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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

(UNIDO)

NORTH -WESTERN INTERNATIONAL CLEANER PRODUCTION and ENVIRONMENTAL MANAGEMENT CENTRE

(NWICP & EMC)

FINAL REPORT

WORKSHOP

"REMOVAL OF BARRIERS TO ELIMINATION OF POPs IN NORTH-WEST OF RUSSIA"

UNIDO Project TF/RUS/01/001 – Strengthening of the International Cleaner Production and Environmental Management Centre –Part 1

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EXECUTIVE SUMMARY

The negative influence of persistent organic pollutants (POPs) upon human health and environment is one of the most actual problems of the present with which accompanies humanity passed on to XXI century. The POPs represent chemical structures containe carbon and hydrogen (as well as a number of other elements, mostly chlorine). "The persistent organic pollutants represent organic substances, that: i) possess toxic features; ii) are persistent; iii) are biologically accumulative; iv) predisposed to long-distance trans-boundary transfer and sediments; v) may cause significant negative consequences for the human health and/or environment closely or far from the sources." (UN, Protocol on persistent organic pollutants, 1998). Most of them are highly toxic and cause serious diseases (cancer, etc.). POPs disperse in air and water masses for long distances, are included in food chains and are accumulated in human and animal organism. Moreover, POPs are extremely persistent in their existence and do remain present for hundreds of years, exerting negative influence. That's why POPs contamination is considered to be a global problem. The WHO experts have pointed out the group of 12 prior POPs, that are to be prohibited and are to be eliminated. These are:

- undesired secondary products – polychlorinated-dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF), which usually figure as "dioxins",
- industrial products – polychlorinated biphenyls (PCB) and hexachlorobenzene,
- pesticides – aldrin, dieldrin, DDT, chlordane, heptachlor, endrin, mirex, toxaphene.

For all of them the following features are typical: highly toxic, broad diffusion in all environmental media, persistent to decomposition, long-distance transfer, inclusion into food chains. PCDD, PCDF and PCB represent the major danger for the human health and environment. In human organism the accumulated POPs cause the wide spectrum of severe diseases – endocrine, immune, cerebral disfunctions, pathologies, abnormal development (progress), cancer, diseases of skin, respiratory, cardiac, digestive diseases.

(Please refer to the diagram 1 in Appendix)

Besides industrial accidents and technogenous catastrophes, improper waste storage, chloro-organic compounds incineration, the major source of dioxins (the most dangerous POPs representatives) is the contamination of industrial products contamination, especially, with PCBs. The latter are extensively used in electrical equipment (to the end of 80-s of XX century the total amount of produced PCB mounted to 1 million of tons, and almost 60% of it is in use in transformers and capacitors).

Experience accumulated by developed economies in the area of nature protection has shown dangerous consequences of POPs exposure by human kind and nature. These issues could be resolved by:

- area environmental assessments, identification of POPs emitting industries, which needed monitoring from the authorities concerned;
- appropriate legislation, regulating handling of POPs in the country and effective law enforcement;
- Monitoring for production, transportation and handling of POPs utilizing modern laboratory facilities;
- Inventory of POPs storage and disposal facilities;
- Selection of efficient technologies for POPs elimination;
- Development of new technologies limiting production of POPs as by-products in the production processes;

- Regional cooperation to arrest POPs danger spreading to other regions;

According to the official data of the inventories in Saint-Petersburg and Leningrad oblast the total amount of PCB in equipment is 1,113.686 tons, in Vologda oblast – 566.2 tons, in Karelia – 70 tons and in Murmansk oblast – 36 tons. The results of complex analysis allow to assume, that the volumes of PCB in North-West region of RF were significantly lowered, and a number of enterprises is not represented in the report. The inventory of the sources and volumes of POPs contamination is the first step to adopt concrete measures for removal of handicaps to the POPs elimination and for the security. The objective and trustworthy information about this fact should decrease the POPs emissions, promote quantitative assessment of the latter and minimization of POPs influence on human health and environment. For example, according to the laboratory results and analytical research of transformer oil, it contained significant amounts of dioxins and furans (34.1 mg/kg). Thus we could assume, that according to the above mentioned data, on the territory of the North-Western region of Russian Federation is at present possibly located no less than 60 kg of supertoxic compounds dioxines/furans. Just in the course of the "Izhorsky plant" incineration (October 12, 2001), 3 tons of transformer oils where burned, where at least 100 g of dioxins, were emitted into environment, (without taking into account the secondary synthesis). That is an extremely large amount, considering their extreme biological activity. The following actions should be directed on the creation of territorial scenario of POPs contamination by the means of transition from "spot" inventory (SPb, Leningrad oblast) to the "regional" (North-West region).

According to the elaborated criteria, 7 "hot spots" were detected on the territory of SPb, Leningrad oblast and North-West region, requiring constant monitoring for existing or incoming POPs: Syas'sky Pulp and Paper plant (Syasstroy, Lenoblast), Volkhov aluminium plant (Volkhov d., Lenoblast), Primorsky dump (Primorsky d., Saint-Petersburg), Power station-2 (Smolny d., Saint-Petersburg) Svetogorsky Pulp and Paper Plant (Vyborg d., Lenoblast) and Vyborg interregional electrical network. Vologda electrical network, Metallurgical plant, "Severstal" and "Ammofos" enterprise could be candidates for the "hot spots" group. The constant active monitoring of PCB and dioxins is necessary on the territories, where the high levels of toxic compounds in soils and human biomedia were detected. Pilot projects in this field allowed to create the PCB contamination picture in Saint-Petersburg. To implement such a monitoring, on one side the modern analytical and instrumental basis is needed, and on the other, registering of PCB-containing equipment and wastes, constantly upgraded data base of potential sources of dioxins, PCBs and other POPs. As a result of the inventory conduction, the creation of a similar data base was initiated. In this respect and for the further formation of the data base, information about the until now not thoroughly investigated sources is necessary. For example, such information would be: industrial wastes of military complex, objects of the Ministry of Defense, accidents and fires at distribution networks, transformer stations and industrial zones, fires on sites, CO2 from the auto engines, as well as information about the following types of activities: canal and river cleaning, ground excavation works, repair works, equipment being taken out of use, recycling of PCB-containing oils, vacuum pumps, voltage stabilizers, and so called "Fluffy waste" production.

To select decontamination and elimination technology for the prohibited for use chemicals (esp. PCB, App. 5) is more complicated. The existing technology of PCB, PCB-containing equipment and waste utilization do not correspond to the current requirements of ecological security. It is worth while to use for POPs destruction the of plasma arc methods and supra thermal methods, which are included in the list of POPs elimination technology .

The main efficiency criterion of household filters for cleaning potable water from chlor-organic pollutants (incl. POPs) is a correct method to detect chlor-organics.

The scientifically based suggestions to administrative and legislative authorities is an important mechanism to remove handicaps for POPs liquidation and for he complex eco-security in SPb, Lenoblast and North-Western region. Particularly important is the elaboration of federal "Law on POPs", the initiation of amendments to the existing federal laws on "Industrial and household wastes", on "Sanitary-epidemiological well-being of population", on "Industrial security of dangerous production sites" (for example, on dioxins, PCBs and other POPs norm harmonization). In this respect, the elaboration of basis for production, use, export, import of PCB-containing equipment, limitation is considered to be very important in perspective. That infringes up on the interests of producers and suppliers of such equipment, enterprises involved in taking equipment out of use and its utilization, exporters and importers, as well as customs services.

INTRODUCTION

The whole amount of work, which was the preliminary phase of the workshop has been accomplished by North-Western International Cleaner Production Center experts and Environmental center. The experts faced the main aim - creation of a mechanism for realization of projects on inventory, identification and elimination of Persistent Organic Pollutants (POPs) in the clearly defined region of Russian Federation. The whole work on preparation to the seminar was lead without using NWICPC & EMC budget. At the same time as the inventory of POPs was carried out in the North-Western Region of Russia, a large arena for future undertakings was revealed. From the point of view of pollution by POPs, the North-Western territories of Russia represent an extremely important object for a more profound research and for transition towards industrial phase. Under industrial phase is to be understood: choice of technology for elimination of POPs and relating this technology to the existing industrial transport infrastructure; creation of pilot installations (equipment) for elimination of POPs; attraction of investment for organization of entire-scale projects according to all available POPs handling phases. Therefore, with the availability of additional budget in frames of NWICPC & EMC as well as excluding it, there would exist a possibility to carry out further the research, technological and industrial segment of the work that is connected to elimination of POPs. Moreover, the experts involved by the center will continue the initiated task because the problem of POPs in the North-West of Russia has only been revealed only upon its minor extent during 6-months of tough work, that was lead according to the project.

In the by UN adopted program "Agenda 21" for the security provision of chemical compounds use, the goal of cessation or prohibition of chemicals application, possessing the properties of long-distance transfer (trans-boundary transfer), toxic, persistent features and accumulation in objects of media and organism. This global problem was addressed at the meeting of Intergovernmental committee for negotiations on international document with obligatory jurisdiction on taking measures relating POPs (dioxins, furans, PCBs and the number of chlororganic pesticides). As a result of negotiations, the text of Stockholm convention on prohibition and liquidation of POPs was prepared. On 22 - 23.05.2001 more than 90 countries as well as EU signed the complete text of the convention, and 115 countries (including Russian Federation) – Final Act of Stockholm Convention, that allows the global coordination, in respect of POPs. In Russia, the problem of environmental pollution with POPs has extreme importance. And the last year conferences with international participation on the elaborating of National Action Plan on ecologically based management of dioxins and other POPs confirmed that.

The major goal of UNIDO project is an attempt to create mechanism to liquidate handicaps for elimination the persistent organic pollutants (POPs) in North-West region of Russian Federation, which are included in Stockholm Convention on POPs. These documents represent the results of UNIDO expert group work on analysis of national reports and other official data concerning environmental protection, results of inventories of the sources of potential dioxin hazard – POPs-containing wastes, products, levels of PCB containing in environment, and also decontamination and elimination technology .

NORTH-WESTERN REGION OF RUSSIA: GENERAL INDUSTRY OVERVIEW AND NEGATIVE ENVIRONMENTAL FACTORS

The North-Western Federal Region of Russia covers the northeast part of Europe. It includes two republics: Karelia and Komi; seven oblasts (Provinces): Arkhangelsk, Vologda, Kaliningrad, Leningrad, Murmansk, Novgorod, and Pskov; one federal city - St. Petersburg; and one autonomous district - Nenetskyi.

The North-Western Region of Russia covers 1.7 mn sq km, about 10% of Russia's territory. The population is around 14.4 million, of which more then 81% lives in cities and towns. In 2000 the larger part of the regional labor force was employed in services (33%) and industry (23%).

The North-West is one of Russia's most industrialized regions. St.Petersburg and Severodvinsk are home to some world-class shipbuilding and ship-repairing companies, and they have begun recovering from the long crisis that eroded industry over the last decade.

Accelerating growth of foreign demand is leading industry's recovery. Severnaya Verf plant is building ships for China. Admiralteiskie Verfi plant produced 8 submarines for the Indian Navy and 2 tankers for the Russian oil giant LUKOIL. In the first for Russian shipbuilders, Almaz shipbuilding company received an order to build a military hovercraft for Greece, a NATO member. All major companies have recently received numerous requests to build new vessels for Russian shipping industry leaders.

Food processing accounts for 18% of industrial output. Forestry, timber, woodworking, pulp and paper industries, each contribute another 15%, as do both ferrous metallurgy and machinery. Aluminum production, including the mining of bauxite, is also of major economic importance, both regionally and nationally.

In 2002 regional industrial output increased by 16.5% y-o-y, significantly more than the Russian average, at 9%. Last year (2001) the North-West share of national gross industrial output was 10.2%.

Furthermore commercial forestry is one of the most significant branches of the regional economy. The North-West is Russia's top region for paper production (60% in 2000), timber (38%) and saw-timber, nation's fish and seafood, and 12% of its of liquor and spirits. The region has a large concentration of machinery plants and metal works, most located in St. Petersburg and surrounding Leningrad oblast. The city Cherepovets in the Vologda oblast is the region's main center of ferrous metallurgy - another industry of national importance; last year the North-West produced 17.3% of Russia's steel and 18.6% of its rolled steel.

The biggest industrial companies in North-West include Severstal, one of the largest Russian metallurgy plants; the ship-building corporation Severnaya Verf; the power-generating giant Lenenergo; the mining company Vorkutaugol; the chemical plants Kirishinefteorgsintez and Akron; the Era machinery plant; the Avtotor car assembly works; and Baltika, the biggest Russian brewery. Of the North-West's 100 largest companies 21.9% of sales in 2000, were from the ferrous 13% each; oil and gas 11.4%; pulp and paper 10.4%; and the food industry 6.5%. More than one third of top 100 companies had their headquarters in St. Petersburg.

(Please refer to the Graph 1 in Appendix)

It would be also important to note shortly most negative environmental factors:

1. There are 8 radiation-hazard sites, 130 chemical-hazard sites and 228 explosive-hazard sites on the territory of St. Petersburg and the Leningrad region alone. At any given point in time, more that 100 tank-loads of chemically dangerous materials are being transported through the region's railway network.

2. Military arsenals and warehouses containing hundreds of thousands of tons of outdated munitions are located on the coastline and islands of the Gulf of Finland. Four warehouses of this kind are situated right within the city limits.

