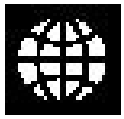
Ministry of Natural Resources and Environmental Protection of the Republic of Belarus



World Bank

The National Plan
of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028

Minsk
2006

УДК 341:349.6:504:574:628:632:661
ББК 20.1:20.18:26.222:26.23:26.35:28.080:30.69:35.33:40.3:51.21(4Беи)
Н35

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Н35 **The National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028** / Ministry of Natural Resources and Environmental Protection of the Republic of Belarus, Global Environment Facility, World Bank. – Minsk: Belsens, 2006. – 183 p.: illustrated.

ISBN 985-6474-66-3 (англ.)
ISBN 985-6474-65-5 (рус.)

This publication was compiled by the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus in the framework of the implementation of the project GEF TF 053865 "Enabling activities related to the implementation of the Stockholm Convention on persistent organic pollutants (POPs) in the Republic of Belarus".

It includes the National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028, and the experts' reports, which give a complex analysis of the current situation in the sphere of POPs management in the Republic of Belarus.

The book is designed for the specialists of the governmental bodies, environmental research organizations, educational establishments, as well as for the attention of general public.

The book comprises: 61 tables, 29 figures and illustrations, 5 photographs, list of references (208 sources).

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ISBN 985-6474-66-3 (англ.)
ISBN 985-6474-65-5 (рус.)

REPUBLIC OF BELARUS

NATIONAL IMPLEMENTATION PLAN FOR THE STOCKHOLM CONVENTION ON PERSISTANT ORGANIC POLLLUTANTS

Introduction and Context

This document is submitted to the Conference of the Parties to the Stockholm Convention (the Convention) by Ministry of Natural Resources and Environmental Protection on behalf of the Government of Belarus as the National Implementation Plan (NIP) of the Republic of Belarus in fulfillment of its obligations under Article 7 of the Convention.

Recognition by the world community of a global threat of persistent organic pollutants (POPs) initiated an international agreement aimed at addressing the problem of POPs. This agreement known as the Stockholm Convention on Persistent Organic Pollutants has the overall objective to protect human health and the environment from the impact of POPs.

The Stockholm Convention came into force on 17 May 2004 after more than 50 countries officially ratified or acceded to it. At present more than 130 countries are the parties to the Stockholm Convention.

The Republic of Belarus officially acceded to the Stockholm Convention in February 2004 assuming alongside with other countries obligations to address the problem of POPs and became a founding Party to the Convention when it came into force.

In accordance with Resolution of the Council of Ministers of the Republic of Belarus "On implementation of the provisions of the Stockholm Convention on persistent organic pollutants" of 5 March 2004 No. 237 the Ministry of Natural Resources and Environmental Protection was defined as the lead governmental body responsible for meeting the obligations under the Stockholm Convention.

In the period of 2004–2006 the Ministry of Natural Resources and Environmental Protection in cooperation with the World Bank undertook development of a formal National Plan aimed at addressing the POPs issue in Belarus, which is presented herein. The approach of developing a formal Nation Plan in accordance with the procedures used for the development, presentation and endorsement was adopted to ensure that the commitments made therein would have full legal effect and budgetary support once endorsed by the Government. This work was supported by an Enabling Activities grant from the Global Environmental Facility (GEF).

This National Program, known as the "*National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the Period of 2007–2010 and until 2028*" (hereinafter referred to as the National Plan) is approved by Resolution of the Collegium of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus of 1 November 2006 No. 11/4 and now has full legal and budgetary authority for its implementation. This National Plan along with the supplementary material provided in this document constitutes the National Implementation Plan for the purposes of meeting the Republic of Belarus' obligations under Article 7 of the Stockholm Convention.

This National Implementation Plan document is present in the following parts:

- Introduction and Context
- Policy Statement of the Government of the Republic of Belarus
- National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028
- Supporting Documents on POPs Inventories, Health and Environmental Monitoring respecting POPs and Legal/Institutional Capacity Assessments prepared in developing the National Plan and NIP.

The measures that are to be undertaken under the National Plan are contained in the Action Plan, which defines a number of priority activities to be undertaken in the period 2007-2010. These also serve as the detailed measures intended to address the country's specific obligations under the Stockholm Convention during this period. The attached table A lists these priority activities along with a summary description and a cross reference to the Stockholm Convention Articles that they specifically address. It is recognized that longer term measures will also apply and these are likewise listed in the National Plan, including provision for flexibility to accommodate changes in the Stockholm Convention including the addition of new POPs.

Table A

Compliance of the National Plan with the provisions of the Stockholm Convention

Action Plan for Priority Measures – 2007 through 2010

Action Plan Component / Priority Task	Description	Convention Provision
1.0 Legal, Regulatory and Institutional Measures		
Task 1.1 ensuring regulation of relations pertaining to the management of polychlorinated biphenyls and POPs chlororganic pesticides.	Measures required to update regulations related to chemical bans/restrictions, waste management, monitoring, norms/standard, registration of sites/ equipment and give legal effect to various NIP activities.	Article 3, Annex A, Annex B
Task 1.2 regulatory framework for monitoring of persistent organic pollutants in the environment.	Elaboration of the methodological framework for monitoring of persistent organic pollutants in ambient air and water eco-systems.	Article 3
Task 1.3 upgrading of regulatory framework for recording unintentional releases of persistent organic pollutants to the environment.	Development and enforcement of the regulations ensuring the inventory, recording and setting of the norms of unintentional releases of persistent organic pollutants.	Article 3
2.0 Institutional Framework for the Management of Persistent Organic Pollutants		
Task 2.1 improvement of the institutional arrangements for the management of persistent organic pollutants.	Optimization of the institutional framework for the management of persistent organic pollutants within the Ministry of Natural Resources and Environmental Protection improvement of POPs management and control system.	Article 3
Task 2.2 provision of the information on POPs management to the government bodies.	Establishment of the specialized database on POPs monitoring within NEMS information system.	Article 11
Task 2.3 reporting on the measures taken to implement the provisions of the Stockholm Convention.	Reporting to the official bodies of the Stockholm Convention on the fulfillment of the obligations assumed by the Republic of Belarus.	Article 9
Task 3.0 Management of POPs Pesticides		
Task 3.1 ensuring environmentally sound storage and disposal of the POPs obsolete pesticides.	Development of a centralized storage facility based on the existing facility in Chechersk (the Gomel region) and other locations as required.	Article 6, Annex A, Annex B
Task 3.2 prevention and reduction of harmful impact of obsolete pesticides burial sites on the environment.	Completion of the elimination of distributed OP storage sites, re-packaging, and removal to secure storage facilities, all inclusive of training and packaging materials.	Article 6, Annex A, Annex B
4.0 Management of the Equipment, Materials and Wastes Containing Polychlorinated Biphenyls		
Task 4.1 identification and recording of PCBs stockpiles and PCB-containing equipment, materials and wastes.	Completion of identification, inventory and labeling of PCB-containing equipment and wastes with PCBs content above 50 mg/kg.	Article 6, Annex A
Task 4.2 collection and environmentally sound storage of PCB-containing equipment, materials and wastes.	Environmentally sound collection and temporary storage of dismantled equipment.	Article 6, Annex A
Task 4.3 disposal of PCB-containing equipment, materials and wastes.	Development of long-term plans for disposal of PCB-containing equipment, materials and wastes; approval of the plans with by the MNREP.	Article 6, Annex A
Task 4.4 clean up of sites contaminated by polychlorinated biphenyls and remediation of the affected environment.	Capture and containment of the most contaminated soils from the sites where PCB leakage and spillage are recorded and ensuring their environmentally sound storage.	Annex 6 (e), Annex A–C
Task 5.0 Development of Monitoring of Persistent Organic Pollutants in the Environment		
Task 5.1 upgrading of technical and analytical capacity for monitoring of persistent organic pollutants in the environment.	Upgrading equipment for POPs analysis along with associated methodological and training support at regional regulatory laboratories for routine monitoring of POPs (PCBs, POPs pesticides) and at least one national specialist laboratories mandated for POPs work and support of the NEMS and health monitoring programs to allow a certified national capacity for PCDD/PCDF analysis.	Article 11(1), Annex E

6.0 Human Health Monitoring		
Task 6.1 organization of monitoring of POPs chlororganic pesticides and polychlorinated biphenyls in food products and drinking water.	Expansion of health related monitoring in food and drinking water for POPs Pesticides and PCBs.	Article 11(1), Annex E
Task 6.2 identification of the categories of the population and workers potentially exposed to POPs pesticides, polychlorinated biphenyls, dioxins and furans.	Methodological support of monitoring of contamination of workers by POPs pesticides and levels of PCBs in blood and biological secretion	Article 11(1), Annex E
7.0 Unintentional releases of persistent organic pollutants		
Task 7.1 priority measures aimed at reduction of unintentional releases of persistent organic pollutants.	Covers practical measures for prevention of random combustion of communal and industrial wastes and other activities for reduction of unintentional releases of POPs.	Article 5, Annex C
8.0 Exchange of Information with the Parties to the Stockholm Convention		
Task 8.1 establishment of the national network for the exchange of information relating to the management of persistent organic pollutants and undertaking of regular exchange of information with the Secretariat of the Stockholm Convention.	Establishment of national information centre and web access capability for POPs information, facilitate exchange information exchange among stakeholders and maintain national reporting of POPs information consistent with Convention obligations. Contribution by the country to international exchange activities.	Article 9, Article 11(a)
9.0 Public Information, Awareness and Education		
Task 9.1 provision to the Belarusian people of the information on the main types and sources of persistent organic pollutants, their health and environmental effects and the rules of handling persistent organic pollutants.	Distribution of POPs related information via written material, workshops and Web based tools.	Article 10
Task 9.2 development and implementation of training programs on the management of persistent organic pollutants in the Republic of Belarus; training of managerial personnel, scientists, educators and workers on the issues relating to the management of persistent organic pollutants.	Training on POPs management for regulatory enforcement personal, industrial technical; staff and other affected stakeholders.	Article 10
Task 9.3 coverage of POPs related issues in the national mass media.	Public information dissemination via mass media.	Article 10
Task 9.4 involvement of the public in decision-making relating to the management f persistent organic pollutants.	Participation of HGOs in addressing the POPs issues.	Article 10
10.0 Research Pertaining to the Management of Persistent Organic Pollutants		
Task 10.1 optimization of research pertaining to environmentally sound management of polychlorinated biphenyls.	R&D activities and evaluation of international technology and practice related to decontamination of PCB containing equipment and PCB soil contamination.	Article 6, Annex A
Task 10.2 studies focusing on clean up and remediation of sites contaminated by persistent organic pollutants.	R&D activities and evaluation of international technology and practice related to decontamination of PCB containing equipment and PCB soil contamination.	Article 6, Annex A
Task 10.3 development of research pertaining to the management of unintentional releases of persistent organic pollutants.	R&D activities and evaluation of international technology and practice related to reduction in unintended releases.	Article 5, Annex C

The Government of Belarus considers this NIP in the international context and for purposes of its implementation in the country it is regarded as one of the major governmental programs of action on environmental protection with the objective of prevention and minimization of the negative impact of POPs on the environment and human health. Its main outcomes are ultimate elimination of use and unintentional production of POPs, environmentally sound disposal of POPs stockpiles, and capacity to likewise proactively deal with new POPs, all within a framework of rational chemicals management. In this regard, the Republic of Belarus fully accepts and endorses the concept that these documents are dynamic in nature and are subject to review and updating on a periodic basis as may be specified by the Conference of the Parties.

The NIP has been prepared in an open and transparent process involving a wide range of stakeholders, including extensive involvement of national and international non-government organizations. Similarly, it has benefited from cooperation with a wide range of international organizations.

The Republic of Belarus has over the last number of years invested significant resources into addressing POPs related issues and with endorsement of the National Plan pledges a continuation and increase in this commitment to its implementation. In the framework of established government programs Government budget and Environment Protection Fund allocations for POPs related issues over the period 2001 to 2006 have been US$ 5,352,030. Additionally, in 2005 the government invested US$ 1,300,000 of budget and Environment Protection Fund funds in the reconstruction of a secure centralized hazardous waste storage facility meeting international standards and which serves as the centralized storage of POPs pesticides and other obsolete pesticides. Additional secure storage facilities are being developed for the centralized storage of PCB-containing wastes, with US$ 2,200,000 being invested by the end of 2006. During the period of 2007-2010 more than US$ 5,000,000 will be allocated for the development of additional operational POPs management capacity and further commitments of US$ 2,000,000 over the period 2007–2010 for the national budget and Environment Protection Fund financing are proposed in the National Plan. This is in addition to approved commitments of US$ 1,471,000 for POPs related monitoring within the NEMS and heath monitoring programs over this period.

In recognition that this would be facilitated and accelerated with international assistance, the Republic of Belarus has completed and submitted a proposal to the Global Environmental Facility through the World Bank for additional resources in the period 2007–2010 to co-finance priority activities detailed in the National Plan that are eligible for such assistance.

In conclusion, the Ministry of Natural Resources and Environmental Protection and the World Bank would like to express their gratitude to all the ministries, enterprises, academic and scientific institutions, local and international non government organizations, other international organizations including the Secretariat and UNEP Chemicals, and particularly individuals in Belarus for their support and assistance in elaboration of the National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028.

Policy Statement of the Government of Belarus on Addressing Persistent Organic Pollutants

Belarus acceded to the Stockholm Convention on Persistent Organic Pollutants (the Convention) in February 2004 in accordance with Decree of the President of the Republic of Belarus of 23 December 2006 No. 594. Since that time, the country has directed its efforts to undertaking the appropriate measures for prevention of the negative impact of Persistent Organic Pollutants (POPs) on human health and the environment. These on-going activities resulted in the development of the *"National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028"*. This document also forms the basis for the country's National Implementation Plan on Persistent Organic Pollutants (NIP) required under Article 7 of the Stockholm Convention.

The priorities of the national POPs management policy legalized in the National Plan and NIP include:

- Improvement of the Belarusian legislation, institutional and regulatory frameworks for the POPs management;
- Environmentally sound handling, storage and disposal of the existing POPs stockpiles and wastes containing persistent organic pollutants;
- Identification, assessment and priority clean up of POPs contaminated sites and remediation of the affected environment;
- Development of the national analytical, technical and personnel capacity for monitoring and analytical control of persistent organic pollutants in the environment and health monitoring;
- Reduction and elimination of unintentional releases of persistent organic pollutants through the use of the best available techniques and the best environmental practices;
- Limitation, regulation and control of productions and processes generating persistent organic pollutants.

Implementation of the activities and strategies of the National Plan will ensure Belarus' compliance with its obligations under the Stockholm Convention, and both maintenance of that status and proactive address of ongoing POPs management requirements and future measures adopted under the Convention.

Elaboration of the National Plan and NIP is consistent with the country's strong commitment towards a better environment and healthier population. On the whole Belarus attaches a high policy priority to environmental protection and specifically to issues associated with chemicals management and trans-boundary movement of pollutants. The latter has been the basis of the country's current and sustaining commitment to POPs management. The country's overall policy commitments are reflected both in the scope of its participation in relevant international conventions and in the basic national legal and regulatory framework to control these issues. Underlying Belarus' commitment to addressing the POPs issue is the country's inherent and perhaps unique sensitivity to and direct experience with situations where the results of industrial activity and application of modern technology result in contamination affecting the health of its population and economic prospects.

The principles of the government policy in the field of the use of chemicals including POPs are embodied in the laws of the Republic of Belarus, the overall one being the Law of the Republic of Belarus *"On Environmental Protection"* of 26 November 1992 (amended in 2002). This is supported by a system of more specific laws and regulations covering the basic aspects of POPs management including waste management generally, hazardous waste management, environmental monitoring, transportation of dangerous goods, registration of chemicals and pesticides, specific bans on substances, control of soil, water and air degradation, and protection of heath. Similarly, POPs are to be explicitly incorporated into the new National Environmental Code that is expected to come into effect in 2009 and will serve to consolidate the legal framework for environmental protection in the country.

Overall government commitment to environmentally sound management of POPs has been given budget authority through linkage to a number of standing policy documents and current government programs including *Concept of the Government Policy of the Republic of Belarus in the Field of Environmental Protection* (September, 1995), *National Strategy of Sustainable Social and Economic Development of the Republic of Belarus until 2020* (June 2004), *National Action Plan for Sound Natural Resource Management and Environmental Protection of the Republic of Belarus for 2006–2010* (May 2006), *National Plan of Actions on the Environmental Hygiene for 2001–2005* (December 2000), *Republican Program for Municipal Waste Treatment until 2007* (July 2002) and the government program *Chemical Crop Protectants (Pesticides) for 2003–2006 and Subsequent Years* (December 2003).

Being aware of the POPs international concern the Republic of Belarus undertakes all possible efforts to prevent POPs negative impact on health and the environment by itself and in cooperation with the world's community, thus contributing to the activities of many other countries on the way to POPs global elimination.

All activities of the Action Plan of the National Plan for 2007–2010 were elaborated in accordance with the relevant articles of the Stockholm Convention. The strategic directions for the different spheres of environmentally sound management of POPs were developed with the aim of complete implementation by the Republic of Belarus of the Stockholm Convention provisions before 2028 and assurance of an on-going compliance with all possible amendments to this convention, in particular, inclusion of new substances in Annexes A and B of the Convention.

The Republic of Belarus : COUNTRY PROFILE

Geography and Population

The Republic of Belarus is located in the farthest western part of the East-European lowland in the basins of the rivers Zapadnaya Dvina, Zapadny Bug, Pripyat, Dnieper and Nieman. Belarus enjoys a strategic geographical location being crossed by the key transit routes from Russia to Western Europe and from South and South-East regions to Lithuania, Latvia and Estonia.

The territory of Belarus is 207.6 thousand square kilometers. The distance from North to South is 560 km and from West to East is 650 km. The Republic of Belarus borders five countries: the Russian Federation in the northeast (the border length is 990 km or 33.4 %), Ukraine in the south (975 km or 32.8 %), Poland in the west (399 km or 13.4 %), Lithuania (462 km or 15.6 %) and Latvia (143 km or 4.8 %) in the northwest. The total border length is 2969 km.

The largest and most important rivers of the country are the Dnieper (2,145 km), Zapadnaya Dvina (1,020 km), Nieman (937 km), Zapadny Bug (831 km) and Pripyat (761 km).

The climate of Belarus is moderate with mild and humid winter and warm and humid summer. The mean temperatures in January and July are –6 ^{O}C and +18 ^{O}C respectively. The annual precipitation is 550–700 mm.

The key mineral resources in the Republic of Belarus are potassium salts, peat and sapropel. The country is also rich in rock products such as granites, dolomites and dolomite limestone, marl, chalk, fusible and refractory clay, loam, sand and gravel. There are raw materials for the production of natural paints (marsh iron ore, ochre, glauconite and etc.).

The population of Belarus is 9,751,000 people (as of 1 January 2006). There are six regions and the capital city of Minsk, which has the status of an administrative and territorial unit, 118 districts, 111 cities, 97 urban settlements and 23,973 rural settlements. The share of urban residents tends to prevail and is steadily increasing (from 67 % in 1991 to 69 % in 1999 and 72 % as of 1 January 2001). About 1.7 million people live in Minsk which is the largest city of the country; the number of residents in each of another five big cities – Gomel, Mogilev, Vitebsk, Grodno and Brest – is over 250 thousand people. The official languages are Belarusian and Russian. The most popular languages for business communication are Russian, English and German.

Political and Government System

The Republic of Belarus is a unitary, democratic, socially oriented rule-of-law state (Article 1 of the Constitution of the Republic of Belarus). In accordance with Article 8 of the Constitution, Belarus recognizes the priority of the universal principles of the international law and is determined to align the national legislation with these principles.

The state power is exercised on the basis of its division into legislative, executive and judicial powers. Belarus is a presidential republic. The President of the Republic of Belarus is a Head of State, guarantor of the Constitution, rights and freedoms of a person and a citizen. In accordance with the Constitution, the legislative power in Belarus is exercised by the Parliament which consists of two chambers. The executive power in Belarus is exercised by the Government – the Council of Ministers – which is a central governmental body.

The Republic of Belarus attained independence in September 1991. At independence, Belarus had a standard of living that was among the highest in the Former Soviet Union. Since then, like all New Independent States (NIS) which emerged following the collapse of the USSR, Belarus has been striving to strike the right balance between the need to implement market reforms and the need to sustain social integrity and to mitigate economic recession and the associated hardships. Therefore, Belarus has pursued a policy of cautious economic reforms reflected in the low share of private sector in GDP, regulated prices on socially important goods, targeted lending, foreign currency subsidies and other forms of subsidizing state-owned enterprises.

Following declaration of independence, the Republic of Belarus entered the international arena as a new independent state, which emerged with the breakup of the USSR, and as a European country having prominent historic traditions of the state system. The most essential pillar of Belarus' integration into the international community is its determined participation in the activities of the leading international organizations.

Being one of the founders of the United Nations Organization, the Republic of Belarus participates in regular and special sessions of the UN General Assembly, the Economic and Social Council and other main bodies of the United Nations. The Republic of Belarus is a full member of large international organizations such as the Organization for Security and Cooperation in Europe (OSCE) and the Commonwealth of Independent States (CIS).

Economic Profile

The Belarusian economy has experienced steady and sizable growth since 1996. In 1996–2004 GDP grew by 77.4 % at 6.6 % on average per annum. As a result of dynamic and sustainable performance of the key economic sectors, in 2005 GDP grew by 9.2 %. However, despite impressive economic growth, high dependence on energy and critical inputs supplies from Russia represents an important source of vulnerability for the Belarusian economy. The economic sector is also highly dependent on developments at foreign markets.

Since 2000 the rate of inflation in Belarus has steadily declined. In the first six month of 2004 the core inflation averaged 1.3 % per month.

The added value of industrial sector in GDP made up 31.8 %, agricultural sector – 2 %, construction sector – 5,7 %, transport and communications – 9.5 %, trade and catering – 9.3 %.

Industry accounts for about 1/3 of the national product of the Republic of Belarus. Overall, there are around 100 sub-sectors in the industrial sector. The most developed are fuel industry (which accounts for 24.3 % of the total industrial output), machine-building and metalworking (22.2 %), food industry (15.2 %), chemical and petrochemical industry (11.7 %).

Production output of certain sectors in the total industrial output (in percentage terms) in 2005 is shown in Figure 1.

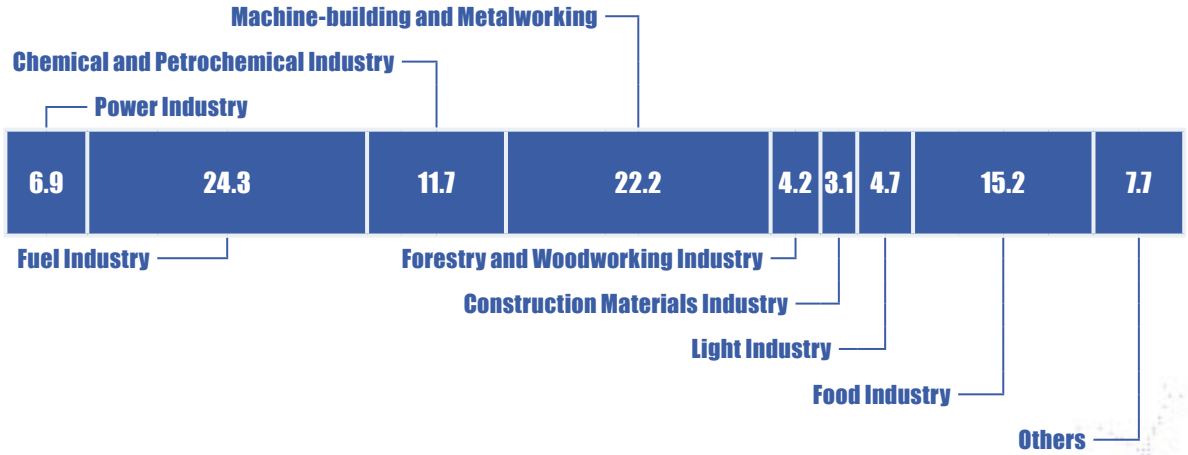


Figure 1: *Production output in Belarus by selected sectors*

High growth rates are recorded in such sectors as production of construction materials, forestry, woodworking industry, pulp and paper industry and ferrous metal production. The distinguishing feature of the national industry is the production of ready-made products most of which are exported.

Environmental conditions in Belarus are favorable for producing highly profitable agricultural products such as milk, beef, pork, poultry, eggs, grain crops, potatoes, long-stalked flax, sugar-beets and etc. About half of the Belarusian territory is covered by agricultural lands. Most agricultural products are produced by large collective and state-owned farms. Private farms are also developing. Particular attention is given to technical upgrading of industrial facilities for processing of agricultural products and enhancement of export potential of the agricultural sector.

Belarus has a developed scientific and research potential. Applied research and fundamental studies in quantum electronics, solid-state physics, genetics, chemistry, powder metallurgy and other promising fields are successfully conducted by the National Academy of Sciences of Belarus, the Belarusian State University, scientific and research institutes.

Environmental Overview

Belarus is facing serious environmental problems, which are similar to the problems of other countries with the economies in transition. Those include air pollution both from regional sources and as a result of transboundary transfer; declining quality of surface and ground waters, primarily ground waters; continuous increase of the volume of buried and stockpiled waste including hazardous wastes and increasing area of lands designated as waste disposal sites. These problems are aggravated by another concern of key significance for Belarus, notably elimination of the consequences of the catastrophe at the Chernobyl nuclear power plant which resulted in radioactive contamination of over 22 % of the country's territory. The current environmental situation in Belarus is adversely impacting the quality of life and health of people, especially children.

In accordance with the principles of the National Strategy of Sustainable Social and Economic Development until 2020, national priorities, in addition to ensuring sustainable economic growth, include implementation of measures aimed at enhancing environmental focus of economic activity, securing the right of every person to healthy environment and balanced use of natural resources as a result of reducing resource and energy intensity.

Air

Air monitoring is regularly conducted in 16 cities of the country where about 65 % of urban population live. There are 53 permanent stations in cities which perform monitoring of 37 pollutants 3–4 times a day.

Air pollution is caused mainly by emissions from stationary and mobile sources. The prevailing ones are emissions of carbon oxides (56.4 %), sulphur dioxide (6.9 %), nitric oxides (11.1 %) and hydrocarbons (14.3 %).

The government nature conservation policy pursued in the Republic of Belarus provides for consistent practical efforts aimed at reduction and prevention of emission of pollutants into the atmosphere.

Ozone Layer Protection and Climate Change

The Republic of Belarus is a Party to the Vienna Convention and Montreal Protocol. It has ratified the London Amendment and is the process of ratifying all latter amendments to the Montreal Protocol. It successfully phase out use of Annex A and B ozone depleting substances (ODS) in 2000 and since that time has further reduced the import of other ODS materials such as HCFCs and their consumption consistent with phase out requirements in the Copenhagen and Beijing Amendments, as well as eliminated to use of methyl bromide.

