutants (2-tp (air), discharges of waste waters (2-tp(water)) and solid waste of industrial, municipal and agricultural enterprises and transport;
- Ecological passports of industrial enterprises;
- Reports on environmental protection activities of local environmental protection authorities, sanitary-epidemiological control services, agricultural administrative authorities and other information sources (Murmansk, 1991-2000; Murmansk, 1996-2000; Murmansk, 2001; Murmansk, 1994-2000; Nenets, 1998; Nenets, 1999; Nenets, 2001);

- Annual reports and reviews of Federal Ministries and Departments (MNR, 2001; Roshydromet, 1995-2000; Roshydromet, 1995-2000; Roshydromet, 1995-2000);
- other official sources and literature.

It is necessary to mention, however, that the information presented by each region varies in completeness, quality and volume, due to different technical, organizational and other facilities of the corresponding local services. In this connection, a number of data had to be calculated based on expert estimates. The methods used for the emission inventory, including the use of expert estimations, were entirely appropriate give the constraints imposed by local conditions.

All conclusions documented in the project report are very relevant for the future management of the PTS problems in the evaluated regions. If the sources of pollution are not known exactly and monitoring does not exist, it is very difficult to solve this problem.

General conclusions in relation to the project report

- Assessment of official statistics on environmental release of pollutants, as well as data obtained by the environmental protection authorities of the administrative territories of the Russian Federation under the scope of the project, clearly indicate that the existing environmental release controls and reporting systems are not adequate. They do not meet the contemporary requirements of the reporting systems needed for controlling the efficiency of actions taken by the countries in connection with international measures to reduce environmental PTS releases, in particular those specified in the Stockholm POPs Convention.
- The control and reporting system of the environmental protection authorities do not adequately cover environmental releases from defence-related activities in the Arctic regions.
- The existing environmental monitoring system does not cover secondary pollution sources, which are not directly linked to environmental pollution by industrial enterprises, but may strongly influence the state of the environment, ecosystems and human health. For example, monitoring of such anthropogenic sources as harbours and ports is not covered. Besides petroleum hydrocarbons and few other contaminants, important PTS that can originate from shipping activities and its wastes, particularly scrapped ships are not covered.

The project report adequately describes the problems of pollution sources in all four evaluated areas.

However, one very important issue is missing – in all the selected regions, and probably also in the North part of Russia, a sufficient and effective waste management system does not exist to date. Disposal of municipal and other wastes including open burning of them, (witnessed on field visits) can be a source of serious problems for long time. **The second deficiency** – was the absence of a detailed inventory of the contamination connected with former and present military bases. These represent a very serious potential pollution problem in the evaluated areas.

Another important potential source of problems is household and occupational sources of exposure. This aspect was studied in detail and provided a new perspective to the evaluation of potential sources of contamination, one that is very relevant to the local situation.

The accumulating knowledge over the last decade about health effects associated with persistent organic pollutants in indigenous people of the North has caused much public concern about their traditional food which is considered to be the major pathway of human exposures to highly toxic organo-chlorines and metals. In the meantime, other exposure sources and pathways of PTS were generally ignored.

To clarify potential indoor (household) and occupational sources and pathways of exposure, a targeted survey including human blood sampling among selected families and domestic and workplace matters were carried out in three selected of indigenous communities.

The targeted survey was designed as a case study involving 28 families from 3 selected native settlements. The selection of families was based on measurements of cord (umbilical) blood concentrations of total PCBs derived from the basic survey of the project. Taking into consideration that umbilical concentrations of PCBs were proved to be generally higher than those measured in venous blood of mothers and also because of higher vulnerability of fetus/children to toxic exposure, demonstrated in number of studies, it has been assumed that the cord blood concentrations of PCBs is better marker of exposure of the mother-child pair.

The work programme included re-interviewing and blood re-sampling of those women showing higher cord blood concentrations of total PCBs (over 500 ng/g lipids) at time of birth as well as interviewing and blood sampling of adults sharing apartments or flats with a target woman (such as husband, brother, sister etc). The reference group was represented by families of those women found to have lower cord blood concentrations of total PCBs (below 500 ng/g lipids) living either in the same native community or in the closest vicinity to it. It has been proven that the required number of (at least 4) families of "exposed" and "less exposed" newborns were available only in:

- the settlement of Lorino, Chukotka coastal study area;
- the district of Khatanga, Taimyr Peninsula;
- and the settlement of Nelmin Nos, Pechora River Basin;

The invitation and interviewing procedures and blood sampling protocol were identical to the those applied for the general indigenous population in the 2001 survey but supplemented with the extended questionnaire focused on occupational and household sources of exposure to PTS since the treatment of animals against mosquito bites, protection of houses against rodents, bed bugs and cockroaches are common in the northern communities. The work programme therefore involved visiting the houses of selected families as well as work places and, where possible, sampling wash-outs and scrapes in home and occupational settings for further analyses for contaminants.

Besides the local food, traditionally considered to be an important source of exposure of the indigenous population to persistent toxic substances, other pathways should not be overlooked. The correlation between PTS concentrations in wild animal and fish species commonly used as the substantial local food and those in human blood appear to be weak.

The impression as to what extent the indigenous population is at higher risk of exposure to PTS through the sources other than local foods can be illustrated by the following information obtained from the questionnaire study:

- Fishing, hunting, and shot (plummet) casting can hardly accounted for sources of significant lead exposure in surveyed populations. Only 7% of indigenous people and below than 1% of pregnant indigenous women have reported activities potentially associated with exposure to lead.
- Smoking is likely to remain one of the most significant sources of cadmium intake in indigenous people, since 54% of adults of general population and 35% pregnant women have reported tobacco smoking habits.
- Household use of toxicants is reported by 34 - 41% of respondents. However, despite the fact that over 30% of the surveyed population grow vegetables in garden plots or greenhouses, few reported use of insecticides to protect cultivated plants.
- 70% respondents of general population and 58 % of pregnant women reported the frequent consumption of alcohol. A significant number of respondents reporting the consumption of homemade alcoholic drinks. A specific source of PTS contamination is that the indigenous people frequently use, for economical reasons, used (second-hand) industrial barrels and plastic containers to produce and to store liquids including homemade alcohols.

Chemical analysis of some insecticides sampled as result of targeted survey shows that the most common household toxicants available in the market in Nenets, Taimyr and Chukchi AOs do not contain PCB, HCH, HCB, DDT in considerable concentrations. The chemical named "Medifox super" produced by "Fox Company" (Russia) is the exception. According to its certificate the main constituent is the permitrin concentrate and "is used for pediculosis treatment and for disinfections of rooms against pediculosis and sarcoptoid ticks". "Medifox" has been found to be used widely in Chukotka kindergartens, schools, health institutions, residential buildings for scabies treatment since the early 1990's.

As far as the POPs in occupational settings, it is necessary to mention that the potential occupational exposure to POPs most frequently reported was in form of the treatment of reindeers by various insecticides to protect the animals against mosquito bites. Blood-sucking insects, especially gadflies that can penetrate into animal's subcutaneous tissues as well as through the naso-pharynx, impose a serious problem for animal health, and during the long-range running, the efficiency of insect control may be a determinant of deer herd health. The current variety of chemicals used to control mosquitoes and gadflies are different to those used in the past. Nowadays, the most common are the synthetic pyrethroids which do not contain organo-chlorines, are not persistent and not capable of accumulating in the body at detectable levels. In the early 1970's organophosphines (chlorophos) with ammonium carbonate or with sodium hydroxide, hexamide with spindle oil and emulsifier, DDVP (dimethyldichlorvinylphosphate), etacide, trichlorometaphos-3, sulphur dioxide, smoke hexachlorane shells, cryoline-hexachlorane liniment and other hexachlorane compounds were widely used in collective reindeer farms. Among the above-mentioned chemicals only "hexachlorane" has been found to contain HCH at significant levels. Other currently used insecticides are generally free of POPs containing an array of organo-chlorine compounds, and are readily degradable in nature.

3) Study of biomagnification in Arctic food chains

This component of the project considered marine, freshwater and terrestrial food webs, the upper trophic levels of which are used as food in the local population. Samples of key species (and where relevant, abiotic media) in the food chains that lead to the main food items were collected. The selection of primary food items was, in my opinion, relevant to the geographical

settings and consumption patterns of the indigenous peoples concerned, and depended, to a large extent, on the results of the dietary survey.

The project proposal clearly described all important aspects of QA/QC procedures such as a sampling protocols based on standardized sampling, pre-treatment, storage and transportation procedures. The sample collection was carried out by qualified laboratory personnel assisted by indigenous peoples to ensure that; sampled plants/organisms represented those actually consumed, contamination was avoided, necessary measurements at the time of sampling were correctly carried out (location, age and sex of organism, etc.), and samples were appropriately packaged and transported to the laboratory. In some cases, it was appropriate to obtain samples from local markets, or from local hunters (e.g. in the case of sampling walrus and whale). Food items and other samples were analyzed for PTS, including a standard suite of POPs, Hg and Cd. Other toxic metals were analysed where specific reasons for this existed based on potential contamination e.g. local sources.

This part of project closely followed the project proposal and was very carefully and effectively realised.

Sampling strategy - environmental sampling and analysis - was aimed at reaching two objectives:

- determination of PTS levels in main biota species, particularly at upper trophic levels, that serve as sources of traditional food for indigenous populations in the pilot areas of the project implementation;
- evaluation of biomagnification, *i.e.* PTS accumulation in terrestrial, freshwater and marine food chains, as they pass through them, keeping in mind that humans in this respect occupy the highest trophic level.

These two objectives imply different requirements for sampling, sample treatment and analysis. In the first case, it is necessary to obtain data, as precise as possible, on PTS level in specific species and their tissues, particularly those that are widely used for traditional food, for estimation of PTS intake with food. In the second case it is necessary to determine average contamination in specific trophic levels, and on higher ones – and accumulation of PTS in different tissues, to evaluate what PTS are of particular concern from the point of biomagnification for human diets.

Environmental sampling was organised in the pilot areas of the project around the more densely settled areas of the indigenous population, keeping in mind that the hunting and fishing grounds can be located in areas rather remote from these settlements. Reindeer herds also migrate depending on the season and weather conditions. In this connection, special tentative consultations with local indigenous peoples involved in traditional activities were arranged prior to field sampling, and areas of environmental sampling were defined based on these consultations. Environmental sampling strictly respected the seasonal variations in the sampling for different environments which depend not only on availability of specific species, but on hunting periods that are sometimes different for different regions. Biota sampling, particularly of those species that require hunting and fishing, was arranged in close collaboration with local fishers and hunters. This was particularly important, not only from the point of efficiency of these activities, but also from formal point of view, since licences for hunting of some species, marine mammals in particular, can be obtained only by indigenous communities.

Types and number of environmental samples were selected in compliance with the objectives of the study of biomagnification in food chains and PTS levels in traditional food sources for the selected indigenous communities. Following this approach, sampling of environmental media was designed to ensure reliable data on average concentration of the contaminants in the sample's site. The same approach was used for lower trophic levels of food chains, particularly vegetation, including lichens, mosses and mushrooms, by pooling of samples.

From biota of upper trophic levels, specific organs/tissues were sampled, which are characteristic for PTS accumulation. Pooling of such samples was made for groups of animals with the same sex and similar age. An exception was made for marine mammals, which are situated on top of long marine food chains and, due to high content of fat in their bodies, accumulate particularly high levels of lipophilic contaminants, including organo-chorine and alkyl-mercury compounds. In their case, single (individual) samples were treated and analyzed. The samples were frozen immediately after delivery to the field camps, and stored prior to analysis. Sample pooling was performed as a part of analytical sample treatment before analysis.

The sampling strategy used was evaluated as being of very high quality– it was based on the long experience obtained from the implementation of the AMAP Programme and this strategy sufficiently addressed the project hypotheses.

Analytical methods used for PTS determination in single and pooled environmental and biotic samples was based on internationally recognized methodologies (ISO, JAMP, NOAA, EPA, UNEP, HASL, ASTM), taking into account AMAP recommendations. The Russian standard methodologies certified by the Russian State Standardization Committee (Gosstandart) were also used when appropriate (GOST, PND, RD).

Conventional extraction and clean-up procedures have been used for analytical treatment of samples. Control of completeness of analyte extraction was carried out by introduction of internal standards before extraction (PCB-198 and dibromooctafluorodiphnyl (DBOF)).

The quantitative analysis of organochlorines was performed by the gas chromatography method with registration by electron capture detector (ECD). In addition, the analysis of samples with an anomalous composition of pollutants or their anomalously high concentrations was made using the GC-MS method to confirm the presence of substances under consideration. The samples where significant concentrations of brominated biphenyls and brominated diphenyl ethers were detected were also subjected to additional GS-MS study.

The quantitative determination was made by the method of absolute calibration using target components and the internal standard – DBOF solution that was added to the sample before its preparation. The routine analysis was performed using a measurement system consisting of the Fisons Mega-2 chromatograph with ECD800 detector and a soft-hardware chromatographic data processing complex "Multichrome-1.4 and "Kristall-2000M" chromatograph with electron capture detector, automated sampler and a chromatographic data processing complex "Chromatec Analytic" 1.21.

The mass-spectrometric analysis of chlorinated compounds was performed using a measurement system comprised of the Fisons 8060 gas chromatograph and a mass-spectrometer MD800 in the electronic shock mode (70 eV). In the case of brominated compounds the measurement system comprised of Carlo-Erba 8060 gas chromatograph and the mass-spectrometer MD800 in the

electronic shock mode. The control of system operation, recording of mass-spectra and their processing was made using the MassLab1.3 software package and the NIST library of organochlorines.

The measurement system consisting of a chromatograph Carlo Erba 8035 and a high resolution mass spectrometer Autospec-Ultima (VG) in the electron impact mode (36 eV) and with resolution ≥10.000 was used for isomer specific analysis of PCDD/Fs, brominated compounds and toxaphenes. Separation of isomers was carried out with a non-polar column DB-5MS J&W Scientific, 60 m.