3. The problem that calls for immediate attention is the final disposal of radio-active waste that is being created at the functioning Leningrad Nuclear Power Plant. The plant is located on the coast of the Gulf of Finland. Waste is also being produced at other radiation-hazard sites in the region. The existing sites for disposal of radioactive materials, assuming that the nuclear power plant continues to operate at its normal level, will be filled in two years from now. In case of emergency there is no place to dispose the nuclear wastes as, at present, no new disposal sites are being constructed.

4. A deep cause of concern is the toxic wastes processing and storage facility at the special-purpose enterprise in the town of Krasny Bor. Out of the eight purpose-built waste incinerating furnaces there only three are currently in a working condition. Built more than 30 years ago, ground storage facilities for toxic wastes are in a threatening condition. At the present level of technology and the amounts of incoming waste processed, the enterprise will be only able to continue to function for another 1.5 years. Any serious spring-time flood in this region could provoke a major environmental disaster. In case of emergency, it is highly likely that toxic wastes would penetrate into the drain, canals, and small rivers, which enter the Neva River upstream of St. Petersburg. The city water treatment system, however, cannot sufficiently treat water to remove toxic materials.
Additionally, during the last two years the amount of toxic waste produced by enterprises is reported to have dropped to a tenth of what it was in the past. In part, this can be explained by the general decline in production in the region. However, another very likely explanation is that "clever" enterprises are merely saving on their waste treatment costs by dumping toxic wastes without any treatment, thus violating environmental protection laws.

5. Further problems that remain unresolved:

- The poor condition or complete absence of waste treatment facilities in the majority of enterprises in the region;
- The unauthorized dumps scattered throughout the region. These contain millions of tons of industrial and household waste.
- The high content of exhaust gases in the streets of St. Petersburg and in other cities throughout the region. The exhaust gases come from both transport (cars, trucks, etc.) and oil- and coal-based boiler facilities (household and industrial).

In general Russian researchers (in particular from St. Petersburg) have developed a series of original and excellent techniques and technologies, which have no analogues in the rest of the world to address the issues of industrial pollution. The preliminary assessment of these new technologies may call for reconsidering of the whole current approaches of waste disposal. By introducing these new technologies, it may become possible to develop highly profitable industrial enterprises and extra sources of raw materials and power that will replace the traditionally unprofitable waste disposal operations. However, very often there is no financing to implement these new technologies. Nor is there any financing for the construction of new environmental protection sites or for the upkeep and maintenance of those that already exist. It is difficult to estimate the damage that would be caused by allowing the existing infrastructure for the monitoring of radiation, chemical and explosive-hazard sites to collapse, and at present its condition can only be described as critical.

6. The unfavorable regional ecological picture would be incomplete if one fails to mention the risk of contamination that threatens vast areas of the Baltic Sea. 300 thousand tons of chemical waste was sunk after World War II in the straits of Skagerrak and Kattegat, off the shores of Sweden, Norway, and Denmark, and the waters of the Baltic are under permanent threat as the seals on this waste could break at any time. The critical years for contamination, when the seals will be most at risk, are 2002-2005.

7. The Baltic Sea also remains unsafe for navigation due to thousands of undetected mines and depth charges left behind from the World war, and due to hundreds of sunken ships, some of which were naval support vessels carrying large quantities of munitions on board.

PRIOR POPS ACTIVITIES IN RUSSIA

In Russia there are a number of specific activities and initiatives that have been undertaken at the national level to demonstrate country commitment to action on POPs.

These include:

- The Government Preparation and implementation of a Federal Programme on dioxins (1993-1997);
- 1995 – 1999: Programme of the regional ecological center of St.Petersburg. Carry out of more than 500 soil analysis for benzpirene, chlorine-organic pesticides and polyaromatic hydrocarbons (Within the framework of mandatory sanitary-hygenic tests of land plots for new construction and reconstruction).
- 1996 – 1997: Federal programme «Protection of population and ecology from dioxins and dioxin like toxic substances for 1996-1997». Decree of the Government of the Russian Federation № 1102 from 05.11.95.
- 1996 – 1998: Programme for clean-up of channels and rivers of St.Petersburg (including PTSs) from the river bed sediments within the framework of the programme of cooperation with the Ministry of economics of the Netherlands;
- 1997 – till now: Sub-Programme «Dioxin» within the programme «clean city», under the auspices of the Government of St.Petersburg.
- August 1998: International training workshop in the town of Baikalsk, «Coordination of research on POPs». Under the auspices of the Institute of Toxicology and the Environmental Protection Agency (EPA, USA).
- Resolution of NGOs in Russia supporting International POPs Convention signed at the Volga River Conference in 1999;
- UNEP expert group meeting on POPs in Pushkino (St.Petersburg area)
- UNIDO,UNEP and EEC sub-regional expert group meeting on reduction of POPs discharges in the region in December 1999 in St.Petersburg ;
- May 2000: Round Table on the project «Consolidated policy of handling of toxic wastes in St.Petersburg and Leningradskaya oblast» within the framework of the TACIS programme «Strengthening of synergy: common strategy for St.Petersburg and Leningradskaya oblast in North-West Russia». Lencomecologia, St.Petersburg.
- June 2000: Russian-American workshop «All about dioxins in Russia», Goscomecologia, Moscow.
- June 2000: Press-conference of scientists and specialists of the St.Petersburg scientific center of the Russian Academy of Sciences related to the presentation of the book «Dioxin danger in the city» (prepared on the materials of the sub-programme «Dioxins» within the programme «clean city» under the auspices of the Government of St.Petersburg). St.Petersburg branch of the Russian Academy of Sciences.
- September 2000: International symposium in St.Petersburg «Health and chemical safety on the eve of XXI century».: UNEP Chemicals (Geneva) and Centre for International projects (Moscow) in cooperation with the Medical academy for post graduate education of St.Petersburg.

- UNIDO/UNIDO ICS Trieste/UNEP workshop on POPs reduction/elimination for the North-West Russia and Baltic states in October 2000 in St.Petersburg
- November 2000: Russian-American meeting of scientists from Russian Academy of sciences and National Academy of sciences of the USA and civic organizations «Ecological problems in Russia (inc. pollution from PTCs) which could be addressed jointly, Moscow.
- December 2000: Fist edition in St.Petersburg of the text book «Toxicology of dioxins» with the support of the foundation of John and Katrin McArtur (USA).
- December 2000: Seminar on «Ecological problems related to POPs dissemination», for Russian civic organizations and NGOs, N.Novgorod
- Activities of the Programme of ecological monitoring and assessment (PEMA, Oslo) on PTCs for the Russian arctic;
- 2000 – till now: Scandinavian NEFCO project for the North-West Russia «NEFCO PSB Fast Track».– CHEMCONTROL A/S (Toxic and Hazardous waste Consultants World-Wide), Denmark.

LIST OF 12 POPS - "DIRTY DOZEN"

FALLING UNDER THE ACTION OF THE STOCKHOLM CONVENTION ON PROHIBITION AND LIQUIDATION OF PERSISTENT ORGANIC POLLUTANTS (POPS)

1. *Undesired by products*	**polychlorinated dibenzo-*para*-dioxins (PCDD)** **polychlorinated dibenzofurans (PCDF)**
2. *Industrial products*	**polychlorinated biphenyls (PCB)** **hexachlorobenzene (HCB)***
3. *Pesticides*	**aldrin** **heptachlor** **dieldrin** **dichlorodiphenyltrichloromethane (DDT)** **mirex** **toxaphene** **chlordane** **endrin**

*** Hexachlorobenzene - limited application in industry, being more used as pesticide**

Undesired by products. "**Polychlorinated dibenzo-p-dioxins and furans (PCDD/ PCDF)** are pollutants of environment and detected practically in all objects of global ecosystem as traces. **PCDD/ PCDF** are never produced on purpose and never possessed any useful properties in contrast to other POPs such as **polychlorinated biphenyls (PCB) or DDT. PCDD/ PCDF** are formed **as undesired by products in many** industrial processes and during burning. Therefore it's impossible to liquidate dioxins and furans through prohibition of their production and application. It's necessary to carry out indirect activities to decrease emissions of **PCDD/ PCDF** in environment and to minimize their influence on humans.

Such work may be successfully fulfilled only if **PCDD/ PCDF** are revealed during research and quantitatively evaluated. Only after that it's possible to establish technology and take measures for minimization and liquidation of the influence from the source. " (K.Topfer, UNEP Executive Director, 1999).

PCDD/ PCDF are tricyclic aromatic compounds, formed by two benzene rings, connected by two oxygen atoms in the case of **PCDD** and by one oxygen atom in the case of **PCDF,** hydrogen atoms being exchanged with chlorine atoms totally not more than eight (UN, Protocol on persistent organic pollutants..., 1998. 75 isomers for **PCDD** and 135 isomers for **PCDF**. The 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCCD) was accepted as standard of toxicity for **PCDD**, and 2,3,7,8- tetrachlorodibenzofuran (TCDF) for **PCDF.**

As far as these isomers are present in the emissions of enterprises and objects of environment in various concentrations and proportions an international scale of the equivalent toxicity factors (I-TEF) was elaborated. Such factors present some coefficient (for example for TCCD it's equal to 1 ; for PCDD - 0.1; for 1,2,3,7,8- pentachlorodibenzo-*p*-dioxin – 0.5, but for 1,2,3,7,8 – pentachlorodibenzofuran - 0.05) which must be multiplied by the detected concentration of concrete isomer and in that way it's toxicity equivalent (TEQ) can be seen. After summing up these equivalents the total probe toxicity may be calculated.

It's necessary to note that isomers of PCDD are more toxic, than ones of PCDF, but taking into account that PCDF's content, as a rule, substantially higher, they are often responsible for the level of total toxicity. Experts of the International Program of chemical safety (IPCS) offered following classification of dioxins research:

1) *Industrial processes*. TCDD formed as a result of the chemical synthesis during catalytic chlorinating of non-chlorinated dioxin, in process of the 2,4,5-trichlorophenol salts dimerisation and its production from 1,2,4,5-tetrachlorobenzene. PCDD and PCDF are formed as by products in the production of chlorinated phenols (di-, tri-, tetra- and pentachlorophenols), in preparation of herbicides on the basis of chlorinated diphenyl ethers. It's important that emergence TCDD in the environment objects is the result of mainly synthesis of 2,4,5-trichlorophenol, using products achieved from this compound and incinerating processes.
2) *Pollution of industrial products.* There are the most substantial levels of dioxins polluting (mainly by TCDD) of herbicides on basis of 2,4-di- and 2,4,5-trichlorophenoxyacetic acids (2,4-D and 2,4,5-T), as well as chlorophenols that are widely used approx. the last 50 years as fungicides, insecticides, antiseptics and disinfectants, bactericidal agent hexachlorophen, herbicides synthesized from chlorodiphenyl ethers, hexachlorobenzene and PCB. Maximal levels of dioxins in 2,4-D and pentachlorophenolates may achieve 2 and 85 mkg/kg correspondingly.
3) *Intensive pollution of environment sources.* These are industrial accidents, rules of industrial waste burying violations, intensive using of chemical substances in military purposes. Literature sources describe a number of small scale accidents on 2,4,5-T production. But chemical catastrophes in Sevezo and Ufa, burning of electroinsulating PVC cable in g. Shelehov are the most known as well as accidents in Times Beach and Love Canal, application of battle defoliant - Orange Agent (mixture of 2,4-D and 2,4,5-T **contaminated with dioxins**) as ecological war weapon. Nowadays the territory of Vietnamese province Kontum (region of the most intensive dioxin pollution) contains TCDD in quantities enough to poison a half of 73 – million Vietnamese population.
4) *Other dioxins sources in environment.* These are: thermal destruction of technical products, incineration of waste waters precipitates, municipal, medical and dangerous wastes (for example articles manufactured from PVC). One of the famous dioxin problem specialists S.S. Jufit notes that incinerator plants (IP) are the main sources of dioxin emissions in large industrially developed countries of Western Europe, the USA and Japan (dioxins emission in biosphere as a result of IP activity in these countries sums up to 70% in total emission). Other dioxins sources in the environment are:

- metal-working and metallurgical industry (in the case of production of nickel and magnesium from their chlorides through electrolysis, casting of steel and copper, melting of scrap-iron as well as aluminum production)
- regeneration of wire materials
- exhausting gases of cars working on gasoline containing Pb –admixtures, incinerating of car oils and gasoline
- pulp and paper industry, using chlorine bleaching paper (dioxins were found in pulp, filtrates, waste waters, gases, solid wastes, finished articles)
- burning and breakage electrical equipment, using PCB as transformer liquid

- fires in inhabited accommodations, industrial buildings, where PVC materials used
- forest fires (forests treated by chlorophenol pesticides, as well as wild forests, where free chlorine adds up to the formation of dioxins)
- cement furnaces where passing incinerating of solid wastes takes place
- pyrolysis of solid fuels such as peat, coal, wood (power stations, furnaces for drying of wood, heat and power plants)
- usage of domestic furnaces, usage of "technical" wood, coal, oil, heavy oil (content of dioxins in soot varies in depending on sort of fuel used and type of heating systems)
- crematorium

Usually the local environment pollution attracts attention, however indeed super toxicants are spread everywhere. They are present in all parts of biosphere: in water, in air and in soil and moreover, they migrate by the mentioned means. As an example: emission in atmosphere of gases polluted with dioxins from dust incinerator plant or "dioxin cloud" of chemical production results in dioxins penetrating together with precipitation into reservoirs and in the soil. Evaporating from the surface of water or with soil dust dioxins get again into reservoirs, and by these means they may pollute soil and air once more. Thus, a "vicious circle" is formed and it's rather difficult to interrupt it. In addition, part of pollutants penetrates into plants and biota resulting in emergence the same vicious trophic chains.