Climate change in the Republic of Belarus is caused by natural and anthropogenic factors. Studies suggest that at present carbon dioxide equivalent emissions of greenhouse gases (GHG) are around 60 million tons. The Republic of Belarus acceded to the Kyoto Protocol to the United Nations Framework Convention on Climate Change on 28 August 2005.

In accordance with the United Nations Framework Convention on Climate Change, the Republic of Belarus has prepared the First National Communication on the fulfillment of its commitments. The inventory of GHG sources and sinks has suggested that global warming effect has decreased by over 50 % compared to 1990.

Water Resources

The total area of surface waters in the Republic of Belarus is 57.9 km^3 of which 34 km^3 are formed within the country. In terms of the availability of water resources, the situation in Belarus is relatively favorable. The available resources of natural waters are quite sufficient to meet the current and future water needs of the country. Per capita water supply in Belarus is 3.6 thousand m^3 including 1.4 thousand m^3 of ground waters.

The quality of natural waters is affected primarily by pollutants discharged with waste waters and brought with atmospheric precipitates. Over the last five years discharge of insufficiently treated waste waters into water bodies has tended to reduce. However, there are still problems caused by substandard operations at some of the water treatment facilities, particularly in rural settlements. This highlights the need for further measures aimed at improving waste water management in Belarus.

Lands and Soils

The findings of soil monitoring, environmental and geo-chemical surveys have suggested that chemical contamination of soils is largely concentrated in cities and suburban areas, near highways and waste disposal sites and on agricultural lands. The estimated area of critical level of soil contamination is 78 thousand hectares in cities, 119 thousand hectares – near highways, 10 thousand hectares within agricultural lands and 2.5 thousand hectares around waste disposal sites. 22 % of the Belarusian territory is contaminated with radioactive isotopes. The key soil pollutants include heavy metals, oil products, nitrites, sulphates, chlorides and radionuclides of cesium-137 and strontium-90. However, the data about soil contamination with polycyclic aromatic hydrocarbons, polychlorinated biphenyls and other pollutants are still insufficient.

On 17 July 2001 the Republic of Belarus signed the United Nations Convention to Combat Desertification/ Land Degradation.

Within the framework of the National Action Plan for Efficient Natural Resources Management and Environmental Protection in the Republic of Belarus for 2001–2005, a number of land and soil protection activities have been carried out including the implementation of the Program of land use optimization and the Program of improving land management and refining the territories of residential settlements.

Biodiversity

Renewable natural resources of Belarus are formed by flora and fauna, natural landscapes and forests.

The current risk of degradation, decline and loss of biological species and natural landscapes continues to exist mainly due to anthropogenic transformation and decline of natural sites resulting from excessive use of biological resources and contamination of the environment.

Belarus ratified the Convention on Biological Diversity on 10 June 1993. The key focuses of biodiversity conservation efforts in the country are embodied in the National Strategy and Action Plan for Conservation and Sustainable Use of Biodiversity approved by Resolution of the Council of Ministers of the Republic of Belarus No. 789 of 26 June 1997. Amendments to these documents are currently drafted drawing upon the new trends and lessons learned in the process of their implementation and taking full account of the biodiversity conservation international commitments assumed by the Republic of Belarus.

Waste Management

More than 800 kinds of industrial wastes with a wide spectrum of physical and chemical characteristics are generated in the Republic of Belarus. In 2005 the total amount of the produced industrial wastes was 34.78 mln. tons, the amount of accumulated wastes – 817.4 mln. tons (as of 1 January 2006).

Bulk wastes constitute the biggest part of the total volume of the generated wastes. Other wastes posing the biggest threat to the environment are PCBs and obsolete pesticides, wastes of galvanic industry (sludge and solutions); cutting fluids; waste emulsions and petroleum mixtures wastes; oil sludge; non-organic acids, including accumulator liquids and others. Medical wastes are a particular threat to the environment and demand respective treatment.

Apart from industrial waste more than 3.2 mln. tons of municipal solid wastes are generated every year; they are mostly disposed of in landfills.

The volume of the recycled industrial waste including bulk wastes makes up 17 % of the annually generated wastes; moreover this figure has been fluctuating between 16 and 17 % for the last ten years. One of the spheres that have to be specially developed is recycling of municipal solid wastes.

Overall, it should be noted that the Republic of Belarus is pursuing a consistent government policy in the field of environmental protection and sustainable natural resources management.

Ministry of Natural Resources and Environmental Protection of the Republic of Belarus

RESOLUTION

1 November 2006 No. 11/4
Minsk

On the draft of the National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028

Having heard the Head of the International Affairs Department Mr. Alexander Rachevskiy, the Head of the Specialized Inspectorate for the State Control of the Wastes Management Mr. Sergey Kuzmenkov and

Having discussed the provided draft of the National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028 the Collegium of the Ministry of Natural Resources and Environmental Protection

1. Approves the provided National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028.
2. Takes into consideration that the National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028 has been approved by all stakeholder ministries, government bodies, and organizations in accordance with the established procedure.
3. Appoints the Specialized Inspectorate for the State Control of the Wastes Management to prepare the necessary documents and introduce to the Council of Ministers of the Republic of Belarus a legal act endorsing the National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028.

Minister Leontiy Khoruzhik

APPROVED
Resolution of the Collegium
of the Ministry of Natural Resources
and Environmental Protection
of the Republic of Belarus
1 November 2006 No. 11/4

The National Plan
of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007-2010 and until 2028

Introduction

In accordance with Decree of the President of the Republic of Belarus No. 594 "On Belarus' Accession to the Stockholm Convention on Persistent Organic Pollutants" of 26 December 2003 (the National Register of Laws and Regulations of the Republic of Belarus, 2004, No. 1, 1/5208), the Republic of Belarus consented to be bound by the Stockholm Convention on Persistent Organic Pollutants.

The National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for 2007–2010 and until 2028 has been developed in order to define effective measures and concrete actions aimed at addressing the problem of persistent organic pollutants in the Republic of Belarus and to implement its obligations under this Convention.

The National Plan has been developed based on the provisions of the Stockholm Convention, the Constitution of the Republic of Belarus, the Law of the Republic of Belarus "On Environmental Protection" adopted on 26 November 1992 and amended on 17 July 2002 (the Bulletin of the Supreme Council of the Republic of Belarus, 1993, No. 1, p.1; the National Register of Laws and Regulations of the Republic of Belarus, 2002, No. 85, 2/875), other environmental protection regulations as well as the provisions of the National Security Concept of the Republic of Belarus approved by Decree of the President of the Republic of Belarus No. 390 of 17 July 2001(the National Register of Laws and Regulations of the Republic of Belarus, 2001, No. 69, 1/2852), the National Strategy of Sustainable Social and Economic Development until 2020, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal adopted in Basel on 22 March 1989 which was joined by the Republic of Belarus in accordance with Decree of the President of the Republic of Belarus No. 541 of 16 September 1999 (the National Register of Laws and Regulations of the Republic of Belarus, 1999, No. 72, 1/647) and other international agreements concluded by the Republic of Belarus.

The Problem of Persistent Organic Pollutants

Persistent organic pollutants are chemically durable organic compounds containing atoms of chlorine in their molecule. Persistent organic pollutants are primary products and by-products of chemical production and display such characteristics as high toxicity, potential for accumulation in the environment, humans and species, potential for long-range environmental transport through air, water and migratory species.

Persistent organic pollutants, even in extremely low concentration, demonstrate genotoxic, immune toxic and cancer inducing effects, negatively affect reproductive function creating a tangible risk for the health of current and future generations.

Therefore, the international community has identified the problem of persistent organic pollutants as a global environmental concern requiring urgent response. On 17 May 2004 the Stockholm Convention on Persistent Organic Pollutants adopted in Stockholm on 22 May 2001 (hereinafter referred to as the Stockholm Convention) entered into force. The principal objective of this Convention is to protect human health and the environment from persistent organic pollutants.

The Republic of Belarus officially acceded to the Stockholm Convention in February 2004 thus assuming the respective obligations for the implementation of this Convention.

Protection of human health is one of the key priorities of the social policy in Belarus. In this regard, the activities aimed at minimization and prevention of the harmful impacts of persistent organic pollutants on human health and the environment are of particular importance.

Objectives and Tasks of the National Plan

Addressing the problem of persistent organic pollutants in Belarus is one of the essential preconditions for the realization of the constitutional right to protection of health and to friendly living environment.

In accordance with the Stockholm Convention and the National Strategy of Sustainable Social and Economic Development of the Republic of Belarus until 2020, the strategic objective of the National Plan is to ensure protection of human health and the environment from the harmful impacts of persistent organic pollutants.

The task of the National Plan is to set priorities in addressing the problem of persistent organic pollutants (POPs) in Belarus for 2007–2010 and until 2028 as well as to define the priority implementation activities for 2007–2010.

The priorities and activities of the National Plan (summarized in the Annex) have been defined based on the findings of the analysis of the situation with POPs management.

POPs Management Priorities for the Period of 2007–2010 and until 2028

POPs management priorities in Belarus for the period 2007–2010 and until 2028 include:

- Improvement of the Belarusian legislation, institutional and regulatory frameworks for the management of persistent organic pollutants;
- Environmentally sound storage and disposal of the existing wastes containing persistent organic pollutants;
- Identification, assessment and clean up of POPs contaminated sites and remediation of the affected environment;
- Development of the national analytical, technical and personnel capacity for monitoring and analytical control of persistent organic pollutants in the environment and health monitoring in connection with the impact of persistent organic pollutants;
- Reduction and elimination of unintentional releases of persistent organic pollutants through the use of the best available techniques and the best environmental practices;
- Limitation, regulation and control of productions and processes generating persistent organic pollutants.

In light of these priorities, the National Plan envisages the activities designed to address the following priority tasks:

- Development of legislative acts regulating POPs management and establishing the norms of POPs content in releases to the environment;
- Improvement of POPs data collection and reporting system;
- Identification, capture, handling and storage of POPs containing stockpiles and wastes in an environmentally sound manner and their disposal;
- Evaluation, containment and clean up of the sites contaminated by POPs pesticides and polychlorinated biphenyls and remediation of the affected environment;
- Systematic development of POPs related environmental and human health monitoring;
- Reduction and elimination of unintentional releases of persistent organic pollutants from the main large “hot spots”;
- Establishment of effective long term mechanisms for the exchange of information with the Parties to the Stockholm Convention;
- Training of managerial personnel, workers, scientists and educators in the field of POPs management;
- Facilitation of public education and awareness with regard to persistent organic pollutants;
- Enhancement of the exchange of information on persistent organic pollutants and the respective international research and technical cooperation;
- Strengthening research capability pertaining to persistent organic pollutants and their management.

Main Activities related to the Management of Persistent Organic Pollutants

Regulatory Framework for the Management of Persistent Organic Pollutants

An essential framework for the fulfillment of the obligations assumed by the Republic of Belarus under the Stockholm Convention is the existence of the system of the national and sectoral programs, concepts and strategies defining the principles and priorities of the government policy which regulates environmental protection, including the management of hazardous chemicals. These policy documents include:

- Concept of the Government Policy of the Republic of Belarus in the Field of Environmental Protection of 6 September 1995 approved by Resolution of the Supreme Council of the Republic of Belarus No. 3851-XII of 6 September 1995 (the Bulletin of the Supreme Council of the Republic of Belarus, 1995, No. 29, p. 382);
- Concept of the National Security of the Republic of Belarus;
- National Strategy of Sustainable Social and Economic Development of the Republic of Belarus until 2020;
- Program of Social and Economic Development of the Republic of Belarus for 2006–2010 approved by Decree of the President of the Republic of Belarus No. 384 of 12 June 2006 (the National Register of Laws and Regulations of the Republic of Belarus, 2006, No. 92, 1/7667);
- National Action Plan for Efficient Natural Resources Management and Environmental Protection of the Republic of Belarus from 2006–2010 approved by Decree of the President of the Republic of Belarus No. 302 of 5 May 2006 (the National Register of Laws and Regulations of the Republic of Belarus, 2006, No. 73, 1/7557);
- Government Program of the National Environmental Monitoring System Development in the Republic of Belarus for 2006–2010 approved by Decree of the President of the Republic of Belarus No. 251 of 18 April 2006 (the National Register of Laws and Regulations of the Republic of Belarus, 2006, No. 69, 1/7482);
- Government Program "Chemical Crop Protectants "Pesticides" for 2003–2006 and Subsequent Years" approved by Resolution of the Council of Ministers of the Republic of Belarus No. 1481 of 24 October 2002 (the National Register of Laws and Regulations of the Republic of Belarus, 2002, No. 121, 5/11365).

The key principles regulating the production and management of hazardous chemicals and wastes are embodied in the Law of the Republic of Belarus "On Environmental Protection", which bans the application of non-decaying toxic chemicals, import of toxic and other wastes to the Republic of Belarus for storage and (or) disposal.

The more detailed regulatory framework for the implementation of the Stockholm Convention in the Republic of Belarus is based the following key Laws:

The Law of the Republic of Belarus "On Wastes" adopted on 25 November 1993 as amended on 26 October 2000 (The Bulletin of the Supreme Council of the Republic of Belarus, 1994, No. 3, p. 22; the National Register of Laws and Regulations of the Republic of Belarus, 2000, No. 106, 2/218) regulates the processes relating to waste management, defines the concept of wastes and hazardous wastes, and the principles of their classification depending on their toxicity (for example, the obsolete pesticides are classified, as a rule, as hazardous wastes of Toxicity Class 1 and 2 thus reflecting the highest environmental hazard of such wastes).

The Law of the Republic of Belarus "On Plants Protection" adopted on 25 December 2005 (the National Register of Laws and Regulations of the Republic of Belarus, 2006, No. 6, 2/1174) establishes legislative, organizational and economic frameworks for the protection of crops from pests, diseases and weeds, and for the management of crop protectants.

The Law of the Republic of Belarus "On Hazardous Cargo Transportation" adopted on 6 June 2001 (the National Register of Laws and Regulations of the Republic of Belarus, 2001, No. 56, 2/775), other regulations adopted as enforcement instruments establish the principles and general rules of transportation of hazardous wastes including hazardous chemicals containing persistent organic pollutants.

The Law of the Republic of Belarus "On Ambient Air Protection" adopted on 15 April 1997 (the Bulletin of the Supreme Council of the Republic of Belarus, 1997, No. 14, p. 260) establishes special requirements relating to the ambient air protection on application of

crop protectants, stimulators, mineral fertilizers and other chemicals and bans unauthorized dumping and incineration in residential settlements of municipal, household and industrial wastes, which pollute the air with hazardous gases and other substances including unintentional releases of persistent organic pollutants.

The Law of the Republic of Belarus "On Health Care" adopted on 18 June 1993 as amended on 11 January 2002 (the Bulletin of the Supreme Council of the Republic of Belarus, 1993, No. 24, p. 290; the National Register of Laws and Regulations of the Republic of Belarus, 2002, No. 10, 2/840) declares the right of people to favorable working and living conditions and enabling of this right through, among other means, the implementation of environmental protection measures.

The Law of the Republic of Belarus "On Sanitary and Epidemiological Safety of Population" adopted on 23 November 1993 and amended on 23 May 2000 (the Bulletin of the Supreme Council of the Republic of Belarus, 1993, No. 36, p. 451; the National Register of Laws and Regulations of the Republic of Belarus, 2000, No. 52, 2/172) establishes legislative and organizational frameworks for prevention and elimination of health impacts associated with environmental factors including chemicals. The Law also establishes requirements for the state hygienic registration, regulation and expert examination of industrial sites and technological processes and regulates provision of information to the public about health related issues and environmental pollution.

The Law of the Republic of Belarus "On Quality and Safety of Raw Food and Food Products for Human Life and Health" adopted on 29 June 2003 (the National Register of Laws and Regulations of the Republic of Belarus, 2003, No. 79, 2/966) regulates the processes relating to ensuring the safety of raw food and food products, the laboratory testing of food products for hazardous substances, and the requirements for the labeling of food products.

The Law of the Republic of Belarus "On Drinking Water Supply" adopted on 24 June 1999 (the National Register of Laws and Regulations of the Republic of Belarus, 1999, No. 50, 2/46) regulates the requirements to the quality and safety of drinking water and establishes the rules of pesticides, fertilizers and chemicals application within the sanitary zones of surface and ground waters.

The Land Code of the Republic of Belarus adopted on 4 January 1999 (the National Register of Laws and Regulations of the Republic of Belarus, 1999, No. 2-3, 2/1), the Minerals Code adopted on 15 December 1997 (the Bulletin of the Supreme Council of the Republic of Belarus, 1998, No. 8-9, p. 103), the Forestry Code adopted on 14 July 2000 (the National Register of Laws and Regulations of the Republic of Belarus, 2000, No. 70,2/195) and the Water Code adopted on 15 July 1998 (the Bulletin of the Supreme Council of the Republic of Belarus, 1998, No. 33, p. 473) provide for a set of environmental protection measures including protection from industrial and chemical pollution.

Other legal acts have been enacted to improve the regulatory framework of the management of hazardous chemicals including persistent organic pollutants covering the following areas:

- Hazardous chemical wastes and pesticides management;
- Establishment of requirements for location and maintenance of sites for hazardous chemical waste treatment and storage;
- Establishment of the norms of unintentional releases of dibenzo-p-dioxins and polychlorinated dibenzofurans (hereinafter referred to as dioxins and furans) in the process of medical waste incineration; and
- Monitoring of persistent organic pollutants in the environment and human health monitoring in connection with the impact of persistent organic pollutants.

The Administrative Code of the Republic of Belarus adopted on 21 April 2003 (the National Register of Laws and Regulations of the Republic of Belarus, 2003, No. 63, 2/946) sets out administrative liability for offenses infringing on ecological safety, environment and the use of natural resources pertaining to the management of hazardous chemicals including persistent organic pollutants.

Chapter 26 of the Criminal Code of the Republic of Belarus which was adopted on 9 July 1999 (the National Register of Laws and Regulations of the Republic of Belarus, 1999, No. 76, 2150) sets out criminal liability for offenses infringing on ecological safety and the environment (such as land contamination with chemical or radioactive wastes; disrespect of the safety rules of production, storage, use, transportation, burial or other forms of handling radioactive, bacteriological and chemical materials or wastes).

The existing legal framework on POPs management has been further strengthened by the Republic of Belarus' assumption of obligations under a number of international agreements. These include: the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal; the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters adopted in Aarhus on 25 June 1998. The latter is given legal force by Decree of the President of the Republic of Belarus of 14 December 1999 No. 726 (the National Register of Laws and Regulations of the Republic of Belarus, 2000, No. 1, 1/837), the Kyoto Protocol to the United Nations Framework Convention on Climate Change adopted in Kyoto on 11 December 1997, to which Belarus acceded in accordance with Decree of the President of the Republic of Belarus of 12 August 2005 No. 370 (the National Register of Laws and Regulations of the Republic of Belarus, 2005, No. 128, 1/6695).

Strategic directions identified for improvement in the regulatory framework of POPs management are:

Stage 1 – 2007–2010:

- Elaboration and enactment of legal acts regulating POPs management;
- Development and enforcement of technical regulations streamlining the procedure of identification and clean up of POPs contaminated sites;
- Development and enforcement of hygienic norms of POPs content in food and water;
- Development and enforcement of POPs monitoring regulations; establishment of legislative arrangements for recording and setting the norms of unintentional releases of persistent organic pollutants to the environment.

Stage 2 – 2011–2028:

- Alignment of national legislation with the international agreements, which are in force in Belarus and which regulate relations in the field of POPs management;
- Elaboration of regulations on the procedure of establishment and maintenance of pollutant release and transfer registries;
- Amendment of legislation providing for administrative and criminal penalties in the field of POPs management;
- Use of the best available techniques and the best environmental practices in the field of POPs management.

Institutional Framework for the Management of Persistent Organic Pollutants

Persistent organic pollutants are managed within the general system of natural resources management and environmental protection.

The National Inter-Agency Coordinating Committee for the Stockholm Convention has been created in pursuance of Resolution of the Council of Ministers of the Republic of Belarus No. 237 "On the Implementation of Provisions of the Stockholm Convention on Persistent Organic Pollutants" of 5 March 2004 (the National Register of Laws and Regulations of the Republic of Belarus, 2004, No. 40, 5/13908). The Committee's major tasks include:

- Development of recommendations on upgrading the national policy relating to the management of persistent organic pollutants;
- Determination of the priority areas of research pertaining to persistent organic pollutants;
- Facilitation of the information exchange between the relevant government agencies, non-governmental and international organizations relating to the implementation of the Stockholm Convention, and
- Provision of public information on persistent organic pollutants.

Deputy Minister of Natural Resources and Environmental Protection has been designated as the National Focal Point for the Stockholm Convention. The RUE "Belarusian Scientific and Research Centre "Ecology" has been designated as an institution responsible for providing research support to the implementation of the Stockholm Convention.

The Ministry of Natural Resources and Environmental Protection of the Republic of Belarus is a government body responsible for the implementation of the obligations assumed by Belarus under the Stockholm Convention. The key functions of the Ministry of Natural Resources and Environmental Protection relating to the management of persistent organic pollutants include regulation and control of the management of wastes and their transboundary transfer; maintenance of the National Environmental Monitoring System (NEMS); control of releases (discharge) of chemicals to the environment, control of waste accumulation and disposal; establishment of the norms of the upper permissible concentration of chemicals and other substances including persistent organic pollutants.

In addition, the Ministry of Natural Resources and Environmental Protection coordinates the activities of other republican authorities, local executive and administrative bodies and other government agencies and organizations related to the management of persistent organic pollutants; provides the information on the state and contamination of the environment and remediation measures associated with POPs impact to the government authorities, local executive and administrative bodies and individuals; participates in the establishment of the system of ecological education and training; collaborates with non-governmental organizations in addressing the problem of persistent organic pollutants; participates in the international cooperation and undertakes analysis, review and dissemination of foreign countries' best practices on the management of persistent organic pollutants.

Certain issues of POPs management are within the competence of other specially authorized government bodies.

The Ministry of Public Health of the Republic of Belarus is responsible for regulation of the processes relating to ensuring safety of the application of chemicals, crop protectants, raw materials, and technologies for human health; hygienic regulation and registration of chemicals and biological substances and articles thereof, raw materials, food products, and crop protectants; justification of the criteria for determining that chemicals are safe for human health; justification and establishment of the hygienic norms of the concentration of chemical substances in natural and industrial environment; social and hygienic monitoring.

The Ministry for Emergency Situations of the Republic of Belarus implements the government policy relating to safety transportation of hazardous goods, including POPs containing materials and wastes, by all means of transport; issues permits for cross-border transportation of hazardous chemicals including POPs.

The Ministry of Agriculture and Food of the Republic of Belarus performs registration of crop protectants and fertilizers, controls the quality of pesticides and their residues in products and raw food of vegetable origin; ensures compliance with safety requirements in the process of application and storage of pesticides and fertilizers.

The State Customs Committee of the Republic of Belarus supervises customs clearance and customs control of import, export and transit of goods representing ecological risk for human health and the environment including chemicals and POPs hazardous wastes; approves the list of goods including chemicals and hazardous wastes, which are banned or restricted for cross-border transportation.

The State Committee for Standardization of the Republic of Belarus is responsible for overall coordination of the elaboration of technical regulations and standards including those pertaining to POPs management; endorsement, enforcement, cancellation and amendment of standards; accreditation and supervision of the laboratories performing chemical analysis of persistent organic pollutants.

Within the framework of the implementation of the National Plan, the management of persistent organic pollutants should be aimed at addressing a set of organizational, technological, social and information issues such as:

- Enhancement of the institutional framework for POPs management;
- Elaboration, endorsement and enforcement of the technical regulations on environmental monitoring and human health monitoring in connection with the impact of persistent organic pollutants;
- Professional training, raising the level of the expert' qualification and awareness about POPs related issues, primarily about those relating to their professional activity;
- Establishment of the system for recording and registration of persistent organic pollutants; assessment of the environmental risk associated with POPs handling;
- Establishment of the respective data base with the aim of enhancing efficiency of the institutional framework for the management of persistent organic pollutants; and
- Planning of activities aimed at prevention of emergencies in the process of POPs handling.

Strategic directions identified for the improvement in the institutional framework for the management of persistent organic pollutants are:

Stage 1 – 2007–2010:

- Optimization of the institutional framework for POPs management;
- Development of the information support of decision making relating to POPs management;
- Elaboration of the procedure of reporting to the official bodies of the Stockholm Convention on the measures the country has taken to implement the provisions of the Stockholm Convention.

Stage 2 – 2011–2028:

- Continuing introduction of the best available techniques and best environmental practices (BAT and BEP) in the sphere of POPs management;
- Regular updating of pollutant release and transfer registries;
- Updating and maintenance of POPs databases, prompt introduction of the respective changes in case of including new chemicals in the list of persistent organic pollutants controlled by the Stockholm Convention.

POPs Pesticides Management

The list of persistent organic pollutants controlled by the Stockholm Convention includes nine chlororganic pesticides: aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorbenzene, mirex, toxaphene and DDT. These pesticides were synthesized to be used in the agricultural sector for protection of crops and for malaria and tick-borne encephalitis vector control. POPs pesticides are characterized, in most cases, by high toxicity; they are resistant to natural destruction and poorly soluble in water, they bioaccumulate through food chains.

The available data suggest that over 20 thousand tons of chlororganic pesticides were used in Belarus between 1960 and 1990 to increase crop productivity.

As of 1 January 2006, 6,558 tons of obsolete pesticides were stockpiled in storehouses and burial sites in Belarus including 718 tons of DDT, which is included in the list of persistent organic pollutants controlled by the Stockholm Convention. 3.372 tons of DDT are stored in storehouses, 714.53 tons – in burial sites. 2,007.9 tons of unidentified obsolete pesticides mixtures are stockpiled in the storehouses; 749.699 tons of obsolete pesticides mixtures have been buried.

The findings of the preliminary analysis of the samples from the biggest storage sites of unidentified mixtures of obsolete pesticides reveal that these mixtures contain varying amounts of such POPs pesticides as heptachlor, aldrin, chlordane and endrin even though there had never been used in the country. Overall data available to date indicates that approximately 20 % of mixtures contain some level of POPs pesticides. This is over 50 % if lindane is included, noting that this is potentially a pesticide controlled by the Stockholm Convention in the future. Nevertheless, the more exact content of 2,007.9 tons of unidentified obsolete pesticides mixtures still has to be defined, as well as the exact levels of POPs pesticides in them. This work demands considerable financial and technical capabilities. Taking this into consideration, the stockpiles of unidentified mixtures of

obsolete pesticides should be treated with the same care as the identified stockpiles of DDT.