All standard solutions of organochlorine pesticides and PCBs used for calibration were produced by Ultra Scientific (USA) and certified by ISO9001. The standards of toxaphenes, brominated diphenyl ethers and brominated biphenyls were produced by the St. Petersburg University.

Measurements of mercury were carried out with the atomic absorption spectrophotometer "Kvant-Z-ETA" (Russia) (Western analogue – Varian-"AA-8000") operating with a mercury generator GRG-106 in the automatic mode with Zeeman background correction.

Mercury contained in the sample was reduced by tin dichloride to the metal state and then transferred in the argon flow by the "Cold Vapor" method to a graphite oven whose internal surface is covered with a fine palladium layer using special methodology ensuring mercury retention in the oven. The mercury detection limit in the solutions under consideration comprises 0.001 μg/L with a relative error of 20 % at this level of concentration.

Measurements of lead and cadmium were carried out on the atomic absorption spectrophotometer "Kvant-Z-ETA" (Russia) (Western analogue – Varian-"AA-8000") operating with electrochemical atomization of the sample with Zeeman background correction and a constant aliquot volume of 5 μL of the solution under consideration. Before the measurements, a palladium modifier in the concentration of Pd – 20 μg/L was injected to the samples.

Determination of PAHs in all samples included their liquid extraction with subsequent clean-up of extracts from interfering substances. Control of PAH extraction completeness from the samples was provided by introducing octafluoronaphthalene (OFN) as an internal standard.

PAH analytical determination was performed by the HRLC method with registration of target components by the diode-matrix and fluorescent detectors connected in series. The quantitative assessment of the levels of PAHs was made by the absolute calibration method with target components and control based on the internal standard – OFN solution that was added to the sample before its preparation. The analysis was performed using a measurement system comprised of the HP1090M chromatograph with a standard diode-matrix component, SPECTRAPHYSICS fluorescent detector with programmed excitation wavelength and the Hewlett-Packard soft-hardware processing complex for chromatographic data.
All standard solutions of PAHs used for calibration were produced by Ultra Scientific (USA) and certified by ISO9001. The standards of octafluoronaphthalene are produced by the St. Petersburg University.

The data quality control included execution of a full set of work on the analysis of blank samples, standard solutions, replicated samples, samples with addition of target components, samples of a different matrix composition with the known levels of the determined components

(Table 5.3) and participation in the international inter-calibration exercises in the framework of the "QUASIMEME" Program and the AMAP Ring Test.

The Russian State Certified Standards and certified standards of other countries (ULTRA Scientific, Wellington Laboratories) were used as calibration standards. As matrix samples with the known levels of the determined components, the samples already analyzed with additions of some components at the level 2-4 times greater than the detected concentrations at routine analysis were employed. The samples disseminated in the framework of the "QUASIMEME" Program whose composition has been already published were also used as control samples.

As agreed with the Secretariat, for the external data quality control the analytical laboratory involved in analysis of environmental and biotic samples participated during the first stage of the work in the inter-calibration exercises of 22 and 24 Rounds of the "QUASIMEME" Program – analysis of bottom sediment and biota samples for the levels of PAHs, OCs and HM and 25 Round – analysis for OCs, HM and mercury in samples of sea and estuarine waters.

Given that the concentrations of toxaphenes, brominated diphenylethers and brominated biphenyls in most pulled samples were below the stable determination levels of these compounds by routine methods, 40 samples (6 samples of bottom sediments, 6 samples of soils, 6 samples of lichens, 6 samples of berries, 3 samples of reindeer kidneys, 4 samples of hare liver, 3 samples of fish liver) have passed control analyses by high resolution GC-MS method with Carlo Erba 8010 chromatograph and Autospec Ultima (V6) mass-spectrometer in the electron impact mode 36 eV and resolution > 10000 (Tables 5.4). Control analyses confirmed data validity.

All the methods described above the evaluator personally verified during field visits and confirmed that all analyses were done by the described methods. Technical details were also discussed during a field visit to AMAP and the sampling and analytical procedure including the QA/QC system which were used in this project are fully acceptable by international standards.

The analytical results processing and presentation were based on, and conducted to, internationally acceptable standards. All results of analysis were divided into groups according to sampling sites and sample types.

For the study of bioaccumulation in the terrestrial environment, the following speciesof plant and mushrooms were collected and analysed for PTSs: lichens -*Cetraria cucullata, Cetraria islandica, Cladina rangiferina, Cladina alpica, Cladonia Stellaris, Cladonia mitis*; bryophytes -*Polytrichum commune, Pleurozium Schreberi*; mosses - *Dicranum sp., Sphagnum balticum, Hylocomium splendens;* berries - low-bush cranberry - *Vaccinium vitis-idaea*, cloudberry - *Rubus chamaemorus*, bilberry - *Vaccinium myrtilis*, blueberry - *Vaccinium uliginosum*, crowberry - *Empetrum nigrum*; mushrooms - orange-cap boletus - *Leccinum auranticum,* brown-cap boletus - *Leccinum scabrum,* mossiness mushroom - *Xerocomus sp.* A number of single samples of each vegetation type collected in a given site used for a pooled sample preparation ranged from 3 to 20 and most commonly was about 10. Vegetation was analysed for all above mentioned PTS.

Similarly, in the case of the freshwater environment, the selection of species and sampling sites was representative. Fish species have been caught from the Lovozero Lake (Kola Peninsula), Pechora River, Ynisey River (Western Taimyr), Khatanga River (Eastern Taimyr) and Kanchalan River (Inland Chukotka). Fish age ranged from 5 to 14 years. The number of single samples of a

tissue collected in a given site and used for preparation of pooled samples, ranged from 1 to 13. The following fish species have been sampled:

Freshwater species:

- pike (*Esox lucius*)
- burbot (*Lota lota*)
- perch (*Perca fluviatilis*)
- ide (*Leuciscus idus*)

Salmon species (family Salmonidae)

- whitefish (*Coregonus lavaretus*)
- arctic cisco (Coregonus autumnalis)
- broad whitefish (*Cerogonus nasus (Pallas)*)
- Inconnu (*Stenodus nelma*)

Fish muscle and liver were analyzed for all PTS listed above. Results of analysis were divided into groups according to sex (female or male) age (young and old or young, middle and old) and a tissue type (muscle and liver). Age differences within a group ranged from 1 to 2 years. The difference between mean ages of the oldest and youngest groups was always less than 2-fold.

From the conclusions of this component of the project it is necessary to highlight the following points:

Levels

- Concentrations of PCDD/Fs exceed maximum permissible levels in meat by approximately 10% in the reindeer muscle from the Kola Peninsula. Concentrations of ∑HCH and ∑DDT in all tissues of all mammals, birds and fish in the Russian Arctic are far below corresponding maximum permissible concentrations established by Russian Ministry of Health and only in marine mammals were they close to them in some samples.
- Concentrations of PCDD/Fs in the muscle are the highest in reindeer and the lowest in terrestrial birds. However, the differences in concentrations between them doesn't normally exceed several times. Other OCs occur in comparable concentrations in marine mammals, salmon species and waterfowl. In terrestrial mammals and birds concentrations are, as a rule, several times lower and the highest occur in reindeer.
- In all sites Pb concentrations in the reindeer tissues are at least several times lower than corresponding maximum permissible concentrations. Cd and Hg levels in all tissues and sites, excepting Hg at Chukotka, are close to corresponding maximum permissible concentrations or slightly exceed them. Concentrations of Pb and Cd in waterfowl are normally below permissible levels and only in few samples was the maximum two times higher than them. Concentrations of Hg in molluscivores, omnivores and piscivores are stably close to the permissible level and in most samples exceed it, the maximum concentration was 4 times. All concentrations in fish muscle are below corresponding maximum permissible concentrations established in Russia for fish, with only one exception (Hg in whitefish from the Khatanga River, exceeded maximum levels 1.5-fold).
- All Hg and the most of Cd concentrations in seals are significantly higher than corresponding maximum permissible concentrations. The maximum for Hg in seal muscle was as high as 100 times.

- Levels of contamination in males are normally slightly higher than those of females, but in the most of cases the difference is statistically insignificant. The only exception is Pb in browsers. Pb concentrations in male browsers are stably twice as high as in females in all 6 sites.
- Concentrations of both OCs and HMs are, as a rule, higher in older animals, but most of differences between the two age groups observed in this study are within a factor of two. For fish species, this is consistent with small ratios of mean ages of groups. The most pronounced concentration dependence on age observed was for HMs in reindeer. In the fist several years of its life this dependence is close to directly proportional with the elimination rate close to 10 years for all 3 HMs.
- Levels of the liver and kidney contamination are normally higher than those of the muscle, especially for HM. The liver/muscle concentration ratio for Hg in reindeer and OCs in burbot as well as the kidney/muscle ratio for Cd in marine mammals can be as high as several hundreds. The highest OC concentrations are found in this studies in the liver of burbot, caught from the Enisey River (580 ng/g of Σ^{15} PCB, 470 ng/g of ∑DDT and 39 ng/g of ∑CHLOR).
- Levels of brominated flame-retardants are below the detection limit (0.2 ng/g) in all samples of water, soil, vegetation, terrestrial mammals and birds. In a few samples of fish and seal liver and in seal blubber 2,2',4,4'-tetrabromodiphenilether is found in concentrations from 0.2 to 1.9 ng/g ww.

Trends

- PCDD/F levels in tissues of reindeer and hare from the Kola Peninsula are an order of magnitude higher than in other sites. Concentrations of PCDD/Fs in birds and fish follow similar, but less pronounced, trends.
- No significant geographical trend in concentrations of OCs other than PCDD/Fs in terrestrial mammals, birds and fish was evident in the Russian Arctic in 2001. Only OC concentrations in molluscivores show distinct maximum at the Eastern Taimyr.
- OC levels in reindeer are in a reasonably good agreement with those previously reported for Russian, Canadian and Norwegian parts of the Arctic. This is consistent with comparable levels of lichen contamination in Canada and Russia.
- OC levels in fish in the Russian Arctic fall into the lowest parts of corresponding concentration ranges in the Canadian Arctic, but similar to those in 3 Norwegian sites in 1994.
- Consistent with relative OC concentrations in fish, OC levels in blubber of seals in the Russian Arctic are close to the lower border of concentration ranges obtained in 1998-2001 in the Canadian Arctic.
- An order of magnitude higher levels of PCDD/Fs in comparison with those determined in this study were found in the fish muscle from the Grate Slave Lake in the Canadian North in 1994/5. On the other hand, PCDD/Fs levels in the muscle on freshwater fish in 4 Scandinavian sites are close to those in the Russian North in 2001.
- Levels of HMs in terrestrial mammals and birds are the lowest at the inland Chukotka and at the Eastern Taimyr. However, differences with other 3 sites are within a factor of 3 or less.
- Levels of HMs in fish and waterfowl birds don't follow any pronounced geographical trend

- Recent levels of HMs in reindeer tissues in the Canadian Arctic are, as a rule, somewhat higher than those in the Russian Arctic.
- Concentrations of Hg in whitefish species in the Russian Arctic in 2001 are close to those in the Canadian Arctic in 1996 –2000 and in the Norwegian North in 1995.
- HM concentrations in the muscle, liver and kidney of seals in the Russian Arctic in 2001 are, as a rule, in ranges similar to those in ringed seal in the Canadian Arctic in 1998 – 2001.
- No significant temporal trend in both OCs and HMs in all biological samples is evident from results of this and previous studies. However, stable and, in some sites, significantly higher concentrations of HCH and Hg in mosses and lichen in 2001 indicates, that, probably, some increase in depositions of these contaminants in the Russian North took place during recent years.

Biomagnifications

- OC patterns in both terrestrial and aquatic food chains in the Russian Arctic are close to those of lipids. This indicates that OCs in the Arctic ecosystems are close to a steady state distribution.
- Concentration of OCs in lichens follows that in mosses. The lichen/moss concentration ratio for OCs is close to unity and concentration in lichens can be used directly as an estimate of concentration in mosses in the same site and vice versa.
- The OC lichen-to-reindeer transfer factor obtained in this study equals 0.3 (ww muscle)/(dw lichens) and is consistent with that previously determined in the Canadian Arctic.
- OC water-to-fish transfer factors obtained in this study are in a reasonably good agreement with those predicted using octanol-water partition coefficients.
- Values of Hg and Cd water-to-fish transfer factors are similar for both fish groups, while those of Pb is several time higher for freshwater species. Geometric means of Hg and Cd TF^{wf}s, calculated using pooled sets of data, equal 3300 and 570 ml/g ww, respectively. Geometric means of Pb TF^{wf}s equals 280 ml/g ww for freshwater species and 60 ml/g ww for salmon species. Transfer factor values for Hg and Pb are in a good agreement with corresponding default values given in the IAEA Handbook.

Based on these data, which are summarized in the previous conclusions, there is no evidence to suggest a dramatic increase in food contamination at high trophic levels. But in the case of some contaminants the process of long-range transport is ongoing, differs in various parts of Arctic territory and an increasing level of some contaminants is detectable. Similarly, the bioaccumulation and biomagnification of assessed pollutants continues.

4) Dietary survey of selected indigenous communities

Dietary surveys of selected indigenous communities were studied through use of a detailed questionnaire which targeted the individuals that participated in the study monitoring PTS levels in humans. The purpose of the questionnaire was to establish the nutritional adequacy of their diet, to evaluate the dietary importance of the various food items, and also to bring to light eventual dietary differences among the ethnic groups. Life style factors (e.g., alcohol consumption, smoking habits, socio-economic conditions etc.) were also included. A comprehensive questionnaire was developed based on the outcome of the previous study.

The evaluator regarded this approach very highly as it formed a good basis for the evaluation of effects of PTS from local sources which, in the evaluator's opinion, are much more serious problems in the project areas than any long-range PTS transport.