For sure, talking about circulation in dioxin's media, it is incumbent to consider so called trans-boundary transfers. As generally this determines the global character of dioxin problem. Even observing all the rules of dioxin security provision, neither nation is hedged of the dioxin entrance with water of air masses from neighboring or even distant territories.

The background concentrations of dioxins in urban atmospheric air fluctuate in amply significant margins (from 0.01 to 5-7 pg/cub. M); their concentration also varies from tithes to tens of pg TE/l in the water of superficial basins. The soils are the main depots of dioxin in the environment. The soil's background concentrations of dioxins are 1.0 – 14500 ng TE/kg (in Germany) and attain 46200 ng TE/kg (Russia, Chapaevsk). Nevertheless we must take into account, that dioxin migration in the soil depends on the concomitant pollutants and biobearers, affecting not only in the depth of toxicant permeation into the soil, but also on its fastening with the soil compounds.

Considering the main way of dioxin transfer in environment: source → air media → water → soil → plants → live-stock → milk products → human being → pectoral milk → new-born child, – just the last one is the major "consumer" of these supertoxicants, because every stage of food chain multiplies the toxic concentrations (biomagnification).

The dioxins are absorbed through the soil by plants, water and soil organisms, that serve as a food for birds, fish and mammals, and finally becomes the human alimentation.

Thus the dioxin penetration into the human organism is realized through the consumption of the contaminated food products, inhaled air, potable water and integument. Herewith the amount of penetrated toxicant in percentage is 94,77: 5,0: 0,2: 0,03. Therefore it is clear, that the alimentary way (through the food products) of dioxin entrance into the human organism is the major one, where the nation acquires the major amount of dioxin (appr. 95%). Especially the sea products are highly contaminated, particularly the fish, because by entering the water media, these toxicants are accumulated in the contextures of hydrobionts, where their concentration is ten or hundred thousands times higher than in hydromedia.

The stability of dioxins/furans contra decomposition and transformation not only in environment, but also in biomedia is one of the conditions for the accumulation in organism. The lypotropic provides their permeation and high concentration in adipose depots and pericranium textures and, what is important and dangerous, in pectoral milk of mammals, including, humans.

Humanity are on the peak of trophic chain and bioaccumulation, what has exclusively serious practical meaning. As a result of extremely slow removal of dioxins out of organism and their lypothropous features, they are intensively accumulated generally in adipose textures. We could use the accumulation index of dioxins/furans in biomedia of organism, i.e. adipose depots, blood, pectoral milk (amount of butter is usually 3,4 – 3,8%), to assess the risk of dioxin danger.

The limited explorations in human population proclaim that the period of TCDD extinction to its half in the organism is 2 – 6 years. However, the significantly higher figures are distinctive for the risk groups. So, the examination of American veterans of Indo-China showed that the period of dioxin halflife in their organism (in TCDD's) is continuous - 8,7-11,3 years. In the rodent's organism the dioxins extinct significantly faster. The known periods of half-extinction for rodents are 12 - 94 days, and for the apes – approximately 1 year.

In all the enquired species the injected dioxins are accumulated differently in the liver and adipose texture and also in derma and adrenals under the higher levels of exposition. Accumulations in human organism is revealed in other parts (spinal cord, liver, muscles, spleen, kidneys, lungs) with significantly minor concentrations. Factor of bio-concentration (FBC; ratio of a substance concentration in organism to a substance in the stable environment concentration) is equal to for PCDD 7900 - 344000, and for PCDF 2570 - 66000.

Time of dioxins withdrawal (it's customary to use index of half- withdrawal period, i.e. time which it takes for elimination from organism a half of toxicant) usually this index varies for rats, mice and hamsters from 12 to 30, for guinea-pigs from 23 to 94 days, while for macacos this index for TCDD is equal to about a year, and for men – from 2 to 6 years. To sum up, considerable fluctuations in inter- and intra- specific sensitivity difference to dioxins can't be satisfactorily explained by observing differences in toxic – kinetic parameters.

A lot of dioxins group agents are high toxic compounds. TCDD toxicity excels such famous poisons as strychnine, curare, hydrocyanic acid, yielding to in only botulism, tetanus and diphtheria toxins.

Sensitivity of different species of mammals to toxic influence of TCDD varies by 10 000 times! Hamsters and some types of rats and mice are resistant to TCDD, but guinea-pigs are extremely sensitive. Till now it's very difficult to answer : "To whom the human is more close in sensitivity, to hamsters or to guinea-pigs?

Calculated average deadly dioxin dose for the human in the case of momentary entering into organism is equal to 70 mg/kg and minimal acting dose is about 1 mg/kg what is substantially less corresponding to doses of known synthetic poisons. Threshold of the chronic dioxin acting on human is on the level 75 pg/kg /day. Taking into account that calculated values of the toxic doses for man is usually predicted with reserve it's supposed that safe dose (maximal not arousing harmful consequences in the case of daily entering during all life) may be equal to 0.1 – 1 pg/kg/day. Dioxins belong to the first class of danger (extremely dangerous).

During the last years a number of specialists are inclining to the opinion that dioxins do their input to accelerated aging of organism. The basis for that the decrease of the average life cycle duration of a person who had a contact for a long time with these substances. If we take into consideration the fact that dioxins provoke disorders of vital activity in concentrations considerably lower, then true hormones then it's impossible to deny the point of view of authors who formulate that these substances are similar to "disadaptation hormones", "hormones of premature aging", "environmental hormones", "endocrine disrupting agents". But the problem is not only in an individual human, but in population as a whole. As a result it's arising lag in the development (in the case of kid), premature aging together with a lot of young man disorders peculiar to senile age.

Industrial products - Polychlorinated biphenyls (PCB) - vast group of aromatic hydrocarbons, represent chloro-derivatives of biphenyls containing in it's molecule from 1 to 10 chlorine atoms. 209 PCB isomers are known, however only 11 of these are highly toxic. Individual chlorinated biphenyls are of rather restricted application, their mixtures are more often used as oils. These PCB compounds are known under various commercial names: arochlor, dicanol, inertin, canechlor, chlophen, piranol, piralen, phenochlor, phenchlor, chlorextol, and others; in Russia – sovol, sovtol, hexol. Unique physico-chemical properties such as thermo stability, high boiling point, non- inflammability, stability towards chemical destruction, small solubility in water, mixing up with organic solvents and plastics, as well as high dielectric constants – all these properties called are the reason for PCB in various fields of industry. They were used as capacitors (sovol) and transformers (sovtol), thermo carriers in thermo exchangers (hexol), liquids in hydraulic systems, plastificators in lacquers, plastics, typographical colors, copying paper, as well as lubricants, isolating materials for cables and wires, filling pesticides materials, adding agents for domestic chemistry goods, etc. PCDD and PCDF as well as naphtalines are found mainly as admixtures to technical PCB. PCB are stable towards hydrolysis, but when come in contact with photolysis and sunlight conditions PCB may form dioxins. The main source of environmental pollution by PCB is industrial emission. PCB penetrate in environment as a result of leakage from transformers, capacitors, thermo carriers, thermo exchangers or hydraulic systems, lixiviation and evaporating from different technical installations, releasing of liquid industrial wastes. Environmental pollution by PCB takes place in the case of wrong exploitation of dust incinerators or in process of open burning of dust on dumps. Locally, the case of straight throwing down hydraulic liquids and lubricants from ships is of a great importance. PCB may penetrate into environment together with pesticides containing PCB as filling pesticides materials.

Together with chloroorganic pesticides, PCB is the most widespread product, polluting environment – water, air, soil and food products. Intensive application of PCB in industry has led to situations when enormous quantities of these compounds have penetrated in natural bio- circulation and this process affected practically all biosphere. As stable compounds PCB accumulate in objects of environment, including food chains, where through transferred to the human. Water organisms – fish, mollusks, crustacea – accumulate PCB in concentrations of several tens mg/kg. Momentary pollution of soils may result in constant local pollution of water organisms on long terms (up to several years) after the actual moment of pollution. Together with food products it may transfer considerable quantities of PCB in man's organism, depending on proportion of fish in ration. According to research of specialists, PCB quantity, which daily enter with food in organism of a man who has no direct contacts with PCBs, may reach 100 mkg. People, having contact with PCB during production appreciable volumes of PCB in tissues where found - in some probes of under skin man's fat concentration of PCB was 100 mg/kg. Rather high PCB concentrations were found in women's pectoral milk. In natural conditions velocity of PCB degradation is extremely low – the most probable time of half-destruction equals to 5 years. Velocity of bio-transformation in organisms depends on the number of chlorine atoms in PCB molecule; thus lower-chlorinated PCBs metabolize relatively easy, but higher- chlorinated PCBs metabolize much slowly.

PCB is detected in air, soil, water, living organisms. Transfer of PCB through food chains promotes their circulation in environment. It's seems that such transfer is the main path of PCB spreading in the animal world. Of a great importance is the transfer of PCB to posterity with mother's milk and as a result, their passing through placenta barrier. According to the research of specialists a baby may receive with mother's milk about 3 mg/kg of PCB.

If we are speaking of humans, PCB quickly penetrate in blood independently of path entering and spread in tissues and organs. They are detected in blood, liver, kidneys, lungs, adrenal glands, ovaries, lymphatic glands, abdominal and hypodermic fat and other organs and tissues. The highest concentrations are being formed in fat tissue, which serves as the main depot of PCB. The fact indicating concentration of PCB in man's organism is: PCB content in milk of a nursing mother is 4 times higher than in their food. FBC of PCB is extremely high and equals to 57000 – 800000. Toxicity of PCB and symptoms of acute and chronic poisoning by these compounds have substantially species, aged and sexual features. PCB have marked cumulative action. In the case of constant PCB entering in organism unfavorable PCB action may be revealed on relatively low levels. The main evidence of PCB toxic influence on man's organism: skin diseases (chloracne), chronic dermatoses and affections of liver, as well as it was shown recently malignant tumors and other remote consequences (deformities and abnormalities, delay of mental development, etc.). PCB belongs to the 2-nd class of danger (highly dangerous)

Hexachlorobenzene (HCB) - according to its chemical structure presents benzene ring with 6 chlorine atoms. It is also being named: perchlorobenzene, amatin, sanocide, hexadin, granox, anticaril. In the industry HCB has rather limited application as intermediary between synthesis of pentachlorophenol (wood conservation), hexafluorinebenzene (ingredient of smoke shells) and pentachlorotiophenol (plastificator for caoutchouc and polyvinylchlorides), as well as some dyes. It's used in some electro insulation materials and as fireproof impregnation. Mainly it's used as fungicide for pickling seeds to prevent diseases of wheat, rye, etc. It enters in the environment while being used as remedy for protection of plants (in the most of European countries it's use is prohibited) as well as release and emissions from industrial enterprises. In water it's period of half-life is more then 100 years, in soil – about 3 years, but in contrast to other POPs it persists in the air rather long time (half-life period is 4.3 years). IT's very stable and accumulate in food chains. FBC HCB varies from 7800 to 22000. Possible cancerogen. Long time influence provokes diseases of liver and sexual organs. Lethal dose for a human equals to 50 g. It belongs to the 3-d class of danger (moderately dangerous).

Pesticides – common name for all chemical compounds used in agriculture for protection of culture plants from pests, weeds, diseases and microorganisms. Among chloroorganic pesticides 8 included in list of POPs – aldrin, heptachlor, dieldrin, dichlorodiphenyltrichloro-methane (DDT), mirex, toxaphene, chlordane, endrin. POPs-pesticides are detected in water, air, soil, living organisms. Their distribution in the environment resembles distribution of PCB, but differs in periods of half-life and figures of bioconcentration factors (FBC). The most of mentioned pesticides have no marked mutation properties, but they are characterised by long term biological, and genetic (genetic-toxic) effects. It's important to mention that PCB is used as filling material for POPs- pesticides.

Dichlorodiphenyltrichloromethane (DDT) - represent the main ecological danger among this group. The most used synonyms are argitan, arcotin, bovidermol, hexaphit, deoval, detox, dicophan, zerdan, neocide, pentachlorine, estonat. It possesses marked insecticide-like properties and was widely used for combating mosquitos of specie Anopheles transfering malaria (nowadays used in epidemic nidi in Africa, Asia, Latin America). This substance is extremely stable and destructs in the nature very slowly. As result of trans – boundary transfers with water masses and biota it has been found everywhere in the environment– from polar ices up to mother's milk.

DDT possesses marked cumulative ability, it concentrats in man's fat tissue, liver, kidneys, brain. FBC DDT equals to 3900 – 91000, permissible DDT content in man's organism being under 10 mg/kg. It possesses mutation properties and represents possible cancerogen for human beings. Combination with other compounds strengthens its dangerous effects. DDT belongs to the 2-nd class of danger (highly dangerous).