Stockpiles of obsolete pesticides are kept in the storehouses of agricultural entities, the communal unitary enterprise "Facility for processing and burial of toxic industrial wastes of the Gomel region" and in seven landfills including three landfills in the Vitebsk region (the Verchnedvinsk, Postavy and Gorodok landfills), one in the Brest region (in Gershony village), one in the Gomel region (the Petrikov landfill), one in the Grodno region (the Slonim landfill) and one in the Mogilev region (the Dribinsk landfill).

In most cases the conditions of storage of obsolete pesticides including POPs pesticides do not meet the environmental protection norms. The obsolete pesticides landfills established in 1970s – early 1980s are in poor technical condition; there's evidence of pesticide migration to the environment. The Dribinsk landfill represents a particular environmental hazard.

In accordance with the requirements set out in Article 6 of the Stockholm Convention, the Republic of Belarus shall take appropriate measures so that the stockpiles of POPs obsolete pesticides are handled, collected, transported and stored in an environmentally sound manner in order to prevent POPs releases to the environment. The country shall also ensure environmentally sound disposal of POPs pesticides in the future. The Stockholm Convention also provides for the development of appropriate strategies for identifying sites contaminated by chlororganic pesticides and remediation of those sites.

Belarus is undertaking measures to meet the abovementioned requirements set out in the Stockholm Convention.

The country has banned import, export and use of the pesticides listed in the Stockholm Convention; has established the requirements for recording, inventory, transportation, repackaging and storage of obsolete pesticides including POPs pesticides; occupational, labor and fire safety rules in the process of obsolete pesticides handling as well as the requirements for conducting monitoring of the environment in the districts where the obsolete pesticide storage facilities are located.

To prevent releases of persistent organic pollutants contained in the obsolete pesticides stockpiles to the environment, the obsolete pesticides are being repackaged in order to ensure their long-term environmentally sound storage. 2,006 tons of obsolete pesticides including DDT, unidentified chemicals and their mixtures were repackaged as of 1 January 2006. It is intended to complete repackaging of all stockpiles of the obsolete pesticides by end 2007.

Strategic directions identified as required for POPs pesticides management are:

Stage 1 – 2007–2010:

- Provision of environmentally sound storage of POPs pesticides;
- Disposal of repackaged POPs pesticides;
- Prevention and mitigation of the environmental impacts of the obsolete pesticides landfills.

Stage 2 – 2011–2020:

- Regular inventory of the stockpiles of POPs obsolete pesticides to identify new stockpiles of POPs pesticides and their disposal sites;
- Development and implementation of measures on environmentally sound handling of pesticides exhibiting the characteristics of persistent organic pollutants in case new pesticides are included in the list of persistent organic pollutants controlled by the Stockholm Convention;
- Further elimination of the obsolete pesticide landfills;
- Completion of the disposal of repackaged POPs pesticides;
- Identification and clean up of the sites contaminated by POPs pesticides.

Stage 3 – 2021–2028:

- Completion of clean up of the sites contaminated by POPs pesticides.

Management of Equipment, Materials and Wastes Containing Polychlorinated Biphenyls

Polychlorinated biphenyls are industrial chemicals, which have been used for a long time as dielectric or cooling fluid in electrical equipment and as plasticizers and other additives in production of lacquers, paints, lubricating oils, hydraulic liquids, cables, fire retardants and other products. Though polychlorinated biphenyls (PCBs) have never been produced in the Republic of Belarus, they have been imported in large quantities.

As of 1 January 2006, 380 power transformers filled with sovtol-10 or similar foreign brand liquids, about 47 thousand PCB-filled power capacitors, 29 containers with PCB-containing dielectric liquids, about 40 thousand small-size capacitors have are estimated to be in the Republic of Belarus. The total amount of the identified polychlorinated biphenyls in liquid form is estimated to be 1,564 tons.

Most polychlorinated biphenyls are concentrated at the enterprises subordinated to the Ministry of Industry and the Belarusian State Petroleum and Chemicals Concern (the Belneftekhim concern). Their respective shares in the total amount of polychlorinated biphenyls in the country are 34 % and 25 %. Among other ministries and agencies supervising enterprises holding large quantities of polychlorinated biphenyls, it is worth noting the Ministry of Energy (about 9 %), the Belarusian State Production and Sales Concern of Pharmaceutical and Microbiological Products (the Belbiofarm Concern) and the Belarusian State Light Industry Goods Production and Sales Concern (the Bellegprom Concern) (6 % each). About 5 % of PCBs are concentrated at the enterprises subordinate to the Ministry of Agriculture and Food, 4 % – at enterprises of the Belarusian Production and Trade Concern of Forestry, Woodworking and Pulp-and-Paper Industry (the Bellesbumprom Concern) and at the enterprises of the Belarusian State Research and Production Concern of Powder Metallurgy and the Ministry of Architecture and Construction (about 2 % each).

13 % of the identified PCB-containing transformers and 27 % of capacitors have been removed from use. The phased-out equipment is stored within the territory of enterprises, quite often at unprepared sites; a major part of equipment is damaged and PCB leakage occurs in most cases. PCB-containing electrical equipment removed from use is subject to immediate disposal.

At some of the sites where electrical equipment containing polychlorinated biphenyls is operated or stored there are cases of soil contamination with polychlorinated biphenyls; there are spots with the content of polychlorinated biphenyls above 50 mg/kg at almost all open storage sites. This underscores the need for soil clean up and remediation. Leakage of polychlorinated biphenyls from damaged equipment poses a risk of subsequent redistribution of polychlorinated biphenyls in the broader environment as well as the risk of water and air pollution and accumulation of polychlorinated biphenyls in biota and food products.

Being a Party to the Stockholm Convention, the Republic of Belarus has assumed the following commitments relating to polychlorinated biphenyls:

- Eliminate the use of polychlorinated biphenyls by 2025;
- Ensure disposal of wastes containing polychlorinated biphenyls by 2028;
- Identify and to label equipment containing polychlorinated biphenyls;
- Identify wastes (substrata) having a polychlorinated biphenyls content above 50 mg/kg;
- Not use equipment containing polychlorinated biphenyls at the enterprises producing feed and food;
- Use only intact equipment;
- Ensure control of the use of equipment and prompt identification of the leakage of polychlorinated biphenyls;
- Not allow recovery of polychlorinated biphenyls; and
- Facilitate identification of the sites contaminated by polychlorinated biphenyls and to take measures on environmentally sound remediation of soils.

The relevant measures are being implemented in the Republic of Belarus including regular inventories aimed at identification of the stockpiles of polychlorinated biphenyls, equipment, materials and wastes containing polychlorinated biphenyls and scheduled replacement of the equipment containing polychlorinated biphenyls. However, financial constraints do not allow at the current stage to remove all outdated PCB-containing equipment from use.

Particular attention will be given to addressing such problems relating to the management of polychlorinated biphenyls as the absence of specially designed storehouses for damaged equipment and proper system of collection, storage and disposal of polychlorinated biphenyls.

Strategic directions identified as required for the management of equipment, materials and wastes containing polychlorinated biphenyls are:

Stage 1 – 2007–2010:

- Identification and recording of the equipment, materials and wastes containing polychlorinated biphenyls;
- Consolidation and temporary environmentally sound storage of PCB-containing equipment removed from use, materials and wastes containing polychlorinated biphenyls;
- Environmentally sound disposal of the stockpiled equipment, materials and wastes containing polychlorinated biphenyls; and
- Clean up of the sites contaminated by polychlorinated biphenyls and remediation of the affected environment.

Stage 2 – 2011–2020:

- Phase out of all PCB-containing capacitors and 60 % of transformers within the territory of the Republic of Belarus;
- Further disposal of wastes containing polychlorinated biphenyls; and
- Clean up and remediation of further sites contaminated by polychlorinated biphenyls.

Stage 3 – 2021–2028:

- Completion of removal of PCB-containing equipment from use and disposal of wastes containing polychlorinated biphenyls (by 20025); and
- Completion of clean up and remediation of sites contaminated by polychlorinated biphenyls.

Monitoring of Persistent Organic Pollutants in the Environment

In accordance with Article 11 of the Stockholm Convention, the Parties to the Convention, shall, within their capabilities, at the national level, undertake monitoring of persistent organic pollutants in the environment in order to estimate environmental contamination with persistent organic pollutants, to assess the impact of persistent organic pollutants on the environment and to develop harmonized methodologies for making inventories of generating sources and analytical techniques for the measurement of releases of polychlorinated biphenyls.

Since the preparatory stage for accession to the Stockholm Convention, Belarus has been undertaking certain measures within the framework of the National Environmental Monitoring System of the Republic of Belarus (NEMS) to organize monitoring of persistent organic pollutants in the environment as part of environmental monitoring activities. A strategy of monitoring of persistent organic pollutants in the environment has been elaborated. The strategy is aligned with the provisions of the Stockholm Convention and is aimed at:

- Identification of the key sources of POPs releases to the environment including monitoring of transboundary movement of persistent organic pollutants via air and water;
- Monitoring of the presence of persistent organic pollutants in the broader environment; and
- Assessment of contamination of the environment by persistent organic pollutants.

The POPs monitoring activities implemented in 2003–2005 included:

- Identification of the POPs content in soil, surface and ground waters in proximity to large landfills and waste disposal sites including at the seven obsolete pesticide landfills, municipal waste disposal sites located in Minsk and regional centers as well as at the hazardous waste disposal sites owned by some large enterprises;
- Scheduled organization of the local monitoring at landfills and waste disposal sites with pesticides and polychlorinated biphenyls being included in the list of monitored parameters;
- Development of the regulations on POPs monitoring in water eco-systems, ground waters and soils;

- Review of the regulatory methodological framework and analytical capacity for expanding monitoring of persistent organic pollutants in the environment in accordance with the requirements set out in the Stockholm Convention:
  - Commencement of the activities aimed at their upgrading including the development (since 2003) of the national standardized techniques for measuring persistent organic pollutants in the environment;
- Development of standards СТБ ISO 6468-2003; СТБ/МЭК 651619-2003; МВІ.МН 2126-2004. Another three standards indispensable for further upgrading of regulatory and technical apacity for POPs monitoring in the environment are being developed.

The need for expansion and integration of POPs monitoring in the environment into NEMS structure is reflected in the Government Program for the Development of the National Environmental Monitoring System in the Republic of Belarus for 2006–2010.

As monitoring of environmental contamination by persistent organic pollutants and POPs impact on the environment-forming components is fairly expensive and has been actively elaborated only recently both at the international and national levels, the implementation of the intended strategy within NEMS involves accomplishment of the priority tasks associated with the development of the regulatory methodological framework and analytical capacity of the laboratories of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus as well as information capacity building for data collection and processing.

Strategic directions identified as required for the development of monitoring of persistent organic pollutants in the broader environment are:

Stage 1 – 2007–2010:

- Upgrading of technical and analytical capacity for monitoring of persistent organic pollutants in the environment.

Stage 2 – 2011–2020:

- Continuous upgrading of technical capacity particularly for measuring dioxins and furans and organization of monitoring of their levels in the broader environment;
- Continuous upgrading of the networks and procedures for monitoring of persistent organic pollutants in response to the change of the information needs and expansion of the list of chemicals controlled by the Stockholm Convention.

Stage 3 – 2021–2028:

- Ensuring sustainable functioning of POPs monitoring within NEMS;
- Ensuring harmonization of processing, analysis and assessment techniques in accordance with the international approaches and the requirements set out in the Stockholm Convention.

Human Health Monitoring

Persistent organic pollutants which are present in the environment cause adverse effects on immune, reproductive, endocrine, nervous and other systems of a human body and can induce carcinogenesis. They can have gonadotoxic, embriotoxic and mutagen effects and can cause malformations and inborn disorders.

In accordance with Articles 1 and 11 of the Stockholm Convention, the Parties to the Convention shall, within their capabilities, undertake monitoring of human health in order to assess the effects of persistent organic pollutants on human health and their presence and levels in humans and to develop measures aimed to protect human health from persistent organic pollutants.

Given that the main dose of human exposure to persistent organic pollutants is formed by food products, the state sanitary control authorities of the Republic of Belarus undertake extensive monitoring of a number of chlororganic pesticides (DDT and its metabolites, aldrin, hexachlor, hexachlorbenzene) in domestically produced and imported foodstuffs. At this stage the primary objective of the laboratory monitoring is to maintain sanitary control of food safety.

Special attention should be given to monitoring of the presence of chlororganic pesticides in the environment, particularly drinking water and soils in the residential settlements. It is also needed to control the presence of other persistent organic pollutants including polychlorinated biphenyls, dioxins and furans in food products and drinking water. This type of control is not conducted at the current stage in Belarus due to inadequate material, technical, regulatory and methodological capacity and financial constraints.

The information on diseases, which can potentially be attributed to persistent organic pollutants (oncological diseases, inborn pathologies and reproductive disorders) is accumulated in the Cancer Register and Inborn Pathology Register, which are built upon the administrative and regional principle taking into account the 10th classification of diseases that has been introduced in Belarus. Monitoring of the contribution of persistent organic pollutants to oncological diseases and inborn pathologies is at the early stage and in large complicated due to the lack of data on high-risk population groups. Monitoring of the contamination of a human body by persistent organic pollutants is conducted occasionally and there is no systematic monitoring of high-risk groups. The available data provide statistical information on the presence and intensity of contamination and confirm that there are health problems attributed to the impact of persistent organic pollutants. However, they do not allow to quantify the contribution of persistent organic pollutants to health disorders and to assess the risk associated with the impact of persistent organic pollutants.

Monitoring of the health of people working in harmful conditions incorporates two components: assessment and description of the working conditions based on instrumental tests and assessment of the incidence of occupational diseases. Assessment of the working conditions in connection with the impact of persistent organic pollutants has not been conducted due to the lack of techniques of quantitative analysis, particularly that of polychlorinated biphenyls, dioxins and furans and due to the absence of the environment quality norms needed for the respective assessment. At present monitoring and assessment of workers' health are conducted in accordance with Resolution of the Ministry of Public Health of 8 August 2000 No. 33 "On the Procedure of Mandatory Medical Checkup of Workers" (the National Register of Laws and Regulations of the Republic of Belarus, 2000, No. 87, 8/3914). The analysis of the incidence of diseases causing temporary incapacity for work is summarized in the statistical forms (16-B). In accordance with the abovementioned Resolution, the list of the monitored indicators varies depending on affecting factors, including certain chemicals. However, persistent organic pollutants are not included in the list of such factors. There are several definite reasons for this. First, there are no methods for POPs identification in the industrial environment. Second, the list of the categories of workers exposed to persistent organic pollutants should is not elaborated and the data on technological processes and productions in the country which may involve a contact with chemicals exhibiting the characteristics of persistent organic pollutants and POPs-containing equipment are not available either. As there is no list of specific symptoms and pathologic manifestations caused by the impact of POPs and subject to monitoring, it is considered unfeasible to establish an appropriate program of medical examination for detecting organic and functional disorders induced by persistent organic pollutants.

Strategic directions identified as required for human health monitoring in connection with the impact of persistent organic pollutants are:

Stage 1 – 2007–2010:

- Implementation of a set of measures to organize monitoring of POPs pesticides and polychlorinated biphenyls in food products and drinking water;
- Identification of the categories of people subject to health monitoring in connection with the impact of persistent organic pollutants; and
- Development of the methodology for monitoring of contamination levels in people handling POPs pesticides and polychlorinated biphenyls.

Stage 2 – 2011–2020:

- Ongoing monitoring of dioxins and furans in food products;
- Development and introduction of the standards for measuring contamination levels

in high-risk population groups in connection with the potential impact of persistent organic pollutants;

- Establishment of a database of the levels of contamination of food products by dioxins and furans, the levels of contamination of breast milk and blood, and of the incidence of diseases in high-risk groups;
- Development and implementation of the analytical methods of POPs monitoring in various environments, including biological environment.

Stage 3 – 2021–2028:

- Ongoing monitoring of functional disorders conditioned by the impact of persistent organic pollutants;
- Establishment of the data bank on functional disorders induced by persistent organic pollutants.

Unintentional Releases of Persistent Organic Pollutants

Unintentional releases of persistent organic pollutants subject to the requirements set out in Article 5 of the Stockholm Convention include releases of dioxins, furans, hexachlorbenzene and polychlorinated biphenyls.

The main source categories of dioxin and furan releases to the environment in Belarus are waste incineration, ferrous and non-ferrous metal production and power generation and heating.

The main source categories of hexachlorbenzene releases to the environment are waste incineration and transportation. Ferrous and non-ferrous metal production and waste incineration are the main source categories of the releases of polychlorinated biphenyls.

The inventory of unintentional releases of persistent organic pollutants into the atmosphere has been conducted in the Republic of Belarus since the late 1990s within the framework of compiling the national data on releases for the Cooperative Programme for Monitoring and Evaluation of Long-Range Transmission of Air Pollutants in Europe (EMEP). The inventory and development of a database of unintentional releases of persistent organic pollutants within the elaboration of the National Plan have involved expansion of the list of the controlled source categories; estimation of dioxin and furan releases not only to air but also to water, land, residues and products; identification of large hot spots and description of the territorial structure of releases.

The releases of dioxins and furans are estimated to total 141.85 grams of Toxic Equivalent (gTEQ) per annum including releases to air – 36.6 gTEQ, releases to water – 0.5 gTEQ, to land – 1.4 gTEQ, in products – 0.05 gTEQ and in combustion residues – 103.3 gTEQ. Releases occur mainly to air (25.8 %) and in residues of combustion processes such as ash and sludge (73 %).

In accordance with Article 1 of the Stockholm Convention, the Republic of Belarus aims to prevent or reduce health and environmental risks associated with unintentional releases of persistent organic pollutants. The priorities of the National Plan with regard to the management of unintentional releases of persistent organic pollutants include: reduction or elimination of unintentional releases of persistent organic pollutants through the use of the best available techniques and the best environmental practices; limitation, regulation and control of productions and processes generating persistent organic pollutants.

Strategic directions identified as required for the reduction of unintentional releases of persistent organic pollutants are:

Stage 1 – 2007–2010:

- Measures to further identify and reduce unintentional releases of persistent organic pollutants from the source categories controlled by Part II of Annex C to the Stockholm Convention.

Stage 2 – 2011–2020:

- Enhancement of industrial and technological capacity for reduction of unintentional releases of persistent organic pollutants;
- Establishment of the limits of POPs levels in releases generated by the new and existing installations controlled by Part II and Part III of Annex C to the Stockholm Convention;

- Further reduction of unintentional releases of persistent organic pollutants through the use of the best available techniques and the best environmental practices at the existing and new sources of releases controlled by Part II and Part III of Annex C to the Stockholm Convention;
- Use of substitute or modified materials, products and processes with the aim of reducing unintentional releases of persistent organic pollutants.

Stage 3 – 2021–2028:

- Further strengthening of industrial and technological capacity for reduction of unintentional releases of persistent organic pollutants;
- Ensuring the use of the best available techniques and the best environmental practices at the new and existing sources of releases of persistent organic pollutants;
- Use of substitute or modified materials, products and processes with the aim of reducing unintentional releases of persistent organic pollutants.

Exchange of Information with the Parties to the Stockholm Convention

In accordance with Article 9 of the Stockholm Convention, the Republic of Belarus has committed to facilitate or undertake the exchange of information relevant to:

- Reduction or elimination of the use and release of persistent organic pollutants; and
- Alternatives to persistent organic pollutants including information relating to their risks as well as their economic and social costs.

The Parties to the Stockholm Convention should exchange the information directly or through the Secretariat of the Convention, which shall serve as a clearing-house mechanism for information on persistent organic pollutants including information provided by the Parties to the Stockholm Convention, intergovernmental and non-governmental organizations.

Taking into account paragraph 3 of Article 9 of the Stockholm Convention and the Resolution of the Council of Ministers of the Republic of Belarus No. 237 of 5 March 2004, the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus has been designated as a national focal point for the exchange of such information.

Strategy directions identified for the exchange of information with the Parties to the Stockholm Convention are:

Stage 1 – 2007–2010:

- Establishment of the national network for the exchange of information relating to the management of persistent organic pollutants; and
- Organization of sustainable exchange of information with the Secretariat of the Stockholm Convention in accordance with reporting requirements mandated by the Parties.

Stage 2 – 2011–2028:

- Improvement of the national network for the exchange of information relating to the management of persistent organic pollutants; and
- Ongoing development of the information exchange within the framework of the international cooperation in the field of POPs management.

Public Information, Awareness and Education

Under the Stockholm Convention the Republic of Belarus has committed to facilitate public awareness with regard to persistent organic pollutants, public participation in addressing persistent organic pollutants issues, POPs health and environmental effects as well as to undertake the exchange of information on the implementation of measures relating to the management of persistent organic pollutants.

The findings of a public opinion survey conducted in 2005 by the Center of Sociological and Political Surveys of the Belarusian State University upon request of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus have suggested that the majority of respondents (76.1 %) know nothing about the Stockholm Convention and 68.6 % of the surveyed have heard about it for the first time. However, 69 % of respondents would like to receive information on persistent organic pollutants on a regular basis.

In order to meet the requirements set out in Article 10 of the Stockholm Convention, the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus has launched a website covering the issues relating to the management of persistent organic pollutants in Belarus. A number of publications have been issued to inform the public about persistent organic pollutants, their health and environmental effects and measures taken by the country to address the problem of persistent organic pollutants.

The issue of persistent organic pollutants is repeatedly covered in the national and local mass media. The Ministry of Natural Resources and Environmental Protection of the Republic of Belarus jointly with other stakeholders have held a series of workshops to discuss topical issues relating to the management of persistent organic pollutants.

Strategy directions identified for public information, awareness and education with regard to persistent organic pollutants include:

Stage 1 – 2007–2010:

- Provision to the Belarusian people of the information on the main types and sources of persistent organic pollutants, their health and environmental effects, the rules of handling persistent organic pollutants and POPs containing wastes as well as on the basic provisions of the Stockholm Convention;
- Development and implementation of the respective education and training programs on persistent organic pollutants;
- Involvement of the national and regional mass media in covering the issues relating to persistent organic pollutants;
- Training of managerial personnel, scientists, educators and workers on the issues relating to the management of persistent organic pollutants; and
- Support of the activities of non-governmental organizations aimed at raising public awareness about persistent organic pollutants and their involvement in socially important decision-making on persistent organic pollutants within the framework of the environmental policy pursued by the government.

Stage 2 – 2011–2028:

- Continuation of the provision to the Belarusian people of the information on the issues relating to the management of persistent organic pollutants;
- Further development of the mechanisms ensuring that the public can get a free access to the information on persistent organic pollutants;
- Improvement of education and public awareness programs on persistent organic pollutants;
- Provision to the Belarusian people of the information about the change of POPs situation in Belarus and about their impact on human health and the environment;
- Ongoing improvement of training of managerial personnel, scientists, educators and workers on the issues relating to the management of persistent organic pollutants; and
- Ongoing provision of support to the activities of non-governmental associations aimed at addressing the problem of persistent organic pollutants in the Republic of Belarus.

Research Pertaining to the Management of Persistent Organic Pollutants

In accordance with Article 11 of the Stockholm Convention, the Republic of Belarus shall, within its capabilities, at the national and international levels, undertake appropriate research, development, monitoring and cooperation pertaining to persistent organic pollutants, to their alternatives and to candidate persistent organic pollutants.

In 2001–2005 the development of priority directions of research and technical activity in the field of the management of persistent organic pollutants was ensured through a broad spectrum of studies conducted within the framework of the Government Research and Technical Program "Ecological Safety" and research works financed from the republican budget and environmental protection funds.

The outputs of research include the inventory of stockpiles, wastes and unintentional releases of persistent organic pollutants, methodological recommendations and guidelines on POPs management, POPs environmental monitoring programs, identification of the sources of POPs releases to the environment, compilation of the national data on unintentional releases of persistent organic pollutants and addressing of other problems relating to POPs management.

The specialists of the institutions subordinate to the Ministry of Public Health and the Ministry of Natural Resources and Environmental Protection have conducted studies of the adverse health effects of dioxins, have developed methodologies for detection of the residues of POPs chlororganic pesticides and polychlorinated biphenyls in food products and drinking water, have drafted recommendations on a daily diet of pregnant women with the aim of improving the quality of breast milk and reducing the content of chlororganic pesticides, and have estimated the level of POPs releases from the obsolete pesticides landfills.

In the framework of this National Plan, research pertaining to the management of persistent organic pollutants will be conducted within the implementation of the government research and technical programs and projects. Special attention will be given to scientific and research works focusing on environmentally sound management of persistent organic pollutants, development of technologies for clean up and remediation of soils contaminated by persistent organic pollutants and optimization of studies relating to unintentional releases of persistent organic pollutants.

Strategic directions identified for research pertaining to the management of persistent organic pollutants are:

Stage 1 – 2007–2010:

- Studies of the sources of POPs releases to the environment;
- Analysis and selection of technologies for clean up and remediation of soils contaminated by persistent organic pollutants; and
- Forecast of the magnitude and modeling of the transmission of unintentional releases of persistent organic pollutants.

Stage 2 – 2011–2028:

- Development and introduction of the techniques of prevention and minimization of the adverse impact of persistent organic pollutants on human health;
- Development and (or) adaptation of methods and technologies of disposal of POPs containing wastes and clean up of the sites contaminated by persistent organic pollutants;
- Search for biochemical, immunological, genetic and endocrine markers revealing the impact of persistent organic pollutants on human health; and
- Development and introduction of methods for biological testing including justified criteria and approaches to data extrapolation on humans.

Assessment of Major Financial Costs and Investment Needs for the Implementation of the National Plan

The activities of the National Plan are to be financed from the republican budget, the National Environmental Protection Fund, the revenues of organizations and other sources permitted by the legislation of the Republic of Belarus.

Given that the allocations and the scope of funding from the Republican Environmental Protection Fundare determined by the President of the Republic of Belarus, the amount of financing of the activities from the Fund's allocations during the implementation of the National Plan can be adjusted in case the respective decision is made by the President of the Republic of Belarus.

The allocations from the republican budget and the Republican Environmental Protection Fund will be spent as set out in the Action Plan appended to this National Plan, including:

- Construction and equipping of large consolidated facilities for environmentally sound storage of stockpiles and wastes containing persistent organic pollutants;
- Disposal of wastes containing polychlorinated biphenyls;
- Monitoring of persistent organic pollutants in the broader environment, human health monitoring;
- Research work pertaining to the management of persistent organic pollutants;
- Development of regulations including technical regulations streamlining relations in the sphere of POPs management and facilitating efficient POPs handling;
- Provision of the compliance with the POPs related legislation; and
- Information exchange, education and awareness with regard to persistent organic pollutants.

The costs of the implementation of the National Plan during this period total BYR 4,175 million including BYR 3,205 million to be financed from the National Environmental Protection Fund, BYR 50 million – from the republican budget and BYR 920 million – by enterprises. The major part of funds (33.46 %) will be spent on the activities aimed at reduction/prevention of adverse effects of the POPs obsolete pesticides and on the activities involving POPs environmental monitoring and analytical capacity building (24.72 %).