As a result of the targeted survey it has been found that the indoor environment, including the home-processed, stored and ready-to-eat foodstuffs sampled from the residencies of selected indigenous families are widely contaminated by persistent organic pollutants. The high percentage of contaminated foodstuffs found in selected houses seems to be consistent with the high prevalence of those residents who have increased blood concentrations of PCBs congeners and DDT metabolites. Occurrences of the persistent organo-chlorines at detectable concentrations both in the local and non-local foods sampled in indigenous communities are much higher as compared to the national averages obtained from the results of the nation-wide food safety monitoring.

Very important is local foodstuffs contamination by heptachlor, in accordance with the national food safety standards, the occurrence of this toxicant in any food is not allowed. DDT and HCH appear to be the most frequently detected pesticides in foods consumed by indigenous families. In the meantime, their concentrations are generally below food safety limits. It should be noted that in native communities of Pechora River Basin the highest PCB concentrations were measured in local freshwater fish and duck fat, whereas for Taimyr Peninsula the highest ones were found in smoked fish and reindeer meat.

The comparison of the POPs concentration in local foods sampled from indigenous residencies with those measured in fish species and reindeer meat sampled in the natural environment clearly indicates that both occurrences and contamination levels may well be increased while storing/processing/preparing at home.

Another important and very relevant issue is the evaluation of cooking effects on PTS food contamination.

In the case of boiling of meat, it has been established that the contamination levels of POPs in local food can be specifically affected by the choice of traditional means of cooking. Important for the application of preventive measures is promoting widespread understanding that the boiling for at least 2 hours is capable of significantly reducing both the PCBs and pesticide contamination of food.

The boiling-mediated decrease in concentrations of POPs ranges from 2.2 up to 5 times as compared to those measured in the uncooked meat of sea mammals. In contrast, it was found that the microbial mediated fermentation in ground pits as well as fermentation involving the long-term immersion in a salt solution may increase the POPs concentrations.

The fermentation of local foods frequently involves, for economic reasons, the uncontrolled use of discarded industrial plastic containers as well as ground pits which are not protected from drained sewage or potentially contaminated soils. Most of native communities still have generally poor sanitation and are environmentally neglected.

Fermented walrus meat, called "kopalchen", was sampled during the targeted survey in 2003 in Chukotka region. It was found to have the highest level of PCB contamination among other ready-to-eat foodstuffs collected in the selected families. "Kopalchen" is an eviscerated unsalted

walrus or other sea mammal's skin with adjacent fat and meat tissues that has undergone the natural microbe-mediated fermentation for several months at a ground pit covered by soil. As a rule such pits are situated in residential areas close to houses and are not properly protected from drainage waters. The duration of pit use is practically unlimited. These results are very important for awareness and education campaigns, but this is a very sensitive topic in the context of the traditional food of indigenous people in the Arctic.

In the indigenous communities of western part of the Russian Arctic (for example Kola Peninsula), where the social and economic status of indigenous people is relatively high, home-made alcohol-containing drinks are not very common. In contrast, such regions as Chukotka Peninsula, where the market liquors are very costly and hence hardly available for indigenous people, home-brewing and 'span' making are in common illegal use. 'Span' is believed to be most popular whereas home-brew is in less demand due to higher cost. According to the questionnaire study, the span consumption in the Northeastern Chukotka ranged from 30-50 liters per adult person. Home-brew production is finished by span distillation, which is capable of significantly decreasing POPs concentrations in the final product.

The health importance of secondary contamination of local food can be illustrated by elevated PCB serum concentrations found in families living in the selected houses where the local food had been stored and processed. Those families in whose houses a higher contamination of home-processed fish (the same species were taken for analyses) was found showed, on average, a 16-fold increase in relative risk of elevated PCB serum concentrations.

The secondary contamination of reindeer meat was not as high compared to fish, probably due to simpler processing and limited contact to waste materials and other contaminated media.

Due to significant individual variations in concentrations of major PTS found in maternal and cord blood of indigenous people residing the same communities. Evaluation of the exposure sources and pathways associated with the certain private and occupational activities involving PTS contaminated materials is of great importance. Clear relationships between contamination of dwellings and the levels of the same contaminants in the blood of inhabitants has been found.

Although this type of a case-study is generally less scientifically rigourous, and thus, the statistical power of the data analysis is limited it is hoped that information on the POPs exposure at indigenous family level involving the risk identification associated with the actual use of specific chemicals in the household and occupational settings will be helpful to clarify some exposure sources and pathways. Generally, these sources of PTS exposure have not yet been properly evaluated and documented in the arctic circumstances especially with respect to the most vulnerable groups of indigenous people.

The results of this part of study are very important for the future preventive strategy. It is necessary to educate people, how natural food and traditional dietary procedures can be dangerous under circumstances where environmental pollution is evident.

This information was used as a part of the project's dissemination activities and public information campaigns. The problem is sensitive in the context of traditional life styles in the regions and life style changes are often closely connected with the economic situation of the region.

5) Monitoring of PTS levels in humans

Monitoring of PTS levels in humans focused on the fetal period which is regarded as the most vulnerable period for exposure to toxic substances. Pregnant women and their newborn children were the basic study group of this component of the project.

The sampling strategy for the determination of PTS levels in human bodies and tissues was organized in the form of human blood sampling in parallel with dietary and lifestyle surveys; the survey covered two types of respondents: pregnant women/cord blood sampling at the delivery departments of local hospitals and members of general adult indigenous populations in the selected indigenous settlements of the pilot areas of project implementation. In addition, control samples from two areas: Norilsk urban population and the Aral Sea area, which is generally acknowledged as a region with high usage of different types of pesticides over many years, have been analyzed to compare their levels with those obtained among the indigenous population of the Russian north. This approach was very effective.

It should be noted that the World Health Organization recommends use of breast milk as the indicator of human body load with dioxins, PCB and other contaminants of this type. In spite of that, The AMAP human health assessments are usually based on PTS levels human blood. This approach was selected based on thorough analysis of all factors, including ethical principles of studies among the indigenous peoples, groups of population covered by surveys, etc. To ensure the project data comparability with both the circumpolar and global data, in one of the project areas (Chikchi peninsula) breast milk samples were taken and analyzed in parallel with blood samples from the same women.

Both matrices, blood and breast milk were collected under in accordance with fully acceptable international procedures and recommendations. Similarly, the analytical methods and the quality control processes used were applied in compliance with all relevant international rules and standards.

Analysis of blood serum for persistent organic pollutants was carried out in the Centre for Environmental Chemistry of SPA "Typhoon" and the Regional Centre for Arctic Monitoring (RCMA).

The evaluator had the opportunity to evaluate the procedures and system of the Typhoon laboratory work and quality control in depth. The quality of work was of the highest order. Analysis conducted in CEC of SPA "Typhoon" is based on the GC/MS method. As part of QA/QC program the samples were analyzed in series. Each series included not more than 12 samples, a procedural blank and a control sample, containing known amounts of analytes. The validity and accuracy of measurements was ensured by using isotope-labelled surrogate standards: analogues of analytes introduced to the samples prior to extraction.

Analysis conducted by the RCMA laboratory was based on chromatographic separation of analytes and their identification by retention time using an electron capture detector. Quantitative calculations were done based on external calibration using standard solutions of analytes.

Analyses were performed with use of recommended internal standards, systems of blanks and standard reference materials. The procedures used for identification and quantification of determined pollutants, were fully acceptable. The detection limits of individual congeners of determined individual substances ranged within satisfactory values.

Quality control procedures involve a set of measures to check the accuracy of measurements and estimate errors arising in the course of sample preparation for analysis and measurement.

Analysis of samples was performed in series. Each series included not more than 12 samples, a control sample prepared in laboratory or sample of certified reference material, and a blank (procedural blank). Since the weight of blood samples delivered to the laboratory did not exceed 10 g, no analysis of duplicates was performed.

For control of completeness of extraction and calculations, prior to extraction the samples were added with surrogate standards - analogues of analytes labelled with ^{13}C. A list of surrogate standards used for each kind of analysis is given in the technique description.

The performance of analytical instruments was checked on a daily basis and included determination of instrument sensitivity, chromatographic and spectral resolution.

PTS levels in the blood of the general adult indigenous population, with minor exceptions, was up to 3-5 times, and for mercury 9 times, higher than those in maternal blood from the respective areas. This fact can be explained by transfer of pollutants from mother to the foetus through the placenta.

Since the occurrence of PTS in human blood in the Russian North is explained by intake of contaminated fish (marine and freshwater), marine mammals, sea birds and reindeer meat, the PTS concentrations in blood of women giving birth and their children are also associated with traditional diet of indigenous people. The highest concentrations of PTS in maternal and umbilical cord blood were detected in the Chukotsky District of Chukchi AO, and the cause of these high levels of PTS in blood in this particular district is thought to be determined by high consumption of traditional foods based on higher trophic levels of long marine food chains. However, this assumption still has to be elucidated in further studies.

The comparison with results presented in the AMAP-2002 Report shows that on a whole, the OCP in human blood from the Russian Arctic are similar to those in the coastal areas of Greenland and Canada, and for some POP such as toxaphenes and mirex, these levels are much lower.

Since maximum contamination of both breast milk and human blood samples with all determined PTS, including PCDD/F and PBDE, was detected in Chukotsky District situated in the coastal area of Chukchi Peninsula, the cause of it is likely to be found in the dietary habits of native populations of the district.

Average concentrations of dioxin and furans detected in breast milk from women from Chukotka are the same as those in breast milk of women from Norway and Ireland and are lower than in Northern Canada (Northern Quebec and Southern Quebec).

6) Assessment of role of pollution on health and development of recommendations

The analysis of demographic and health conditions of the indigenous population in four regions of the Russian Arctic (Chukotka, Taimyr, Lower Pechora and Kola Peninsula) shows striking similarities. Despite ethno-genetic, social and economic differences, the population of the

examined areas show similar dynamics, age and gender distribution, death and birth rates and morbidity.

The financial and economic crisis in the 1990s led to massive emigration of non-indigenous population from the Northern regions, which resulted in the reduction of the total population in some of the project areas. At the same time, the indigenous population in all 4 regions has not undergone significant changes for the last 10 years and remains stable at the same levels as 20-30 years ago.

The age structure of the indigenous population of the examined regions is characterized by a high percentage of young people, in all regions the indigenous population younger than 40 years old constitutes about 70% while those over 60 years old – less than 10%. This is common for northern indigenous populations, where the life expectancy does not exceed 50 years. This is related to many factors of the Arctic environment, both internal and external, where the most important factors are the genetic conditionality and the attrition of physical resources during the adaptation to the severe climate and life conditions.

The birth rate of northern aboriginals is higher than the average for the Russian Federation; however, differences in these indices appear when comparing the examined areas. The total death rate of aboriginals in the examined areas varied for the last 20 years between 10 and 20 cases per 1000 people, which corresponds to the average Russian rate. The infant mortality for all examined areas was 30-60 cases per 1000 live-born, which exceeds the similar index for the Russian Federation (15-20 cases).

The correlation between the birth and death rates determines the population growth in Chukotka and Taimyr, while in the Lower Pechora area it remains unchanged and decreases in the Lovozero area. Therefore the population dynamics for Nenets is alarming, while the population of Kola Saami shows clear tendency towards extinction.

High levels of cancer among the indigenous population of the Far North in 1960-1970s (twice as high as in the USSR in general) has no satisfactory explanation. Some researchers related the high level of cancer pathologies to the increased radiation experienced by the reindeer-breeders because of nuclear weapon testing in Novaya Zemlya.

The morbidity and sickliness of the indigenous population is typical for the examined areas. The prevailing diseases are respiratory diseases (up to 30-40% of all diseases), traumas, eye diseases, cardiovascular pathologies, diseases of the digestive apparatus and urogenital systems.

The increase of sickliness (reported morbidity) is common for all examined areas, which can be explained by a number of factors including the greater accessibility of medical treatment. This evaluator highlight the importance of remarks made by the physicians from Naryan Mar that they are not aware of the results of this project. They participated in the collection of samples and the feedback information to them is very important for their every day work.

Other important and socially relevant problems are tobacco smoking and alcohol intake. Tobacco smoking is found to be one of most common adverse habits among indigenous populations with the highest prevalence in Chukchi AO. The dietary and lifestyle survey reported that almost 96% of total adult indigenous populations regularly consume alcoholic drinks at least once a month. As expected, vodka was apparently the preferred alcoholic beverage everywhere in the Russian

Arctic. About 2/3 of adult indigenous respondents (74% men and 42% women) reported consuming solely vodka or vodka-like strong drinks.

Unfortunately, the original questionnaire administered in the dietary survey doesn't specify homemade alcoholic drinks, the production of which is illegal. However, the average consumption of those is estimated to range from 50 liters a year among Chukotka indigenous communities to 11 liters in Taimyr communities. As a result of the 2003 targeted survey, it has been established that homemade alcoholic drinks are often consumed as a raw (not distilled) brew that may be highly contaminated by POPs. Alcohol intake at amount of 3 L ethanol per year by indigenous women has been demonstrated to cause a number of adverse reproductive health effects e.g. low birth weight, reduced gestational age of neonates, stillbirth and birth defects.

It is commonly accepted that the poverty and unemployment are very important health risk factors compromising human health. The global trend is that the nutritional patterns among less favored groups of a population change to lower animal protein and fat consumption. In contrast, the indigenous people of the North with low monetary income become more reliant on local foods, in particular fish and wild (marine) animals, which are generally more available there than the market food. Since local fish and marine mammals in many Arctic areas are significantly more contaminated by POPs compared to imported foodstuffs, the total burden of PTS is increasingly elevated for those lacking access to market products. Thus, poverty can be, and often is, a predisposing risk factor of higher exposure to PTS among arctic indigenous people.