Toxaphene - represents a mixture of polychlorinated camphens. Synonyms are amphophen, geniphen, stroban-T, toxadust, phenacide, estanox. It's an insecticide for protection of cotton, against locust, caterpillars as well as for protection of domestic animals from small insects – parasites. Being used mainly in Western Europe and the USA. The half-life period in soil is higher 10 years, in water – more 20 years. FBC toxaphene equals 19500 - 70800.

It is teratogen for mammalia, possible cancerogen for a man. Toxaphene belongs to the 2-nd class of danger (highly dangerous).

Chlordane – an insecticide of wide spectrum of action. Synonyms are: aspon, dowchlor, niran, octachlor, topichlor, chloridan. Used mainly in the USA. The half-life period in soil is higher than one year. FBC of chlordane equals to 7100 - 37000. It is a teratogen for mammalia, possible cancerogen for a man. It belongs to the 1-st class of danger.

Mirex - synonyms are dechloran, perchlordihomocubane, perchlorpentacyclodecane, ferriamicide. It's an insecticide for combating mosquitos, for protection of cotton. Used mainly in the USA, Latin America and Brasilia. It's extremely stable in the environment, the half-life period in soil is more than 600 years. FBC of mirex equals to 18100 - 20400. It possesses marked reproduction toxicity for mammalia, possible cancerogen for a man. It belongs to the 2-nd class of danger.

Heptachlor - an insecticide for combating mosquitos and ground insects. Synonyms are: agroceres, heptamul, heptachloran, heptagran, drinox, radiachlor. Used mainly in the USA. The half-life period in the soil is more than 6 months. FBC of heptachlor equals to 200 - 37000. It is a teratogen for mammalia. It belongs to the 2-nd class of danger.

Aldrin - synonyms are: aglucon, artophen, veratox, octalen. It is an insecticide with wide spectrum of action. It's an insecticide for combating pests of cereals and cotton. Used mainly in the USA, Western Europe and Japan. In plants, organism it's turned into dieldrin. The half-life period in water is about 2 years, in soil more than 5 years. FBC of aldrin equals to 10710. It belongs to the 3-d class of danger.

Dieldrin - synonyms are: dialdrex, illoxol, octalox. It is an insecticide with wide spectrum of acting. It's an insecticide for combating pests of cereals and cotton. Used in the USA, Western Europe and Japan. The half-life period in water and soil is about 2 years. FBC of dieldrin equals to 2100 – 34700. It belongs to the 3-d class of danger.

Endrin - synonyms are: hexandrin, mendrin, octanex, endrex, endricol. Just as eldrin and dieldrin, endrin is an insecticide of wide spectrum of action and is used for combating pests of cereals and cotton in the USA, Western Europe and Japan. The half-life period in water and is about 3 months, but in soil more than 12 years. FBC of endrin equals to 4900 - 49800. It belongs to the 3-d class of danger.

Table 1.2. Genuine pecularities of polychlorinated dibenzo-p-dioxins (PCDD), dibenzofurans (PCDF) and biphenyls (PCB), conditioned their influence to environment and human health*

Danger Peculiarities:
1. High toxicity. These compounds are super-ecotoxicats and cellular poisons, which can damage all living organisms. Ubiquitar distribution. These compounds are found in air, water, soil, food. 2. Resistence to decomposition. These compounds are very stable and can persist in biosphere for several years. 3. Migration. These compounds are able to move for long distances with water, air and biota. 4. Bioaccumulation. These compounds penetrate through food chains into human organism, are accumulated by different tissues, and being a reason for a wide spectrum of diseases.

* peculiarities mentioned in table are typical for other POPs, but in lower level of expression, as a rule.

Table 1.3. The diseases induced by dioxins and other POPs

Malignant tumors Soft-tissue sarcoma; lung cancer, neoplasms of breast, stomach, liver; non-Hodgkin's lymphoma
Male reproductive toxicity Reduced sperm count; testicular athrophy; abnormal testis structure; lesions of hormonal levels; libido decreasing; feminization
Female reproductive toxicity Hormonal changes; decreased fertility; problems of pregnancy; ovarian dysfunction; endometriosis
Effects on unborn fetus Birth defects; structure abnormality of genitalia; delayed puberty; neurological disorders; retardation of psychic and somatic development

Skin disorders Chloracner; hirsutism; hyperpigmentation; keratosis; Peyronie′s disease
Metabolic and hormonal changes Changes in thyroid hormones; altered fat metabolism; altered porphyrin metabolism; decreased insulin levels; arteriosclerosis
Damage of nervous systems: Impaired neurological symptoms; irritability and nervousness; decrease pin pirck sensation
Damage of liver Cirrhosis, enlarged liver, evation of GGT, LDH, AST, ALT levels
Damage of immune system Reduced size of thymus; increased T-4 cells; increased risk of cancer
Lung problems Irritation; decreased lung function; tracheobronhit
Other disorders Loss of appetite; nausea; damage to heart leading to circulatory disorders and heart disease

Reference to Table 1.3

In commentaries to the table it's necessary to note that the list of mentioned diseases is far from being complete - "it's may not be completed just as well as the list of HIV patients. In such sense journalistic nickname of dioxins "chemical HIV" is more proper... It's impossible to die from HIV, but diseases affected the patients are – and it is a pity! – deadly on 100%. Indeed, it's reasonable that cardiovascular pathology and malignant tumors are two main reasons of population mortality, but other diseases named "don't touch so deeply" (Dioxins. Political history of dioxins. Main conceptions and problems. M.: Two Worlds, 1996.)

There aren't, perhaps, with the exception of chloracne, specific dioxin diseases, but diseases spectrum of people, exposed to influence of different persistent organic pollutants, is wide and various. First of all because in that case al the protection systems of organism are broken down. Definitely, dioxins and other POPs do have influence on growth and regulation of metabolism, reproduction and development as well as susceptibility to infection diseases.

It should be noted that dioxins and dioxin-like compounds influence ruinously the health even if present in extremely low doses. As it was noted in materials of III Civil Conference "Time to act", that was held in 1996, Baton-Rouge (Louisiana, the USA): "...some damaging effects of dioxins are being revealed in concentrations, which are only 10 times more than the value detected nowadays in organism of common people. In that case we are very close to be "utmost filled up" by dioxins, i.e. to such quantity present in organism, which may lead to dangerous influence on the health.

PRIMARY INVENTORY OF PCB-CONTAINING EQUIPMENT AND PCB-CONTAINING WASTES ON THE TERRITORY OF SAINT-PETERSBURG, LENINGRAD OBLAST AND NORTH-WESTERN FEDERAL REGION

According to the existing data, approximately 180 000 tons of PCB and PCB-based(sovols, sovtols, trichlorbiphenyls) were produced in USSR and Russia during the period of 1939-1993. During 1995 and 1995 Ministry of natural resources and the Goskomecologia carried out 2 inventories, according to which, the total amount of PCB, containing in electrical equipment was 13,000 tons. These figures are lowered, because, the inventories of 26 enterprises in Saint-Petersburg and Leningrad oblast showed that 1,083.7 tons of PCB were located in equipment. The reports from that ones testify the absence of PCB.

The implemented inventory of PCB and PCB-containing equipment of the enterprises of railway, ship, chemical, pulp and paper industries, fuel and power complex showed that there are 302 transformers and 21,949 capacitors on the territory of Saint-Petersburg and Lenoblast; they contain 637.04 and 476.49 tons of PCB, correspondingly. It is important to note the large volume of PCB at Admiralteysky shipyards, Baltiysky and Kirovsky plants (SPb), Svetogorsky PPP, Izhorsky plants, Transmash (Tikhvin, Lenoblast). In addition to these 26 enterprises, it is worth while to point out the "Arsenal" plant, where 67 transformers TN and 41 capacitor KS are located, that in sums up to 188,5 tons of PCB. The figures on Vyborg and Tikhvin districts, are, obviously, objective; it is strange, that there is absolutely no information about Volkhov aluminium plant, Priozersky and Syas'sky PPP and the number of other industrial sites of Leningrad oblast. The data on SPb enterprises of power and fuel complex indicate the full absence of PCB-containing equipment.

It is to be noted, that only Vyborgskaya power station (RAO EEC "Russia") takes out of use own transformers and officially places them at range "Krasniy Bor", the single specialized enterprise for waste storage. Many trademarks of synthetic oils, determined as non-containing PCB, actually are trichlorbiphenils or related to sovols and sovtols. The laboratory results and analytical research of transformer oil, made by certified laboratory "Taifun" are highly important. This analysis (evaluated in toxic equivalent) showed extremely high amounts of dioxins in PCB (34.1 mg/kg). Thus, the fact is, that only officially registered volume of PCB in Saint-Petersburg and Leningrad oblast (1113.686 tons) contains more than 40 kg of dioxins. As dioxins are extremely toxic agents (concentrations chemically and biologically active equal to 10^{-12}mg/kg) this quantity is very very high.

The most exhaustive data on analytical PCB inventory was presented by enterprises of Vologda oblast. Maximal quantity PCB-containing equipment and PCB-containing wastes was located on a metallurgy plant "Severstal" – 191 transformers and 3654 capacitors. Thus, total amount of PCB in "Severstal"is 488.8 tons. Other enterprises except Vologda electrical net and "Ammophos" plant bring insignificant contribution to the whole picture. Less convincing figures were presented by Murmanskaya oblast. The single enterprise included in our inventory is "Appatit" works which has 14 transformers with 35.92 tons of PCB. Similar situation was sighted in other 11 subjects of North-Western Federal region. Especially peculiar is the fact of the absolute nonexistence of PCB in Pskov oblast.

PCB-containing equipment inventory recording

Table 3.1. PCB-containing equipment inventory recording for St Petersburg and Leningrad Oblast

No	Enterprise	Transformers				Capacitors				Total PCB amount, t
		Total	In use	In reserve	PCB amount, t	Total	In use	In reserve	PCB amount, t	
1	Railway Coach Plant after Yegorov, St. Pb.	4	4	-	10,081	-	-	-	-	10,081
2	"Phosphorit" Plant, Kingisepp	-	-	-	-	178	126	62	4,094	4,094
3	Engineering Plant after Kolyakova, St. Pb.	5	5	-	11,867	55	55	-	0,935	12,802
4	Kyrovsky Plant, St. PB	9	9	-	22,148	111	111	-	1,887	24,035
5	Transmash plant, Tikhvin	10	10	-	23,83	1433	1433	-	14,651	38,481
6	Sverdlov LSPO, St. Pb	8	8	-	15,267	34	34	-	0,58	15,847
7	Znamya Truda Plant, St. Pb	3	3	-	7,316	45	45	-	0,765	8,081
8	Kulakova Plant, St. Pb	1	1	-	1,786	89	89	-	1,513	3,299
9	Metallist Plant, St. Pb	-	-	-	-	70	70	-	1,19	1,19
10	Metallichesky Plant St. Pb	5	5	-	9,909	25	25	-	0,425	10,334
11	Proletarsky Plant, St. Pb	5	5	-	10,888	50	50	-	0,85	11,738
12	Nevsky Plant, St. Pb	-	-	-	-	87	87	-	1,479	1,479
13	Kyrov PTO, St. Pb	3	3	-	6,337	-	-	-	-	6,337
14	"LenKraz" St. Pb	2	2	-	4,551	75	75	-	1,275	5,826
15	Leninets Plant St. Pb	6	6	-	13,653	30	30	-	0,5	14,153
16	Baltic Plant St. Pb	10	10	-	22,755	-	-	-	-	22,755
17	"North Shipyard" Plant,	-	-	-	-	77	77	-	1,309	1,309

	St.Pb									
18	"Admiralteysky Shipyard", St. Pb	8	8	-	18,204	61	61	-	1,037	19,241
19	"Krasnogvardeets" Plant, St. Pb	8	8	-	16,246	31	31	-	0,527	16,773
20	"Krasny Vyborzhets" Plant, St. Pb	8	8	-	15,246	102	102	-	1,734	17,001
21	Pulp and Paper Mill, Svetogorsk	188	188	-	378,313	-	-	-	-	378,313
22	Plant after Karl Libkneght, St. Pb	-	-	-	-	83	83	-	1,411	1,411
23	"Izorskye Zavody," St. Pb	14	14	-	37,731	151	151	-	2,567	40,298
24	"elektrosyla" Plant, St. Pb	5	5	-	10,888	230	230	-	3,91	14,798
25	"Lenenergo", St. Pb	-	-	-	-	62	62	2	1,24	1,24
26	City Power Network, Viborg	-	-	-	-	18870	13192	5678	434,010	434,010
	Total	**302**	**302**	-	**637,037**	**21949**	**16271**	**5678**	**476,649**	**1.083,686**

(Please refer to Diagram 2 in Appendix)

Table 3.2. PCB-containing equipment inventory recording for Vologodskaya Oblast

No	Enterprise	Transformers				Capacitors				Total PCB amount, t
		Total	In use	In reserve	PCB amount, t	Total	In use	In reserve	PCB amount, t	
1	Brewery, Vologda	2	2	-	1.54	-	-	-	-	1.54
2	Engineering Plant, Vologda	-	-	-	-	23	11	12	0.322	0.322
3	City Power Network, Vologda	-	-	-	-	3700	-	3700	36.84	36.84
4	Furniture factory "Progress" Vologda	6	6	-	3.11*	30	30	-	0.3*	3.41
5	"Severstal" Steel Production Plant, Cherepovets	191	164	27	442.0	3659	3486	173	46.8	488.8
6	Ammofos Plant, Cherepovets	12	12	-	18.84*	651	651	-	7.8*	26.64
7	"Cherepovetsky Azot", Cherepovets	-	-	-	-	153	153	-	1.84	1.84
8	Steel Rolling Plant, Cherepovets	-	-	-	-	375	375	-	4.806	4.806
9	Veliky Ustug Electrical Plant	-	-	-	-	450	-	450	1.35	1.35
10	Sokolsky Pulp and Paper Mill, Sokol	-	-	-	-	20	20	-	0.24	0.24
11	Sukhonsky Pulp and Paper Mill, Sokol	-	-	-	-	30	30	-	0.36	0.36
12	Sokolremmash Plant, Sokol	-	-	-	-	2	1	1	0.024	0.024
	Total:	211	184	27	465.49	9093	4757	4336	100.682	566.172