Supplemental investment needs of the Republic of Belarus for financing the implementation of the National Plan may be supported from external sources which would contribute to the costs of:

- Disposal of POPs pesticides and their mixtures;
- Repackaging of the POPs obsolete pesticides;
- Phase out of the old electrotechnical equipment containing polychlorinated biphenyls;
- Disposal of wastes containing polychlorinated biphenyls;
- Clean up of the sites contaminated by persistent organic pollutants, remediation of the affected environment;
- Development of POPs monitoring programs;
- Introduction of the best available techniques and the best environmental practices aimed to reduce and eliminate unintentional releases of persistent organic pollutants;
- Strengthening of regulatory and technical capacity for the management of persistent organic pollutants; and
- Raising public awareness about persistent organic pollutants.

It is expected to raise supplementary funds within the programs of the international technical assistance provided to the Republic of Belarus for implementing activities aimed at addressing persistent organic pollutants and other sources of foreign investment.

Implementation Arrangements and Monitoring of the National Plan

The implementation of the National Plan is based on the principle of partnership and collaboration of the government authorities, local executive and administrative bodies, academic institutions and other organizations including non-government organizations as well as clear division of powers and responsibilities of all stakeholders of the National Plan.

The Ministry of Natural Resources and Environmental Protection of the Republic of Belarus is responsible for the management and supervision of the implementation of the National Plan.

The Ministry of Natural Resources and Environmental Protection represents the Republic of Belarus at the Conference of the Parties and provides the following information to the Secretariat of the Stockholm Convention:

- Information on the measures taken to implement the provisions of the Stockholm Convention;
- Evaluation of the effectiveness of such measures in meeting the objectives of the Stockholm Convention;
- Statistical data on total quantities of production, import and export of each of the chemicals listed in Annex A and Annex B to the Stockholm Convention;
- A list of the States from which the substances listed in Annex A and Annex B to the Stockholm Convention have been imported and a list of States to which the substances listed in Annex A and Annex B to the Stockholm Convention have been exported;
- Reports and other monitoring data on the presence of the chemicals listed in Annexes A, B and C to the Stockholm Convention as well as their global environmental transport; and
- Information on non-compliance with the provisions of Article 17 of the Stockholm Convention.

Taking into account the requirements set out in the Stockholm Convention and the Plans of Social and Economic Development of the Republic of Belarus, the Ministry of Natural Resources and Environmental Protection shall, if needed, furnish to the Council of Ministers of the Republic of Belarus the proposals on changing and amending the National Plan.

Any changes and amendments introduced to the National Plan should be communicated to the Secretariat of the Stockholm Convention pursuant to the established procedure.

The Ministry of Natural Resources and Environmental Protection of the Republic of Belarus shall ensure coordination of efforts on the implementation of the activities of the National Plan, targeted and efficient use of the allocations from the republican budget, fulfillment of agreements with the regions on financing the activities from local budgets and off-budgetary sources. The Ministry of Natural Resources and Environmental Protection shall collaborate with the agencies responsible for the implementation of the activities of the National Plan.

The agencies responsible for the implementation of the activities of the National Plan shall:

- Organize dissemination of information and explanation of the objectives and tasks of the National Plan;
- Monitor the implementation of the activities of the National Plan and report the progress to the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus;
- Coordinate the activities of co-implementing agencies in the process of the implementation of the activities of the National Plan;
- Be responsible for the implementation of the activities and the respective methodological support; and
- Supervise targeted use of budgetary allocations.

By 1 April of the year following the reported year the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus together with the relevant government authorities, regional and Minsk sity executive committees shall submit to the Council of Ministers of the Republic of Belarus the progress reports on the implementation of the National Plan.

ANNEX

to the National Plan of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for 2007-2010 and until 2028

Action Plan

Description	Timing	Estimated Costs (BYR million)					Financing Sources	Outcomes	Implementing/ Co-implementing Agencies
		Total	including by years						
			2007	2008	2009	2010			
1	2	3	4	5	6	7	8	9	10
Regulatory Framework for the Management of Persistent Organic Pollutants									
1. Objective: upgrading of regulatory framework for the management of persistent organic pollutants									
1.1. Task: ensuring regulation of relations pertaining to the management of polychlorinated biphenyls and POPs chlororganic pesticides									
1.1.1. Development of a draft regulation defining the procedure and terms of the use, alienation, export and import of persistent organic pollutants; its further submission, according to the established procedure, to the Council of Ministers of the Republic of Belarus	2007	–	–	–	–	–	–	Regulatory framework relating to the use, alienation, export and import of persistent organic pollutants is upgraded	MNREP, other government authorities, NASB
1.1.2. Development and enforcement of a technical regulation defining the procedure of POPs contaminated sites clean up	2008	–	–	–	–	–	–	Regulatory framework for POPs contaminated sites clean up and remediation of the affected environment is established	MNREP
1.1.3. Development and enforcement of hygienic norms of the POPs pesticides and PCB content in food products and water	2009–2010	30	–	–	10	20	Republican Environmental Protection Fund	Hygienic norms of the POPs pesticides and PCB content in food products and water are established	Ministry of Health
1.2. Task: regulatory framework for monitoring of persistent organic pollutants in the environment									
1.2.1. Development and enforcement of the regulations establishing the procedures of sampling and measuring the levels of persistent organic pollutants in ambient air and water eco-systems	2007–2009	42	14	14	14	–	Republican Environmental Protection Fund	Methodological framework for monitoring of persistent organic pollutants in ambient air and water eco-systems is upgraded	MNREP

1	2	3	4	5	6	7	8	9	10
1.3. Task: upgrading of regulatory framework for recording unintentional releases of persistent organic pollutants to the environment									
1.3.1. Development and enforcement of the regulations ensuring the inventory, recording and setting of the norms of unintentional releases of persistent organic pollutants	2008–2009	50	–	25	25	–	Republican Environmental Protection Fund	Methodological framework for the inventory, recording and setting of norms of unintentional releases of persistent organic pollutants is upgraded	MNREP, NASB
TOTAL		**122**	**14**	**39**	**49**	**20**			
including		122	14	39	49	20	Republican Environmental Protection Fund		
Institutional Framework for the Management of Persistent Organic Pollutants									
2. Objective: upgrading of the institutional framework for the management of persistent organic pollutants									
2.1. Task: improvement of the institutional arrangements for the management of persistent organic pollutants									
2.1.1. Optimization of the institutional framework for the management of POPs within the Ministry of Natural Resources and Environmental Protection (MNREP)	2007	–	–	–	–	–	–	Efficiency of the institutional framework for the management of persistent organic pollutants is improved	MNREP
2.1.2. Holding of training workshops on POPs management requirements set out in the environmental protection legislation for inspectors of the territorial departments of the MNREP and specialists of other government authorities and organizations	2007	–	–	–	–	–	–	POPs management and control system is improved	MNREP, Ministry of Industry, Ministry of Energy, Ministry of Communication, Ministry of Architecture and Construction, Ministry of Agriculture and Food, other government authorities, Belarusian Railways, Concerns “Bellesbumprom”, “Belneftekhim”, “Belbiopharm”, “Belgospischeprom”
2.1.3. Training of specialists in the elimination of accidents, which may emerge in the process of POPs handling	2008–2009	–	–	–	–	–	–	Specialists are trained in the elimination of accidents, which may emerge in the process of POPs handling	Ministry for Emergency Situations, other government authorities, organizations
2.1.4. Development of the plans of actions in case of emergencies at the sites where POPs are handled	2007	–	–	–	–	–	–	Consequences of accidents which may emerge in the process of POPs handling are prevented and minimized	Ministry of Industry, Ministry of Energy, Ministry of Communication, Ministry of Architecture and Construction, Ministry of Agriculture and Food, other government authorities, Concerns “Bellesbumprom”, “Belbiopharm”, “Belneftekhim”, “Belgospischeprom”, Belarusian Railways, organizations

1	2	3	4	5	6	7	8	9	10
2.2. Task: provision of the information on POPs management to the government bodies									
2.2.1. Establishment of the specialized database on POPs monitoring within NEMS information system	2008–2010	30	–	10	10	10	Republican Environmental Protection Fund	Government bodies are timely informed about the findings of monitoring of POPs in the broader environment	MNREP
2.2.2. Maintenance and updating of the electronic database on POPs pesticides, landfills and sites contaminated by POPs pesticides	2007–2010	40	10	10	10	10	Republican Environmental Protection Fund	Information support of decision making relating to the management of POPs pesticides is ensured	MNREP, Ministry of Agriculture and Food, other government authorities, organizations
2.2.3. Maintenance and updating of the electronic database on the PCB stockpiles, equipment, materials and wastes containing PCBs and the PCB-contaminated sites	2007–2010	40	10	10	10	10	Republican Environmental Protection Fund	Information support of decision making relating to PCB management	MNREP, other government authorities, NASB, organizations
2.2.4. Maintenance and updating of the electronic database on unintentional releases of POPs	2007–2010	40	10	10	10	10	Republican Environmental Protection Fund	Information support of decision making relating to the management of unintentional releases of POPs	MNREP, other government authorities, NASB, organizations
2.3. Task: reporting on the measures taken to implement the provisions of the Stockholm Convention									
2.3.1. Reporting to the official bodies of the Stockholm Convention on the fulfillment of the obligations assumed by the Republic of Belarus	2007–2010	–	–	–	–	–	–	The provisions of Article 15 of the Stockholm Convention are implemented	MNREP, other government authorities, NASB, organizations
TOTAL		**150**	**30**	**40**	**40**	**40**			
including		150	30	40	40	40	Republican Environmental Protection Fund		
Management of POPs Pesticides									
3. Objective: improvement of the arrangements for the management of POPs pesticides									
3.1. Task: ensuring environmentally sound storage and disposal of the POPs obsolete pesticides									
3.1.1. Completion of repackaging of POPs pesticides stockpiled at the temporary storehouses owned by organizations	2007	150	150	–	–	–	National Environmental Protection Fund	Sources of environmental contamination by persistent organic pollutants are eliminated	Ministry of Agriculture and Food, MNREP, organizations
3.2. Task: prevention and reduction of harmful impact of obsolete pesticides burial sites on the environment									
3.2.1. Engineering and technical measures aimed at reduction of harmful environmental impacts of POPs pesticides buried in landfills	2007	247	247	–	–	–	National Environmental Protection Fund	Contamination of the environment by persistent organic pollutants is reduced	local executive and administrative bodies, MNREP, organizations

1	2	3	4	5	6	7	8	9	10
3.2.2. Implementation of a set of measures for the elimination of the Brest obsolete pesticides landfill	2007	1000	1000	–	–	–	Republican Environmental Protection Fund	Contamination of the environment by POPs is prevented; affected environment is remediated	Brest Regional Executive Committee, MNREP
TOTAL		**1397**	**1397**	–	–	–			
including		1397	1397	–	–	–	Republican Environmental Protection Fund		
Management of the Equipment, Materials and Wastes Containing Polychlorinated Biphenyls									
4. Objective: prevention and minimization of adverse impact of polychlorinated biphenyls (PCBs) on the environment									
4.1. Task: collection and environmentally sound storage of PCB-containing equipment, materials and wastes									
4.1.1. Completion of identification, inventory and labeling of PCB-containing equipment and wastes with PCBs content above 50 mg/kg	2007–2008	90 including 70 20	45 35 10	45 35 10	– – –	– – –	Republican Environmental Protection Fund enterprises financing	System for control of PCB-containing equipment and wastes is upgraded	Ministry of Industry, Ministry of Energy, Ministry of Communication, Ministry of Architecture and Construction, other government authorities, NASB, Concerns “Bellesbumprom”, “Belneftekhim”, “Belbiopharm”, “Belgospischeprom”, Belarusian Railways, organizations
4.2. Task: collection and environmentally sound storage of PCB-containing equipment, materials and wastes									
4.2.1. Removal from use and dismantling of PCB-containing equipment in poor condition; environmentally sound collection and temporary storage of dismantled equipment within the territory of enterprises	2007–2010	300	75	75	75	75	Enterprises financing	Contamination of the environment by PCBs is prevented	Ministry of Industry, Ministry of Energy, Ministry of Communication, Ministry of Architecture and Construction, other government authorities, Belarusian Railways, Concerns “Belgospischeprom”, “Bellesbumprom”, “Belneftekhim”, “Belbiopharm”, organizations
4.2.2. Elaboration and endorsement in coordination with the MNREP of the procedure of acceptance and storage of the PCB-containing equipment removed from use, PCB-containing materials and wastes	2007	–	–	–	–	–	–	The system of collection and environmentally sound storage of PCB-containing hazardous wastes is established	CUE “Facility for processing and burial of toxic industrial wastes of the Gomel region”
4.2.3. Ensuring acceptance of the PCB-containing equipment removed from use, PCB-containing materials and wastes delivered by organizations for storage in accordance with the annual plans	2008–2010	–	–	–	–	–	–	Environmentally sound storage of PCB-containing equipment, materials and wastes is ensured	CUE “Facility for processing and burial of toxic industrial wastes of the Gomel region”

1	2	3	4	5	6	7	8	9	10
4.2.4. Transportation of PCB-containing equipment removed from use and PCB-containing materials to the CUE "Facility for processing and burial of toxic industrial wastes of the Gomel region"	2008–2010	–	–	–	–	–	–	Number of landfills for PCB-containing hazardous wastes is reduced	Ministry of Industry, Ministry of Energy, Ministry of Communication, other government authorities, Concerns "Belgospischeprom", "Belneftekhim", organizations
4.3. Task: disposal of PCB-containing equipment, materials and wastes									
4.3.1. Analysis, selection and justification of the PCB disposal technologies, which are the most appropriate for their application and use in Belarus	2008	20	–	20	–	–	Republican Environ-mental Protection Fund	List of environmentally sound and efficient technologies for PCB disposal is compiled	NASB, MNREP
4.3.2. Development of long-term plans for disposal of PCB-containing equipment, materials and wastes; approval of the plans with by the MNREP	2009	–	–	–	–	–	–	Planning PCBs disposal is ensured	Ministry of Industry, Ministry of Energy, Ministry of Communication, Ministry of Architecture and Construction, other government authorities, Belarusian Railways, Concerns "Belgospischeprom", "Bellesbumprom", "Belneftekhim", "Belbiopharm"
4.4. Task: clean up of sites contaminated by polychlorinated biphenyls and remediation of the affected environment									
4.4.1. Capture and containment of the most contaminated soils from the sites where PCB leakage and spillage are recorded and ensuring their environmentally sound storage	2008–2009	200	–	100	100	–	Enterprises financing	Level of soil contamination by PCBs is reduced; PCBs migration in the environment is prevented	Ministry of Industry, Ministry of Energy, Ministry of Communication, Ministry of Architecture and Construction, other govern-ment authorities, Belarusian Railways, Concerns "Belgospischeprom", "Bellesbumprom", "Bel-neftekhim", "Belbiopharm", NASB, organizations
4.4.2. Initiate pilot clean up of PCB-contaminated sites at Sub-station 330 "Lida" (Lida) and OJSC "Polimir" (Novopolotsk)	2009–2010	200	–	–	100	100	Republican Environ-mental Protection Fund	PCBs impact on the environment is mitigated	MNREP, Ministry of Energy, Ministry for Emergency Situations, Concern "Belneftekhim", organizations
TOTAL		**810**	**120**	**240**	**275**	**175**			
including		290 520	35 85	55 185	100 175	100 175	Republican Environmental Protection Fund Eenterprises financing		

1	2	3	4	5	6	7	8	9	10
Development of Monitoring of Persistent Organic Pollutants in the Environment									
5. Objective: obtaining of reliable data on generation, migration and levels of persistent organic pollutants in the environment with the aim of information provision in the process of POPs management									
5.1. Task: upgrading of technical and analytical capacity for monitoring of persistent organic pollutants in the environment									
5.1.1. Updating and upgrading of technical capacity for POPs monitoring and expansion of analytical works	2008–2009	432	–	216	216	–	Republican Environmental Protection Fund	Technical capabilities for monitoring of POPs in the environment are enhanced	MNREP
5.1.2. Procurement of equipment and organization of the monitoring of the levels of dioxins and furans in releases to the environment	2009–2010	600	–	–	300	300	Republican Environmental Protection Fund	Technical capacity for monitoring of dioxin and furan releases to the environment is established	MNREP
TOTAL		1032	–	216	516	300			
including		1032	–	216	516	300	Republican Environmental Protection Fund		
Human Health Monitoring									
6. Objective: minimization and prevention of the intake of polychlorinated biphenyls and POPs chlororganic pesticides through food products and drinking water									
6.1. Task: organization of monitoring of POPs chlororganic pesticides and polychlorinated biphenyls in food products and drinking water									
6.1.1. Adaptation of the technique of PCB content definition in fish products for PCB content definition in other food products	2008	20	–	20	–	–	Republican budget *	Technique for PCB content definition in food products is introduced	Ministry of Health
6.1.2. Development and implementation of the methodology for monitoring of POPs pesticides and PCBs in food products and drinking water	2008–2009	–	–	–	–	–	–	Monitoring of POPs chlororganic pesticides and PCBs in food products is improved	Ministry of Health
6.1.3. Equipment of the laboratories of the regional (Minsk municipal) centers of hygiene and epidemiology with the facilities for analytical control of PCBs in food products and drinking water	2008–2009	–	–	–	–	–	–	Technical capacity for PCBs quantification in food products and drinking water is enhanced	Local executive and administrative bodies
6.1.4. Organization of the monitoring of PCBs and POPs pesticides in food products and drinking water	2008–2010	–	–	–	–	–	–	Database on contamination of food products and drinking water by POPs pesticides and PCBs is established	Ministry of Health, Ministry of Agriculture and Food, Ministry of Housing and Communal Services
6.2. Task: identification of the categories of the population and workers potentially exposed to POPs pesticides, polychlorinated biphenyls, dioxins and furans									
6.2.1. Compilation of the list of occupational risk groups exposed to persistent organic pollutants based on the list of the technological processes involving potential contact with POPs	2008–2009	–	–	–	–	–	–	List of technological processes and occupations involving potential contact with POPs is compiled	Ministry of Health, Ministry of Labor and Social Protection, other government authorities, organizations

* – within Task 4.2 of the Government Research and Technical Program “Ecological Safety”

1	2	3	4	5	6	7	8	9	10
6.2.2. Development of the methodology for monitoring of contamination of workers by POPs pesticides and PCBs	2009–2010	–	–	–	–	–	–	Methodological support of monitoring of contamination of workers by POPs pesticides and levels of PCBs in blood and biological secretion is ensured	Ministry of Health
TOTAL		**20**	**–**	**20**	**–**	**–**			
including		20	–	20	–	–	Republican budget		
Unintentional Releases of Persistent Organic Pollutants									
7. Objective: reduction and elimination of unintentional releases of persistent organic pollutants to the environment									
7.1. Task: priority measures aimed at reduction of unintentional releases of persistent organic pollutants									
7.1.1. Development and implementation of a set of measures aimed at reduction of unintended releases of POPs from the source categories controlled by Part II of Annex C to the Stockholm Convention	2007–2010	400	100	100	100	100	Enterprises financing	Reduction of POPs releases in accordance with Article 5 of the Stockholm Convention is achieved	Ministry of Industry, Ministry of Housing and Communal Services, MNREP, Concern "Belneftekhim", organizations
TOTAL		**400**	**100**	**100**	**100**	**100**			
including		400	100	100	100	100	Enterprises financing		
Exchange of Information with the Parties to the Stockholm Convention									
8. Objective: establishment of the system of exchange of information relating to reduction, elimination and use of POPs and alternatives to POPs with the Parties and the Secretariat of the Stockholm Convention									
8.1. Task: establishment of the national network for the exchange of information relating to the management of POPs and undertaking of regular exchange of information with the Secretariat of the Stockholm Convention									
8.1.1. Ensuring that the government bodies and the public have an access to the key international and natinal information resources on POPs management	2007–2010	–	–	–	–	–	–	The infrastructure for sustainable exchange of information relevant to POPs management is established	MNREP, other government authorities, research institutions, organizations
8.1.2. Organization of regular exchange of information relating to POPs management with the Secretariat of the Stockholm Convention	2007–2010	–	–	–	–	–	–	Implementation of paragraph 4 of Article 9 of the Stockholm Convention is ensured	MNREP
TOTAL		**–**	**–**	**–**	**–**	**–**			
Public Information, Awareness and Education									
9. Objective: raising awareness of the Belarusian people about persistent organic pollutants and their harmful impacts on human health and the environment									
9.1. Task: provision to the Belarusian people of the information on the main types and sources of persistent organic pollutants, their health and environmental effects and the rules of handling persistent organic pollutants									
9.1.1. Production and distribution of social adverts and information materials on persistent organic pollutants	2007–2010	50	10	10	15	15	Republican Environmental Protection Fund	Awareness of the Belarusian people about persistent organic pollutants is improved	MNREP, Ministry of Health, other government authorities, local executive and administrative bodies, organizations, NGOs

1	2	3	4	5	6	7	8	9	10
9.1.2. Maintenance of the website covering the issues related to persistent organic pollutants	2007–2010	50	10	10	15	15	Republican Environmental Protection Fund	Information on persistent organic pollutants is promptly obtained	MNREP
9.1.3. Conducting regular sociological surveys with the aim of assessing the level of public awareness about persistent organic pollutants	2007–2010	14	3	3	4	4	Republican Environmental Protection Fund	Level of public awareness about persistent organic pollutants is monitored	MNREP
9.2. Task: development and implementation of training programs on the management of persistent organic pollutants in the Republic of Belarus; training of managerial personnel, scientists, educators and workers on the issues relating to the management of persistent organic pollutants									
9.2.1. Development and introduction of education and training programs within the framework of the current education system relating to the management of persistent organic pollutants, their health and environmental effects and alternatives to persistent organic pollutants	2007–2010	–	–	–	–	–	–	System of public information, awareness and education relating to persistent organic pollutants is improved	Ministry of Education
9.2.2. Incorporation of POPs related issues in the programs of training, raising of proficiency level of managers and specialists of the government authorities, local executive and administrative bodies and organizations	2007–2010	–	–	–	–	–	–	Qualification of managers and specialists of the government authorities, local executive and administrative bodies and organizations is raised	Ministry of Education, other government authorities, Academy of State management under the aegis of the President of the Republic of Belarus, local executive and administrative bodies, organizations
9.2.3. Inclusion of the issues relating to POPs handling in safety instructions for the personnel employed in agricultural, industrial, energy and housing and utilities sectors	2007–2010	–	–	–	–	–	–	Safety of people handling persistent organic pollutants is ensured	Ministry of Agriculture and Food, Ministry of Industry, Ministry of Housing and Communal Services, Ministry of Energy
9.3. Task: coverage of POPs related issues in the national mass media									
9.3.1. Regular coverage of POPs related issues in the central and regional mass media	2007–2010	–	–	–	–	–	–	Public awareness about persistent organic pollutants is raised	Ministry of Information, MNREP, other government authorities, local executive and administrative bodies
9.3.2. Organization of press conferences, workshops, roundtables, lectures, briefings and other informational events relating to POPs management	2007–2010	–	–	–	–	–	–	Infrastructure for the provision of information on persistent organic pollutants to the public is available	Ministry of Education, Ministry of Health, MNREP, Ministry of Information, research institutions, non-governmental associations

1	2	3	4	5	6	7	8	9	10
9.4. Task: involvement of the public in decision-making relating to the management of persistent organic pollutants									
9.4.1. Involvement of NGOs in decision-making relating to the management of persistent organic pollutants	2007–2010	–	–	–	–	–	–	Participation of HGOs in addressing the POPs issues is facilitated	MNREP, other government authorities, local executive and administrative bodies, non-governmental associations
9.4.2. Republican contest of NGO projects aimed at informing the public about persistent organic pollutants	2007–2010	30	5	5	10	10	Republican Environmental Protection Fund	Activities of NGOs on provision of information on persistent organic pollutants to the public are supported	MNREP, non-governmental associations
TOTAL		**144**	**28**	**28**	**44**	**44**			
including		144	28	28	44	44	Republican Environmental Protection Fund		
Research Pertaining to the Management of Persistent Organic Pollutants									
10. Objective: improvement of efficacy of research pertaining to the management of persistent organic pollutants									
10.1. Task: optimization of research pertaining to environmentally sound management of polychlorinated biphenyls									
10.1.1. Studies of PCBs accumulation in anthropogenic substrata; assessment of their hazard as secondary sources of PCBs transmission to the environment; development of recommendations on prevention of PCBs transmission from accumulators of anthropogenic substrata in the environment	2010	30	–	–	–	30	Republican budget (the Government Research and Technical Program "Ecological Safety")	Risk of PCBs dissemination in the environment is reduced	NASB
10.2. Task: studies focusing on clean up and remediation of sites contaminated by persistent organic pollutants									
10.2.1. Analysis and selection of POPs contaminated soil clean up and remediation technologies which are the most appropriate for the Republic of Belarus	2008	30	–	30	–	–	Republican Environmental Protection Fund	Environmentally sound and cost-efficient technologies for clean up and remediation of POPs contaminated soils are introduced	NASB, MNREP
10.3. Task: development of research pertaining to the management of unintentional releases of persistent organic pollutants									
10.3.1. Forecast of the magnitude of POPs unintentional releases until 2020	2008–2009	40	–	20	20	–	Republican Environmental Protection Fund	Information support of decision-making on regulation of POPs unintentional releases is ensured	NASB, MNREP
TOTAL		**100**	**–**	**50**	**20**	**30**			
including		70 30	– –	50 –	20 –	– 30	Republican Environmental Protection Fund Republican budget (the Government Research and Technical Program "Ecological Safety")		

	Estimated Costs (BYR million)					Financing Sources
	Total	including by years				
		2007	2008	2009	2010	
TOTAL	**4,175**	**1,689**	**733**	**1,044**	**709**	
including by financing sources:	3,205	1,504	428	769	504	Republican Environmental Protection Fund
	50	–	20	–	30	Republican budget (the Government Research and Technical Program “Ecological Safety”)
	920	185	285	275	175	Enterprises financing

ANNEXES

Assessment of the Current Situation in the Sphere of POPs Management in the Republic of Belarus

(implemented by the experts of the project GEF TF 053865
"Enabling activities related to the implementation of the Stockholm Convention
on persistent organic pollutants (POPs) in the Republic of Belarus")

ANNEX 1. Assessment of the Regulatory Framework for the Management of Persistent Organic Pollutants
Prepared by: Elena Layevskaya, Candidate of Juridical Science

ANNEX 2. Assessment of Institutional Capacity for the Management of Persistent Organic Pollutants in the Republic of Belarus
Prepared by: Oleg Ivashkevich, Doctor of Chemical Science

ANNEX 3. Inventory of POPs Pesticides Stockpiles and Their Disposal Sites
Prepared by: Oleg Beliy, Candidate of Technical Science,
Venera Avdi,
Sergey Deschits,
Natalia Lysukho,
Victor Khodin

ANNEX 4. Inventory of PCB-containing Equipment, Materials, Wastes and their Disposal Sites
Prepared by: Tamara Kukharchik, Candidate of Geographical Science,
Sergey Kakareka, Doctor of Technical Science,
Anastasia Krylovich

ANNEX 5. Inventory of Unintentional Releases of PCB, PCDD/PCDF and HCB to the Environmenty
Prepared by: Sergey Kakareka, Doctor of Technical Science,
Anna Malchikhina

ANNEX 6. Assessment of Environmental Contamination by Persistent Organic Pollutants in the Republic of Belarus
Prepared by: Valery Khomich, Doctor of Geographical Science,
Saveliy Kuzmin, Candidate of Geographical Science,
Svetlana Utochkina, Candidate of Chemical Science,
Lyudmila Skripnichenko, Candidate of Chemical Science,
Natalia Sviridovich

ANNEX 7. Assessment of the Problems in the Sphere of Healthcare and Environmental Protection in Connection with the POPs Impact
Prepared by: Irina Zastenskaya, Candidate of Medical Science

ANNEX 1

Assessment of the Regulatory Framework for the Management of Persistent Organic Pollutants

1.1. Outline of the Current Legislative Framework regulating the Use of Chemicals including Persistent Organic Pollutants

International Agreements within the Legislative System of the Republic of Belarus

In accordance with Article 8 of the Constitution of the Republic of Belarus, the country acknowledges the priority of the universal principles of the international law and is committed to align the national legislation with these principles [1].