Indoor and occupational sources of exposures to PTS are likely to be an underlying contributor to higher blood concentration of persistent contaminants in arctic indigenous populations of Russia. Thus, for instance, almost half of the respondents in Chukchi AO and Kola Peninsula reported regular use of a number of highly toxic substances against insects and rodents. The majority of those chemicals have not been properly labeled and their use is practically uncontrollable. It has been established that at least some of these substances (the most were imported from China) contain significant amount of POPs such as PCBs, DDT and HCH.

Obviously, the Russian Arctic population is highly dependent on local foods. Practically all indigenous populations in the project pilot areas rely on traditional local food in their diets. High consumption of marine mammal meat and fat by indigenous populations of coastal Chukotka should be particularly noted.

POPs concentrations in blood serum are known to vary due a number of individual factors, e.g. age, diet, parity etc. This study has shown that the most pronounced differences are associated with gender and age. Thus, the group of men older than 40 had a 1.3-fold increase in concentrations of total PCBs, DDT, HCH as compared to younger group of men living in the same communities. The differences between identical age groups of indigenous women are found to be larger than between men, reaching a 2-fold increase in POP concentrations among aged persons. Pregnant women showed the lowest serum concentrations of a number of organo-chlorines such as HCB, total toxaphens, and, to some extent, sums of PCBs and DDT. The possible explanation of this phenomenon is that the pregnant women, according to medical recommendations, are often admitted to a delivery department 3-4 weeks prior to expected time of delivery to provide them proper health care including special nourishment which is completely based on imported foodstuffs. Another uncertainty to be taken into consideration is that the group of pregnant women represents the whole study area but not the specific communities. So, it is difficult to rule out some intercommunity variations.

A number of experimental findings suggest that the exposure to PTS is associated with reproductive health effects. However, the epidemiological evidence for that is very limited. In order to rule out the alcohol abuse which, unlike tobacco smoking, has been confirmed to be a severe reproductive health risk factor and thus, might play a role as a confounder to PTS-induced reproductive health effects, the data for those women who did not report drinking hard liquors was analyzed separately for selected pregnancy outcomes by levels of PTS exposure. The prevalence of reported health problems related to known chronic diseases among indigenous men at age over 40 has not been found to associate closely with measured current blood concentrations of PTS, probably due to lack of awareness on manifestations and symptoms of health disorders. In contrast the indigenous women at the same age showed quite a significant association between the prevalence of reported chronic diseases and elevated blood concentrations of some PTS, particularly Pb.

The representative groups of surveyed indigenous populations from each of the project geographical areas, including 255 mother-child pairs and 1576 adults, has provided comprehensive data on gender, age, place of abode, forms of traditional activity, diet, life-style details, self-evaluation of health and family health history. In addition, the database was supported by reliable medical information obtained from the personal medical charts kept by local hospitals and measurements of all major PTS in blood that made it possible to consider that the study populations presented by the project adequately reflect the general patterns characteristic for the indigenous populations residing in the Russia Arctic as a whole.

PTS blood concentrations document that all indigenous communities residing in study areas of the Russian Arctic have been moderately exposed to major groups of global environmental pollutants transmitted through the food chains such as PCBs, DDT, HCH, HCB, lead and mercury. However, only lead concentrations in blood were found in some cases to exceed the threshold effect level currently recommended by WHO (100 μg/L). The main sources of lead exposure in arctic circumstances are assumed to be the contamination of local food through both the long-range transport and uncontrolled use of lead-containing materials such as paint and homemade ammunitions (pellet and bullet casting).

Actual serum concentrations of total PCBs (Arochlor 1260) were frequently found in the range of 5-8 μg/L. It may well be considered as a matter of health concern regardless of the fact that national guidelines for these toxic substances in blood were not established. Recent evidence suggests that PCBs might have adverse reproductive, developmental, and endocrine effects. Despite the fact, that manufacture of PCBs in most of the Arctic countries has been banned since 1977 (in Russia – early 90s), a number of current exposure sources do remain. It is well known that the highest human exposures to PCBs occur mostly via the consumption of contaminated fish.
It is seen from the concentrations measured in the maternal blood serum that the exposure of indigenous pregnant women living in coastal areas of the Russian Arctic to a group of "old banned" pollutants particularly HCB, DDT and PCBs is one of the highest currently reported for other Arctic indigenous peoples.

It is likely that the DDT and HCH blood contamination mostly originated from common exposure sources which are not closely related to contamination of wild nature. Based on the results of the targeted survey, the extensive uncontroled household application of the lead-

containing materials, and also insecticides and anti-rodents toxicants may significantly contribute to the human PTS loads through the secondary contamination of food stored and processed at home.

A very important result from the global point of view is the evidence of Mirex blood occurrence. Bearing in mind that some pesticides such as Mirex have never been manufactured in or imported to Russia (as well as the former Soviet Union), this affords an opportunity to roughly evaluate the relative contribution of global transfer to the POP exposure experienced by indigenous populations residing in the study area. It is assumed that most of the study populations in Russia are exposed to long-range transported persistent toxicants from 4 to 100 times less than those residing in coastal area of Chukotka Peninsula.

Low-income indigenous families are at greater risk of exposure to POPs due to significantly higher consumption of the local foods, particularly fish and marine mammals enriched by fat, which are in many cases playing a role of the major source of human exposure to environmental toxicants.

Formally speaking, only the mean PCBs and lead blood concentrations in the adult indigenous populations, exceed the internationally recognized levels of concern evoking preventive actions. However, the statistical analysis of recorded health impairments in connection with elevated blood concentrations of some other pollutants (Hg, Cd, HCHs) indicates their possible associations with the prevalence of certain reproductive and developmental endpoints as well as with the prevalence of chronic diseases in aged people.

All criteria proposed for the POP limitation in human blood and tissues involves a large number of uncertainties because of the lack of precise toxicological information especially that addressing the most sensitive sub-group of people (e.g., infants, elderly, and most indigenous people who are nutritionally compromised) to effects of hazardous substances.

In the meantime, the identification of 38 cases of fatal outcomes of pregnancy, 62 cases of reduced birth weight (16 of them are extremely low ones), 27 cases of premature births, 8 cases of serious birth defects and 31 spontaneous abortions supported by life-style, occupational and other information on risk factors, as well as by measurements of wide range of PTS in the environment, food, indoor matter and blood specimens collected during the cross-sectional study, gives an opportunity to consider the causal role of exposure to individual environmental contaminants.

The evidence of support for the classical causation indicators of plausibility, consistency, coherence and analogy is judged to be acceptable for PCBs, as well as for lead and total mercury exposures as measured in human blood. Because the health effects associated with the PCB exposure that have been suggested previously constituted limited population-based reports and not the outcome of a systematic epidemiological study, the temporality and reversibility of the reviewed findings cannot be assessed.

The evaluator full reviewed and accepted the results and conclusions presented in documents produced by the project. The project findings reflect the present local situation in the evaluated regions. All region-specific priorities of environmental health are correctly presented. The evaluator strongly recommends additional work on the interpretation of the health effects and evaluation of causality between the environmental pollution and observable effects. This would

include more detailed study of newer research projects connected with the broader study groups such as the work done on the EU project PCB-Risks.

7) Capacity building

A major component of the capacity building undertaken by the project was the training of personnel (indigenous people representatives) to conduct dietary surveys and health study related interviews. Additionally, local staff of monitoring stations and in hospitals were trained in sampling procedures to a standard consistent with internationally recognized guidelines. Local staffs were trained for correct use of the equipment available and a number of training workshops were organized for local personnel of environmental and medical laboratories.

8) Dissemination

The full results of the project were published in English and Russian by the AMAP Secretariat in a user-friendly format comparable to the 1997 State of the Arctic Environment Report.

The AMAP Secretariat and RAIPON established in 2005 four dissemination teams that include representatives of RAIPON, health professionals from the Russian Federation Ministry of Health Northwest Public Health Research Centre and representatives of regional authorities. A comprehensive dissemination plan was developed and implemented during the period from March to September, 2005, covering all areas to be studied (Kola, Taimyr and Chukotka Peninsulas, and Pechora River Basin). The Dissemination Group was responsible for development and implementation of the dissemination strategy. This group was coordinated by RAIPON (Larissa Abryutina) with the assistance of NWPHRC (Dr. Valery Chashchin). The AMAP Secretariat had an observer status in this group.

Sixteen sections of laws and regulations were identified that mandated dissemination of environmental safety and health information related to toxic exposure. A four-stage approach for tracking dissemination and considering the flow of information was delineated. Special areas and target groups of dissemination were identified: the information needs of the changing environmental strategy, education of young indigenous people; sustainable traditional activities and small businesses; and people with difficulty in understanding or reading written information materials.

Key messages from the project that were delivered to public and local authorities during the dissemination phase were that, in total, PTS impact on the indigenous peoples of the Russian North; particularly of HCB, HCH and, in some cases, DDT and PCB, is one of the highest compared to the other Arctic regions. The highest exposures and associated health risks are documented for the coastal areas of Chukotka, where the traditional diet of the indigenous populations is largely based on marine mammals and fish.

A significant proportion of total global PTS in the Arctic environment is determined by their long-term transport. Among toxic substances detected in the blood of the Arctic indigenous inhabitants, there are some that have never been produced and used in USSR/Russia. At the same time, data and information on local PTS pollution sources available to federal and local environmental and human health authorities do not adequately reflect the actual situation in the Russian Arctic regions. The surveys arranged within the project framework indicate environmental impacts from unknown local sources. Indoor and occupational sources of PTS, including contamination of dwellings, are likely to be a significant contributor to blood contamination among indigenous peoples of the Russian North.

However, in this regard very important problems are not clearly described – the important source of local problems – the environmental contamination from military activities which can be very strong because there any system of control of military activities did/does not currently exist. The second very important problem is the absence of any reasonable waste management system. There is no evidence concerning the contents of dumps, there are no systems for waste disposal; open burning of dumps and waste disposal is quite common and nobody seems to care that it can be very important source of emission of PCDDs/Fs and polycyclic aromatic hydrocarbons.

In general, PTS levels in the natural environment and biota of the Russian Arctic are at moderate levels compared to other Arctic regions. However, in a number of cases, home-made local food contains higher levels of PTS contamination than raw products obtained from the natural environment. It is assumed that food receives additional contamination during storage and processing in contaminated household environment. This problem has to lead to activities aimed at increasing the awareness of governmental institutions and NGOs.

All project participants have agreed that the environmental aspects of human health, particularly those associated with PTS exposure of indigenous peoples, are closely linked to the economic and social status of indigenous families. In this respect, a significant reduction in the effects of PTS on human health cannot be successfully achieved without improvement in the economic and social conditions of the Russian Arctic indigenous peoples.

However, there is a weak connection with the development of Russian National implementation plan of the Stockholm Convention. It is necessary to note that the Russian Federation has a huge number of environmental problems connected with PTS contamination which it is necessary to solve in the near future. For this reason it is very important to mention and clearly define the problems of the Russian North in the NIP. This issue has been successfully pursued through professional contact between the project management and the NIP co-ordinators.

The project's results dissemination was aimed at providing to stakeholders with scientifically sound, technically feasible and ethically acceptable information to facilitate elaboration of measures which can be employed to reduce the health effects associated with the overexposure of the communities of the Russian Arctic to residual persistent pollutants. This can be achieved by developing appropriate improvements in sanitation, dietary advice, food safety, and decontamination of waste sites and houses and the delivery of advice to the affected indigenous communities on their implementation.

Legislative and regulatory requirements and voluntary initiatives for dissemination of the project information were identified and assessed. Literature on information dissemination was reviewed to identify important issues and useful approaches.

A framework for dissemination of the project information and needs to focus on the extent to which decision-makers and others receive and use such information have been developed and underscored.

It was stressed that communication with indigenous communities is a keystone part of the dissemination strategy. Publication of recommendations, focusing on the elements of traditional foods specific for this region that represent the most significant health risks and on how to prevent them, was recognized as the most efficient way of disseminating the project results

among the indigenous communities. Another important element of the dissemination strategy was to distribute video films in the regions.

Special summaries and recommendations were addressed to politicians and decision makers (government, parliament, and local authorities). The role of other NGOs, besides Indigenous Organizations, was also mentioned. The project outputs and its dissemination strategy were generally approved by the Arctic Council Ministerial Meeting held in November 2004. This was documented in the agreements with governors and regional authorities which were available for this evaluation in Russian language.
Foods recommended to various communities were adapted to the nature of pollution and other regional peculiarities, particularly national lifestyle and cultural traditions. Two different types of recommendations were developed in the form of region-specific booklets distributed by project people and NGOs among general populations.

Longer term impact will be achieved by the development and implementation of a strategy concerning to the protection of the living conditions of indigenous people and protection of the vulnerable arctic environment against the chemicals with a persistent nature.

Upon written consent from pregnant women who participated in the project, health experts transferred to local health care professionals appropriate information on levels of PTS contamination measured in blood samples and the health risk involved to make sure the findings were recorded in the personal medical files of these women. Special attention was paid to communication with the federal governmental agencies, lawmakers, local authorities and indigenous organizations.

The project results and recommendations were summarized and formally presented for discussion and decision making to all major stakeholders at the federal level, including the State Duma, Federal Assembly, Ministry of Health and Social Development, Ministry of Natural Resources, Congress of RAIPON.

The highest priority was given to the risk management for the reproductive health effects associated with exposure to PTS for indigenous females of reproductive age.

Even though the lines of evidence for the causal role of POPs are generally not complete and there are a number of uncertainties to establish reliable causation, it should be taken into account that the anticipated health effects associated with the PCB and pesticide exposure experienced by vulnerable groups of the arctic indigenous population might be rather serious e.g. birth defects and fatal outcomes of pregnancy. In such a case, the application of the precautionary principle is suggested as the key guiding principle to be considered when implemented recommendations and planning public health action.

In the course of dissemination actions, the local state and municipal authorities and indigenous people raised questions regarding the need to develop and implement methods and techniques of decontamination of settlements and premises. Information was also provided on potential PTS contamination sources. Based on the information provided, the expert team visited these sources locations to study the situation and determine possible ways of decontamination.