(Please refer to Diagram 3 in Appendix)

Table 3.3.
PCB-containing equipment inventory recording for Murmanskaya Oblast

No	Enterprise	Transformers				Capacitors				Total PCB amount, t
		Total	In use	In reserve	PCB amount, t	Total	In use	In reserve	PCB amount, t	
1	Apatit Plant, Kirovsk	14	13	1	35.92	-	-	-	-	35.92
	Итого:	14	13	1	35.92	-	-	-	-	35.92

(Please refer to Diagram 4 in Appendix)

Table 3.4.
PCB-containing equipment inventory recording for the Republic of Karelia

No	Enterprise	Transformers				Capacitors				Total PCB amount, t
		Total	In use	In reserve	PCB amount, t	Total	In use	In reserve	PCB amount, t	
1	"Karelsky Okatush", Kostomuksha	10	10	-	2.05	2342	2277	65	40.28	42.33
2	Kondopogshsky Pulp and Paper Mill	-	-	-	-	62	50	12	1.07	1.07
3	Electrical Power Network of Karelia	-	-	-	-	1167	1152	15	26.845	26.845
	Total for Karelia:	10	10	-	2.05	3571	3479	92	68.195	70.245

(Please refer to Diagram 5 in Appendix)

PCDD/PCDF analysis of sovtol samples

PCDD/PCDF analysis of sovtol samples taken from a TNZ-1600 transformer manufactured in 1976.

PCDD/PCDF	Sovtol KO-M2	
	ng/g	TEQ ng/g
2378 TCDD	28.7	28.7
12378 PeCDD	58.3	29.15
123478 HxCDD	32.2	3.22
123678 HxCDD	24.4	2.44
123789 HxCDD	30.4	3.04
1234678 HpCDD	17.6	1.76
OCDD	4.5	0.0045
2378 TCDF	5392.0	539.2
12378 PeCDF	23497.0	1174.85
23478 PeCDF	44060.0	22030.0
123478 HxCDF	48808.0	4880.8
123678 HxCDF	11142.0	1114.2
234678 HxCDF	1119.0	111.9
123789 HxCDF	39450.0	3945.0
1234678 HpCDF	6133.0	61.33
1234789 HpCDF	14492.0	144.92
OCDF	2100.0	2.1
Σ TEQ		34072.614

Note: Analysis was carried out by a certified laboratory "Taifun".

Analysis of the official statistic form 2-TP-toxic wastes from the enterprises of St.-Petersburg and Leningrad area for 1999 (for comparison with the last inventory of State Committee of Russian Federation for Environmental Protection)

№	Enterprise	Location	PCB - containing oil, data from 2-TP-toxic wastes, ton	
			Was saved	Was formed
1.	Egorov carriage-repairing plant	St.-Petersburg	no data	no data
2.	Association "Phosforit"	Kingisepp	0	0
3.	Kotlyakov Machine-building factory. Data from Kotlyakov printing house	St.-Petersburg	0	0
4.	"Kirovskiy plant" Data from " Southern "Kirovets"	St.-Petersburg	0	0
5.	Plant "Transmash"	Tikhvin	0	0
6.	"Sverdlov association"	St.-Petersburg	0	0
7.	"Banner of work plant"	St.-Petersburg	0	0
8.	Kulackov plant	St.-Petersburg	0	0
9.	"Metallist plant"	St.-Petersburg	0	0
10.	"Metal plant"	St.-Petersburg	0	0
11.	"Proletarian plant"	St.-Petersburg	0	0
12.	"Nevskiy plant"	St.-Petersburg	0	0
13.	Kirov association Data from Kirov company	St.-Petersburg	0	0
14.	"LenKARZ"	St.-Petersburg	no data	no data
15.	Leninets plant Data from 6 enterprises	St.-Petersburg	0	0
16.	"Baltic plant"	St.-Petersburg	0	0
17.	"Northern shipyard plant"	St.-Petersburg	0	0
18.	"Admiralty shipyards" Data from 5 enterprises	St.-Petersburg	0	0
19.	Krasnogvardeets plant	St.-Petersburg	0	0
20.	Krasniy vyborgets plant	St.-Petersburg	0	0
21.	Paper and mill plant	Svetogorsk	0	0
22.	Karl Libkneht plant	St.-Petersburg	0	0
23.	"Izorstsky plants"	St.-Petersburg	0	0
24.	"Electrosila plant"	St.-Petersburg	0	0
25.	"Lenenergo" Data from 23 enterprises	St.-Petersburg	0	0
26.	Electric system	Vyborg	0	0

Inventory data about Hazardous Industrial Wastes from the 26 chosen enterprises of St.-Petersburg and Leningrad area for 1999

№	Enterprises	Location	The type of oil	Present oils, grade of dangers, ton.	
				Was saved	Was formed
1.	Egorov carriage-repairing plant	St.-Petersburg	no recyclable oils (3 gr. of dangers)	No data	No data
2.	Association "Phosforit"	Kingisepp		---	14,6
3.	Kotlyakov Machine-building factory.Data from Kotlyakov printing house	St.-Petersburg	Recyclable oils (3 gr. of dangers)	---	0,09
4.	"Kirovskiy plant"	St.-Petersburg		---	---
5.	Plant "Transmash"	Tikhvin	no recyclable oils (2 gr. of dangers)	19,32	37,0
6.	"Sverdlov association"	St.-Petersburg	Recyclable oils (3 gr. of dangers)	4,35 (Under the sanction)	
7.	"Banner of work plant"	St.-Petersburg	Used industrial oil (3) Used compress oil (3)	1,535 0,13	0,515 0,09
8.	Kulackov plant	St.-Petersburg	Used industrial oil (3) Used compress oil (3)	0,26 0,002	0,47 0,027
9.	"Metallist plant"	St.-Petersburg	Used industrial oil (3)	0,004	0,044
10.	"Metal plant"	St.-Petersburg	no recyclable oils (3 gr. of dangers)	16,0	14,0
11.	"Proletarian plant"	St.-Petersburg	Oil regeneration slug (2)	---	1,5
12.	"Nevskiy plant"	St.-Petersburg	no recyclable oils (2 gr. of dangers) Recyclable oils (3 gr. of dangers)	3,0 6,55	--- ---
13.	Kirov association Data from Kirov company	St.-Petersburg	Used industrial oil (3) Recyclable oils (3 gr. of dangers)	--- 1,3	--- 3,96
14.	"LenKARZ"	St.-Petersburg	No data		
15.	Leninets plant Data from 6 enterprises	St.-Petersburg	no recyclable oils (2 gr. of dangers) Recyclable oils (3 gr. of dangers) Used compress oil (3)	0,05 0,4 0,01	0,36 0,08 0,012
16.	"Baltic plant"	St.-Petersburg	Used industrial oil (3) Used compress oil (3)	--- ---	22,85 0,3
17.	"Northern shipyard plant"	St.-Petersburg	no recyclable oils (2 gr. of dangers) Used industrial oil (3)	--- ---	0,15 5,75
18.	"Admiralty shipyards" Data from 5 enterprises	St.-Petersburg	no recyclable oils (2 gr. of dangers) Recyclable oils (3 gr. of dangers)	--- ---	7,5 8,42
19.	Krasnogvardeets	St.-Petersburg	no recyclable oils	8,0	2,8

	plant		(2 gr. of dangers) Used electro-technical oils (2) Used compress oil (3)	---	0,35 0,17
20.	Krasniy vyborgets plant	St.-Petersburg		---	---
21.	Paper and mill plant	Svetogorsk	no recyclable oils (2 gr. of dangers)	54,0	46,0
22.	Karl Libkneht plant	St.-Petersburg		---	---
23.	"Izorstsky plants"	St.-Petersburg	Recyclable oils (3 gr. of dangers)	---	12,5
24.	"Electrosila plant"	St.-Petersburg	Recyclable oils (3 gr. of dangers)	---	8,0
25.	"Lenenergo" Data from 23 enterprises	St.-Petersburg	Recyclable oils (3 gr. of dangers)	0,5	0,3
26.	Electric system	Vyborg		---	---

"HOT SPOTS" REVEALED ON THE TERRITORY OF SAINT-PETERSBURG, LENINGRAD OBLAST AND NORTH-WESTERN FEDERAL REGION

Most dangerous sources of pollution on the Baltic sea have been in St.Petersburg region. They are called "hot spots" by Helsinki Commission (HELCOM) and the Government implements activities on their elimination and/or reduction of their negative effects on environment.

Verification of the work implementation is carried our by the Control Chamber of the Russian Federation.

There are the following kinds of hot spots identified by HELCOM in St.Petersburg:

- new sewage facilities
- municipal and industrial wastes
- Phosphates from waste water
- Toxic wastes

The method of choosing priority criteria of the POPs local sources on the territory of Saint-Petersburg, Leningrad oblast and North-West Federal region for analytical monitoring and detailed inventory was based upon the following: using dioxinogenic technology and/or initial data about POPs contaminating the object and/or territory as well as social importance of the object.

To these criteria corresponded:

- Syasky pulp and paper mill, where chlorine for separating and deleting of lignin from wood-pulp then for cellulose and paper bleaching is used;
- Volkhov aluminum plant: during producing of aluminum chlorine-containing and potentially dangerous technology are used;
- Waste-dump "Krasny Bor", where industrial wastes are being collected and stored as well as non-regenerating oils are burned;
- Prymorsky dump which is a non-cultivated dump of solid domestic wastes on territory of 75 hectares, storing 4.8 millions cubic meters of dump masses;
- Ashes dump of power station "2", where ashes after fuel burning are being collected and stored.

This initial list of "hot spots" may be lead further or shortened during establishing of detailed POPs inventory. However, just according to our data the Vyborg MES "EC Russia" and Svetogorsky pulp as well as paper mill ought to be added to the aforesaid list. Potential candidates in "hot spots" list are Vologda electrical net, " Severstal" and "Ammophos" plants in Vologodskaya Oblast as well.

"Hot spots" list for St. Petersburg, Leningrad Oblast and the NW Region of Russia.

Enterprises and sites	Reason for identification as a "hot spot"
1. Syas'ki Pulp and Paper Mill	HELCOM recommendation
2. Volhov Aluminum Plant	HELCOM recommendation
3. Krasny Bor Landfill	HELCOM recommendation
4. Primorskaya Landfill	Territory pollution
5. Heat Station No 2	Territory pollution
6. Svetogorsky Pulp and paper Mill	Present inventory
7. Viborgskaya Power Station of the United Energy Systems of Russia	Present inventory
8*. Vologda Electric Power Network	Present inventory
9*. "Severstal" Plant	Present inventory
10*. "Ammofos" Plant	Present inventory

The following activities have been implemented in the recent past to manage toxic wastes:

1. The Temporary Regional Codifier of wastes was developed in St. Petersburg and Leningrad area in 1988. The decisions on site selection for waste depositing and treatment are taken on the basis of the Codifier.
2. The administration of St. Petersburg (Committee on economics and industrial policy), State Committee for Ecological protection of St. Petersburg and the State enterprise "Poligone Krasny Bor" started a project on a monitoring and control of environmentally safe management of toxic industrial wastes in the year 2000.
3. There was a new methodology of assessment of Persistent Toxic Substances (PTS) release for the new industrial projects introduced in the year 2000. The assessment is made by the companies that are storing or processing PTCs.
4. Work started in the region to identify and eliminate "wild" land fills of PTS. A pilot project in the Kolpino region of St. Petersburg was implemented in 1999.
5. There was a spot monitoring of POPs presence in the tree media, soil, water and air during the last five years. Unfortunately the data are inconsistent, as several methodologies have been in use. However, presence of POPs in soils and water is well documented.
6. Work started for testing of new methodologies of POPs identification at the "Poligone Krasny Bor" with participation of "green NGOs".