In accordance with the Law of the Republic of Belarus "On Legislative Acts of the Republic of Belarus" [2], the legislative norms set out in the international agreements concluded by the Republic of Belarus that have entered into force shall constitute a part of the existing legislation of the Republic of Belarus and shall be subject to direct enforcement except for cases when an international agreement contains a provision stipulating that the enforcement of these norms warrants adoption of an internal legislative act and shall have the force of the legislative act, through which the Republic of Belarus has consented that the respective international agreement is mandatory for it.

To this end, formation of the legislative framework of the Republic of Belarus addressing the issues of safe chemicals use including POPs is largely influenced by the international agreements regulating the relations in this field. In particular, the Republic of Belarus is a Party to the following international agreements:

- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (accedence by Decree of the President of the Republic of Belarus of 16 September 1999 No. 541);
- Convention on Long-Range Transboundary Air Pollution (ratified by Decree of the Presidium of the Supreme Council of the Republic of Belarus of 14 May 1980);
- the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (approved by Decree of the President of the Republic of Belarus of 14 December 1999 No. 726);
- the Convention on Transboundary Impact of Industrial Accidents (accedence by the Law of the Republic of Belarus of 30 April 2003).

In accordance with Decree of the President of the Republic of Belarus No. 594 [3] of 26 December 2003, Belarus joined the Stockholm Convention on Persistent Organic Pollutants. The provisions of the Convention have thus gained the legal force of the Presidential Decree.

National and Sectoral Programs, Concepts and Strategies

An important factor influencing the formation of the system for the management of chemicals including POPs is the existence of national and sectoral programs, concepts and strategies determining, to one or the other extent, the principles and priorities of the government policy aimed to enhance safe use of toxic chemicals. It should be stressed that in Belarus these documents usually have the status of regulations and are mandatory for execution if adopted (endorsed) by the government bodies empowered with law-making functions.

Among others, it is worth noting:

- Concept of the Government Policy of the Republic of Belarus in the Field of Environmental Protection of 6 September 1995 [4],
- Concept of the National Security of the Republic of Belarus of 17 July 2001 [5],
- National Strategy of Sustainable Social and Economic Development of the Republic of Belarus until 2020,
- Program of Social and Economic Development of the Republic of Belarus for 2001–2005 [6],

- National Action Plan for Sound Natural Resource Management and Environmental Protection of the Republic of Belarus for 2001–2005 [7],
- National Plan of Actions on the Environmental Hygiene for 2001–2005 [8],
- Republican Program for Municipal Waste Treatment until 2007 [9],
- Government Program "Chemical Crop Protectants "Pesticides" for 2003–2006 and Subsequent Years" [10].

Laws

The principles of the government policy in the field of the use of chemicals including POPs are embodied in the laws of the Republic of Belarus. The major relevant law is the Law "On Environmental Protection".

The Law of the Republic of Belarus "On Environmental Protection" [11] of 26 November 1992 with subsequent changes and amendments sets out the following principles:

- Observance of the rights of people to friendly environment and compensation of damage inflicted as a result of infringement of this right;
- Ensuring friendly livelihoods for life and health of people;
- Protection, efficient use and reproduction of natural resources as a necessary condition for securing friendly environment and environmental safety;
- Preventive nature of environmental protection measures and prevention of any damage to the environment;
- Government regulation of environmental protection and natural resource management;
- Fee-based special use of natural resources and compensation of the damage inflicted as a result of adverse impact on the environment;
- Independence of control in the field of environmental protection;
- Mandatory government ecological expertise of draft papers and other documents justifying economic or other activity that may entail adverse environmental impacts and may pose a threat to life, health and property of people;
- Permissibility of environmental impacts as a result of economic and other activity taking into account environmental protection requirements;
- Presumption of environmental risk of intended economic and other activity taking into account the requirements for the environment protection;
- Reduction of adverse environmental impact of economic and other activity through the use of technologies ensuring that environmental protection requirements are properly met taking into account economic and social factors;
- Prohibition of economic and other activity that may result in degradation of natural ecological systems, change and (or) destruction of genetic value of flora and fauna, degradation of natural resources and other negative changes in the environment.

Article 46 of the Law stipulates that hazardous chemicals can be produced and managed in Belarus only after the relevant hygienic and toxicological testing of these chemicals, establishment of the treatment procedure taking into account environmental protection requirements and the government registration of these chemicals in accordance with the procedure set out in the legislation of the Republic of Belarus. Decontamination of hazardous chemicals shall take place upon availability of the respective technological documentation that has been agreed upon in accordance with the procedure set out in the legislation of the Republic of Belarus.

In accordance with Article 48, legal entities and individuals are supposed to observe the requirements pursuant to production, storage, transportation and use of chemicals in agricultural and forestry sectors as well as environmental protection regulations and to undertake measures to prevent adverse impacts associated with economic and other activities and to eliminate aftereffects to ensure quality of the environment, sustainable functioning of environmental systems and conservation of typical and rare natural landscapes. This norm assumes imperative ban on the use of non-decaying toxic chemicals.

Article 50 establishes environmental protection requirements pursuant to waste treatment. Waste disposal is banned on the territory of specially protected areas, in national parks, reserves, natural heritage assets, wetlands, water protected areas, sanitary protection zones of water resources used for water supply. Waste disposal is

also banned on lands having recreation, historic and cultural value and in residential settlements and their "green zones" in case of infliction or a risk of inflicting damage to the environment, life and health of people as a result of adverse impact on the environment. It is banned to import hazardous or other wastes to Belarus for the purpose of stockpiling and (or) decontamination.

In accordance with Article 21, to prevent adverse environmental impact of economic and other activities, legal entities and individual entrepreneurs (users of natural resources) should observe the norms of permissible environmental impact including the norms of permissible emission and discharge of chemicals and other agents; the norms of industrial waste generation; the norms of any other permissible environmental impact in the process of economic and other activities which are set out in the legislation of the Republic of Belarus.

Article 41 sets out environmental protection requirements for the use of agricultural assets. In particular, legal entities and individual entrepreneurs producing, harvesting and processing agricultural products and providing services on maintenance and repair of agricultural equipment, storage of fuel and oil, organic and mineral fertilizers, pesticides and growth stimulators and other chemicals are supposed to establish a sanitary protection zone around production premises and to have treatment facilities ensuring that environmental protection requirements are met.

Article 98 of the Law specifies the following types of offenses with regard to environmental protection: disrespect of environmental protection regulations; disrespect of environmental safety requirements; disrespect of safety rules applicable to the management of hazardous chemicals, agents and wastes; infringement of the Belarusian legislation on waste-related issues and etc.

Article 28 of the Law of the Republic of Belarus "On Sanitary and Epidemiological Security of the Population" [12] of 23 November 1993 with subsequent changes and amendments articulates requirements to industrial products, household goods and the respective production technologies. Particularly, industrial products, their production, transportation, storage and use as well as household goods and packaging materials (further referred to as products) should not produce an adverse impact on human health and the environment. These products should meet sanitary requirements. The new (first ever developed or put into production) products shall be allowed for production, use and sale to households on condition of the availability of the state hygienic registration certificate issued by the authorities and agencies responsible for state sanitary supervision. New technological processes can be launched following obtaining a permission from the authorities and agencies responsible for state sanitary supervision.

In accordance with Article 30, the quality of drinking water and waters for household needs as well as materials and articles directly contacting with water at all stages of its production, treatment and distribution should meet the existing standards and sanitary requirements. In case the quality of drinking water fails to meet the existing standards and sanitary requirements, individuals and legal entities providing drinking water supply services should terminate water supply to consumers and promptly inform about such facts the authorities and agencies responsible for state sanitary supervision. Similar requirements to the quality of air in residential settlements, public recreation areas, working premises and premises for permanent and temporary staying of people are set out in Article 32 stipulating that the quality of air in residential settlements, public recreation areas, working premises and premises for permanent and temporary staying of people should meet sanitary requirements. The hygienic standards of air and limits pursuant to adverse impacts shall be approved by the Senior Sanitary Doctor of the Republic of Belarus.

Government agencies, individuals and legal entities should undertake measures intended to prevent air pollution in residential settlements, premises for permanent and temporary staying of people as well as measures for prevention of atmospheric impact of physical factors and for elimination of pollution in accordance with the Law of the Republic of Belarus.

In accordance with the Law of the Republic of Belarus "On State Ecological Expertise" [13] of 18 June 1993 with subsequent changes and amendments, the state ecological expertise is meant to prevent adverse environmental impact of the intended economic and other activities. The state ecological expertise is aimed:

- To determine whether environmental protection measures specified in the design documents of the intended economic and other activities are sufficient and justified;
- To identify the degree of the environmental risk that can emerge in the process of the intended economic or other activities and can have a direct or indirect impact on the environment;
- To prevent potential adverse impact of the intended economic and other activities on the environment and the associated aftereffects.

In accordance with Article 11 of the Law, the state ecological expertise is a mandatory element of planning, designing and making decisions on social and economic development and implementation of economic and other activities in the Republic of Belarus.

Article 12 of the Law requires that the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus shall approve the list of the types and sites of economic and other activities subject to mandatory environmental impact assessment of the intended economic and other activities.

With regard to the types and sites of economic and other activities subject to mandatory environmental impact assessment of the intended economic and other activities, it is required that the package of documents to be furnished to the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus or to its territorial departments for the purposes of the state ecological expertise shall contain the report summarizing the findings of the environmental impact assessment of the intended economic or other activity drafted in accordance with the requirements set out in the Instruction on the procedure of environmental impact assessment.

Based on the findings of the state ecological expertise, an expert opinion statement shall be drafted. It shall summarize conclusions on whether the designs of the intended economic and other activities correspond to the requirements set out in the Belarusian environmental protection legislation and whether the implementation of these activities is reasonable. As expert opinion statement shall be signed by the experts and shall be endorsed by the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus or its territorial departments.

Findings of the state ecological expertise shall be mandatory for implementation by a customer (initiator of the intended economic and other activities).

If the proposed design is rejected by the state ecological expertise, a customer (initiator of the intended economic and other activities) should take into account the comments and recommendations summarized in the expert opinion statement, should furnish the design for repeated expertise or abandon the implementation.

Funding and implementation of the design plans of the intended economic and other activities subject to the state ecological expertise shall be prohibited unless “no objection” statement of the state ecological expertise has been issued.

The following basic principles of the government regulation and management of nature assets are set out in the natural resource management codes and laws such as the Land Code of the Republic of Belarus, the Water Code of the Republic of Belarus, the Mineral Resources Code of the Republic of Belarus, the Forestry Code, the Law “On Natural Resource Protection and Management” and the Law “On Flora”:

- Prioritization of protection and reproduction of nature assets and their efficient management;
- Conservation of bio-diversity and ensuring observation of other environmental protection;
- Prevention of adverse impacts on the environment;
- Creation of economic incentives for protection and reproduction of nature assets and their efficient management;
- Liability for disrespect of the Belarusian legislation on environmental protection and natural resource management;
- Compensation of damage inflicted to the environment, livelihoods and health of people as well as of damage inflicted to the property of individuals and legal entities resulting from an adverse impact on the environment;
- Ensuring access of people (in accordance with the legislation of the Republic of Belarus) to the information about the condition of environment and environmental protection measures.

The principle of fee-based use of natural resources is set out in the Law of the Republic of Belarus "On Environmental Protection" including charges for the use of natural resources and for adverse impact on the environment. Charges for adverse impact on the environment include charges for atmospheric emissions, waste landfill, import to Belarus of ozone-depleting substances and (or) products containing ozone-depleting substances. Fee-based use of natural resources is regulated by the Law of the Republic of Belarus "On the Tax on the Use of Natural Resources (Ecological Tax)".

The Law of the Republic of Belarus "On Wastes" [14] of 25 November 1993 with subsequent changes and amendments is meant to regulate relations in the process of waste treatment and to specify the procedure of state regulation and management in the field of waste treatment as well as the procedure of waste treatment supervision and control.

The Law provides a definition of hazardous wastes. Hazardous wastes shall be understood as wastes containing substances having one or more hazardous properties (toxicity, infectious properties, explosiveness, fire risk, high reactive ability and (or) other similar properties) in such amount and form that these wastes may pose – independently or if contacting with other substances – a potential threat of inflicting damage to the environment, human health and (or) to the property owned by individuals, also as a result of the adverse impact on the environment. By the degree of the adverse impact on the environment, human health and (or) property owned by individuals resulting from adverse environmental impact, wastes fall into toxicity classes. Hazardous wastes can fall into a higher class of toxicity if they have additional hazardous or specific properties. In particular, obsolete pesticides are usually regarded as hazardous wastes of toxicity class I and II meaning that these wastes represent the highest degree of environmental hazard.

In accordance with Article 17 of the Law, waste certification procedure and the form of waste toxicity certificate shall be determined by the State Committee for Standardization of the Republic of Belarus in coordination with the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus. The list of wastes subject to certification shall be approved by the Ministry of Natural Resources and Environmental Protection in coordination with the Ministry of Public Health and the State Committee for Standardization of the Republic of Belarus.

Waste decontamination and disposal sites shall be subject to registration in the state register of waste decontamination and disposal sites. The procedure of maintaining the state register of waste decontamination and disposal sites shall be determined by the Council of Ministers of the Republic of Belarus. Waste decontamination and (or) disposal sites shall be managed in accordance with the technological specification of the management of these sites, which shall be developed as part of the portfolio of documents for construction and use of these sites.

In accordance with Article 32 of the Law, disposal of hazardous wastes is allowed only at the specially arranged waste disposal sites.

Staff members allowed to handle hazardous wastes shall take up special training.

The activity generating hazardous wastes can be restricted, suspended of banned in accordance with the procedure set out in the legislation of the Republic of Belarus if there is no technical or any other method of securing environmentally sound and human-safe management of hazardous waste.

Transportation of hazardous waste is allowed only if the following requirements are met:

- Availability of the waste toxicity certificate or its copy in case compilation of such certificate is mandatory in accordance with the legislation of the Republic of Belarus;
- Availability of the special document specified in Article 30 of the respective Law and, in case of trans-boundary transportation, of the documents specified in Article 31 of the respective Law and other regulations of the Republic of Belarus;
- Use of special vehicles and transportation methods specified in the legislation of the Republic of Belarus;
- Observance of safety rules of hazardous waste transportation.

Methods of hazardous waste transportation in special vehicles, loading and unloading, packaging, labeling and other requirements intended to secure environmental, fire and other safety of hazardous waste transportation are set out in the transportation regulations and other relevant legislation of the Republic of Belarus.

The Law of the Republic of Belarus "On Safety of Hazardous Industrial Sites" [15] dated 10 January 2000 sets out the basic principles of safe operation of hazardous industrial sites and is intended to prevent accidents at hazardous industrial sites and to build capacity of entities running hazardous industrial sites to mitigate and to eliminate the aftereffects of such accidents.

The Law of the Republic of Belarus "On air protection" [16] of 15 April 1997 with subsequent changes and amendments is intended to preserve and to improve the quality of air to ensure environmentally safe livelihoods and to prevent an adverse impact on the environment.

In accordance with Article 2, one of the priority objectives of the Law is to prevent and to reduce adverse chemical, physical, biological and other impacts on air.

The norms with respect to the quality of air shall be established with the purpose of setting permissible limits of the atmospheric impact securing human health and friendly environment.

Permissible limits of the atmospheric impact and their determination methods shall be approved by the agencies responsible for state control in the field of air protection and shall be improved with the development of science and technology taking into account the international rules and standards.

If the norms of the quality of air are disrespected, the activity of the economic entities releasing pollutants to air can be restricted, suspended or terminated upon request of the authorities responsible for state control in the field of air protection.

Article 35 sets out special requirements with regard to protection of air when using crop protectants, stimulators of crop growth, mineral fertilizers and other chemicals. The list of crop protectants, stimulators of crop growth, mineral fertilizers and other chemicals which are allowed for use as well as the techniques of their use shall be agreed with the agencies responsible for state control in the field of air protection. When new chemicals intended for the use for purposes specified in part 1 of this article are developed, it is required to establish the maximum permissible concentration and methods of quantifying residues of these chemicals in the air. Enterprises, entities and organizations as well as individuals should observe the requirements pursuant to transportation, storage and use of crop protectants, stimulators of crop growth, mineral fertilizers and other chemicals to prevent air pollution.

Irregular stockpiling of industrial, household and other wastes, which are the sources of air pollution with dust, hazardous gaseous and other substances in residential settlements is banned. Incineration of the referred wastes within the territory of enterprises, organizations and residential settlements is banned except cases when wastes are incinerated in special incinerators in compliance with air protection requirements.

The government guarantees with regard to drinking water supply to consumers are laid down in the Law of the Republic of Belarus "On drinking water supply" [17] of 24 June 1999. In particular, Article 17 stipulates that drinking water supply certification requirements shall be applicable to drinking water (in bottles or other containers) intended for distribution to customers; technological processes, equipment, materials and chemicals for drinking water purification and decontamination; individual and group-level facilities for water purification and decontamination. Certification in the field of drinking water supply shall be carried out in accordance with the procedure set out in the legislation of the Republic of Belarus.

The Law sets out legal regimes of sanitary protection zone of surface and ground sources of drinking water supply. The use of pesticides and fertilizers is banned in the first belt of the sanitary protection zone of surface and ground sources of drinking water supply.

Within the second belt of the sanitary protection zone of surface source of drinking water supply it is required to identify facilities causing pollution of drinking water supply sources and to elaborate water protection measures specifying funding sources and contractors. In the second belt of the sanitary protection zone of the surface source of drinking water supply it is banned to use pesticides; in the second belt of the sanitary protection zone of the ground source of drinking water supply it is banned to use pesticides and fertilizers.

In accordance with other natural resources management codes and laws such as the Land Code [18], the Forestry Code [19], the Water Code [20], the Mineral Resources Code [21] the measures on nature assets protection include protection from contamination with industrial wastes and chemicals.

The Law of the Republic of Belarus "On Hazardous Cargo Transportation" [22] of 6 June 2001, the Law of the Republic of Belarus "On Motor Transport and Motor Transportation", the Transport Code and other regulations have established the principles and general requirements pursuant to hazardous cargo transportation. As a rule, chemicals, including POPs, fall into the category of hazardous cargo.

In accordance with the definition specified in the above referred laws, hazardous cargo are understood as substances, materials and articles having the properties, manifestation of which during motor transportation may cause an explosion and (or) ignition, may result in death, disease, injury, poisoning, radioactive exposure or burns of people and (or) animals, may damage buildings, vehicles or other motor transportation facilities and (or) may have an adverse impact on the environment. Consignor should specify the data on hazardous cargo in a waybill. A customer of transportation services should enclose supporting documents specified in the Belarusian legislation and technical regulations on hazardous cargo transportation. In Belarus hazardous cargo transportation is subject to licensing. To secure safe storage and transportation of hazardous cargo, it is envisaged to set up, if appropriate, safeguard zones on the territories adjacent to hazardous cargo storehouses and transportation routes where any construction works and certain forms of economic activity non-associated with hazardous cargo transportation shall be limited.

Government supervision in the field of hazardous cargo transportation safety is ensured by the Committee on Supervision of the Safety of Works in Industrial and Nuclear Energy Sectors under the Ministry for Emergency Situations of the Republic of Belarus in accordance with the requirements set out by the Council of Ministers of the Republic of Belarus as well as by other government authorities within the limits of their competence in accordance with the legislation of the Republic of Belarus.

The government system for prevention and elimination of the emergency situations in the Republic of Belarus is regulated by the Law of the Republic of Belarus "On Protection of Population and Territories from Emergencies of Natural and Anthropogenic Origin" [23] of 14 June 2005.

The Administrative Code of the Republic of Belarus [24] has established administrative responsibility for such offences as, for example, damage of forest areas caused by waste waters, chemicals, hazardous emissions, wastes and garbage (Article 72); contamination of forests with construction and household wastes, waste waters or as a result of disposal of hazardous industrial waste or in any other way (Article 73); disrespect of the industrial and household waste stockpiling requirements, disrespect of air protection requirements during industrial and household waste incineration (Article 83); combustion of fuel in installations, which are not suitable for this type of fuel as well as sales of fuel without quality certificate (Article 83-1); disrespect of the rules and norms of transportation, storage and use of pesticides and other chemicals that has entailed or may entail contamination of the environment (Article 84); disrespect of the procedure regulating import to Belarus of all used or expired wastes, materials and products (Article 85-2); disrespect of the rules and norms of transportation, storage and use of pesticides and growth stimulators, mineral fertilizers and other chemicals that has entailed damage to fauna (Article 86-1) and etc.

Criminal responsibility for offences against environmental safety and nature is embodied in Chapter 26 of the Criminal Code of the Republic of Belarus [25]. In particular, Article 269 stipulated responsibility for the damage of lands, such as contamination with chemicals or radioactive substances, industrial and consumption wastes, sewage waters, bacteria and parasitic organisms or any other illegal damage of lands committed within a year after an administrative penalty for such offences was imposed. Article 278 stipulates responsibility for disrespect of the safety requirements pursuant to production, storage, use, transportation, landfill or other forms of treatment of radioactive and bacteriological substances, chemicals or industrial and consumption wastes that has taken place within a year after an administrative penalty was imposed for a similar offence or if committed despite awareness that such actions may have a risk of inflicting damage to human health and the environment.

Other Regulations (Resolutions of the Council of Ministers and Government Agencies; Technical and Legal Regulations)

Chemicals produced in Belarus shall have safety certificates in accordance with the technical and legal regulations, including:

- СТБ (Standard of Belarus) 1304–2002 "Safety Certificate of a Substance (Material) and the Procedure of Its Agreement, Endorsement and Registration";
- Regulation of the Republic of Belarus No. 04 100.57-2002 "Agreeing of the Safety Certificate of a Substance (Material) with the Government Supervision Authorities. Basic Provisions".

It should be noted, however, that POPs pesticides listed in Annexes A and B to the Stockholm Convention have never been produced in the Republic of Belarus. Furthermore, the use of all pesticides listed in the referred Annexes was banned with the signature of the Stockholm Convention. Besides, POP-containing pesticides have been deleted from the Government register of fertilizers and pesticides allowed for use in Belarus. However, like in many other countries, Belarus has stockpiles of the obsolete pesticides including certain POPs pesticides, which are classified as wastes in accordance with the legislation of the Republic of Belarus.

Belarus has rather advanced legislation on waste treatment. The Provision of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus No. 05-19/1764 of 19 September 1990, the Ministry of Public Health of the Republic of Belarus No. 11-2/1927 of 19 September 1990 and the Belarusian Concern of Material Assets 1990 No. 5-1/3664 of 20 September 1990 "On the Procedure of Recording, Collecting, Stockpiling and Burying Toxic Industrial Wastes on the Territory of BSSR" gives a definition of the category of toxic industrial wastes, which includes mixtures of physiologically active substances that are formed during the technological cycle and have toxic effect.

As a follow-up to Decree of the President of the Republic of Belarus of 14 July 2003 No. 17 "On Licensing of Certain Activities" [26], on 20 October 2003 the Council of Ministers of the Republic of Belarus approved the Provision on licensing of activities associated with the use of natural resources and the impact on the environment [27].

In accordance with the referred Provision, the use of wastes of Toxicity Class 1–3 and waste decontamination activities are subject to licensing. In addition, licensing is required for the production of aluminum, lead, zinc, tin, copper and moulding of final goods and semi-finished products out of aluminum and heavy metals. The respective licenses shall be issued by the Ministry of Industry of the Republic of Belarus.

In accordance with the Resolution of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus "On Endorsement of Classifier of Wastes Generated in the Republic of Belarus" [28] of 8 October 2001, the category of wastes includes obsolete or banned wastes of crop care chemicals and insecticides, spoiled or polluted mixtures of crop care chemicals and insecticides, seed treatment chemicals and crop protectants (pesticides, insecticides, herbicides, fungicides, regulators of crop growth and other), their residues and etc.

The List of Wastes Subject to Certification [29] includes, among others, the wastes listed in the Classifier of Wastes Generated in the Republic of Belarus, particularly obsolete or banned crop care chemicals and insecticides.

The Resolution of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus and the Ministry of Housing and Communal Services of the Republic of Belarus of 20 December 2004 No. 38/37 "On Environmental Protection Requirements for Location and Operation of the Sites for Municipal Wastes Separation and Reclamation" [30] stipulates that the concentration of dioxins/furans and polyaromatic hydrocarbons in releases should be controlled at least twice a year. During the first 12 months after the sites are put into operation, the control should be undertaken at least once in two months; the duration of sampling for dioxins/furans and polyaromatic hydrocarbons should be minimum 6 hours. For technologies and installations for thermal treatment and chemical transformation of natural and synthetic substances (thermolysis and other similar processes) involving generation of gas for subsequent use, the norms

of permissible atmospheric emission of pollutants are regarded as those related to 5 % concentration of oxygen in standard conditions (0 ^{O}C; 101.3 kPa) and should not exceed the norms of permissible atmospheric emissions of pollutants in accordance with Annex 4. The average values of dioxin and furan concentration obtained through sampling during at least 6 hours should not exceed the upper limit of emission, which is 0.1 ng/m^3.

Order of the Ministry of Natural Resources and Environmental Protection of 8 February 1996 No. 19 "On Introduction of the Environmental Certificate of a Waste Disposal Site" [31] requires that the Environmental Certificate of a waste disposal site should summarize the findings of air quality control, for example with regard to concentration of dioxins.