The following important potential contamination sources have been identified by the project:

- Decommissioned and abandoned facilities equipped with powerful electrical installations including transformers and radars;
- Used metal containers and drums with visible traces of mineral oil, lubricants, paints and solvents. According to the expert team information, there are over 10,000 tons of unutilized industrial wastes and metal containers deposited in Lavrentievsky Region alone, one of Chukchi Autonomous District coastal regions;
- Large unorganized solid and liquid waste dumps whose composition has not been analyzed were found in all settlements inhabited mainly by indigenous people where the Project work was being performed..

Again, there is a very important omission; an inventory of military problems analysis of existing waste management systems which are not mentioned in any part of project report.

The dissemination process included many meetings with federal bodies of state power, workshops and seminars with participation of regional bodies of state power and local authorities, health professionals and environmental services, reports submitted to federal ministries, services and agencies, materials for the State Report on"Sanitary and Epidemiological Conditions in the Russian Federation in 2004", project materials broadcast on federal television channels, on regional television channels and on local radio stations, dissemination of illustrated booklets for indigenous people covering 28 settlements, and at the time of preparing this report, the development of draft guidelines for health professionals to prevent PTS hazardous impact on human health, press conferences for news agencies, scientific publications, website presentations in Russian (www.sznc.sp), and in English (www.amap.no).

Based on these wide-ranging dissemination activities, considerable feedback was received and follow-up proposals were discussed and developed. For example, coordinated plans of action of the executive bodies, health and environmental protection authorities and Association of the indigenous peoples of the North, Siberia and Far East of the Russian Federation. As a part of this work, special workshops have been arranged in all regions of the project implementation, which became a starting point for taking practical measures at local level on improvement of the situation.

The outputs of the project were presented on November 24th 2005, to the Arctic Council Ministerial Meeting. For the rehabilitation follow up measures it is important that the Russian Federation bodies allocate sufficient resources to initiate appropriate actions and that other Arctic countries play an active role in the implementation of such actions.

The results obtained in the course of project implementation are provide useful baseline data and recommendations for use by other projects financed from regional, federal and international sources including UNEP, IPS, INTAS, Barents Health Program, Children of Russia (sub-program Children of the North).

In particular it was agreed to consider, together with international agencies such as UNEP-GEF, UNDP and the World Bank, the possibility of initiating a special rehabilitation project in Chukotka and Nenets AO. Organization of similar studies in other regions of the Russian Arctic, in particular in Yamal-Nenets AD and the Northern part of the Republic of Sakha (Yakutia) was agreed as another important follow-up action. It was also acknowledged - and this evaluator strongly recommends - that additional scientific studies are urgently needed to improve understanding of the processes that lead to PTS intake by the indigenous peoples and consequent

health effects. Particularly, the meeting participants stressed the need to organize continuous monitoring of the long-range transport of PTS to and within the Arctic, modelling of long-range transport with the use of current observation data, and on causation of PTS levels and health effects.

This evaluators strongly recommends the application of new tools for monitoring such as, the application of the polyurethane passive samplers for ambient air monitoring of PTS which are one of the recommended procedures of the global POPs monitoring programme of the Stockholm Convention. The first pilot phase will be covered by Regional POPs Centre, MU Brno, CR in the co-operation with AMAP and Typhoon.

A number of important findings made during the period of project implementation have promoted the development of conclusions and recommendations specific to Arctic Russia, and consistent with the objectives of the project.

It was strongly recommended that:

- new forms of state statistical reports on industrial atmospheric emissions, waste water discharges and solid wastes, be developed and approved, which should be adequate for the requirements of the Stockholm Convention on Persistent Organic Pollutants and other international treaties and agreements aimed at the limitation of environmental and human health effects of persistent toxic substances.
- the experience gained in the development and use of registers for emissions of contaminants and transport be used.
- a source inventory system be developed and implemented in the Arctic administrative territories inhabited by the indigenous peoples, that covers both former and current releases of PTS from all economic activities (Taking into account the objectives aimed at implementation of the Environmental Doctrine of the Russian Federation and the Fundamentals of the State Policy in Chemical Safety).
- a special section on the rehabilitation of PCB-contaminated sites, including land and housing be developed and implemented. With respect to this issue, special attention should be paid to land and settlements inhabited by Arctic indigenous peoples, taking into account their lifestyle and social vulnerability - within the framework of the Russian National Action Plan on implementation of the Stockholm Convention.
- the Government of the Russian Federation, in cooperation with the other member countries of the Arctic Council, take active measures in the international arena to ensure the reduction, and in the future, the full elimination of environmental and human health threats from global PTS (based on the facts that the Russian Federation ratifies the Stockholm Convention on Persistent Organic Pollutants, and joins the Aarhus Persistent Organic Pollutants and Heavy Metals Protocols of the UN-ECE Convention on Long-range Transboundary Air Pollution).
- the National Plan of Economic and Social Development of the Northern Territories of the Russian Federation, which, it is envisaged, is to be developed or reconsidered following the Meetings of the State Council Board of the Russian Federation and of the President of the Russian Federation with the representatives of the northern territories of the Russian Federation in Salekhard, 28-29 April, 2004; should fully address improvements to the social and economic conditions of the Russian Arctic indigenous peoples. This action should be undertaken with the full involvement of the indigenous peoples.

- the Russian federal executive human health and environmental authorities, in close collaboration with the Russian Association of Indigenous Peoples of the North, Siberia and Far East and regional and local administrations, develop a set of practical activities aimed at achieving, in full acknowledgement and respect of the traditional lifestyle and cultural identity of the Russian Arctic indigenous peoples, a significant reduction in their PTS intake. These measures, which should be an integral part of the National Plan of Social and Economic Development of the Russian Northern Territories, should include actions required at the federal, regional and local levels, taking into account the circumstances of each area. More specific regionally-based recommendations, addressed to the indigenous peoples should be presented in special publications in Russian.
- that the human health authorities and administrations of the territories of the Russian Arctic inhabited by indigenous peoples, in close collaboration with the regional branches of RAIPON and in full acknowledgement of the importance of the traditional diet for nutrition and preservation of the national and cultural identity of the indigenous peoples, as part of their lifestyle, develop appropriate targeted measures to reduce PTS intake with traditional food, based on specific recommendations, the improvement of social and economic conditions and the raising of awareness about existing problems.
- in the development of practical follow-up measures, special attention should be paid to the situation in the Chukchi AO, taking into account both, the social and economic status of the indigenous peoples in this region of Russia, and the health risks associated with PTS intake. On the basis of data obtained within the framework of the project, the coastal areas of the Chukchi AO are of main concern with respect to human health risks.
- the remedial action to remove PTS contamination from the houses of indigenous families, should be an important and urgent action, aimed at e improving the social and economic status of indigenous communities.
- proposals for amendments to the Federal Law "On safe handling of pesticides and agro-chemicals" be developed, to ensure implementation of strict and efficient control measures over the production and trade of pesticides and other chemicals for private use, particularly those used for protection against insects and rodents, which would ensure a complete ban on the use of PTS in these chemicals.
- the local human health authorities, in close collaboration with regional branches of RAIPON, work out an efficient action plan to improve sanitary conditions in indigenous houses. These measures should be integrated with communication with indigenous families and efforts to raise awareness about the health risks associated with contamination of home-processed food.
- the Russian human health authorities implement internationally recognized levels of concern for PTS blood concentrations. It is further recommended that dietary safety advice based on the benefits of traditional food are made an important component of prenatal care and of family planning strategies for the indigenous communities at risk.
- the international and Russian national health and environmental protection authorities develop recommendations for the assessment of human PTS intake, based on levels of these contaminants in blood and breast milk, taking into account the advantages and drawbacks of using these indicators for different groups within the population.

Based on the project results and conclusions, it is recommended that local, regional and federal authorities and institutions in co-operation with international organizations such as UNEP-GEF, UNDP and the World Bank follow up the completed PTS project by developing and implementing the following:

1) Rehabilitation projects focused on the identification of local sources of PTS exposure and implementation of appropriate remedial measures, with the indigenous communities of Chukotka and Nenets AO as the first priorities;

2) Health effect prevention projects that can improve:

- Prenatal care practices in indigenous women at higher risk of PTS exposure;

- Traditional food safety;

- Lifestyle and behavioural health risk management;

3) Efficiency of educational programs for schoolchildren and young people

4) Experience transfer projects that can document the actual PTS exposure and implement adequate remedial measures to other indigenous communities of the Russian Arctic, in particular those located in Yamal-Nenents AO, Kamchatka Peninsula and the Northern part of the Republic Sakha (Yakutia);

5) Long-term monitoring projects comprising contaminants released from global, regional and local sources in the Northern Russia including environment, food and humans, with first priority in Chukotka and Nenets AO. This work should be coordinated with the follow up to the Stockholm Convention.

6) Research projects intended to select most effective decontamination techniques and methods applicable to the harsh arctic climatic conditions and that are compatible with the international standard methods.

FINANCIAL EVALUATION

Based on the available information from the UNEP DGEF Fund Officer, the evaluated project was examined and overall conclusions with respect to financial issues were as follows:

- The project was financially closed at the time of evaluation.

- A financial audit of project expenditure for the period 1 February 2001 to 30 September 2004 which reported the total cost of the project was performed.

- There are no outstanding financial reports.

Based on the conclusions presented in the final audit report, the Fund manager confirmed that the project can account for use of 100% of the project budget.

The available project revisions were as follows:

(i) Revision 1 was to reflect actual cost of the project in the year 2001, to re-phase the unspent balance of the year 2001 to 2002 and to re-allocate funds within the objects of expenditures in the year 2002 (this was necessitated due to the requirement from one of the donors to use its co-financing.
(ii) Revision 2 was to reflect the actual cost in the year 2002 and to re-allocate US$ 20,000 from object of expenditure 2206 to 2204.
(iii) Revision 3 was to reflect the actual cost of the project in the year 2003, to extend the project through six months to June 2004 to enable completion of additional targeted surveys per the decision of the project steering committee (ref. AMAP fax dated 28th Oct. 2003) and to re-phase the unspent balance of the year 2003 to the year 2004.
(iv) Revision 4 was to reverse the inadvertent mistake of Revision 3 where 2003 savings on object codes 2204 and 2205 were re-phased to 2004.
(v) These should actually have been left in 2003 and only the unspent balance of US$55,000 on object code 2207 to be re-phased to year 2004.
(vi) Revision 5 was to reflect the actual cost of the project to the year 2004, to extend the project to November 2005 to enable finalization of the report from the dissemination workshops held in Summer'05 (Ref. letter from AMAP dated 24th Oct. 2005) and to do completion revision of the project pending receipt of final evaluation and other reports.

The above available revisions are considered to be consistent with sound financial management.

CONCLUSIONS AND RATING

The project has been implemented with active participation of the Russian Association of the Indigenous Peoples of the North, Siberia and Far East (RAIPON) and its regional branches. RAIPON representatives acted as equal partners with the scientific teams in all project activities, including the development of recommendations.

In this respect, the project objective to assist indigenous peoples in developing remedial actions to reduce the health risks resulting from the contamination of their environment and traditional food sources has been fully realised.

The overview of the original and supplementary project goals, objectives and outcomes from the project documents

Supplement to MSP rationale and objectives	Evaluation Comment	Indicators	Evaluation Comment
(1) Improvement of the reliability of the assessment of indigenous peoples' exposure to PTS	**Objective achieved**	(1) Understanding of relationships between PTS levels in human blood and breast milk as indicators of female human exposure to PTS.	**Addressed by project**
(2) Wide dissemination of the project results among indigenous communities.	**Results widely disseminated**	(2) Awareness of indigenous communities regarding project results and recommendations on measures to reduce exposures to PTS.	**Increasing interest of indigenous people and local authorities is evident**
(3) Guidance to local administrations, medical and environmental personnel and indigenous organizations regarding measures to reduce exposure of local indigenous communities to PTS	**Guidance provided**	(3) Improved capacity of local administrations, medical and environmental personnel and indigenous communities to reduce human exposure to PTS, and to remediate the associated health consequences.	**Based on the personal contacts, there is a evidence of improved capacity**
10. Supplement to MSP outcomes:		Indicators:	
(1) Assessment of data compatibility on PTS levels in human blood and breast milk as indicators of female exposure to PTS.	**Completed**	(1) Inclusion of conclusions regarding the compatibility of PTS levels in human blood and breast milk for indicating female human exposures to PTS in the Final Project Report.	**Completed**
(2) Improved capacity of local administrations, medical and environmental personnel and indigenous organizations to reduce human exposures to PTS and to remediate the associated health consequences.	**Based on the personal contacts, there is evidence of improved capacity**	(2) Records of proceedings of regional workshops on capacity building and dissemination.	**Verified**
(3) Awareness of indigenous communities regarding risks of PTS and recommendations on measures to reduce exposures.	**Increasing interest of indigenous people and local authorities is evident**	(3) Wider distribution of project outcomes, including recommendations relating to PTS exposures and health risks among members of indigenous communities	**Verified**
11. Supplement to MSP activities to achieve outcomes:		**Indicators:**	