CONTAMINATION LEVELS OF THE TERRITORY OF SAINT-PETERSBURG AND PCB CONTENT IN HUMAN ORGANISM

The analysis of the Saint-Petersburg territory contamination carried out in the 2000 (in the amount of 70 probes) showed that soil content of PCB in 5 from 7 zones corresponds to prearranged standards whereas in the Western and Central zones PCB concentration levels exceed **Maximal Permissible Concentration (MPC)** in 2 and 2.5 times respectively (see Appendix 4). However this data, satisfactory as a whole, does not reflect actual contamination of the city's territory because there are so called "micro hot-spots" existing near pollution sources in Saint-Petersburg and therefore the character of this contamination is "spots-like" (hotbed). Total selective data about ground contamination and ground accumulation indicates PCB presence in concentrations that here and there exceed **MPC**. Rather high figures are observed on the territories of dumps and near (thus, PCB content is 2 times **MPC** and more than figures on the territory of Kupchino, Petershof and near Prymorskaya dump). On the territory and near by exists a number of enterprises, PCB content of which exceeds MPC by 2 or more times (close to sewage stations of "Vodokanal"on the Belyi Island - in 3.5 times). On the city territory ground of Ohta River and Dolgoye Lake are contaminated (MPC exceeds the norm by 2-2.5 times). Especially high PCB concentrations in probes of soils near highways with intensive traffic should be emphasized. Maximal contaminations (more than 14 times MPC) were revealed on Levashovo – Gorelovo highway near S.Novoselky (zone influenced by Prymorsky dump) as well PCB content is 7 – 8 times MPC on the English embankment and Volkhonka highway. It's necessary to note that all the data is qualitatively equal to the observation results lead during previous years (monitoring was carried out since 1995). However the comparison of quantitative figures is incorrect in respect of another method of PCB analytical control used beforehand and at present. The electronic version of the city's territories contaminated by PCB (Appendix 3) was made on the basis of the results of PCB analytical determination carried out in 2000 for soil and ground of Saint-Petersburg. This map will be constantly renovated according to the new determinations and thus it will be the basis for PCB monitoring. In 1997 the analysis of dioxins was made in Saint-Petersburg and Leningrad oblast and it has revealed that concentration of TCDD in soil of 7 most PCB contaminated places equaled to 1.0 – 7.2 ng/kg. Taking into consideration that pectoral milk is a concentrator of POPs, investigations of a number of these toxic compounds from 40 nursing mothers were carried out and relatively high concentrations of POPs (mg/kg counting through fat) were determined:

Hexachlorocyclohexane - 372.0 ± 25.0
Hexachlorobenzene - 133.0 ± 12.5
DDT - 410 ± 18.0
PCB – 35.0

During special tests the presence of PCB in blood of 15 children, 8 men and 9 women, living in settlement Novoselky (Prymorsky dump zone of influence) and settlement Levashovo (near by military airdrome) was sighted. Average PCB level in blood: for children 0.4 and 0.285 / for men 0.82 and 1.5 / for women 1.4 and 0.53 mg/kg for Novoselky and Prymorsky respectively.

St.-Petersburg

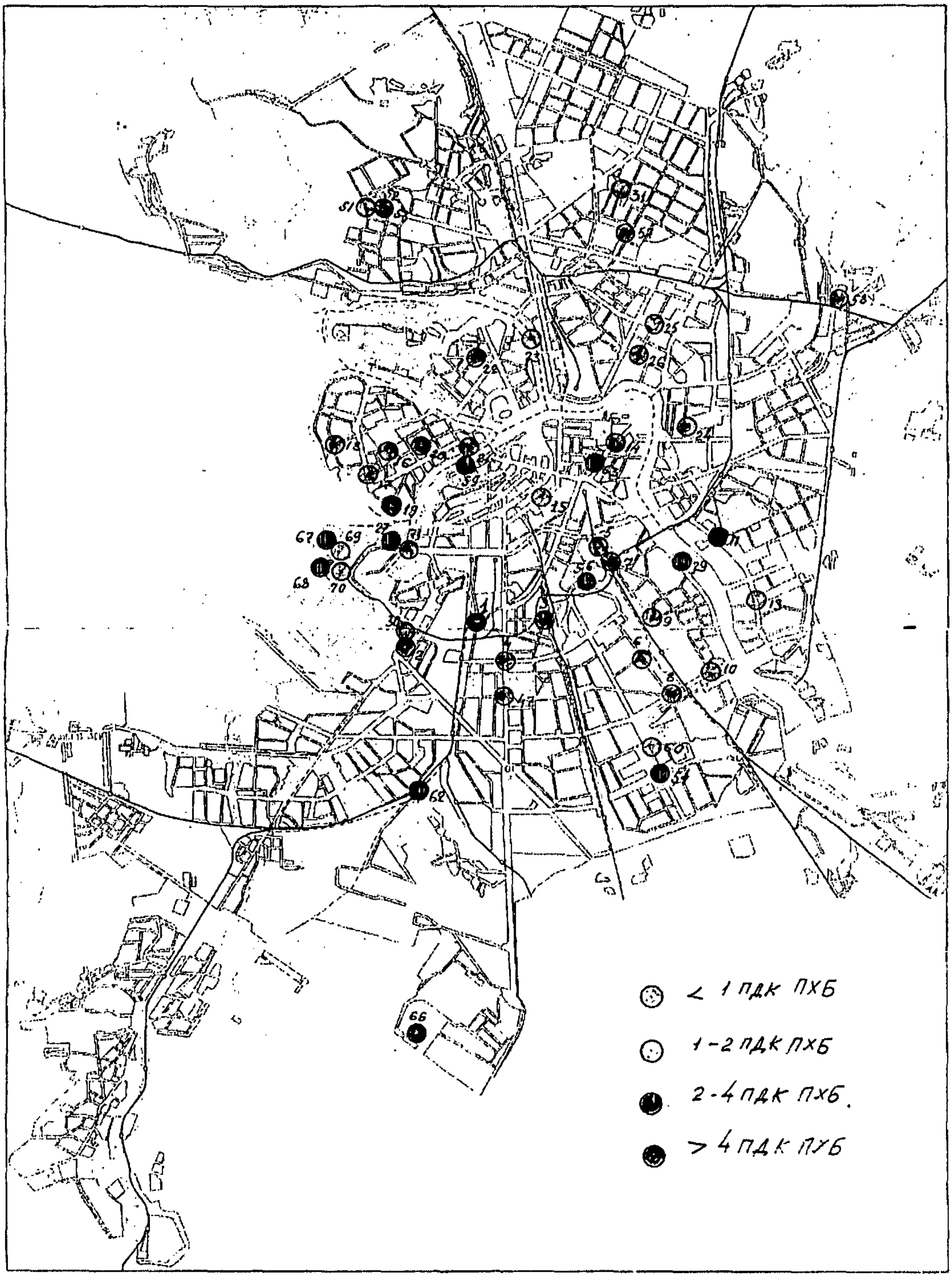

Table 4.1
The average level of PCB and DDT in St. Petersburg in 2000*

Zones of the city	Polychlorinated biphenils (mkg/kg)	DDT (mkg/kg)
North-East	29,2	29,1
North-West	19,1	29,4
East	13,3	60,8
South-East	36,6	7,6
South	112,1	155,2
South-West	16,3	18,4
Center	157,1	139,0

* the detection of PCB and DDT levels was carried out according to HPLC-method

(Please refer to Diagram 6 in Appendix)

Suppl.4.

POPs \ Medium Air (mg/cub.m) Soil (mg/kg) Water (mg/l)
MPL OSL MPL OSL MPL

Dioxins/furans (ITEQ) 0,5 pg/cub.m 0,03-01 pg/kg 20 pg/l
0,13 pg / cubm* 1 pg / l.**
0,01 pg / l*
PCB 1,0 0.06 0,001
Aldrin 0,005
Heptachlor 0,005 0,001
Hexachlorbenzene 0,003
Toxaphene 0,5
DDT 0,001 0,1 0,1

ANALYSIS OF EXISTING TECHNOLOGY AND RECOMMENDATIONS ON UTILIZATION (RENDERING HARMLESS) OF PCB, PCB-CONTAINING EQUIPMENT AND PCB-CONTAINING WASTES

Usage of PCB – containing equipment. The PCB and PCB-containing equipment inventory results showed that in the Noth-Western region of Russian Federation special attention should be paid to Saint-Petersburg and Leningrad oblasts and Vologda oblast. In Vologda oblast 85% of PCB were detected on the territory of one enterprise - Metallurgy plant "Severstal" (Cherepovetz city). In Saint - Petersburg and Leningrad oblast the main quantity of PCB is concentrated in towns – Vyborg (40%) and Svetogorsk (35%) as well as in Saint – Petersburg (24%).

Storing of PCB wastes. At present the reliable information about PCB wastes storages and contaminated territories is lacking (with exception of data mentioned in parts 2-4 of this document).

Technical aspects of PCB problem. From the technical point of view problems of transformers and capacitors are different. If transformers' PCB may be poured out easily, whilst dielectric TCB of capacitors penetrates into the paper, which swells it. Taking into consideration relatively small quantities of PCB in capacitors (17.5 kg per capacitor in average) it's rather difficult and economically unreasonable to remove PCB from them. Taking into consideration these two aspects actions should be carried out separately. Capacitors should be destroyed together with their content PCB using appropriate technology. Transformers should be liberated of PCB and then cleaned with corresponding solvents. It's necessary to elaborate and use special technology for cleaning (according to appropriate ecological standards) transformers of PCB, that remains after removal of the main volume of electro-insulating liquid. These processes shouldn't be accompanied by formation of too large quantities of contaminated solvents, that demand further utilization. Technically defective transformers must be cut onto sections and then processed to iron-scrap. Well repaired transformers may be filled by electro-insulating liquid with adequate characteristics again and then may be used several times. However the creation of such liquids is very complex and is a particular task. The destruction of PCB in regions where their estimated content is hundreds of tons may be carried out in stationary equipment specially adopted for the task and corresponding to economical demands. It's not rational to build that installations for destruction PCB in regions where PCB is present in relatively small quantities (such as Murmanskaya oblast, Republic of Karelia).

(Please refer to Diagram 7 in Appendix)

In places with small concentrations of PCB there are two alternatives to solve the problem:

1) Building mobile installations which may be transported for local PCB destruction;

2) Building mobile installations only for pouring out PCB and rendering harmless (cleaning transformers from contaminations with further transporting PCB in special containers to stationary installations for destruction.

Preliminary analysis of existing PCB destroying technology showed that technology based on thermal destruction are the most studied in Russia. In North-Western region there are two experimental installations for destroying PCB at present, working on the basis of:

- High thermal (using of jet propulsions, Cherepovetz city) and-
- Plasma chemical processes (Saint-Petersburg)

Both technologies may be taken as a basis in further work and possible designing. However similar projects have to include as well other modern technology of PCB destruction, for example cement furnaces that are being successfully used in Europe. The possibility of repeatable usage of transformers filled with alternative electro – insulating liquid without PCB present only technology of ecologically safety removing PCB from electro – technical equipment and cleaning of this equipment from PCB. Building installation device for cleaning transformers and PCB destruction may be used not only for one city or suburbs, but for the North-Western region as a whole, and especially for adjacent regions. It leads to necessity of solving technical, transport and financial problems of interregional collaboration. Moreover special attention should be paid to analytical control because during destruction PCB the formation of dioxins *de novo* and incomplete destroying of PCB is relatively possible.

New methods of PCB neutralization/destruction

Technology	Technology description
Gas-phase hydrogenation	Hydrogen reacts with chlorinated and non-chlorinated organic substances under high temperature decomposing them into methane and hydrogen chloride. The system is closed and does not emit into the environment.
Electrochemical oxidation	Electrochemical cell emits oxidants in an acid solution. The oxidants attack organic substances, which are then decomposed into carbon dioxide, water and non-organic ions.
Melted metals	Under a high temperature in a steel furnace organic materials together with metal are decomposed into gases and metals, which can be recycled and the inert wastes can be removed and send to other waste treatment facilities.
Melted salts	Organic compounds are injected into a melted alkaline salt with a temperature about 1000^0C. Then organic compounds are decomposed and non-organic salts are generated. Non-organic salts are kept in salt trap and must be taken to the place of its safe treatment.

Process of electron solvation	It obtains halogens from organic substances by means of caustic solution, which has enough free electrons and metal cat ions.
Supercritical oxidation of water	Organic compounds are dissolved in a supercritical amount of water under high temperature and pressure. Non-hazardous substances are generated.
Plazmatron	Wastes are injected into a Plazmatron arc under extremely high temperature of 5000-15000^{0}C so that all chemical substances are decomposed into atoms.

Existing technology of POPs neutralization

Technology	Technology description	Notes
High temperature combustion	Proper destruction of organic substances requires high temperature combustion, not less than 1200°C, retention time min 2 seconds and final destruction efficiency not less than 99,99%.	It is necessary to control gas emissions to prevent generation of secondary toxic substances such as dioxins, furans and etc. The community is traditionally very negative to incineration of wastes, especially to incineration of hazardous wastes.
Cement furnace	In some countries cement furnaces are used for destruction of hazardous wastes. In principal only those chemicals, which emit a lot of heat when incinerated, can be used together with oil and gas. But the resulting wastes must be again somehow treated.	Compared to the high temperature incineration units modern cement furnaces often provide higher technical characteristics, longer retention time, more effective system of oxygen injection and consequently they reach the same or even higher efficiency of destruction.
Chemical treatment	Chemical treatment can be used for decomposition of hazardous wastes into different components. This method has no or very limited impact on polluted materials or containers and actually poses a hazard to the population and environment because many processes are hazardous themselves.	This process tends to be very specific and aimed only at one chemical one time. Common waste is usually a composition of many different chemical substances, so it is very seldom when we can get sufficient amount of one particular substance to pay back the costs of chemical treatment.
Hazardous wastes disposal landfill	To make a landfill we need to construct an isolated water tide site based on stabile and sound soils far enough from ground water table and lakes.	The landfill must be equipped with facilities for collection and treatment of gas and filtrate emitted by wastes. It is forbidden in the EU and in the USA to construct landfills for hazardous wastes disposal.