The Instruction on the Rules and Methods of Medical Waste Decontamination of 22 November 2002 No. 81 [32] stipulates that emissions of polychlorinated dibenzo-p-dioxins/furans during waste incineration should not exceed 0.1 mg TEQ/m^3.

As a follow up to the Law of the Republic of Belarus "On Wastes", the country keeps the Government Register of Waste Recycling Technologies and the Government Register of Waste Decontamination and Disposal [33]. Waste records [34] are kept; the Methodological guidelines on selection and arrangement of temporary waste stockpiling sites and mini-sites for solid household waste disposal in rural environments [35], the Methodology of environmentally sound landfill of industrial wastes [36], the Methodology of estimating damage for unauthorized disposal of wastes [37] are available in Belarus.

In the recent years considerable attention has been given to pesticides. The Obsolete Pesticides Treatment Regulations issued on 3 February 2005 [38] have set out nature protection requirements in the process of the obsolete pesticides treatment in Belarus including the procedure of organizing works involving the obsolete pesticides treatment in Belarus; the duties of owners of obsolete pesticides with regard to their treatment; the procedure of recording and establishing inventories of obsolete pesticides; the requirements to storage and transportation of obsolete pesticides; the procedure of obsolete pesticides re-packaging; the procedure and methods of identification of obsolete pesticides; safety rules, fire and labor safety requirements when dealing with obsolete pesticides; the procedure of organizing and conducting environmental monitoring at the obsolete pesticides storage sites; nature protection requirements pursuant to decontamination of obsolete pesticides.

Containers that meet the requirements of the European Agreement concerning the International Carriage of Dangerous Goods by Road of 30 September 1957 shall be used for re-packaging and storage of obsolete pesticides in the Republic of Belarus. Sampling of obsolete pesticides subject to re-packaging and unidentified obsolete pesticides stockpiled in bulk shall be carried out by the specialists of the laboratory accredited in accordance with the Regulation 0212.6-2002 "Technique of Wastes Sampling" approved by Resolution of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus No. 3 of 8 January 2003.

Obsolete pesticides shall be decontaminated at the special sites licensed and registered in the Government Register of Waste Decontamination and Disposal Sites.

In accordance with Article 46 of the Law "On Environmental Protection" of 26 November 1992 and the Law "On State Ecological Expertise" of 18 June 1993, design plans for construction of the sites for decontamination of obsolete pesticides are subject to the state ecological expertise in the Ministry of Natural Resources and Environmental Protection and to other forms of expertise in accordance with the procedure set out in the legislation of the Republic of Belarus. The method and technique of decontamination should be established pursuant to each type of obsolete pesticides. Obsolete pesticides shall be decontaminated only after their identification.

Unidentified obsolete pesticides shall be decontaminated only after laboratory tests verifying that permissible level of the environmental impact specified in the nature protection legislation of the Republic of Belarus will not be exceeded during decontamination.

In accordance with the above referred regulations, landfill of obsolete pesticides is banned.

The hygienic regulation and registration of pesticides is ensured by the Ministry of Public Health of the Republic of Belarus in accordance with the procedure and terms specified in Resolution of the Council of Ministers of the Republic of Belarus of 14 December 2001 No. 1807 "On improvement of the system of hygienic regulation and registration of chemical and biological substances, materials and articles there of, consumer and industrial goods, agricultural inputs and food products as well as materials and articles used for production, packaging, storage, transportation, sale and other forms of distribution and use of agricultural inputs and food products" [39] and Resolution of the Ministry of Public Health of the Republic of Belarus of 8 October 2003 No. 44 "On Endorsement of the List of Chemical and Biological Substances, Materials and Articles there of, Consumer and Industrial Goods, Agricultural Inputs and Food Products as well as Materials and Articles used for Production, Packaging, Storage, Transportation, Sale and other Forms of Distribution and Use of Agricultural Inputs and Food Products Subject to Hygienic Regulation and Registration" [40].

At the same time the registration of pesticides and fertilizers is regulated by the Instruction on the Procedure of Registration of Pesticides and Fertilizers in the Republic of Belarus of 26 November 2004 [41] specifying the procedure of testing and registration of pesticides or fertilizers produced in and outside Belarus in order to verify their compliance with the requirements on human life, health and environmental safety as well as to verify their biological effectiveness and economic efficiency. Testing and registration of pesticides or fertilizers is ensured by the Ministry of Agriculture and Food through the authorized government agency, namely the Government Inspection on Seed-Farming, Quarantine and Crop Protection.

The Government Register of Fertilizers and Pesticides, which are allowed for use in the Republic of Belarus is maintained within the framework of registration of pesticides and fertilizers. The last edition (2000) is intended for 2000-2010. The Register contains the list of pesticides, regulators of crop growth, pheromones and bio-technical agents and specifies the rules of their use in the agricultural sector (including private farms), forestry sector and at the individual subsidiary plots.

The Ministry of Natural Resources and Environmental Protection keeps a database containing the data on the quality and quantity of stockpiled or landfilled pesticides by regions. In accordance with Resolution of the Council of Ministers of the Republic of Belarus of 29 May 2001 No. 784 with changes and amendments of 1 September 2004 "On the List of Information Resources of State Significance", the database was included in the list of the information resources of state significance under the category of "stockpiled and landfilled pesticides" [42].

In accordance with Regulations on Hazardous Cargo Motor Transportation in the Republic of Belarus of 8 November 2004 [43] hazardous cargo of Toxicity Class 9 includes substances and articles that represent a risk during transportation that is not covered by the names specified under other classes. In particular, hazardous cargo of Toxicity Class 9 includes (M2) substances and appliances that can release dioxins in case of ignition.

The Regulations for Railways Transport for Public Use of 2 August 1999 [44] gives a definition of hazardous cargo i.e. substances, materials and articles having the properties, the manifestation of which during transportation can cause an explosion and (or) ignition and can entail death, disease, injury, poisoning, radioactive exposure or burns of people and (or) animals as well as can damage buildings, vehicles or other transportation assets and (or) can affect the environment. Hazardous cargo shall be transported with an account for their specifics in accordance with the requirements set out in the legislation of the Republic of Belarus.

Transport vehicles, buildings, facilities, containers, packaging and packaging sets and other things used for transportation of hazardous cargo should meet the regulatory requirements pursuant to hazardous cargo transportation.

These requirements are laid down in the Safety Regulations of Hazardous Cargo Transportation by Railroad on the Territory of the Republic of Belarus approved by Resolution of the Ministry for Emergency Situations of the Republic of Belarus of 20 October 2004 No. 34 [45], the Regulations of Hazardous Cargo Motor Transportation in the Republic of Belarus approved by Resolution of the Ministry of Emergency Situations of the Republic of Belarus of 8 November 2004 No. 38 [43].

The rules of safe motor and railroad transportation of hazardous cargo especially substances with poisonous and strong effect (including import, export and transit) are subject to mandatory agreement with the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus [46] in accordance with the Resolution of the Council of Ministers of the Republic of Belarus of 18 March 1997 No. 218 "On Establishment of Bans and Restrictions Pursuant to Transportation of Articles Across Customs Border of the Republic of Belarus" [47] and Resolution of the Cabinet of Ministers of the Republic of Belarus of 2 August 1996 No. 510 "On Measures to Implement the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)" [48].

The rules of transportation of obsolete pesticides that have not been re-packaged and repackaged obsolete pesticides within the territory of Belarus are laid down in Chapter 5 of Resolution of the Ministry of Natural Resources and Environmental Protection and the Ministry of Agriculture and Food of the Republic of Belarus of 3 February 2005 No. 5/6 "On Endorsement of the Regulations Pesticides Management".

The legislative acts of the Soviet Union that do not contradict the legislation of the Republic of Belarus including instructions and standards are still in force in Belarus. Those include:

- Rules of Motor Transportation of Mineral Fertilizers and Pesticides (hazardous agricultural wastes) adopted by "Soyuzselkhozkhimiya" on 29 December 1986. – Ryazan, 1987;
- Instruction on Safety Rules of Storage, Transportation and Use of Pesticides in the Agricultural Sector adopted by "Soyuzselkhozkhimiya" on 18 June 1984. – Moscow: Agropromizdat, 1985.

The Hygienic Regulations on Storage, Use and Transportation of Pesticides and Agricultural Chemicals No. 2.2.3.12-17-2003 have been endorsed.

The List of Articles Banned and Restricted for Transportation Across the Customs Border of the Republic of Belarus of 18 March 1997 No. 218 was approved by Resolution of the Council of Ministers of the Republic of Belarus of 17 June 2005 No. 661 "On Bans and Restrictions Pursuant to Transportation of Articles Across Customs Border of the Republic of Belarus" [47]. The List of Articles Banned for Transportation Across Customs Border of the Republic of Belarus includes, for example, "production and consumption wastes that cannot be recycled or used in Belarus". The List of Substances with Poisonous and Strong Effect, which are Restricted for Transportation Across Customs Border of the Republic of Belarus was approved by Resolution of the State Customs Committee of the Republic of Belarus of 30 July 2002 No. 70 in subsequent version of 29 January 2003 No. 3 "On Endorsement of the List of Goods Restricted for Transportation Across Customs Border of the Republic of Belarus" [49]. However, as pesticides are not highlighted as a specific category, recording of their import and transit is complicated.

Order of the State Customs Committee of the Republic of Belarus of 12 April 1999 No. 134-ОД in subsequent version of 9 December 2002 "On improvement of Customs Control over Transportation of Industrial and Municipal Wastes Across Customs Border of the Republic of Belarus" [50] banned import, including for the purposes of transit, of goods specified in the List of wastes, which cannot be recycled or used within Belarus. The List of production and consumption wastes that cannot be recycled or used within Belarus in accordance with Annex 1 to the Order has been approved. The List includes, among others, "polychlorinated dibenzo-p-dioxin (dioxin) and other similar compounds".

Resolution of the Council of Ministers of the Republic of Belarus of 14 December 2001 No. 1807 "On Improvement of the System of Hygienic Regulation and Registration of Chemical and Biological Substances, Materials and Articles there of, Industrial and Technical Products, Household Goods, Agricultural Inputs and Food Products as well as Materials and Articles Used or Production, Packaging, Storage, Transportation, Sale and other Forms of Distribution and Use of Agricultural Inputs and Food Products" [51] bans production, sale and use (distribution) of chemical and biological substances, materials and articles there of, industrial and technical products, household goods, agricultural inputs and food products as well as materials and articles used for production, packaging, storage, transportation, sale and other forms of distribution and use of agricultural inputs and food products that are subject to hygienic regulation and registration but have not gone through the respective procedures.

In accordance with the Provision on the hygienic regulation and registration of chemical and biological substances, materials and articles there of, industrial and technical products, household goods, agricultural inputs and food products as well as materials and articles used for production, packaging, storage, transportation, sale and other forms of distribution and use of agricultural inputs and food products approved by the Ministry of Public Health of the Republic of Belarus on 4 May 2004, the items specified in Group 0601 "crop protectants and growth regulators" shall be subject to hygienic regulation and registration.

In accordance with para 4.20 of the Provision on the Ministry of Agriculture and Food of the Republic of Belarus endorsed by Resolution of the Council of Ministers of the Republic of Belarus of 31 October 2001 No. 1590 [52], the Ministry of Agriculture and Food is supposed to organize testing of the agricultural machines and equipment, new chemicals, chemical and biological forms of crop protectants, biologically active substances and fertilizers as well as registration of chemicals and fertilizers produced in and outside Belarus. The Ministry is responsible for ensuring government control of the quality of chemicals produced in Belarus and imported chemicals.

In accordance with the Methodology of Large-Scale Agrochemical and Radiological Study of Agricultural Lands in the Republic of Belarus dated 4 July 1991 [53], assessment of agricultural lands' fertility is intended:

- To make assessment of lands at the farm and plot levels and to estimate the cost of land plots depending on their quality, technological condition and location;
- To ensure regular monitoring of the dynamics of agro-chemical indicators and subsequent development of proposals on preservation and improvement of agricultural lands' fertility;
- To develop proposals intended to reduce the scope of the use of chemicals per unit of land;
- To give an objective assessment of the efficiency of agricultural production across regions.

The Interim Methodology of Identification of Economical Damage Incurred by Soil Degradation endorsed by Order of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus of 20 May 1997 No. 112 [54] set out the procedure of estimating economic losses resulting from land contamination with chemicals including chlorinated hydrocarbons (including chlorine-containing pesticides, DDT, HCCH, 2,4-D and others), degradation and disturbance of lands and defined the procedure of fund recovery and use.

The Methodology of Environmentally Sound Landfill of Industrial Waste endorsed by the Ministry of Natural Resources and Environmental Protection on 2 December 1998 No. 349 (the document has not been officially published) distinguishes between chemical production wastes, machine-building wastes, agricultural chemicals production wastes (insecticides, pesticides and etc.). The Methodology bans arrangement of technically inappropriate stockpiling (disposal sites) of wastes.

The Methodology of estimating the government losses resulting from disrespect of water protection legislation adopted on 6 January 1995 classifies furan as a chemical of B-2 Toxicity Category.

In accordance with the Procedure of Crop Production Safety Monitoring endorsed by Order of the Ministry of Agriculture and Food of 23 July 1999 No. 191 [55], general managers, agronomic departments of agricultural entities and other land users are responsible for ensuring scientifically grounded use of chemicals and production of products meeting the regulatory requirements. Crop producers are obliged to keep records of the used crop protection chemicals.

Concentration of residues of pesticides in food products shall be monitored in accordance with Order of the Ministry of Public Health of the Republic of Belarus of 9 February 1994 No. 33 "On Introduction of the Republican Monitoring of Residues of Pesticides in Food Products".

The Republic of Belarus ratified the Protocol on the uniform procedure of using technical, medical, pharmaceutical, sanitary, veterinary, phytosanitary and environmental standards, norms, regulations and requirements pursuant to the goods imported to the member-states of the Customs Union Agreement that was signed in Moscow on 28 January 1999 [56]. The Protocol bans import of wastes with the purpose of landfill or incineration within the territory of the Customs Union member-states.

The Methodological Guidelines on selection and arrangement of temporary waste stockpiling sites and mini-sites for solid household waste disposal in rural environments of 19 January 2000 [35] bans incineration of wastes on the territory of mini-sites (para 5.8.6).

In accordance with para 4.17 of the Regulations and Norms of Residential Houses Maintenance in Cities and Villages of BSSR enforced on 1 October 1990 by Order of the BSSR Ministry of Housing and Communal Services of 2 August 1990 No. 102, incineration of any wastes in houses and garbage collectors is banned.

A number of regulations of the Soviet Union is still in force in Belarus including:

- Rules of Acceptance, Storage and Distribution of Pesticides at the Selkhozkhimiya Storage Facilities approved by Souzselkhozkhimiya on 18 May 1982. – Moscow: Agropromizdat, 1985;
- Temporary Guidelines on Determining Suitability of Pesticides for Agricultural Use if Their Quality Has Changed approved by Souzselkhozkhimiya on 20 May 1985. – Ryazan, 1985;
- Instruction on Safety Rules of Storage, Transportation and Use of Pesticides in the Agricultural Sector approved by Souzselkhozkhimiya on 18 June 1984. – Moscow: Agropromizdat, 1985;
- Rules of Fire Safety at Selkhozkhimiya Storage Facilities for Pesticides approved by "Souzselkhozkhimiya" on 13 August 1988. – Moscow: Agropromizdat, 1989;
- Methodological Guidelines for Safe Use of Pesticide. USSR Research Institute on Labor Safety in Agricultural Sector. – Moscow: Agropromizdat, 1985.

1.2. Assessment of the Efficiency of the Legislative Framework of the Republic of Belarus regulating the Use of Chemicals including POPs

The analysis of the legislative acts of the Republic of Belarus regulating the use of chemicals including POPs allows to assess the efficiency of legal regulation in this area.

In general, the Republic of Belarus has rather advanced legislation regulating relations between entities with regard to chemicals use and waste management.

The specifics of formation of the respective legislation is determined by a number of factors.

Firstly, it is determined by the "factor of objective" because the priority objective of legal imperatives in this area of relations is to safeguard protection of the environment and protection of the right of people to friendly environment, life and health.

Secondly, it is determined by the "factor of activity" because in order to achieve the above referred objectives a law-maker has to ensure regulation of relations emerging during production of chemicals, their use in industrial and agricultural sectors, transportation, other forms of movement, disposal and recycling. Therefore, proposals for improvement of legal regulation in this area will affect environmental and natural resource management legislation as well as sanitary-epidemiological, transport, customs, economic, agrarian, administrative, penal and other legislation.

At the same time it should be noted that development of the key legislative acts indicated in part 1 of this report, as a rule, was not based on assessment of the threat posed by toxic chemicals such as POPs to life, health and the environment.

Given that, it should be noted that a concept of POPs is not defined in the current legislation of the Republic of Belarus. Therefore, regulation intended to ensure safety of POPs is fairly fragmented and covers only certain stages of management of certain POPs thus failing to meet the provisions of the Stockholm Convention that sets out safety mechanisms since the emergence of POPs in the process of use, unintentional production and further on until the stage of reclamation.

It should be noted that this is the reason of weak and inefficient management, control and revelation of offenses. It can be said that a system for reliable recording and monitoring in this field has not been established yet.

In terms of the implementation of the provisions of the Stockholm Convention, a serious current problem of the respective legislation in the Republic of Belarus is associated with the absence of provisions giving a definition of the "best available techniques" and the "best environmental practices" pursuant to the source categories listed in Part II and Part III of Annex C to the Stockholm Convention.

The analysis of the legislative acts and their comparison against the provisions of the Convention allows to conclude that Belarus does not have efficient legal regulation in the field of collecting information about POPs. In particular, there is no methodology of identifying and recording POPs sources and assessing the degree of hazard. Legal provisions on establishment of inventories of POPs pesticides and their disposal sites and on establishment of inventories of PCB-containing equipment, materials, wastes and their disposal sites and PCB, PCDD/PCDF and HCB releases into the environment have not been developed yet.

Belarus has recently paid considerable attention to the problem of obsolete pesticides including such efforts as adoption of the Obsolete Pesticides Management Regulations and the inventory of banned pesticides, their stockpiles and landfills that was conducted in 2004. At the same time, however, over 250 pesticides are still allowed for use in the country. Therefore, an important legal issue is the development of technical and legal acts outlining the standards of the new technologies of repackaging and disposal of pesticides as well as safety requirements during production, distribution, storage, on-the-ground and aviation methods of pesticides' application, use of pesticides at protected soils; safety rules of the use of pesticides in cattle- and poultry-breeding and forestry sectors; safety rules of fumigation of premises and soils, use of pesticides at the individual subsidiary plots and etc.

There is virtually no legal regulation of control of the spread of PCBs and dioxins in the environment; there is still no laboratory control of their concentrations, which would otherwise allow to quantify them and would positively influence management decisions.

The analysis of the legislation has allowed to identify another legal problem, namely the absence of legal regulation of decommission and disposal of PCB-containing equipment. The existing regulations fail to address such issues as recording of PCB-containing equipment, the inventory of used and decommissioned PCB-containing equipment, organization of environmentally sound storage of the damaged PCB-containing equipment until the decision on its disposal is made. Contamination of the environment around the sites of use and storage of PCB-containing equipment is not monitored; there are no legal provisions on disposal of contaminated soils and PCB-containing equipment; there are no requirements and standards with regard to specially arranged storage facilities for the damaged PCB-containing equipment and wastes; there is no control whether such equipment is managed in environmentally sound manner.

Concentration of dioxins/furans and HCB in the environmental compartments is not measured in Belarus.

Inefficient monitoring and control, lack of ma"ximum permissible concentrations for certain POPs make it almost impossible to impose penalties for administrative and criminal offences in this field thus contributing to latent nature of the offenses.

1.3. Recommendations on the Improvement of the Legislative Framework of the Republic of Belarus regulating the Use of Chemicals including POPs

1. To develop and to endorse the implementation plan of the Stockholm Convention, which should identify the prospects of its implementation taking into account the specifics of the Republic of Belarus.
2. To formulate the legal concept of POPs and specific requirements pursuant to the activities associated with release, transportation, storage and disposal of POPs in the respective laws ("On Environmental Protection", "On Wastes", "On Sanitary and Epidemiological Safety") and other regulations adopted on the basis of these laws.
3. To make a provision in legislative acts for the system of agencies dealing with POPs management (to define the competence of the agencies, the responsibility, rights and obligations of individuals collaborating with the referred agencies).
4. To develop a system of monitoring and control of POPs management at all stages.
5. To elaborate legal provisions giving a definition of the "best available techniques" and "best environmental practices" pursuant to the source categories listed in Part II and Part III of Annex C to the Stockholm Convention.
6. To develop the Provision on the establishment of inventories of POPs pesticides and disposal sites; the Provision on the establishment of inventories of PCB-containing equipment, materials, wastes and their disposal sites; the Provision on the establishment of inventories of PCB, PCDD/PCDF and HCB releases into the environment.
7. To develop technical and legal acts outlining the standards of new technologies of re-packaging and disposal of pesticides as well as safety requirements during production, distribution, storage, on-the-ground and aviation methods of pesticides' application, use of pesticides at protected soils; safety rules of the use of pesticides in cattle- and poultry-breeding and forestry sectors; safety rules of fumigation of premises and soils, use of pesticides at the individual subsidiary plots and etc.
8. To develop the Provisions on the inventory of used and decommissioned PCB-containing equipment and organization of environmentally sound storage of damaged PCB-containing equipment until the decision on its disposal is made as well as the Provisions on disposal of contaminated soils and disposal of PCB-containing equipment.
9. To develop the norms regulating the access of public to the information about POPs.
10. To change and amend criminal and administrative legislation (based on the above referred legislative changes) with regard to penalties for administrative and criminal offenses in this field of relations.

ANNEX 2

Assessment of Institutional Capacity for the Management of Persistent Organic Pollutants in the Republic of Belarus

2.1. Institutional Framework for Environmental Protection and Natural Resources Management

Environmental Protection and Natural Resources Management in the Republic of Belarus

The government management in the field of environmental protection is exercised by the President of the Republic of Belarus, the National Assembly of the Republic of Belarus, the Council of Ministers of the Republic of Belarus, as well as by local executive and administrative bodies including regional, municipal, district, village and rural councils and executive committees (See Fig. 2.1).

The President of the Republic of Belarus as the Head of State, on the basis and in accordance with the Constitution of the Republic of Belarus, issues decrees and instructions including those relating to the protection of the environment, which are mandatory within the territory of the country. The President exercises, directly or through the agencies designated by the President, control over observance of the environmental protection legislation.

The Parliament – the National Assembly of the Republic of Belarus – as the representative and legislative body determines the main directions of the environmental policy, passes laws on environmental protection and natural resources management and, if necessary, declares territories the zones of ecological calamity.

The Government – the Council of Ministers of the Republic of Belarus – is a central government authority of the country. It exercises the executive power in the Republic of Belarus and is responsible for pursuing environmental policy, development and implementation of the government environmental programs and large-scale nature conservation activities, coordination of environmental protection and natural resources management measures undertaken by the ministries and government bodies, and international cooperation on environment-related issues.

Local deputy councils, executive and administrative bodies are responsible for the state of the environment within the territories of their jurisdiction, implementation of the environmental programs and other environmental protection activities, development and endorsement of local environmental protection programs, facilitation of the implementation of these programs as well as logistic, technical and financial support.

The system of government bodies also incorporates special bodies authorized with environmental protection functions under the legislation of the Republic of Belarus.

The key government body responsible for natural resources management and environmental protection is **the Ministry of Natural Resources and Environmental Protection**. The powers of the Ministry of Natural Resources and Environmental Protection are embodied in the Laws of the Republic of Belarus "On Environmental Protection", "On Ambient Air Protection", "On Wastes", "On Government Ecological Expertise", other environmental protection and natural resources management regulations and the Provision on the Ministry of Natural Resources and Environmental Protection endorsed by Resolution of the Council of Ministers of the Republic of Belarus [57]. Its key tasks include:

- Implementation of the uniform government policy with regard to environmental protection and efficient natural resources management and hydrometeorological activity;
- Government administration relating to study, protection, reproduction and efficient management of natural resources including minerals, waters, fauna, flora, environmental protection as well as government regulation in the field of hydrometeorology;
- Elaboration of the economic policy aimed at improving efficiency of natural resources management and ensuring environmental safety of economic activity;
- State ecological expertise;

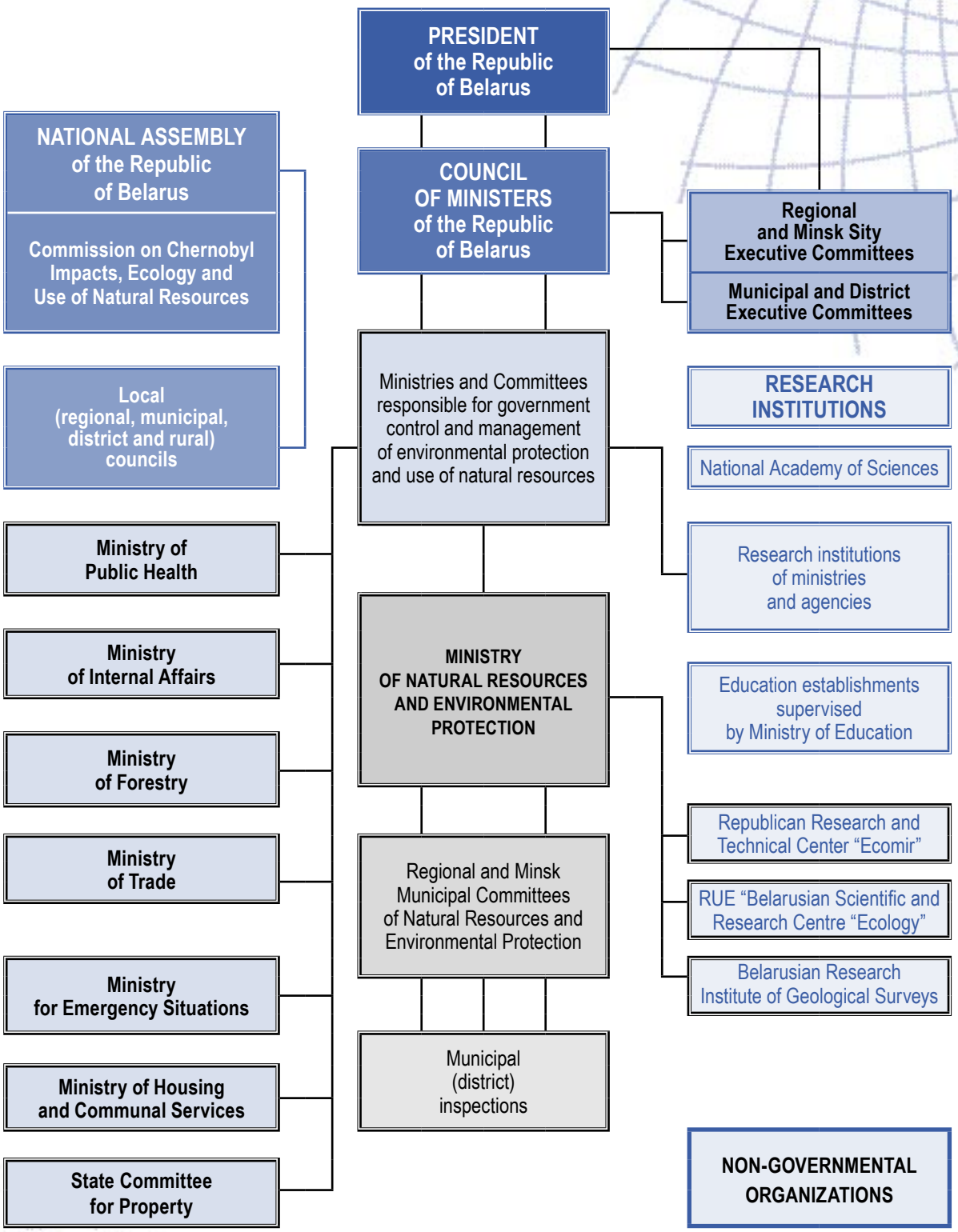


Figure 2.1. Environmental Protection and Natural Resources Management in the Republic of Belarus

- Government regulation and control of waste management including transboundary movements of wastes;
- Facilitation of the functioning of the National Environmental Monitoring System, control of releases of chemicals to air and water bodies, accumulation and disposal of wastes and levels of chemicals in ground waters;
- Justification and setting of ecological norms;
- Approval of safety passports of substances (materials);
- Licensing of activities involving environmental impact;
- Coordination of efforts pertaining to ensuring environmental safety, protection of the environment and efficient management of natural resources as well as coordination of hydrometeorological activity of other government authorities, local executive and administrative bodies and organizations;
- Government control in the field of environmental protection and supervision over hydrometeorological activity;
- Provision to the government authorities, local executive and administrative bodies and organizations and individuals of the information on the state and contamination of the environment and measures on protection and remediation of the environment; promotion of ecological knowledge, participation in the establishment of ecological education and awareness system, collaboration with non-governmental organizations (associations);
- International cooperation, study, consolidation and dissemination of the best practices of foreign countries in the field of environmental protection and natural resources management and in the field of hydrometeorological activity.