(1) Analysis of breast milk samples collected from indigenous women of the Chukotka Peninsula.	**Completed**	**(**1) Laboratory reports and assessment of results.	**Results Verified**
(2) Comparative estimation of PTS exposures to indigenous women based on corresponding data on PTS levels in human blood and breast milk.	**Completed**	(2) Corresponding section and conclusions for inclusion in the Final Project Report.	**Results Verified**
(3) Capacity building and dissemination workshops in four pilot areas for local administrations, medical and environmental personnel and indigenous organizations.	**Completed**	(3-1) Records from 4 capacity building and dissemination workshops. (3-2) Agreement among local administrations, medical and environmental authorities and indigenous organizations on local action plans to reduce exposures of indigenous communities to PTS	**Verified** **Local administration and authorities are preparing a many follow-up activities in the connection with the NIP SC development**
(4) Meeting among Russian federal authorities, the Russian Parliament and RAIPON on project outcomes and follow-up actions.	**Completed**	(4) Records from the Meeting of Russian governmental authorities, the Russian Parliament and RAIPON.	**Verified**
Project rationale and objectives: Overall goal: To reduce the contamination of the Arctic environment by Persistent Toxic Substances.	**No direct evidence of attributable impact as yet**	**Indicators:** Russian authorities, with the support of the other Arctic States, take steps to reduce emissions of contaminants to the Arctic.	**These topics will be a part of the NIP**
Original Objectives:			
i) To assist indigenous peoples in developing appropriate remedial actions to reduce the health risks resulting from the contamination of their environment and traditional food sources.	**Completed**	*(1)* Indigenous peoples of the Russian North apply recommendations designed to reduce their exposure to environmental contamination by PTS, particularly exposure through consumption of traditional foods.	**These topics will be a part of the NIP**
ii) To enhance the position of the Russian Federation in international negotiations to reduce the use of PTS, and to empower indigenous peoples to participate actively and fully in these negotiations.	**The ratification of the Stockhol Convention (SC) is a basic step for the enhancement of the RF in the international activities**	*(2)* Proactive participation of the Russian Federation in regional and global fora aimed at reducing the use and releases to the environment of PTS. Indigenous Peoples organizations participate in national, regional, and global fora aimed at reducing use and releases to the environment of PTS.	**RF actively participates on the activities which are connected with the SC and CRLTAP POPs implementation**
iii) To enable the Russian Federation and RAIPON to increase their involvement in the work of the eight-nation Arctic Council to reduce emissions of PTS.		Via Activities of Russian Polar Programme in State Duma is evident of increased involvement in the Arctic Council	
Project outcomes:		Indicators:	
i) Recommendations to federal and local authorities, indigenous peoples and the international community on measures to reduce exposure of indigenous peoples to PTS, including identification of priority areas where actions are	**Completed**	*(1)* Agreement among experts, executive authorities of the Russian Federation, and Indigenous Peoples Organizations on recommendations on remedial actions, including dietary recommendations.	**Verified**

needed.			
ii) Assessment of the significance of aquatic food chains as a pathway of exposure of indigenous peoples to PTS.	**Completed**	*(2)* Agreement among Russian and circumpolar experts on the significance of aquatic food chains as pathway of exposure to PTS.	**Verified**
iii) Assessment of the relative importance of local and distant sources, and the role of atmospheric and riverine transport of PTS.	**Completed and verified**		
Project activities to achieve outcomes:		Indicators:	
Assessment of role of pollution on health and development of recommendations (A7).	**Completed**	Agreement among Russian and circumpolar experts on the significance and impact of contamination of traditional foods on human health of indigenous peoples.	**Verified**
Study of biomagnification in Arctic food chains (A4).	**Completed**	Laboratory reports and assessment of results.	**Verified**
Monitoring of PTS levels in humans (A6).	**Completed**	Laboratory reports and assessment of results.	**Verified**
Dietary surveys of selected indigenous communities (A5).	**Completed**	Activity report.	**Verified**
Assessment of local pollution sources in the vicinities of selected indigenous communities (A2).	**Completed**	Publication of report on pollution sources.	**Verified**
Assessment of distant sources and fluxes of PTS to Arctic Russia (A3).	**Completed**	Laboratory reports and modelling results and their assessment.	**Verified**
Capacity building (A8).	**Completed**	No of people trained / number of workshops organised.	**Verified**
Dissemination (A9).	**Completed**	Publication of final project report(s) and targeted information products (e.g. health advice).	**Verified**
Co-ordination, management, and support to the project (A1).			

OVERALL PROJECT RATING TABLE

Criteria no.	Criteria	Subcriteria	Rate	Total rate	Assessment
1.	**Attainment of objectives and planned results**			**HS**	All planning objectives were performed very effectively and successfully.
		Effectiveness	*HS*		*Project has effectively informed the NIP*
		Analysis of impact and outcomes	*S*		*No direct evidence of attributable impact as yet but outcomes that will lead to such impact are favourable (e.g. development of NIP)*
		Relevance	*HS*		*Russian NIP is developing and all relevant project recommendations are being adopted as they are believed t be a good base for the solution of POPs problems in the RF. Project approaches and outputs are quite relevant for other regions.*
2.	**Achievement of outputs and activities**			**HS**	Project outputs and activities were realized to an excellent level, the results are available, are published , and they are accepted by the international scientific community. All results and conclusions are very useful for governmental decision, they can be included to the NIP and environmental policy of the RF.
		Delivered outputs	*HS*		*All planned activities were successfully performed, published results are of a high scientific quality.*
		Assess the soundness and effectiveness	*HS*		*All applied methodologies, methods, procedures, sampling designs, analytical methods, QA/QC systems are on the fully acceptable internationally levels, data from the monitoring part is fully comparable with the international standards which are represented by the AMAP. Used dissemination strategy covered all relevant stakeholders, the project results presentations were sufficient.*
		Weight of scientific authority	*HS*		*Credibility of project team members is high by international standards*
3.	**Cost-effectiveness**			**HS**	The project budget was very effectively used, project outputs are fully adequate in relation to the level of financial inputs.
		Cost-effectiveness	*HS*		*The very comprehensive project results concerning sources of pollution, emission inventory, determination of occurrence in the abiotic and biotic matrices including man are quite appropriate for the project budget. The budget was used very effectively and to internationally acceptable standards of accountability.*
		Assess the contribution of cash and in-kind co-financing	*HS*		*Co-financing support for the project covered many additional activities and contributed to the effective realisation of the project proposal.*
		Incorporated scientific and technical information and knowledge	*HS*		*Relevant and up to date knowledge from environmental, toxicology, ecotoxicology and risk assessment were incorporated into the project proposal and project activities and have led to fully sufficient results.*
4.	**Financial Planning**			**HS**	Based on the available information from the UNEP DGEF Fund, the evaluated project was certified and overall conclusions of the financial audit are satisfactory. The project was financially closed at the time of evaluation. A financial audit of project expenditure for the period 1 February 2001 to 30 September 2004 which reported the total cost of the project was performed. There

					are no outstanding financial reports.
5.	**Impact**			**HS**	The project defined many of the existing problems connected with the living conditions of indigenous people and it has had a strong effect on the development of the NIP and Russian PTS strategy.
		Evaluate the immediate impact	*HS*		The project is a good base for the development of national PTS strategy and the NIP and increasing of the role of Russian Federation in PTS-related deliberations of the international and national fora.
		Assess the potential longer-term impacts	*HS*		Longer term impact will be achieved by the development and implementation of a strategy concerning to the protection of the living conditions of indigenous people and protection of the vulnerable arctic environment against the chemicals with persistent nature.
6.	**Sustainability**			**S**	Based on the projects outcomes the high probability of continued long-term projects exists and is realistic.
		Financial resources	*MS*		*Sustainability will depends on ongoing international support (e.g. GEF), national resources are limited mainly from the point of view of a number other PTS problems in the RF. But system of PTS monitoring and evaluation is being discussed and prepared on the governmental level.*
		Socio-political	*S*		*The sufficient public and stakeholder awareness in support of the long term objectives of the project is a long-term process and must be closely connected with the NIP development and governmental strategy.*
		Institutional framework and governance	*S*		*National institutions are fully able to continue in this work, but a legal framework and relevant legislature including the conclusions and recommendations of the nip is needed.*
		Ecological	*HS*		*The potential for eventual ecological impact is large but depends on adequate follow up actions*
		Replication and catalysis	*HS*		*The project is replicable in many other region as site or region specific types of contamination evaluation and also is replicable in the same area with the extended programme from the follows-up financial sources or from the national sources.*
7.	**Stakeholder participation / public awareness**			**HS**	The participation of stakeholders was sufficient broad and effective, project results and outcomes have led to very complex programme the increasing of the public awareness focused not only on the indigenous population but also on the stakeholders and Russian society and international communities.
		Mechanisms put in place by the project for identification and engagement of stakeholders	*HS*		*Fully acceptable and effective*
		Assess the degree and effectiveness of collaboration/interactions	*HS*		*The co-operation between project partners was very effective and led to the excellent results.*
		Assess the degree and	*HS*		*Public awareness activities mentioned in project*

		effectiveness of any various public awareness			*documentation and recognized during the visit of the RF represent important part of the projects outcomes. It is necessary to realize the broad feedback of project results to all participants and volunteers of the project.*
8.	**Country ownership / driveness**			**S**	Project has led to the activities of the national, regional and local authorities, which are focused on the development of legislative framework and definition of priorities connected with the problems of Northern Russia.
		Assess the level of country ownership	S		*Project initiated many activities in the State Duma, national, regional and local authorities and institutions, NGO etc. which will be reflected in the NIP.*
9.	**Implementation approach**			HS	Effective, optimal, without visible problems.
		Extent the project implementation mechanisms	*HS*		*Project and all its part was managed based on the plan of the activities, sampling campaigns, analysis, publishing, public activities were effectively managed were consistent with the project proposal and time schedule for the realisation*
		Evaluate the effectiveness and efficiency and adaptability of project management and the supervision of project activities	*HS*		*There was no evidence of any problems.*
		Assess the effectiveness of supervision and administrative and financial support	*HS*		*There was no evidence of any problems and supervision and administration was optimal.*
		Identify administrative, operational and/or technical problems and constraints	*HS*		*None of significance was identified.*
		Assess whether the logical framework was used during implementation as a management tool	*HS*		*The project document, with its hierarchy of goals, objectives and outcomes, was closely followed by project management*
10.	**Replicability**			**HS**	Highly, conceptual approach is replicable in any other region or country and the feasibility in this case will be very high.
11.	**Monitoring and Evaluation**			**HS**	The evaluation of project steps and a project as whole was optimal and effectively realized during the whole project duration based on the detailed plan of control and monitoring of effectiveness of all project measures and steps. The M&E system was implemented by use of interim reports, meetings of the steering committee and all project bodies, a high frequency of field trips of project co-ordinators and management, detailed systems of control and effective system of quality assurance/quality control.
	TOTAL RATE			**HS**	**The project is a example of perfect prepared of project proposal, effective planning and realisation and optimal use of project outcomes and results. I evaluate this project as HIGHLY.**

The evaluator fully supports the methods used and verifies the acheivement of the main objectives in the project proposal. The project conclusions and outcomes documented in the project report are, after careful scrutiny, fully accepted.

The project is an excellent example of a highly sophisticated environmental study. The study had a detailed project preparatory phase including very good QA/QC system, with a very well prepared sampling design. The project generated a, a large quantity of high-quality results and with quite relevant data presentation and interpretation.

In the evaluator's professional opinion the project proposal was fully covered and realized.

LESSONS LEARNED

The approach, which was based on the experiences gained from AMAP's long-term experiences, represents an excellent example of this type of study and has great potential for replication in other locations. The applied project approaches, sampling design and strategy, work with official authorities, public and NGO, the dissemination of project results represent a very good example for any other projects under UNEP and GEF umbrella.

RECOMMENDATIONS

It is recommended that projects to prepare; a detailed inventory of military sources of pollution and to develop adequate waste management systems in the Russian north be developed and implemented as soon as possible.

It is recommended that the project results and outputs be fully included in the Russian National Implementation Plan of the Stockholm Convention and the preparation of follow-up activities should be continued. [*This process is now ongoing based on the direct co-operation and participation of the project staff in the NIP development.*]

The project's conclusion recommending that the Russian federal executive for human health and the environmental authorities, in close collaboration with the Russian Association of Indigenous Peoples of the North, Siberia and Far East and regional/local administrations, develop a set of practical activities aimed at significant reduction of their PTS intake is fully supported by this evaluator. These measures, with full acknowledgement and respect of traditional lifestyle and cultural identity of the Russian Arctic indigenous peoples, should be an integral part of the National Plan of social and economic development of the Russian northern territories and should cover actions at the federal, regional and local levels.

Brno, 25/06/2006

Prof. Dr. Ivan Holoubek

Annex I. Co-financing and Leveraged Resources. Co-financing (basic data to be supplied to the consultant for verification)

Co financing (Type/Source)	IA own Financing (mill US$)		Government (mill US$)		Other* (mill US$)		Total (mill US$)		Total Disbursement (mill US$)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
– Grants	0.725	0.725	0.99		0.3		2.015		2.015	
– Loans/Concessional (compared to market rate)										
– Credits										
– Equity investments										
– In-kind support	.032	0.032	.308		0.06		0.4		0.4	
– Other (*) - - - - -										
Totals										

sector and

Leveraged Resources

Leveraged resources are additional resources—beyond those committed to the project itself at the time of approval—that are mobilized later as a direct result of the project. Leveraged resources can be financial or in-kind and they may be from other donors, NGO's, foundations, governments, communities or the private sector. Please briefly describe the resources the project has leveraged since inception and indicate how these resources are contributing to the project's ultimate objective.

Annex II: TERMS OF REFERENCE OF THE EVALUATION

Terminal Evaluation of the UNEP GEF project
"Persistent Toxic Substances (PTS), Food Security and Indigenous Peoples of the Russian North"
GF/4030-01-01

1. PROJECT BACKGROUND AND OVERVIEW

Project rationale

The project on "Persistent Toxic Substances (PTS), Food Security and Indigenous Peoples of the Russian North" was designed as an integral component in a range of activities addressing identified information needs concerning environmental contamination in Arctic Russia, its effects on indigenous peoples, and the development of proposals for actions to improve the situation in the region. The project was designed as the key component in an overall strategy, in which a number of international projects and programmes, including those of the Secretariat of the Arctic Monitoring and Assessment Programme (AMAP) that supported this project by providing data and information.

The overall goal of the project was to reduce the contamination of the Arctic environment by Persistent Toxic Substances.