CRITERIA ANALYSIS OF DOMESTIC FILTERS EFFECTIVENESS FOR PURIFICATION OF DRINKING WATER FROM CHLORINE-CONTAINING ORGANIC POLLUTANTS

We have analyzed more than 120 different companies that produce domestic filters for purification of drinking water from Cl-organic pollutants. As a result, it was found that the most serious study of Cl-testing was made by "Aquaphore", "Instapure" and " Emerald" companies (Appendix 6).

The most convincing data exists about RO (reversed osmosis) filters, electrochemical filters as well as filters produced by "Aquaphore" company. It is important that all adsorbent filters should work only a short time and after 2-3 months cartridge must be changed. However it is very hard for a common consumer to determine this moment. That's why it would be desirable to provide the consumers right protection unions by cheap photometers produced by "HACH"

Company: DR 2010, UV-VIS DR 4000, DR 890 and DR 860 (approx. 2000-2700 $).

Some domestic filters purificating drinking water from Cl-containing organic pollutants.

trademark (country)	Effectiveness of purification from Cl-organic comps, %	Producti-vity, l/ hr	Resource, liters	Method of purification (adsorbent)	Price $
"Rosa" (Russia)	**75**	10	5000	Carbon filter	5.5-17
"Barrier" (Russia)	**76**	3	500	Activated carbon	11.5
"Brita" (Germany)	**70**	1	150	Activated carbon	20.5-26
Aquaphore (Russia)	**> 95%**	0,5-1,5	1000-15000	Activated carbon	7
Instapure F-3CE(USA)	**74**	180	760	Activated carbon	28
Instapure RO - 100	**90**	15-23 per day	2-3 years	Reversed osmosis	650
ATOLL (USA)	**90**		1,5 - 2 years	Reversed osmosis	300-400
"Emerald" (Russia)	**98**	60-120	2 000 000 5-10 years	Electro-chemical	110

RECOMMENDATIONS ON FORMATION OF MECHANISM FOR REMOVAL OF HANDICAPS FOR ELIMINATION OF POPS AND ECOLOGICAL SAFETY PROVISION

- For removal of handicaps for ecological safety provision and elimination of POPs the elaboration and replenishment of database on POPs resources in region is necessary. Lists of PCB-containing and contaminated equipment, as well as register of ecologically well-grounded technology that render harmless and destruct POPs. Such modern information and provision of objectives may serve as one of the mechanisms to persuade authorities of North-Western Federal region to realize the danger of dioxins and find possibilities to solve the problem.
- Special attention should be paid to adequate data provision about volumes of PCB and other POPs, their transformation and migration (including trans-boundary transfer) within "hot spots" of North-Western region of Russian Federation. Therefore it's necessary to stimulate investigations on elaboration of ecologically well-ground methods of rehabilitation of contaminated territories and alternative PCB dielectrics, as well as stimulate investigations on accumulation studying, changes and natural migration of POPs- toxicants within ecosystems and food chains on territories of North-Western Federal region.
- It's advisable to elaborate effective conditions to carry out monitoring of POPs – contaminations on territories that are potentially dangerous in the region (volume, periodicity, methods unification) and technical support (formation of special laboratories provided with modern devices of analytical control). Further monitoring should be directed onto formation of whole picture regarding territory contamination by POPs- toxicants through transfer from "spots" inventory (Saint-Petersburg and Leningrad oblast) to "regional" (North-Western Federal region) through recruitign experts of region.
- For harmonization of approved in Russia hygienic standards on POPs according to international recommendations and demands as important juridical mechanism it's necessary to introduce corresponding proposals to local authorities as well as federal laws "about wastes of production and consumption", "About sanitary-epidemiological prosperity of population" and "about industrial safety of dangerous manufacturing objects".
- Database on potential sources of pollution by PCB and dioxins should be formed considering new data about unknown sources such as industrial military wastes, accidents and fires on electrical networks, transformer stations, industrial zones, fired buildings, motor exhaust gases, as well as following sorts of activity: cleaning of rivers and channels, equipment repairing, PCB –containing oils regeneration etc.
- Technology for rendering harmless or destruction of POPs (mainly waste burning installations and incinerator plants) exist, work or are planned to be used in the North-Western Federal region as a rule don't correspond in full measure to modern ecological demands; (in the region and outside because of trans – boundary transfer) it's desirable to use all possible legal opportunities of parties, social organizations, civil and administrative structures for lobbying through and installation presented itself in a good

plasma chemical installations and ecologically acceptable methods of high thermal destruction POPs.

- Effective mechanism to achieve set aims is juridical elaboration and stating of demands for: limitation of producing, application, import and export of PCB-containing equipment (what concerns producers, importers, customs); contraction of package quantities to destroy, instillation of repeatedly used package, use of returned and repeatedly filled package for production and wastes, containing PCB, unified estimation of effectiveness of domestic filters purification of drinking water, providing tests and certify organizations by express analytical control devices (for example DR 890 and DR 860 produced by HACH company).
- In case of emergency situations and technogenic accidents for preventive measures against POPs poisoning, recommendations and propaganda through mass media rational living standards (gymnastics, food with natural adsorbents, fats with vegetables, vitamins and anti oxidants) are desirable. People who were poisoned by dioxins, PCB and other POPs are recommended to use adsorbent therapy (pectine mixtures, carbon-adsorbents), anti oxidant therapy (ascorbic acid, vitamin E, preparation of amber acid – reamberin and citoflavin).
- For solving POPs problem interaction and assistance of Federal and local authorities – The Ecology Committee of State Duma, machinery of President's Plenipotentiary Representative in North-Western Federal region, Administrations of Saint-Petersburg and Leningrad oblast, as well as of non-governmental organizations are extremely necessary.

ADVANTAGES AS A RESULT OF THE PROJECT

Not only the Baltic sea nations will be enjoying the advantages resulting from the project, but also the whole planet will indirectly benefit through them.

Environmentally sustainable economic development of that part of Russia: Persistent Organic Pollutants (POPs) can injure human health and ecosystems at locations nearby the site from which they escape into the environment and also at very far distant from that site. Because of their unique properties, POPs do not respect national boundaries, and therefore pose a special kind of challenge that makes it impossible for any one-nation acting alone to remedy the problems. The implementation of cost-effective and clean, environmentally sound technologies for destruction, detoxification and containment of obsolete stockpiles of POPs would support environmentally sustainable economic development of the North-West Russia.

Conservation of Biological Diversity of the Baltic sea: The risks posed by POPs have become increasing concern in many countries around the Baltic sea due to their inherent toxicity; they can impact adversely on wildlife, marine life, domestic animals and humans. POPs can travel very long distances and move upwards in the food chain.

Improved water quality of the Baltics: POPs routinely escape from storage sites and from contaminated locations into the wider environment by votalization, by ground and surface water run-off and by other means. By providing the framework for the destruction and cleanup of obsolete pesticides and hazardous industrial chemicals, the project will therefore contribute in preventing future contamination and treats to the quality of the global hydrological cycle.

Applicable models: Other part of Russia and some Baltic countries lack adequate and appropriate technical capacity to properly destroy obsolete stocks of POPs (and some other persistent toxic substances or PTS) and/or remediate PTS-contaminated environmental reservoirs. This project would provide a model to address the POPs issue in these regions.

Reduction of risk of technological disasters. New POPs elimination technologies would reduce risks of major technological disasters.

CONCLUSION

1. The first step to accept concrete measures for removal of handicaps for elimination of POPs and safety provision is records of searchers and volumes of POPs contamination. According to the official data provided by the records in Saint-Petersburg and Leningrad oblast the total amount of PCB in equipment is 1113.686 tons, in Vologda oblast – 566.2 tons, in Karelia – 70 tons and in Murmansk oblast – 36 tons. The results of complex analysis allow to assume, that volumes of PCB in North-West region of RF are significantly reduced, and the number of enterprises is not represented in the report.

2. According to the laboratory results and analytical research of transformer oil, the last one contains significant amounts of dioxins and furans (34.1 mg/kg). Thus we could conclude, that according to the cited above data, on the territory of the North-Western region of Russian Federation no less than 60 kg of supertoxic compounds dioxins/furans is possibly located at present.

3. According to the elaborated criteria, 7 "hot spots" were picked out on the territory of SPb, Leningrad oblast and North-West region, that require constant monitoring of existing or incoming POPs: Syas'sky Pulp and Paper plant (Syasstroy, Lenoblast), Volkhov aluminium plant (Volkhov d., Lenoblast), Primorsky dump (Primorsky d., Saint-Petersburg), Power station-2 (Smolny d., Saint-Petersburg) Svetogorsky Pulp and Paper Plant (Vyborg d., Lenoblast) and Vyborg interregional electrical network. Vologda electrical network, Metallurgical plant, "Severstal" and "Ammofos" enterprise could be candidates to that "hot spots" group.

4. The monitoring of Saint-Petersburg territory revealed high levels of PCB content (in some cases dioxins content as well) in soil, especially near by Prymorskaya dump and Power Station 2, just as PCB presence in pectoral milk of nursing mothers and blood of citizens (including kids) of these places. The electronic version of the city's territories contaminated by PCB was made on the basis of the results of PCB analytical determination carried out in 2000 in soil of Saint-Petersburg. This map will be constantly updated according to new data and thus will be the basis for PCB monitoring.

5. The analysis of existing technology that render harmless or destruct PCB, PCB-containing equipment and PCB-containing waste show that most of them don't correspond in full measure to modern ecological safety demands. The most advanced methods to destruct POPs in North – Western Federal region are the method of super high- thermal destruction (using of jet propulsions) and the method of plasma arc.

6. The main efficiency criterion of household filters for cleaning potable water from chloral-organic pollutants (including POPs) is the correct methodology for chloral-organic detection. It was used by SES and ROSTEST during issuing of hygienic certificate or quality certificate on some marks, modification filters imported on territory of Russian Federation. Among these, the electrochemical and reversed osmosis

membrane filters are being used and are the most effective.

7. Scientifically based recommendations were proposed for complex providing of ecological safety in Saint-Petersburg, Leningrad oblast and North-Western Federal region, including both concrete measures of objective and adequate information as well as proposals to local and federal administrative and juridical authorities such as elaboration of federal "Law on POPs", the initiation of amendments to the existing federal laws on "Industrial and household wastes", on "Sanitary-epidemiological well-being of population", "On Industrial safety of dangerous production sites" (for example, on dioxins, PCBs and other POPs standards harmonization) in particular.

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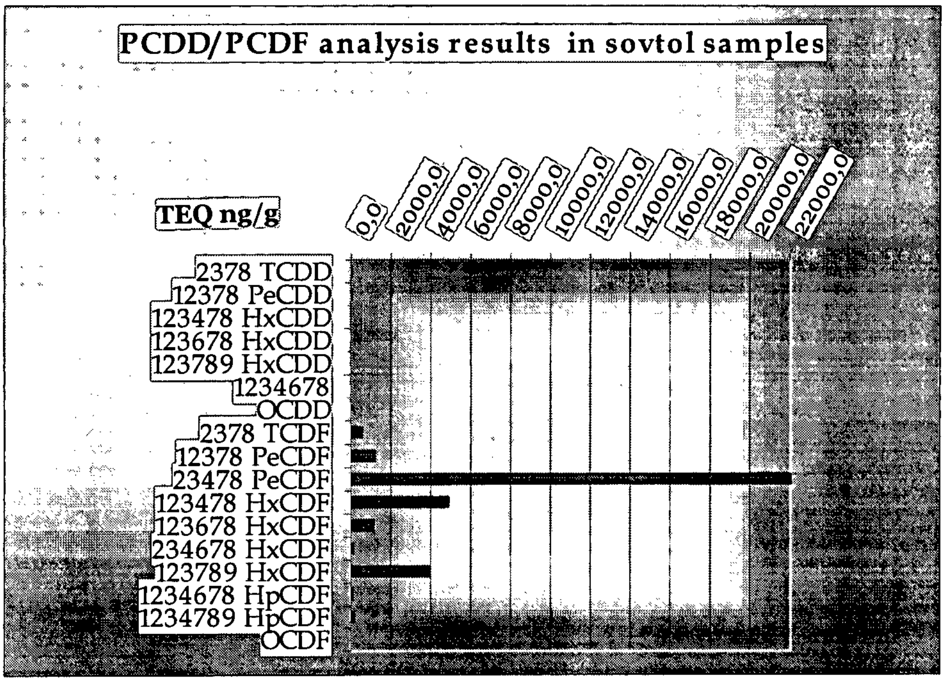
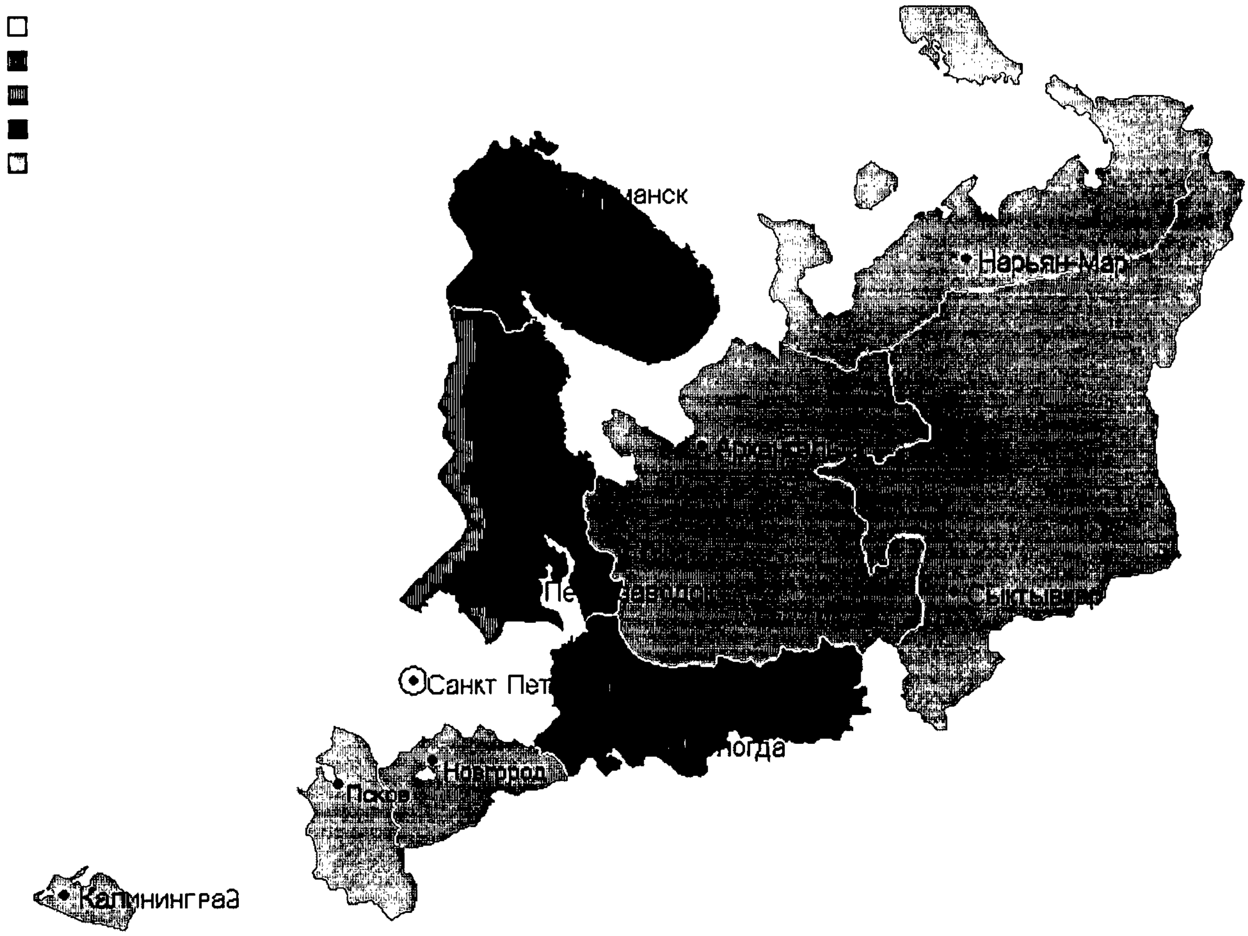
EXECUTIVE SUMMARY