Certain issues of the government regulation and control with regard to the environment are within the competence of other government authorities:

Ministry of Public Health is responsible for:

- Implementation of policies ensuring that chemicals, pesticides, raw materials and technological processes are safe for human health;
- Issuance of permits for the application of chemicals and pesticides in the country;
- Hygienic regulation and registration of chemical and biological substances and articles thereof, raw materials, food products and pesticides;
- Justification of the criteria of chemicals' safety for people's health;
- Assessment of the hazard of chemicals, pesticides and wastes for human health;
- Justification and establishment of hygienic norms pertaining to the levels of chemicals in natural and industrial environment and establishment of requirements relating to transportation, use, storage and disposal of chemicals;
- Approval of safety passports of substances (materials);
- Registration of diseases and poisoning including occupational diseases and poisoning;
- Coordination of activities involving the use of drugs, psychotropic substances and their precursors;
- Control of the presence of chemicals in the environment, food products, drinking water and at workplaces;
- Social and hygienic monitoring.

Ministry for Emergency Situations is responsible for:

- Performing special functions related to prevention and elimination of the accidents associated with chemicals;
- Facilitation of the functioning of the state system of emergency warning;
- Approval of safety passports of substances (materials);
- Performing special functions related to industrial and technological safety, safe transportation of hazardous waste, protection and efficient use of mineral resources;
- Licensing of the activity in the field of industrial safety with regard to the operation of industrial sites where hazardous substances (inflammable materials, oxidizing agents, combustible materials, explosives, highly toxic and toxic substances hazardous for the environment) are produced, used, treated, generated, stored, transported and disposed;
- Issuance of permits for transportation of hazardous substances across the customs border.

Ministry of Forestry is responsible for:

- Ensuring human and environmental safety on application of substances protecting forests from diseases and pests.

State Customs Committee is responsible for:

- Supervision of customs clearance and customs control of import, export and transit of goods representing ecological risk for human health and the environment (chemicals, hazardous wastes, ozone-depleting substances and others);
- Approval, in accordance with the legislation of the Republic of Belarus, of the list of goods including chemicals and hazardous wastes, which are banned or restricted for transportation across the customs border of the Republic of Belarus.

Ministry of Labor and Social Protection is responsible for:

- Development of regulations on ensuring labor safety at workplaces;
- Control over the quality of attestation of workplaces to verify compliance with the safety rules;
- Development and implementation of measures on improving the working conditions in the economy sectors;
- Expert assessment of design documents for construction, upgrading and repairs of industrial sites in order to prevent harmful impact on workers.

Ministry of Agriculture and Food is responsible for:

- Formulation of the government policy relating to chemicalization of the agriculture;
- Registration of pesticides and fertilizers;
- Testing and control of raw food for the presence of pesticides and fertilizers;
- Ensuring compliance with the safety requirements on application of pesticides and fertilizers;
- Ensuring environmentally safe application, storage and disposal of pesticides and fertilizers.

Ministry of Industry is responsible for:

- Ensuring production of chemicals, use of recycled materials and waste recycling;
- Organization and coordination of the compliance with the requirements pertaining to standardization, certification and quality of products;
- Ensuring observance of the requirements pertaining to labor and environmental safety on use and production of chemicals;
- Introduction of technologies reducing the risks associated with chemicals.

Ministry of Architecture and Construction is responsible for:

- Ensuring safe use of chemicals during production of construction materials;
- Organization and coordination of the compliance with standardization and product quality requirements in architecture and construction sectors;
- Creation of safe working conditions at the enterprises producing construction materials;
- Introduction of technologies reducing the risks associated with chemicals.

Belarusian State Petroleum and Chemicals Concern is responsible for:

- Ensuring production and supply of chemicals and petrochemical products;
- Organization and coordination of the observance of the requirements pertaining to standardization, certification and quality of products;
- Ensuring environmental safety of industrial production;
- Provision of safe working conditions for people employed in chemical and petrochemical industry;
- Introduction of technologies reducing the risks associated with chemicals.

Belarusian State Production and Sales Concern of Pharmaceutical and Microbiological Products is responsible for:

- Ensuring environmental safety of production processes;
- Introduction of technologies reducing the risks associated with chemicals.

Belarusian Production and Trade Concern of Forestry, Woodworking and Pulp-and-Paper Industry is responsible for:

- Ensuring production and supply of chemicals, lacquers and paints;
- Ensuring environmental safety of production processes;
- Provision of safe working conditions for people handling chemicals.

Ministry of Energy is responsible for:

- Ensuring environmentally safe use of chemicals in fuel and energy sector;
- Pprovision of safe working conditions.

Ministry of Transport and Communications is responsible for:

- Ensuring safe transportation of hazardous goods;
- Approval of safety passports of substances (materials);
- Ensuring that operation of vehicles is safe for human health and the environment.

Ministry of Economy is responsible for:

- Forecast and identification of prospects for production, use, export and import of chemicals and projections for chemical and petrochemical sectors' development;
- Economic assessment of the draft concepts of industrial sectors' development.

Ministry of Foreign Affairs is responsible for:

- Coordination of Belarus' participation in international efforts aimed at ensuring safe use of chemicals;
- Regulation of the country's participation in international trading of chemicals and wastes.

State Committee for Standardization is responsible for:

- Establishment of the procedure for development, approval, registration, examination, revision, change, abolishment and enforcement of technical codes and government standards and supervision of the compliance with technical regulations;
- Approval, enforcement, abolishment and change of the government standards;
- Registration of technical regulations, technical codes, government standards and technical specifications;
- Ensuring establishment and functioning of the national accreditation system;
- Accreditation and supervision of testing laboratories;
- Ensuring establishment and functioning of the national system for verification of compliance.

State Committee for Property is responsible for:

- Recording of lands and maintenance of the government land register;
- Supervision of the use and protection of lands and performance of land management service.

Research Pertaining to Environmental Protection and Natural Resources Management

Research work geared towards addressing environmental problems is conducted by:

the scientific and research institutes of the National Academy of Sciences of Belarus including:

Institute of Genetics and Cytology,
Institute of Geological Science,
Institutes of Zoology,
Institute of the Problems of Use of Natural Resources and Ecology (*hereinafter* – IPUNRE NASB),
Institute of Radiobiology,
Institute of Radio-ecological Problems,
Institute of Experimental Botany,
Institute of Forestry,
Institute of Bio-Organic Chemistry,
Institute of Microbiology,
Republican Research and Technical Center "Ecomir" (*hereinafter* – RRTC "Ecomir"),
and other institutes;

research institutions under supervision of:

Ministry of Natural Resources and Environmental Protection:
- Republican Unitary Enterprise "Belarusian Scientific and Research Centre "Ecology" (*hereinafter* – RUE "BSRC "Ecology"),
- Republican Unitary Enterprise "Central Scientific and Research Institute of the Complex Use of Water Resources" (*hereinafter* – RUE "CSRICUWR");

Ministry of Public Health:
- State Institution "Republican Center of Hygiene, Epidemiology and Public Health" (*hereinafter* – SI "RCHEPH"),
- State Institution "Republican Research and Practical Center of Hygiene" (*hereinafter* – SI "RRPCH");

Ministry of Agriculture and Food:
- Institute of Crop Protection,
- Institute of Soil Studies and Agro-Chemistry;

Ministry for Emergency Situations:
- Institute of Radiation Safety;

Ministry of Education:
- Belarusian State University,
- International State Ecological University named after A.D. Sakharov,
- Belarusian National Technical University,
- Belarusian State Agricultural Academy,
- Belarusian Technological University and others.

Environmental Non-Governmental Organizations

328 non-governmental organizations dealing with environmental protection are officially registered in the country.

Non-governmental organizations focusing on chemical safety including POPs related issues include:

International Non-Governmental Organization "Ecoproject" (Minsk)

Non-Governmental Organization "Ecoproject" was established in Minsk in 2000 by professionals dealing with environmental protection, efficient use of energy and other aspects of sustainable development. The organization collaborates with non-governmental and private sector institutions, education establishments and government bodies. "Ecoproject" focuses on the development and implementation of environmental and energy projects contributing to sustainable development at the local, regional and international levels.

International Non-Governmental Organization "Ecosphere" (Minsk)

The association was established in Minsk in 2000 and was registered on 3 January 2001.

Its key objective is to attract public attention to environmental problems and to protect the right of its members to friendly environment.

The key environmental focuses include:

- Ecological education and training;
- Dissemination of environment-related information materials;
- Ecological actions aimed at prevention of contamination of the environment;
- Provision of counselling services to individuals.

NGO "Ecosphere" organizes various environmental protection events, ecological quiz games and meetings as well as workshops on POPs issues. Close collaboration with the media (drafting and publication of articles) is maintained. The association also collaborates with the Ministry of Natural Resources and Environmental Protection and is a member of the Working Group for the Convention to Combat Desertification; actively participated in the implementation of Belarus-Denmark joint project on pesticide disposal in Belarus.

Non-Governmental Organization "Nerush" (Baranovichi)

The association was set up by the Youth Ecological Club in November 1997 in Baranovichi Private Economic and Legal College. Its objectives include development of community-based initiatives; consolidation of efforts of young people and professionals in various fields of research for the sake of Nature and Human protection; formation of contemporaneous ecological mentality and building up social and legal behavior skills of different population categories (primarily young people).

The main tasks are the following:

- Collection of information on the state of environment and society;
- Ecological and social studies;
- Dissemination of information;
- Holding of trainings, lectures, workshops and conferences, including POPs related activities;
- Publication of information bulletins covering ecological and historic issues.

The Belarusian Non-Governmental Organization "Ecological Initiative"

The Belarusian Non-Governmental Organization "Ecological Initiative" is a republican non-government association focusing on the implementation of environmental protection and sustainable nature resources management programs and projects as well as ecological outreach work with the Belarusian people. POPs related activities of the "Ecological Initiative" include:

- Publication of information materials on POPs impact on human health and the environment;
- Participation in the inventory of POPs pesticides;
- Organization of topical workshops for people living close to large obsolete pesticides landfills.

Non-Governmental Organization "ENDO" (Mogilev),
The Belarusian Office of the International Academy of Ecology (Minsk)

The key activities include:

- Development and adaptation of environmental technologies consistent with sustainable development principles;
- Introduction of cavitation emulsifiers in the Belarusian energy sector (Ministry of Energy, State Energy Efficiency Committee);
- Introduction of straw-bale technology in Belarus (change of the government policy with regard to few-storied housing);
- Studies of wind energy parameters in the northwest regions of Belarus.

2.2. Assessment of the Existing Institutional Capacity for the Management of Persistent Organic Pollutants consistent with the Requirements set out in the Stockholm Convention

The institutional capacity in each of the areas described in Section 1 will be assessed in this subsection. Capacity of research institutions will be assessed in other subsections. Particular attention will be given to the Ministry of Natural Resources and Environmental Protection as it is the key government body authorized to manage environmental protection activities and, in accordance with the Government decision [58], is responsible for the implementation of commitments assumed by the Republic of Belarus under the Stockholm Convention.

Structure and Capacity of the Ministry of Natural Resources and Environmental Protection

There are eight Specialized Inspectorates within the Ministry of Natural Resources and Environmental Protection, which are responsible for regulation and control in the following areas:

- Environmental assessment of projects;
- Use and protection of lands, flora, forests and landscapes;
- Use and protection of fauna and management of hunting and protected areas;
- Waste management;
- Protection of ambient air, ozone layer and climate;
- Monitoring and organization of analytical control;
- Use and protection of waters.

The Headquarters of the Ministry of Natural Resources and Environmental Protection also incorporate departments of environmental protection policy, organization and economics of natural resources management, international cooperation, regulation of natural resources management and information.

The Ministry of Natural Resources and Environmental Protection supervises the Department of Geology and the Department of Hydrometeorology, RUE "BSRC "Ecology", RUE "CSRICUWR", 6 regional and Minsk municipal committees of natural resources and environmental protection, 118 municipal (district) inspectorates of natural resources and environmental protection.

In order to implement the provisions of the Stockholm Convention, the Ministry of Natural Resources and Environmental Protection has issued directives on [59, 60]:

- Designation of the Deputy Minister of Natural Resources and Environmental Protection as the National Focal Point of the Stockholm Convention;
- Designation of the RUE "Belarusian Scientific and Research Centre "Ecology" as an institution responsible for research support of the implementation of the Stockholm Convention;
- Establishment of the Working Group on Persistent Organic Pollutants, which was responsible for drafting of the required documents for accession to the Stockholm Convention and is currently elaborating the activities for the implementation of the Stockholm Convention. The Working Group includes representatives of the Specialized Inspectorate for Monitoring and Organization of Analytical Control, Specialized Inspectorate for Control of Ambient Air, Ozone Layer and Climate Protection, Specialized Inspectorate for Waste Management Control, Department of International Cooperation and the RUE "BSRC "Ecology". Representatives of the SI "RRPCH" and the IPUNRE NASB also participate in the Working Group on a regular basis;
- Designation of the Specialized Inspectorate for Waste Management Control as a structural unit responsible for organization of activities related to the implementation of the Stockholm Convention. Its work is supervised by the Deputy Minister of Natural Resources and Environmental Protection/National Focal Point for the Stockholm Convention. The Specialized Inspectorate consists of two departments – a department of waste management regulation and a department of waste management control – and has eight staff members including a person who is responsible for organization of work for the implementation of the Stockholm Convention and is a secretary of the Working Group and the Coordinating Committee for the Stockholm Convention. The work of the Specialized Inspectorate is regulated by the Provision stipulating the following functions of the Inspection:
  - development of the targeted comprehensive policy of the Ministry, strategy and policies of waste management supervision and control;
  - organization of waste management regulation;
  - organization and implementation of the government control over:
    - cobservance by legal entities and individuals of the Belarusian legislation and international agreements relating to waste management;
    - transboundary movements of wastes;
    - execution of tasks set by the government in the field of waste management;
    - implementation of the government projects involving construction of waste disposal sites and putting them into operation;
  - provision of regulatory, methodological and information support to the territorial departments of the Ministry and other government bodies in organization and implementation of the government control and regulation of waste management;
  - ofacilitation of the implementation of the international com-mitments and agreements of Belarus related to waste management within its territory;

- development of regulations and other legislative documents on waste management;
- facilitation of the introduction of research outputs and best practices in the field of application of low-waste technologies, use and (or) disposal of wastes;
- participation in the continuous education programs including training, retraining and upgrading of qualification of the employees of the Ministry and its structural units;
- ensuring appropriate and timely record keeping.

In accordance with the instruction of the Council of Ministers, the Ministry of Natural Resources and Environmental Protection has issued a directive on establishment of the Coordinating Committee for the Stockholm Convention [61] comprising representatives of the Ministry of Natural Resources and Environmental Protection, Department of Chemistry and Land Studies of the National Academy of Sciences of Belarus, the SI "RRPCH"of the Ministry of Public Health, Ministry for Emergency Situations, Ministry of Industry, Ministry of Architecture and Construction, Ministry of Foreign Affairs, Ministry of Agriculture and Food, Ministry of Energy, Ministry of Transport and Communications, Ecology and Radiation Safety Service of the Ministry of Defense. Representatives of other stakeholders can also be invited to participate in the meetings of the Coordinating Committee.

The activity of the Coordinating Committee is regulated by the Provision defining its key tasks, functions, powers and working arrangements. The key tasks of the Coordinating Committee include:

- Development of recommendations on improvement of the national policy relating to the management of persistent organic pollutants;
- Definition of the priority areas of research pertaining to persistent organic pollutants;
- Coordination of efforts of the government bodies and other organizations aimed at the implementation of the obligations of the Republic of Belarus under the Stockholm Convention on persistent organic pollutants;
- Facilitation of the exchange of information between the relevant government bodies, non-governmental and international organizations relating to the implementation of the Stockholm Convention;
- Provision to the public of the information on persistent organic pollutants.

Regulation of Production and Use of POPs Pesticides and Polychlorinated Biphenyls

The issues related to the implementation of the policies intended to ensure that application of chemicals, pesticides, raw materials and technological processes are safe for human health; issuing permits for the application of chemicals and pesticides in the country; hygienic regulation and registration of chemical and biological substances and articles thereof, inputs, material, food products and pesticides are within the competence of **the Ministry of Public Health**.

Given that POPs pesticides are not produced in Belarus and that their use is banned, there is no need for regulation of POPs production and use. Polychlorinated biphenyls (PCBs) are used in electrical equipment.

Consistent with the provisions of the Stockholm Convention, it is needed to formulate requirements relating to the environmentally sound use of PCB-containing equipment such as:

- Identification and labeling of PCB-containing equipment;
- Mitigation of risks associated with PCBs impacts and releases to the environment;
- Removal of PCB-containing equipment from use and its disposal in an environmentally sound manner.

The main government bodies that should be involved in the development of the above referred requirements are the Ministry of Natural Resources and Environmental Protection, Ministry of Public Health, Ministry for Emergency Situations, the IPUNRE NASB as a research institution, which has built up some knowledge and experience pertaining to the use of PCBs as well as ministries and concerns owning the above referred equipment.

To enable submission of a report on the progress in eliminating polychlorinated biphenyls, the Ministry of Natural Resources and Environmental Protection should provide for the inventory of PCB-containing equipment to be undertaken every five years. The Ministry should also develop and approve the procedure of maintaining PCB register designating the IPUNRE NASB as an agency responsible for its maintenance and regular updating.

Regulation of Import and Export of POPs Chlororganic Pesticides and PCBs

The list of goods banned or restricted for transboundary transportation is compiled by **the Council of Ministers of the Republic of Belarus**. The list includes hazardous and other wastes transboundary transportation of which is subject to permission of **the Ministry of Natural Resources and Environmental Protection**.

The Specialized Inspectorate for Waste Management Control of the Ministry of Natural Resources and Environmental Protection examines the documents and drafts proposals on issuing or denying permits. It should be noted that at present in accordance with the directive of the State Customs Committee [50], import and transit of obsolete pesticides, PCBs, liquids and solvents contaminated by PCBs and PCB-containing materials and articles through the territory of Belarus is banned. A ban on export of the referred wastes is not stipulated, but the Republic of Belarus is a Party to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and transboundary movement of hazardous wastes is conducted in accordance with this convention. The Ministry of Natural Resources and Environmental Protection is a government body responsible for the implementation by Belarus of the requirements set out in the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. In accor-dance with the directive of the Ministry of Natural Resources and Environmental Protection [62], the Specialized Inspectorate for Waste Management Control is responsible for the implementation of the Basel Convention.

Customs control over import and export is performed by the departments of **the State Customs Committee.**

Import and transit of the obsolete pesticides and PCBs is banned in Belarus and it is needed to restrict their export except for the purpose of environmentally sound disposal in accordance with the requirements set out in the Basel Convention. Enforcement of the restrictions is within the competence of the Council of Ministers of the Republic of Belarus; the Ministry of Natural Resources and Environmental Protection is responsible for drafting the respective documents.

Assessment of New Pesticides or New Chemicals in case of their inclusion in the List of Chemicals in Annexes A, B and C to the Stockholm Convention

The government bodies dealing with assessment of new pesticides or new chemicals are listed below.

Ministry of Public Health is responsible for:

- Hygienic registration and regulation of chemical and biological substances and articles thereof, raw materials, food products and pesticides meaning that their use in the country is permitted;
- Justification of the criteria of chemicals' safety for the health of people and workers;
- Assessment of the degree of hazard of chemicals, pesticides and wastes for human health.

Ministry of Agriculture and Food is responsible for:

- Registration of crop protectants and fertilizers;
- Testing and monitoring of food products for the presence of pesticides and fertilizers.

The Council on Pesticides and Fertilizers of the State Inspectorate on Seed-Growing, Quarantine and Crop Protection is responsible for:

- Organization of testing of pesticides and fertilizers for registration purposes;
- Registration and re-registration of pesticides, crop growth regulators and fertilizers;
- Issuing of registration certificates;
- Establishment of the Register of current pesticides and fertilizers;
- Cancellation of registration of non-effective and environmentally hazardous pesticides and fertilizers;
- Compilation and publication of the list of pesticides and fertilizers, the use of which is banned or restricted;
- Publication of the Catalogue of pesticides and fertilizers permitted for application in Belarus;
- Scientific and technical cooperation with the respective authorities of other countries.

Given the above said, it can be concluded that Belarus has established and ensured functioning of the institutions for regulation of the use of new pesticides and chemicals, but it is needed to facilitate the implementation of the requirements of the Stockholm Convention pertaining to the use of POPs criteria for assessment.

Unintentional Releases of Persistent Organic Pollutants: Use of the Best Available Techniques and the Best Environmental Practices (BAT/BEP)

In accordance with the Law "On Ambient Air Protection", **the Ministry of Natural Resources and Environmental Protection** shall:

- Organize that air pollution is recorded and measured; compile the republican data bank of the state of ambient air; maintain, jointly with the relevant government bodies and the National Academy of Sciences of Belarus the government register and conduct monitoring of the state of ambient air;
- Facilitate comprehensive management, develop a common research and technical policies and government programs pertaining to ambient air protection;
- Exercise control of ambient air protection and implement the state ecological expertise;
- Develop and endorse the norms, rules and provisions pertaining to ambient air protection; participate in elaboration, jointly with the relevant government bodies, of ambient air quality norms and standards;
- Establish reasonable limits and, if necessary, impose a ban on releases of air pollutants;
- Develop proposals on the improvement of economic instruments of ambient air protection;
- Issue and cancel permits on air pollutants releases.

The Specialized Inspectorate for Ambient Air, Ozone Layer and Climate Protection Control is directly responsible for the execution of the referred functions. It incorporates the department for ambient air protection control and the department for ozone layer and climate protection control.

In accordance with the Law of the Republic of Belarus "On Ambient Air Protection", the sanitary control bodies of the Ministry of Public Health endorse the maximum permissible concentration of pollutants in ambient air and the level of harmful physical and other affecting impacts in order to secure safety for human health and the environment as well as the methods of their detection.

There are almost no regulations pertaining to control of PCBs and dioxins in the environment in the country; until recently the laboratory monitoring of the content of these substances has not been performed. Such control would allow to quantify these substances and would influence decision-making in a positive way.

Regulation of the Management of POPs Chlororganic Pesticides, PCBs and Wastes containing or contaminated by Persistent Organic Pollutants

The Specialized Inspectorate for Waste Management Control is responsible for regulation and control of waste management including wastes containing or contaminated by persistent organic pollutants including the pesticides listed in the Stockholm Convention and PCB-containing equipment removed from use.

The Specialized Inspectorate for Waste Management Control coordinates the works on identification of the stockpiles and wastes containing chlororganic pesticides and PCBs. Jointly with the research institutions (the IPUNRE NASB, the RUE "BSRC "Ecology"), the Inspectorate has developed methodological guidelines on the inventory of the POPs obsolete pesticides and equipment, wastes and materials containing PCBs:

- "Methodological recommendations for the establishment of the inventory of obsolete and banned pesticides containing POPs", approved by the Ministry of Natural Resources and Environmental Protection on 9 March 2005;
- "Methodological guidelines for the inventory of polychlorinated biphenyls", "Report on polychlorinated biphenyls", "Guidance for filling in the form of the report on polychlorinated biphenyls", approved on 29 December 2003.

The IPUNRE NASB has been the leading agency for the inventory of PCB-containing equipment, wastes and stockpiles while **the RUE "BSRC "Ecology"** has been the leading agency for the inventory of the obsolete pesticides.

Considerable attention is given to addressing the obsolete pesticides. The POPs Pesticides Management Rules have been endorsed; the Joint Collegium of the Ministry of Natural Resources and Environmental Protection and the Ministry of Agriculture and Food has issued a resolution related to the management of persistent organic pollutants stipulating that an inventory of the stockpiles of the obsolete pesticides should be performed in order to identify POPs pesticides stockpiles.

Regulation of the use of POPs containing equipment is not within the competence of the Specialized Inspectorate for Waste Management Control as this equipment is not classified as wastes. At present there is no regulation formulating the requirements related to the management of this equipment, its dismantling and storage. The issues related to recording of PCB-containing equipment, organization of environmentally sound storage of damaged PCB-containing equipment pending elimination are not embedded in regulations; assessment of environmental contamination at the sites where PCB-containing equipment is operated or stored is not performed; there are no legal provisions on disposal of contaminated soils and PCB-containing equipment; there are no requirements and standards regulating arrangements for special storehouses for the damaged equipment and PCB-containing wastes; there is no control of compliance with the rules of environmentally sound management of such equipment.