The main objectives were stated as:

4. Assisting indigenous peoples in developing appropriate remedial actions to reduce the health risks resulting from the contamination of their environment and traditional food sources.
5. Enhancing the position of the Russian Federation in international negotiations to reduce the use of PTS, and to empower indigenous peoples to participate actively and fully in these negotiations.
6. Enabling the Russian Federation and Russian Association of Indigenous Peoples of the North (RAIPON) to increase their involvement in the work of the eight-nation Arctic Council to reduce emissions of PTS.

The expected outcomes from this global assessment project included:

4. Recommendations to federal and local authorities, indigenous peoples and the international community on measures to reduce exposure of indigenous peoples to PTS, including identification of priority areas where actions are needed.
5. Assessment of the significance of aquatic food chains as a pathway of exposure of indigenous peoples to PTS.
6. Assessment of the relative importance of local and distant sources, and the role of atmospheric and riverine transport of PTS.

Relevance to GEF Programmes

The project conforms to the GEF Operational Programmes 10 "Contaminant-based" by supporting "…activities that help characterise the nature, extent, and significance of contaminants […] such a mercury and persistent organic pollutant (POPs)". During the course of the preparation and implementation of the project, GEF Operational Programme 14

"Persistent Organic Pollutants" was drafted and later approved to which this project directly relates.

Executing Arrangements

The project was executed by the Secretariat of the Arctic Monitoring and Assessment Programme, in collaboration with the RAIPON under the overall responsibility of the Executive Secretary, AMAP Secretariat and the vice-president, RAIPON. The UNEP/GEF Co-ordination Office, in association with the AMAP Secretariat and RAIPON were responsible for monitoring the implementation of activities.

A Steering Group was established for the project to provide overall direction, suggest corrective actions if necessary, and approve technical and financial reports. The Steering Group was to include representatives from RAIPON, the AMAP Secretariat, organizations and countries providing financial support and the Russian Federal Executing Agencies participating in the project's implementation.

Project Activities

The initial project duration was 35 months starting February 2001, which was later revised and extended to end in November 2005.

The project had nine components:

10) **Co-ordination, management, and support to the project**
11) **Assessment of local pollution sources in the vicinities of selected indigenous communities**
12) **Assessment of distant sources and fluxes of PTS to Arctic Russia**
13) **Study of biomagnification in Arctic food chains**
14) **Dietary survey of selected indigenous communities**
15) **Monitoring of PTS levels in humans**
16) **Assessment of role of pollution on health and development of recommendations**
17) **Capacity building**
18) **Dissemination.**

Budget

The total budget was US$ 2,440,000, with US$ 750,000 funded by the GEF Trust Fund and co-funding from; Canada US$ 250,000, Denmark US$ 250,000, Finland US$ 110,000, Norway US$ 300,000, USA (NOAA) US$ 80,000, Nordic Council of Ministers US$ 110,000, Salamander Foundation US$ 10,000, University of Tromsø US$ 150,000 and World Meteorological Organisation, US$ 4,200,000. The Russian Government agencies/experts and the University of Tromsø provided US$ 308,000 and US$ 60,000 respectively, of in-kind contributions. For the PDF-A phase a US$ 32,000 was used.

TERMS OF REFERENCE FOR THE EVALUATION

1. Objective and Scope of the Evaluation

The objective of this terminal evaluation is to examine the extent and magnitude of any project impacts to date and determine the likelihood of future impacts. The evaluation will also assess project performance and the implementation of planned project activities and planned outputs against actual results. The evaluation will focus on the following main questions:

1. What is the extent of the applicability and relevance of the assessments/recommendations in assisting indigenous peoples to develop appropriate remedial actions to reduce health risks that result from the contamination of their environment and traditional food sources? To what extent have the specific needs of the target groups of stakeholders been considered in the process and the recommendations?

2. To what extent has the project directly or indirectly affected the participation of the Russian Federation in international fora for POPs/PTS and to what extent has the Russian Federation succeeded in enhancing it's position in international negotiations as a direct/indirect result of this project?

3. What is the extent of, and evidence supporting, increased participation and involvement of the Russian Federation and RAIPON in the work of the eight nation Arctic Council for POPs/PTS reduction as a direct/indirect result of this project?

2. Project Ratings

The success of project implementation will be rated on a scale from 'highly unsatisfactory' to 'highly satisfactory'. In particular the evaluation shall **assess and rate** the project with respect to the eleven categories defined below:[1]

1. **Attainment of objectives and planned results:**
   The evaluation should assess the extent to which the project's major relevant objectives were effectively and efficiently achieved or are expected to be achieved and their relevance.
   - *Effectiveness:* Evaluate how, and to what extent, the stated project objectives have been met, taking into account the "achievement indicators". In particular, evaluate whether and to what extent the results of this project will assist indigenous peoples in setting up policy and strategy that will eventually lead to reducing food-inflicted health risks, enhanced the position of the Russian Federation and empowered indigenous peoples in negotiations at international level; and enabled the Russian Federation and RAIPON to increase their involvement in the Arctic Council on PTS emissions-related issues.
   - The analysis of impact and outcomes achieved should include, *inter alia*, an assessment of the extent to which the project has (1) built consensus among stakeholders on recommendations the project has produced with respect to remedial actions to PTS and the significance of aquatic food chains as a pathway of exposure to PTS; and (2) enhanced the position of the Russian Federation and Indigenous Peoples organizations in national, regional and global fora.
   - *Relevance*: In retrospect, were the project's outcomes consistent with the focal areas/operational program strategies? Ascertain the nature and significance of the contribution of the project outcomes to the wider portfolio of GEF Operational Programme no. 10 – Contaminant based. [2]

[1] However, the views and comments expressed by the evaluator need not be restricted to these items.
[2] Note: This project was approved within the framework of OP 10 (contaminant based), as noted previously, during the life of the project OP 14 (Persistent Organic Pollutants) was drafted and came into effect to which this

2. **Achievement of outputs and activities:**
    - Delivered outputs: Assessment of the project's success in producing each of the programmed outputs, both in quantity and quality as well as usefulness and timeliness.
    - Assess the soundness and effectiveness of the methodologies used for the assessment and monitoring of PTS emissions, the training approach and dissemination strategy.
    - Assess to what extent the project outputs produced have the weight of scientific authority / credibility, necessary to influence policy makers, particularly the Arctic Council and other relevant fora.

3. **Cost-effectiveness:**
   Cost-effectiveness assesses the achievement of the environmental and developmental objectives as well as the project's outputs in relation to the inputs, costs, and implementing time. It also examines the project's compliance with the application of the incremental cost concept. The evaluation will:
    - *Efficiency*: Include an assessment of *outcomes* in relation to inputs, costs, and implementation times based on the following questions: Was the project cost–effective? How does the cost-time vs. outcomes compare to other similar projects? Was the project implementation delayed?
    - Assess the contribution of cash and in-kind co-financing to project implementation and to what extent the project leveraged additional resources.
    - Determine the extent to which scientific and technical information and knowledge have been incorporated within, and have influenced the execution of, the project activities.

4. **Financial Planning**
   Evaluation of financial planning requires assessment of the quality and effectiveness of financial planning and control of financial resources throughout the project's lifetime. Evaluation includes actual project costs by activities compared to budget (variances), financial management (including disbursement issues), and co- financing. The evaluation should:
    - Assess the strength and utility of financial controls, including reporting, and planning to allow the project management to make informed decisions regarding the budget and allow for a proper and timely flow of funds for the payment of satisfactory project deliverables.
    - Present the major findings from the financial audit if one has been conducted.
    - Identify and verify the sources of co- financing as well as leveraged and associated financing (in co-operation with the IA and EA).
    - Assess whether the project has applied appropriate standards of due diligence in the management of funds and financial audits.
    - The evaluation should also include a breakdown of final actual costs and co-financing for the project prepared in consultation with the relevant UNON/DGEF Fund Management Officer of the project (table attached in Annex 1 Co-financing and leveraged resources).

project is also directly relevant.

5. **Impact:**
    - Evaluate the immediate impact of the project on the role of the Russian Federation and Indigenous Peoples organizations in PTS-related deliberations of the Arctic Council and other fora, and other possible impacts.
    - As far as possible, also assess the potential longer-term impacts of setting priorities and presenting agreed actions for implementation, considering that the evaluation is taking place upon completion of the project and that longer term impact is expected to be seen in a few years time. Frame recommendations to enhance future project impact in this context. Which will be the major 'channels' for longer term impact? The evaluation should formulate recommendations that outline possible approaches and necessary actions to facilitate an impact assessment study in a few years time.

6. **Sustainability:**

Sustainability is understood as the probability of continued long-term project-derived outcomes and impacts after the GEF project funding ends. The evaluation will identify and assess the key conditions or factors that are likely to contribute or undermine the persistence of benefits after the project ends. Some of these factors might be outcomes of the project, i.e. stronger institutional capacities, legal frameworks, socio-economic incentives / or public awareness. Other factors will include contextual circumstances or developments that are not outcomes of the project but that are relevant to the sustainability of outcomes. The evaluation should ascertain to what extent follow-up work has been initiated and how project outcomes will be sustained and enhanced over time.

Five aspects of sustainability should be addressed: financial, socio-political, institutional frameworks and governance, ecological (if applicable), and replication[3]. The following questions provide guidance on the assessment of these aspects:

- *Financial resources.* What is the likelihood that financial and economic resources will be available such as the project outcomes/benefits will be sustained once the GEF assistance ends (resources can be from multiple sources, such as the public and private sectors, income generating activities, and market trends that support the project's objectives)? Was the project was successful in identifying and leveraging co-financing?
- *Socio-political:* What is the likelihood that the level of stakeholder ownership will allow for the project outcomes/benefits to be sustained? Is there sufficient public / stakeholder awareness in support of the long term objectives of the project?
- *Institutional framework and governance.* What is the likelihood that institutional and technical achievements, legal frameworks, policies and governance structures and processes will allow for the project outcomes/benefits to be sustained? What is the relevance and

[3] Replication refers to repeatability of the project under quite similar contexts based on lessons and experience gained. Actions to foster replication include dissemination of results, seminars, training workshops, field visits to project sites, etc. GEF Project Cycle, GEF/C.16/Inf.7, October 5, 2000

applicability of the project's recommendations to reduce the exposure of indigenous peoples to PTS to federal and local authorities, indigenous peoples and the (international community)? While responding to these questions consider if the required systems for accountability and transparency and the required technical know how are in place.

- *Ecological.* The analysis of ecological sustainability may prove challenging. What is the likelihood that project achievements will lead to sustained ecological benefits?
- *Replication and catalysis.* What examples are there of replication and catalytic outcomes that suggest increased likelihood of sustainability? Replication approach, in the context of GEF projects, is defined as lessons and experiences coming out of the project that are replicated or scaled up in the design and implementation of other projects. Replication can have two aspects, replication proper (lessons and experiences are replicated in different geographic area) or scaling up (lessons and experiences are replicated within the same geographic area but funded by other sources).

7. **Stakeholder participation / public awareness:**
   This consists of three related and often overlapping processes: information dissemination, consultation, and "stakeholder" participation. Stakeholders are the individuals, groups, institutions, or other bodies that have an interest or stake in the outcome of the GEF- financed project. The term also applies to those potentially adversely affected by a project. The evaluation will specifically:
   - Assess the mechanisms put in place by the project for identification and engagement of stakeholders and establish, in consultation with the stakeholders, whether this mechanism was successful, and identify its strengths and weaknesses. Particular attention should be paid to the level of participation by Indigenous Peoples in Northern Russia through their organisations (AMAP, RAIPON and ICC) and relevant Russian Government agencies.
   - Assess the degree and effectiveness of collaboration/interactions between the various project partners and institutions during the course of implementation of the project.
   - Assess the degree and effectiveness of any various public awareness activities that were undertaken during the course of implementation of the project.
8. **Country ownership / driveness:**
   This is the relevance of the project to national development and environmental agendas, recipient country commitment, and regional and international agreements. The evaluation will:
   - Assess the level of country ownership. Specifically, the evaluator should assess whether the project was effective in catalyzing action taken by the authorities in Northern Russia to address the level of emissions of contaminant to the Arctic.
9. **Implementation approach:**

This includes an analysis of the project's management framework, adaptation to changing conditions (adaptive management), partnerships in implementation arrangements, changes in project design, and overall project management. The evaluation will:

- Ascertain to what extent the project implementation mechanisms outlined in the project document have been closely followed. In particular, assess the role of the various committees established and whether the project document was clear and realistic to enable effective and efficient implementation, whether the project was executed according to the plan and how well the management was able to adapt to changes during the life of the project to enable the implementation of the project.
- Evaluate the effectiveness and efficiency and adaptability of project management and the supervision of project activities / project execution arrangements at all levels (1) policy decisions: Steering Group; (2) day to day project management: the AMAP Secretariat, RAIPON, relevant Russian federal government agencies and laboratories.
- Assess the effectiveness of supervision and administrative and financial support provided by UNEP/DGEF.
- Identify administrative, operational and/or technical problems and constraints that influenced the effective implementation of the project.
- Assess whether the logical framework was used during implementation as a management tool and whether feedback from M&E activities more broadly was used for adaptive management.

10. Replicability:

- Assess whether the project has potential to be replicated, either in terms of expansion, extension or replication in other countries and/or regions and whether any steps have been taken by the project to do so and the relevance and feasibility of these steps.

11. Monitoring and Evaluation:

- The evaluation shall include an assessment of the quality, application and effectiveness of project monitoring and evaluation plans and tools, including an assessment of risk management based on the assumptions and risks identified in the project document. The evaluation shall comment on how the monitoring mechanisms were employed throughout the project's lifetime and whether this allowed for tracking of progress towards project objectives and how the project responded to the challenges identified through these mechanisms. The tools used might include a baseline, clear and practical indicators and data analysis systems, or studies to assess results that were planned and carried out at specific times in the project.