Diagram 1 *(referring to the page 3 of the Final Report)*



NORTH-WESTERN REGION OF RUSSIA: GENERAL INDUSTRY OVERVIEW AND NEGATIVE ENVIRONMENTAL FACTORS

Graph 1 *(referring to the page 7 of the Final Report)*
Accumulative quantity of POPs in equipment according to analysis of 1999



The North-Western International Cleaner Production and Environment Management Centre (NWICP & EMC) aims at helping the North-Western part of Russia, notably St. Petersburg and Leningrad region, and Kaliningrad Province (Baltic region), Murmansk and Arkhangelsk Province, Nenetsky autonomous region (Barents nor Arctic region), Karelia and Komi Republics to solve the accumulated environmental problems associated with non-processed waste, industrial and municipal waste management, weaponry, military equipment and munitions waste as well as managing nuclear and radio-active waste and military arsenals and warehouses to prevent environmental disasters from happening and to preserve the large marine ecosystems of the Baltic and Barents Seas, which is surrounded by 10 European states.

Russian North-Western Federal District includes 11 Federal subjects of Russian Federation:

1. Saint Petersburg
2. Leningrad district
3. Kaliningrad district
4. Pskovskaya district Zemlja
5. Novogorodskaya district
6. Vologodskaya district
7. Republic of Karelia
8. Republic of Komi
9. Nenetskyi autonomous district
10. Arhangelsk district (incl. islands Novaya and Kolguev)
11. Murmanskaya district

PRIMARY INVENTORY OF PCB-CONTAINING EQUIPMENT AND PCB-CONTAINING WASTES ON THE TERRITORY OF SAINT-PETERSBURG, LENINGRAD OBLAST AND NORTH-WESTERN FEDERAL REGION

Diagram 2 *(referring to the page 23 of the Final Report)*

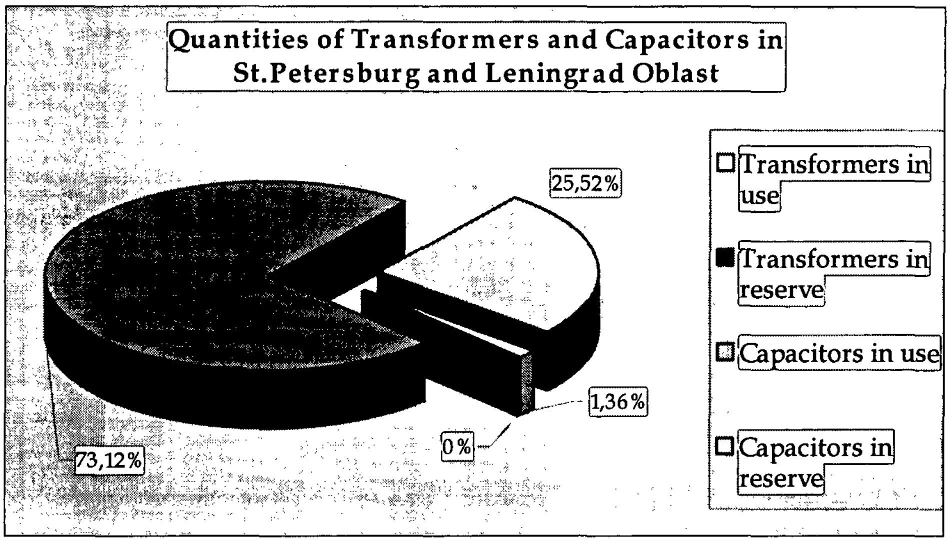


Diagram 3 *(referring to the page 24 of the Final Report)*

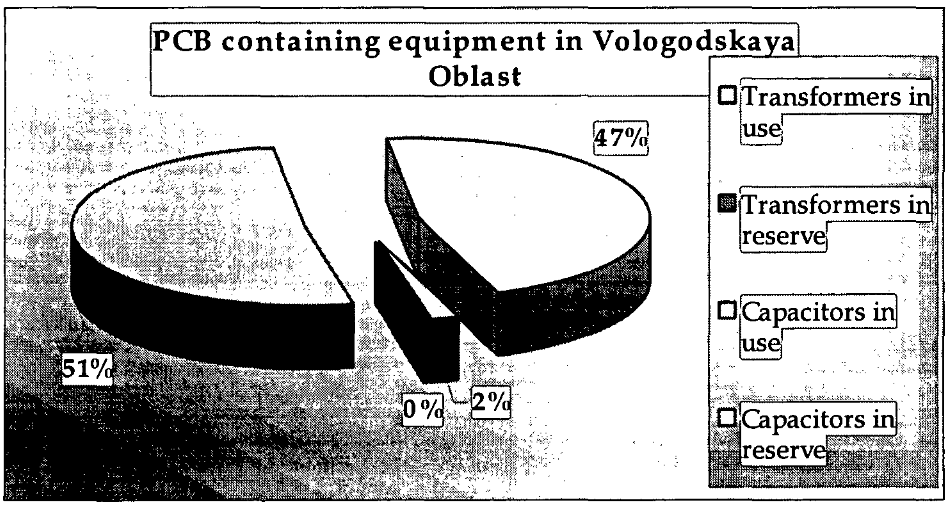


Diagram 4 *(referring to the page 25 of the Final Report)*

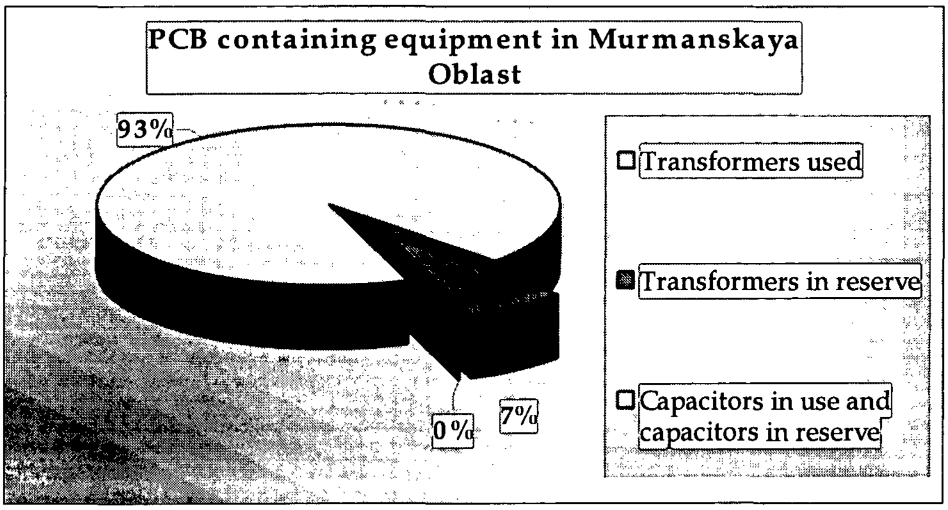


Diagram 5 *(referring to the page 25 of the Final Report)*

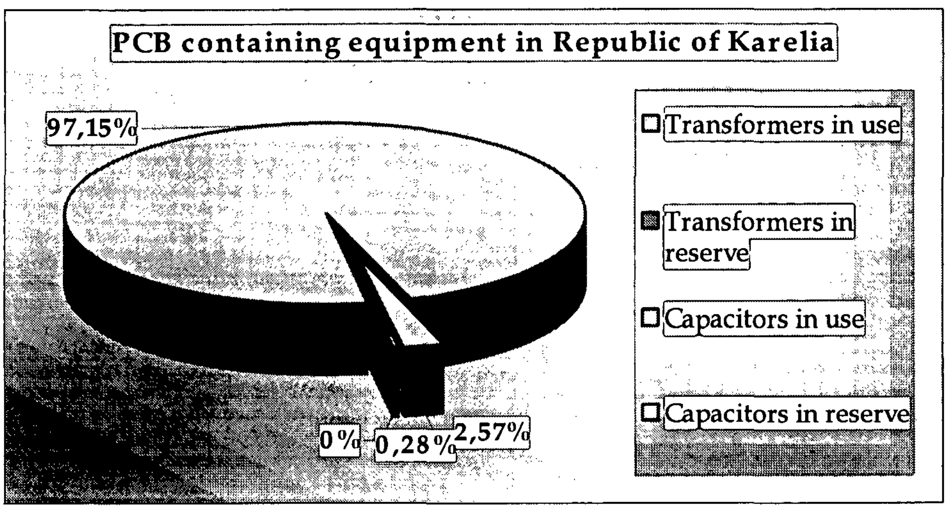
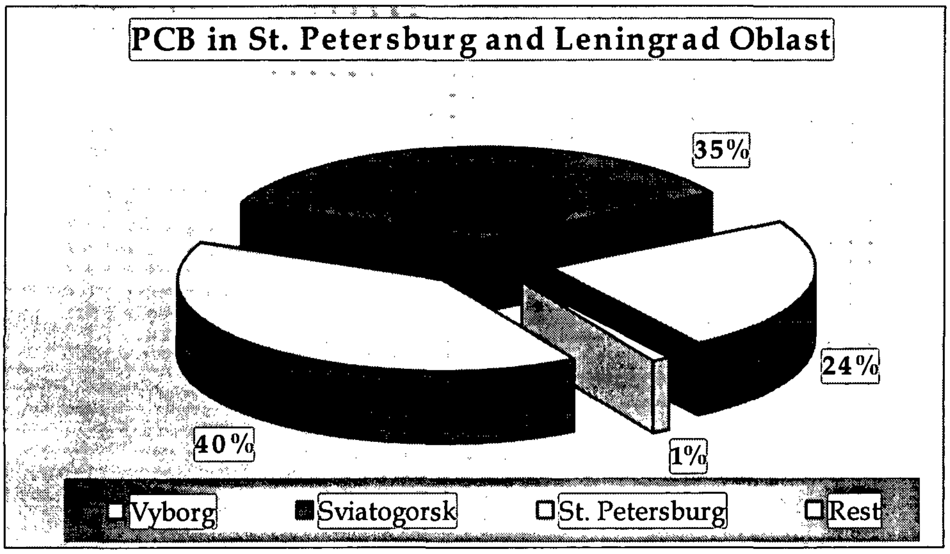


Diagram 6 *(referring to the page 34 of the Final Report)*



THE ANALYSIS OF EXISTING TECHNOLOGY AND RECOMMENDATIONS ON UTILIZATION (RENDERING HARMLESS) OF PCB, PCB-CONTAINING EQUIPMENT AND PCB-CONTAINING WASTES

Diagram 7 *(referring to the page 35 of the Final Report)*