The ***ratings will be presented in the form of a table***. Each of the eleven categories should be rated separately with **brief justifications** based on the findings of the main analysis. An overall rating for the project should also be given. The following rating system is to be applied:

HS = Highly Satisfactory
S = Satisfactory
MS = Moderately Satisfactory

MU = Moderately Unsatisfactory
U = Unsatisfactory
HU = Highly Unsatisfactory

3. Methods

This terminal evaluation will be conducted as an in-depth evaluation using a participatory approach whereby the UNEP/DGEF Task Manager, key representatives of the executing agencies and other relevant staff are kept informed and regularly consulted throughout the evaluation. The consultant will liaise with the UNEP/EOU and the UNEP/DGEF Task Manager on any logistic and/or methodological issues to properly conduct the review in as independent a way as possible, given the circumstances and resources offered. The draft report will be circulated to UNEP/DGEF Task Manager, key representatives of the executing agencies and the UNEP/EOU. Any comments or responses to the draft report will be sent to UNEP / EOU for collation and the consultant will be advised of any necessary revisions.

The findings of the evaluation will be based on the following:

4. A desk review of project documents including, but not limited to:
   (a) The project documents, outputs, monitoring reports (such as progress and financial reports to UNEP and GEF annual Project Implementation Review reports) and relevant correspondence.
   (b) Review of specific products including laboratory reports and assessments, reports and publications, targeted information products and deliberations of the meetings of the Arctic Council and recommendations related to wider adoption of the findings of the assessments prepared by the project.
   (c) Notes from the Steering Group meetings.
   (d) Other PTS related material produced by the AMAP Secretariat
   (e) Relevant material published on web-sites maintained by the AMAP Secretariat and ICC.

5. Interviews with project management (such as the Project Coordinator, the Executive Secretary of AMAP, the Vice-President of RAIPON, representatives of involved Russian Government agencies and members of the Steering Group).

6. Interviews and Telephone interviews with Indigenous Peoples organizations, intended users for the project outputs and other stakeholders in the region, which were involved with this project. As appropriate, these interviews could be combined with an email questionnaire.

7. The Consultant shall determine whether to seek additional information and opinions from representatives of donor agencies and other organisations (e.g. Canada, Denmark, Finland, Norway, NOAA, the Nordic Council of Ministers, Salamander Foundation, University of Tromsø and WMO by e-mail or through telephone communication.

8. Interviews with the UNEP/DGEF project task manager and Fund Management Officer, and other relevant staff in UNEP dealing with POPs/PTS related activities as necessary. The Consultant shall also gain broader perspectives from discussions with relevant GEF Secretariat staff.

4. Evaluation report format and review procedures

The report should be brief, to the point and easy to understand. It must explain; the purpose of the evaluation, exactly what was evaluated and the methods used. The report must highlight any methodological limitations, identify key concerns and present evidence-based findings, consequent conclusions, recommendations and lessons. The report should be presented in a way that makes the information accessible and comprehensible and include an executive summary that encapsulates the essence of the information contained in the report to facilitate dissemination and distillation of lessons.

Evidence, findings, conclusions and recommendations should be presented in a complete and balanced manner. Dissident views in response to evaluation findings may be appended in an annex. The evaluation report shall be written in English, be of no more than 50 pages (excluding annexes), use numbered paragraphs and include:

i) An **executive summary** (no more than 3 pages) providing a brief overview of the main conclusions and recommendations of the evaluation;
ii) **Introduction and background** giving a brief overview of the evaluated project, for example, the objective and status of activities;
iii) **Scope, objective and methods** presenting the evaluation's purpose, the evaluation criteria used and questions to be addressed;
iv) **Project Performance and Impact** providing factual evidence relevant to the questions asked by the evaluator and interpretations of such evidence;
v) **Conclusions and rating** of project implementation success giving the evaluator's concluding assessments and ratings of the project against given evaluation criteria and standards of performance. The conclusions should provide answers to questions about whether the project is considered good or bad, and whether the results are considered positive or negative;
vi) **Lessons learned** presenting general conclusions from the standpoint of the design and implementation of the project, based on established good and bad practices. Lessons must have the potential for wider application and use, and the context in which lessons may be applied should be specified; Lessons learned, should be explored mainly beyond project design and management issues and also incorporate possible technical aspects such as effectiveness of technical methodologies, scope and buy-in of stakeholder participation.
vii) **Recommendations** suggesting actionable proposals regarding improvements of current or future projects. The evaluator shall make recommendations that may (1) enhance the likelihood of further project impacts beyond the life of the project, (2) contribute to the assessment and development of GEF's portfolio of marine/coastal environment related projects and (3) ensure linkages and synergies between on-going and new marine and coastal environment related projects implemented by UNEP. Recommendations should always be specific in terms of who would do what and provide a suggested timeframe;
viii) **Annexes** include a breakdown of final actual costs and co-financing for the project prepared in consultation with the relevant UNON/DGEF Fund Management Officer of the project (table attached in Annex 1 Co-financing and leveraged resources); terms of reference, list of interviewees, and so on.

The scope of the evaluation is as specified in the "Global Environment Facility Guidelines for Implementing Agencies to conduct Terminal Evaluations, May 2003"[4] to evaluate the

[4] http://www.gefweb.org/MonitoringandEvaluation/MEPoliciesProcedures/MEPTools/IA_Guidelines_for_TE.pdf

activities supported by GEF through this project. The "achievement" indicators provided in the log frame of the project document should be used together with the evaluation parameters described.

Examples of UNEP GEF Terminal Evaluation Reports are available at www.unep.org/eou

Review of the Draft Evaluation Report

Draft reports submitted to UNEP EOU are shared with the corresponding Programme or Project Officer and his or her supervisor for initial review and consultation. The DGEF staff and senior Executing Agency staff are allowed to comment on the draft evaluation report. They may provide feedback on any errors of fact and may highlight the significance of such errors in any conclusions. The consultation also seeks agreement on the findings and recommendations. UNEP EOU collates the review comments and provides them to the evaluators for their consideration in preparing the final version of the report.

Quality Assessment of the Evaluation Report

All UNEP GEF Terminal Evaluation Reports are, themselves, subject to quality assessments by the GEF independent Office of Evaluation (GEF OE). UNEP EOU therefore applies these GEF OE quality assessment criteria and the GEF Minimum Requirements for Terminal Evaluations to the draft Terminal Report as a tool for providing structured feedback.

The quality of the draft evaluation report will be assessed and rated against the following criteria:

Report Quality Criteria	UNEP EOU Assessment notes	Rating
A. Did the report present an assessment of relevant outcomes and achievement of project objectives in the context of the focal area program indicators if applicable?		
B. Was the report consistent and the evidence complete and convincing and were the ratings substantiated when used?		
C. Did the report present a sound assessment of sustainability of outcomes?		
D. Were the lessons and recommendations supported by the evidence presented?		
E. Did the report include the actual project costs (total and per activity) and actual co-financing used?		
F. Did the report include an assessment of the quality of the project M&E system and its use for project management?		

Rating system for quality of terminal evaluation reports

A number rating 1-6 is used for each criterion: Highly Satisfactory = 6, Satisfactory = 5, Moderately Satisfactory = 4, Moderately Unsatisfactory = 3, Unsatisfactory = 2, Highly Unsatisfactory = 1, and unable to assess = 0.

A score for the quality of the terminal evaluation report is calculated by applying the GEF OE formula as follows:

Quality of the TE report = 0.3*(A + B) + 0.1*(C+D+E+F)
The total is rounded and converted to the scale of HS to HU
Quality of the TE report = Moderately Unsatisfactory

General comments on the draft report with respect to compliance with these TOR will also be compiled and shared with the evaluation team.

5. Submission of Final Terminal Evaluation Reports.

The final report shall be submitted in electronic form in MS Word format and should be sent to the following persons:

Segbedzi Norgbey, Chief, Evaluation and Oversight Unit
UNEP, P.O. Box 30552
Nairobi, Kenya
Tel.: (254-20) 624181
Fax: (254-20) 623158
Email: segbedzi.norgbey@unep.org

With a copy to:

Ahmed Djoghlaf, Director
UNEP/Division of GEF Coordination
P.O. Box 30552
Nairobi, Kenya
Tel: + 254-20-624166
Fax: + 254-20-624041/4042
Email: ahmed.djoghlaf@unep.org

Bahar Zorofi
UNEP/GEF Task Manager
United Nations Environment Programme (UNEP)
Division of GEF Coordination (DGEF)
PO Box 30552
Nairobi, Kenya
Tel: 254 20 623765
Fax: 254 20 624041
Email: bahar.zorofi@unep.org

Matthias Kern
UNEP/GEF POPs SPO
United Nations Environment Programme (UNEP)
Division of GEF Coordination (DGEF)
PO Box 30552
Nairobi, Kenya
Tel: 254 20 623765
Fax: 254 20 624041
Email: matthias.kern@unep.org

The final evaluation report will be printed in hard copy and published on the Evaluation and Oversight Unit's web-site www.unep.org/eou. Subsequently, the report will be sent to the GEF OME for their review, appraisal and inclusion on the GEF website.

6. Resources and schedule of the evaluation

This final evaluation will be undertaken by an international evaluator contracted by the Evaluation and Oversight Unit, UNEP. The contract for the evaluator will begin on March 1st

2006 and end on May 15th 2006 (20 days) spread over 11 weeks (10 days of travel, to Oslo and Russia, and 10 days desk study). The evaluator will submit a draft report on 24th April 2006 to UNEP/EOU, the UNEP/DGEF Task Manager, and key representatives of the executing agencies. Any comments or responses to the draft report will be sent to UNEP / EOU for collation and the consultant will be advised of any necessary revisions. Comments to the final draft report will be sent to the consultant by 5th May 2006 after which, the consultant will submit the final report no later than 15th May 2006.

The evaluator will after an initial telephone briefing with EOU and UNEP/GEF travel to the AMAP Secretariat in Oslo and meet with project staff at the beginning of the evaluation. Furthermore, the evaluator is expected to travel to one of the four districts in Northern Russia involved in the project and meet with representatives of government agencies and Indigenous Peoples organizations.

In accordance with UNEP/GEF policy, all GEF projects are evaluated by independent evaluators contracted as consultants by the EOU. The evaluators should have the following qualifications:

The evaluator should not have been associated with the design and implementation of the project. The evaluator will work under the overall supervision of the Chief, Evaluation and Oversight Unit, UNEP. The evaluator should be an international expert in human health and have the following minimum qualifications: (i) experience in PTS-related contamination issues; (ii) experience with management and implementation of projects and in particular with policy-related assessments that generate knowledge and information; (iii) experience with project evaluation. Knowledge of UNEP programmes and GEF activities is desirable. Field experience in the Arctic North and knowledge of Indigenous Peoples issues an advantage. Fluency in oral and written English and Russian is a must.

7. Schedule Of Payment

The evaluator will receive an initial payment of 40% of the total amount due upon signature of the contract. Final payment of 60% will be made upon satisfactory completion of work. The fee is payable under the individual SSAs of the evaluator and is NOT inclusive of all expenses such as travel, accommodation and incidental expenses. Ticket and DSA will be paid separately.

In case, the evaluator cannot provide the products in accordance with the TORs, the timeframe agreed, or his products are substandard, the payment to the evaluator could be withheld, until such a time the products are modified to meet UNEP's standard. In case the evaluator fails to submit a satisfactory final product to UNEP, the product prepared by the evaluator may not constitute the evaluation report.

Annex 1. Co-financing and Leveraged Resources

Co-financing

Co financing (Type/Source)	IA own Financing (mill US$)		Government (mill US$)		Other* (mill US$)		Total (mill US$)		Total Disbursement (mill US$)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
– Grants										
– Loans/Concessional (compared to market rate)										
– Credits										
– Equity investments										
– In-kind support										
– Other (*) - - - - -										
Totals										

* Other is referred to contributions mobilized for the project from other multilateral agencies, bilateral development cooperation agencies, NGOs, the private sector and beneficiaries.

Annex 2

Evaluation Ethics (from the UN Evaluation Group Norms and Standards for evaluation)

Selected Norms

Evaluators must have personal and professional integrity.

Evaluators must respect the right of institutions and individuals to provide information in confidence and ensure that sensitive data cannot be traced to its source. Evaluators must take care that those involved in evaluations have a chance to examine the statements attributed to them.

Evaluators must be sensitive to beliefs, manners and customs of the social and cultural environments in which they work.

In light of the United Nations Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender inequality.

Evaluations sometimes uncover evidence of wrongdoing. Such cases must be reported discreetly to the appropriate investigative body. Also, the evaluators are not expected to evaluate the personal performance of individuals and must balance an evaluation of management functions with due consideration for this principle.

Selected Standards

- Evaluations should be carried out in a participatory and ethical manner and the welfare of the stakeholders should be given due respect and consideration (human rights, dignity and fairness). Evaluations must be gender and culturally sensitive and respect the confidentiality, protection of source and dignity of those interviewed.

- Evaluation procedures should be conducted in a realistic, diplomatic, cost-conscious and cost-effective manner.

- Evaluations must be accurate and well-documented and deploy transparent methods that provide valid and reliable information. Evaluation team members should have an opportunity to disassociate themselves from particular judgments and recommendations. Any unresolved differences of opinion within the team should be acknowledged in the report.

- Evaluations should be conducted in a complete and balanced manner so that the different perspectives are addressed and analysed. Key findings must be substantiated through triangulation. Any conflict of interest should be addressed openly and honestly so that it does not undermine the evaluation outcome. Evaluators should discuss, in a contextually appropriate way, those values, assumptions, theories, methods, results, and analyses that significantly affect the interpretation of the evaluative findings. These statements apply to all aspects of the evaluation, from its initial conceptualization to the eventual use of findings.

- The rights and well-being of individuals should not be affected negatively in planning and carrying out an evaluation. This needs to be communicated to all persons involved in an evaluation, and its foreseeable consequences for the evaluation discussed.

Full details from:

UNEG Norms and Standards. http://www.unep.org/eou/Pdfs/Norms.doc