Development of the Implementation Plans

The Specialized Inspectorate for Waste Management Control has been authorized to organize the work for the implementation of the Stockholm Convention [59]. Elaboration of measures for the implementation of the Stockholm Convention is also one of the tasks of **the Coordinating Committee for the Stockholm Convention** [61]. Responsibilities for the development, review and updating of the National Implementation Plan for the Stockholm Convention are still to be better defined.

Information Exchange and Reporting

In accordance with the Resolution of the Government [58], **the Ministry of Natural Resources and Environmental Protection** has been designated as the National Focal Point for the exchange of information. The Ministry of Natural Resources and Environmental Protection has not yet defined the functions and tasks of the National Focal Point. Organization of collection and submission of information relevant to the measures on the implementation of the Convention is a responsibility of the Specialized Inspectorate for Waste Management Control; the mechanism of collection and submission of information has not been developed yet.

Public Information, Awareness and Education

One of the tasks of the Ministry of Natural Resources and Environmental Protection is “to provide to the government authorities, local executive and administrative bodies and individuals the information on the state and contamination of the environment as well as on environmental protection and remediation measures; to promote ecological knowledge; to participate in the establishment of the system of ecological awareness and education and to collaborate with non-governmental organizations (associations)” [57]. The Department of Information of the Ministry of Natural Resources and Environmental Protection is responsible for the fulfillment of this task. The Republic of Belarus is a Party to the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. Following consultations with a number of non-governmental organizations, a **Public Coordinating Environmental Committee** [63, 64] consisting of 17 representatives of non-governmental organizations and associations was established under the Ministry in July 2001. It should be noted that non-governmental organizations dealing with POPs related issues are not the members of the Council but its sessions are open for all stakeholders. Sessions are held once in a quarter; invitations and materials are distributed by e-mail. The draft regulations on topical issues are examined at the stage of obtaining “no objections” from the stakeholders.

The decisions of the Public Coordinating Environmental Committee are summarized in a protocol which is communicated to the stakeholders and is posted at the website of the Ministry (http://minpriroda.by).

To facilitate collaboration with the public, the Ministry of Natural Resources and Environmental Protection has established a public communication office offering hotline services. Daily experience suggests that most often a public communication office is approached by individuals.

Non-governmental organizations and individuals can obtain prompt information relevant to the environment by visiting the official website of the Ministry of Natural Resources and Environmental Protection, which is updated on a weekly basis. Such information can also be obtained from the annual reports on the state of the environment prepared by the Ministry of Natural Resources and Environmental Protection and through inquiries.

The Ministry of Natural Resources and Environmental Protection actively collaborates with the Ministry of Education in elaborating training programs on environmental protection. For example, a Republican multi-level integrated program on environmental education and awareness for 2005-2010 has been drafted.

Non-governmental organizations can play an essential role in improving public information and awareness. The following projects can be listed as examples of the initiatives of non-governmental organizations and initiatives:

- The First Republican Conference "Persistent organic pollutants in the Environment of Belarus" in 2003, which culminated in an Address to the President of the Republic of Belarus and the Government urging to join the Stockholm Convention. The conference was organized by the International Association "Ecoproject" and the Ministry of Natural Resources and Environmental Protection with the support from the World Bank;
- Roundtables, which are held almost every year and bring together the representatives of the general public and the government bodies responsible for addressing persistent organic pollutants. In May 2004 several ecological NGOs organized a roundtable "Stockholm Convention: The Beginning" focusing on discussion of the prospects of the implementation of the Stockholm Convention in Belarus in 2004. Two roundtables were held in April 2005. One of them – "Stockholm Convention – One Year On" -– was organized by ecological NGOs and was dedicated to the evaluation of the annual progress in the implementation of the Convention. Another roundtable – "POPs in Modern House and Office" – was organized by the NGO "International Academy of Ecology";
- International Association "Ecosphere" was an active participant of Belarus-Denmark project for re-packaging of the obsolete pesticides. Members of the organization made a valuable contribution to provision to the public of the information on the problems and risks associated with the obsolete pesticides;
- In early 2005 several Belarusian ecological NGOs jointly with the International POPs Elimination Network (IPEN) and the "Arnika" Association (Czech Republic) tested egg samples taken in the village of Bolshoy Trostenets (which is located 5 km southeast from Minsk near Household Waste Disposal Site "Trostenets"). The tests have detected high level of PCBs and elevated level of dioxins in eggs. Based on the findings, a report entitled "Egg Contamination by Dioxins, PCBs and Hehachlorobenzene in the Vicinity of "Trostenets" Household Waste Disposal Site" was developed and published". This report was a part of a IPEN global project "Keep the Promise, Eliminate POPs!" timed to the First Conference of the Parties to the Stockholm Convention, which was held in Uruguay in May 2005;
- "Krynitsa" Non-Governmental Organization (Molodechno) focuses its efforts on dissemination of information on the problems associated with POPs in Molodechno.

In summary, evaluation of participation of people and organizations in addressing persistent organic pollutants suggests that the role of non-governmental organizations (NGOs) has enhanced. NGOs played a considerable role in Belarus' accession to the Stockholm Convention. Non-governmental organizations of Belarus made a valuable contribution to the coverage of the problem of POPs, its importance for the country and, to a certain extent, accelerated the accession process. Non-governmental associations focus mainly on dissemination of information among different population groups, organization of workshops and roundtables for

NGOs, representatives of education establishments and research institutions as well as on publication of various information materials. NGO representatives should be more actively involved in elaboration and discussion of draft laws, research work and inventories, for example as experts representing non-governmental institutions. In the opinion of most NGOs, it is very important to establish a dialogue between the government authorities, industrial sector and the public.

At the same time, particular attention should be given to the establishment of information dissemination mechanisms, for example registers of releases and transfer of pollutants as well as to regular updating of the information on persistent organic pollutants consistent with the Convention.

Therefore, it can be concluded that the Ministry of Natural Resources and Environmental Protection has established mechanisms enabling active public participation in decision-making on environmental protection and facilitating access to public information, awareness and education. At the current stage it is needed to incorporate POPs related issues into the available mechanisms.

ANNEX 3

Inventory of POPs Pesticides Stockpiles and their Disposal Sites

Introduction

In accordance with the provisions of Article 6 of the Stockholm Convention each Party shall develop appropriate strategies for identifying stockpiles consisting of or containing chemicals listed either in Annex A or in Annex B. Thus, the preliminary measure, which has to be undertaken, is the establishment of the inventory of stockpiles of pesticides containing or consisting of POPs.

In the framework of the assignment for the establishment of the inventory of POPs pesticides their disposal sites within the project GEF TF 053865 "Enabling activities related to the implementation of the Stockholm Convention on persistent organic pollutants (POPs) in the Republic of Belarus" the following tasks have been implemented:

- Available international and national regulatory and methodological documents for the POPs pesticides inventory taking have been analyzed;
- The interim inventory (content and quantity identification) of the available stockpiles of POPs at the storage sties of the Ministry of Agriculture and Food, other owners of these stockpiles has been taken;
- The available data on POPs pesticides contamination of food products, drinking water, and soil provided by the Ministry of Agriculture and Food, Ministry of Public Health and Ministry of Natural Resources and Environmental Protection have been analyzed;
- The level of contamination of soil, water sources, main groups of food products with POPs pesticides has been undertaken;
- POPs disposal capacity has been assessed and the proposals for environmentally sound disposal of the stockpiles of POPs pesticides have been drafted;
- Proposals for POPs pesticides management improvement for their inclusion in the NIP of the Stockholm Convention and the current system of social-sanitary monitoring have been elaborated;
- Register of the POPs pesticides stockpiles and their disposal sites has been developed.

3.1. Methodology of the Establishment of the Inventory of POPs Pesticides in accordance with the Provisions of the Stockholm Convention

The Stockholm Convention as a basic document regulating POPs management does not specify any particular requirements for the establishment of the inventory of POPs pesticides. Para 1 of Article 6 of the Stockholm Convention states that:

"… each Party shall:

(a) Develop appropriate strategies for identifying:
  (i) Stockpiles consisting of or containing chemicals listed either in Annex A or Annex B; and
  (ii) Products and articles in use and wastes consisting of, containing or contaminated with a chemical listed in Annex A, B or C;

(b) Identify, to the extent practicable, stockpiles consisting of or containing chemicals listed either in Annex A or Annex B on the basis of the strategies referred to in subparagraph (a);"

In accordance with these requirements, the Interim Guidance for developing a national implementation plan for the Stockholm Convention (World Bank, UNEP Chemicals, 2003) recommends "Training manual for inventory taking of obsolete pesticides", (FAO Pesticide Disposal Series 10) as the basic guidance for the inventory taking. This guidance contains general information relating to the establishment of the inventory, obsolete pesticides handling, safety requirements for the inventory taking.

Apart from the mentioned manual there are other international and national regulatory and methodological documents relating to the establishment of the inventory of obsolete pesticides, including POPs. A number of these documents have been used for the POPs inventory taking in the framework of various international projects, in particular, projects on the territory of the CIS countries (Russia, Ukraine, Belarus, Moldova etc.).

The summary of the this documents is given in Table 3.1.

Table 3.1
Summary of the documents regulating obsolete pesticides management

International documents	National documents	Contents, requirements and recommendations of the documents
Training Manual for Inventory taking of obsolete pesticides. – FAO, Rome.	"Obsolete Pesticides Treatment Regulations", approved by Resolution of the Ministry of Natural Resources and Environmental Protection and the Ministry of Agriculture and Food of the Republic of Belarus of 3 February 2005 No. 5/6	Characteristics and preparatory forms of pesticides containing POPs. General principles of the pesticides inventory organization, including: • Procedure of identification of pesticides (labeling, the condition of containers, color, aggregative state, solubility, density, analysis of chemical composition); • Sampling for identification of chemical composition of obsolete pesticides; • Quantification and identification of the of the storage method (packaged, not packaged, condition of containers); • Characteristics and identification of the POPs pesticides storage site; • Identification of the owners of the POPs pesticides stockpiles; • Kinds of registration forms for the pesticides inventory taking; • International requirements for collection and repackaging of pesticides. Requirements for POPs pesticides sampling. Requirements for storage, use and transportation of pesticides and hazardous chemicals. Safety requirements for obsolete pesticides handling, including POPs pesticides handling: • Preliminary training; • Permanent monitoring; • Individual safety kit; • Provision of the first-aid-kit and antidotes during the inventory procedures; • Organization of bio-medical monitoring; • First aid in case of chemical poisoning. Recommendations for automated registration of the inventoried pesticides .
Disposal of Unwanted Pesticide Stocks (chapter 2 "Identification and Preparation"). – GIFAP, Brussels, Belgium, 1991.		
Principles for Identifying Unacceptable Pesticides, No 4/92. – KEMI.	"Methodological recommendations for the establishment of the inventory of obsolete and banned pesticides containing POPs", approved by Order of the Ministry of Natural Resources and Environmental Protection of 9 March 2005 No. 61	
International Code of Conduct on the Distribution and Use of Pesticides. – Rome, 1999.		
Disposal of Unwanted Pesticide Stocks. Guidance on the selection of practical options.		
Inventory Guidelines, COWI, Denmark.	Sanitary regulation 2.2.3.17–2003 "Hygienic requirements for storage, use, and transportation of pesticides and agrochemicals"	
Summary guidance for the inventory, identification, collection and storage of obsolete and banned pesticides, Russia, Moscow, 2005/		
Guidelines for quality control		

Based on the analysis of international and national regulatory and methodological documents relating to the inventory of obsolete pesticides the following conclusion can be made:

1. Available information relating to the inventory of obsolete pesticides is sufficient for the establishment of the inventory of POPs pesticides stockpiles and their disposal sites in accordance with the provisions of the Stockholm Convention;
2. The Republic of Belarus possesses the required organizational and methodological capacity for the inventory, identification and treatment of obsolete pesticides, in particular:
   - Organizational aspects are rendered in the "Obsolete Pesticides Treatment Regulations";
   - Methodological basis and requirements for the establishment of the inventory are given in "Methodological recommendations for the establishment of the inventory of obsolete and banned pesticides containing POPs";
   - The means of prevention of possible negative impact of the activities relating to POPs pesticides treatment on the workers and general population are set forth in SR 2.2.3.17–2003 "Sanitary requirements for the storage, application, and transportation of the pesticides and agricultural chemicals".
3. The principles of the inventory set forth in national regulatory documents are elaborated on the basis of the current international guidelines and on the whole correspond to the international requirements.

3.2. Establishment of the Interim Inventory (Identification and Quantification) of the Existing Stockpiles of POPs at the Storehouses of the Ministry of Agriculture and Food, other agricultural entities

Based on the overview of the requirements set forth in the Stockholm Convention and the available regulations and methodological guidelines on the inventory of POPs-containing pesticides, the following methodology of the inventory has been developed:

1. Identification of chemicals subject to the inventory, notably aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorbenzene, mirex, toxaphene and DDT as well as stockpiles of mixtures of the obsolete pesticides and liquids with unknown content as at present they are not identified and may contain persistent organic pollutants thus being the sources of POPs. The inventory also covered HCCH (hexachlorocyclohexane) and chemicals, in which it had been used as an active ingredient (such as fentiuram and pentatiuram) because HCCH may be soon included in the list of POPs of the Stockholm Convention and its use is limited in accordance with the Protocol on POPs of 1998. However, as HCCH was not officially included in the list of POPs of the Stockholm Convention, the data on its stockpiles were not included in the register of the stockpiles of pesticides classified as POPs and their disposal sites.
2. Identification of the entities subject to the inventory, notably agricultural enterprises of the Ministry of Agriculture and Food owning the stockpiles of pesticides classified as POPs and their disposal sites and landfills of the obsolete pesticides as well as other state-owned and private enterprises potentially owning the stockpiles of POPs pesticides.
3. Establishment of the parameters for the inventory and compilation of the pesticides' register including their aggregative state, preparative form, quantity, packaging, labeling, disposal site, storage method, condition of the storage sites and assessment of the associated environmental impacts.
4. Verification of data reliability through random control involving field visits by project experts and daily control of the landfills and disposal sites of the obsolete pesticides classified as POPs conducted by the regional and district inspectorates of natural resources and environmental protection.

In accordance with the Obsolete Pesticides Treatment Regulations approved by Resolution of the Ministry of Natural Resources and Environmental Protection and the Ministry of Agriculture and Food of 3 February 2005 No. 5/6, the owners of the obsolete pesticides shall be responsible for their inventory. The owners of the stockpiles of the obsolete pesticides classified as POPs are, above all, agricultural enterprises and crop protectant services within the system of the Ministry of Agriculture and Food. The Ministry of Natural Resources and Environmental Protection and the Ministry of Agriculture and Food have been officially requested to provide information on the findings of the inventory of the stockpiles of pesticides classified as POPs and their disposal sites). Given other potential sources, purposes and methods of the use of pesticides classified as POPs, the respective requests have been furnished to the Ministry of Public Health and the sectoral services for disinfection, disinsectization and deratization. In order to check the information obtained from several sources, the Ministry of Natural Resources and Environmental Protection has instructed the regional and district committees of natural resources and environmental protection to conduct their own simultaneous inventory of the stockpiles of pesticides classified as POPs and their disposal sites located in the respective regions and districts.

The analysis of the responses and the findings of the project experts during field visits have allowed to collect the following information about the quality and quantity of the existing stockpiles of pesticides classified as POPs on the territory of the Republic of Belarus:

1. As of 1 November 2005, 6,558 tons of the obsolete pesticides were stored in storehouses and landfills including 718 tons of DDT, which is listed in the Stockholm Convention. Any other POPs-containing pesticides listed in the Stockholm Convention have not been identified on the territory of Belarus within the current inventory.
2. 2,733 tons of unidentified mixtures and 25 tons of unidentified liquids, which can be regarded as potential POPs are stored at storehouses and in landfills.
3. At present pesticides classified as POPs are not used for disinfection, disinsectization and deratization in Belarus.

Pesticides classified as POPs, unidentified mixtures and unidentified liquids are stored mainly at the storehouses of the agricultural enterprises of "Belagroservice", "Selkhozkhimiya", state inspectorate on plants protection, collective and state-run farms, hothouses and agricultural cooperatives. DDT is stored at the storehouses of the Brest, the Vitebsk and the Grodno regions; unidentified liquids – at the storehouses of the Vitebsk, the Minsk and the Mogilev regions and unidentified mixtures – at the storehouses in all regions of the country except the Gomel region. There are no stockpiles of the obsolete pesticides classified as POPs, unidentified mixtures and unidentified liquids on the territory of the Gomel region because between 1999 and 2004 they were collected and transported by the regional station for crop protection to the Communal Unitary Enterprise (CUE) "Facility for processing and burial of hazardous industrial wastes of the Gomel region".

The analysis of the information provided upon request and the data collected during selected visual examination of the storehouses with the stockpiles of obsolete pesticides has demonstrated that the current condition of the storehouses is, in general, satisfactory: 92 % of the examined buildings are made of brick with concrete floors. All of the buildings have durable doors with locks. There is an administrative staff member responsible for the supervision of the storehouse; in many cases storehouses are guarded by a special guard service. However, in most cases the conditions of the storage of obsolete pesticides including those classified as POPs fail to meet the nature conservation regulations. For example, repackaged and non-repackaged pesticides and the respective containers are kept together; spilled pesticides are not removed; there's no ventilation. The key problem for conducting an inventory at the storehouses is the lack of clear system of recording and labeling of the obsolete pesticides, which are stored there. However, it is expected to address the problem within the next couple of years. Starting from 2004 onwards the works on repackaging and labeling of obsolete pesticides in accordance with the contemporary international standards financed from the government budget have been carried out. Completion of these works will certainly become one of the most important stages in the implementation by the Republic of Belarus of its commitments under the Stockholm Convention regarding the treatment of obsolete pesticides classified as POPs. Considerable support in repackaging of obsolete pesticides was provided to Belarus between 1997 and 2003 within the framework of Belarus–Denmark joint project on repackaging of obsolete pesticides that was implemented by the Ministry of Natural Resources and Environmental Protection, the Ministry of Agriculture and Food and the International Consortium COWI with support from the Danish Environmental Assistance to Eastern Europe (DANCEE). The output of this project is that by 1 June 2005, 98 % of the obsolete pesticides stockpiled in the Grodno region had been repackaged into the containers meeting the European requirements for obsolete pesticides repackaging.

Based on the findings of the examination of the storehouses with stockpiles of obsolete pesticides and their mixtures, which was conducted by the project experts, the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus has been recommended to oblige all companies owning storehouses for the obsolete pesticides to undertake respective measures to ensure proper maintenance and guarding of these storehouses in line with the requirements set out in the Obsolete pesticides management regulations. To prevent contamination of the environment around the sites with stockpiles of pesticides, it has been recommended that the Ministry of Natural Resources and Environmental Protection should undertake urgent measures on their repackaging.

In addition to the storehouses for the stockpiles of obsolete pesticides classified as POPs, the inventory has also involved examination of all landfills of the obsolete and banned pesticides located on the territory of Belarus. The country has seven obsolete pesticides landfills: three of them are located in the Vitebsk region (the Verkhnedvinsk, the Postavy and the Gorodok landfills), one is located in the Brest region (in the village of Gershony), one – in the Gomel region (the Petrikov landfill), one – in the Grodno region (the Slonim landfill) and one in the Mogilev region (the Dribin landfill). CUE "Facility for processing and burial of hazardous industrial wastes of the Gomel region" located in the Chechersk district of the Gomel region is also classified as an obsolete pesticides landfill. In addition to processing, it is used for storing considerable stockpiles of obsolete pesticides.

The Brest obsolete pesticides landfill is located in the south-west suburb of Brest between the villages of Mitki (north), Kotelnya-Boyarskaya (west and south-west) and Bernady (east and south-east). The site and villages are located on the territory of the Gershony rural council with the center in the village of Gershony, which is located 2 km to the north. The average distance between the landfill and 3 refereed villages is 0.5 km. Individual household plots are located to the east of the site.

The landfill is geomorphologically adjacent to the territory between the Zapadny Bug river and the Mukhavets river. The distance to the river-beds is 2.8 km to the west and 6.0 km to the north.

The obsolete pesticides are stored in the caponier of the fort marked with letter "3". According to the data of the Memorial "The Brest Fortress-Hero", this fort is a part of the second (outer) defense line of the Brest Fortress. Its construction was launched in 1912 and lasted until 1915 but was not completed. Before the Second World War it was not used. During the war it was partly destroyed and until 1988 it was used as a disposal site for solid municipal wastes of Brest.

The caponier used for storage of pesticides is a concrete rectangular facility with sub-latitudinal orientation. Its length is about 120 meters, width – 5 meters, height above the foundation is 4 meters. According to the staff of the Memorial, the design documents have been lost. Therefore, there are no reliable data on the structure of the foundation. It is believed that boulders fixed with binding materials were laid under the concrete foundation. There's a trapdoor going to the part of the caponier where no pesticides are stored. During examination conducted by the staff of the Memorial in summer 2004, there was a 5 cm sheet of water on the caponier's floor.

82.881 and 42.0 tons of 15 types of the obsolete pesticides were buried in the caponier in 1978 and 1988 respectively. Unknown pesticides and their mixtures account for 70 % of the total amount.

The Brest obsolete pesticides landfill is totally different from other landfills in Belarus.

Firstly, insecticides were buried in a specific fortification facility (caponier) though built of concrete and on a stone and concrete foundation.

Secondly, the caponier is built on the natural surface and the majority of pesticides are piled above the natural ground.

Thirdly, unlike other landfills, which are located in a dense and hardly accessible forests, the Brest landfill is located within an eminent plain close to hard-cover roads.

Fourthly, instead of being located far away (3.0 km and more) from residential settlements, this site is located close to them (0.5 km) and is surrounded by the villages of Bernady, Kotelnya-Boyarskaya and Mitki. Some evidence suggests that these villages and the village of Gershony will soon be incorporated into the city of Brest. In that case "the environmental mine" will be located within the city.

Fifthly, at the time of the first landfill the site was used for disposal of solid municipal wastes of Brest. By the time of its closure in 1988, it had accumulated a considerable amount (up to 6.0 meters) of different (most likely, not only municipal) wastes containing both organic and non-organic chemicals, which are well-soluble in water. The data collected by the project experts during a field visit, suggest that the Brest landfill contains 12.7 tons of unidentified mixtures of obsolete pesticides, which can be potentially classified as POPs.

The Gorodok obsolete pesticides landfill is located to the east of the Gorodok district of the Vitebsk region, 36 km away to the north-east of the district center – a town of Gorodok. It is located 10 km to the north-west of Belarus' state border with the Russian Federation. The form of the landfill is approximately rectangular sized 75 x 28 (29.5) meters. Long sides are oriented from south-east to north-west. The eastern side, close to the south-east angle of the storing facility has an outer square ledge sized 11 x 11 (12.5) meters. The site is located in a pine forest. The surface of the landfill is not forest-covered. The territory is managed by the Schelbovskoye forestry enterprise of the Surazh forestry area.

The obsolete pesticides were buried in the Gorodok district in October 1973 following the decision of the Vitebsk Regional Executive Committee No. 431 P of 4 September 1973. However, at present the construction documents are not available. There are also no documents, which are most important for the ecological assessment of the landfill such as materials of engineering and geological surveys (if conducted at all), the construction designs and acceptance certificates on concealed works.

Photo 1: 6.5 tons of pesticides are stored at the open site in the Klichev district of the Mogilev region

Photo 2: A typical storehouse for repackaged obsolete pesticides (a storehouse of "Ivyeselkhoztechnika", Gavya station, the Ivye district of the Grodno region)

Photo 3: Storehouse of "Ivyeselkhoztechnika"

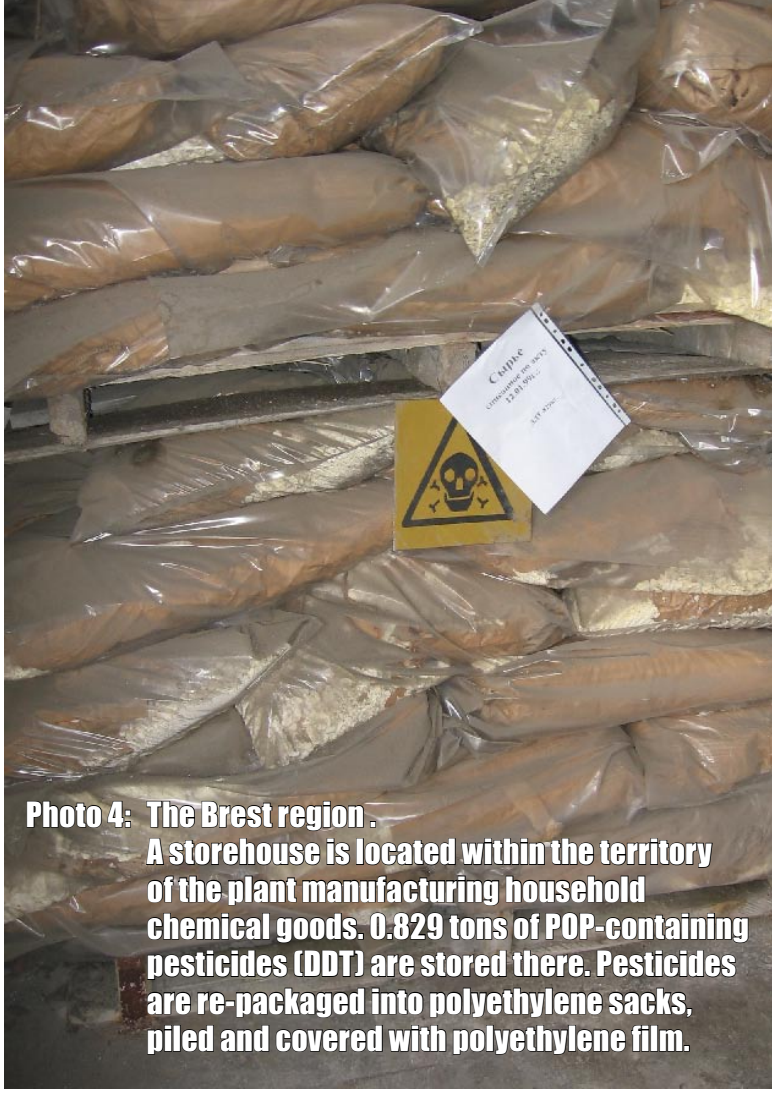


Photo 4: The Brest region .
A storehouse is located within the territory of the plant manufacturing household chemical goods. 0.829 tons of POP-containing pesticides (DDT) are stored there. Pesticides are re-packaged into polyethylene sacks, piled and covered with polyethylene film.

Photo 5: The Grodno region: "Indura" storehouse with stockpiles of unidentified mixtures of pesticides. Pesticides are stored in inappropriate paper sacks and metal containers. Re-packaging is required.

It is known that the majority of landfill works were regulated by the temporary instruction, which was in force at that time. In accordance with the instruction, pesticides in standard packages were piled in trenches, bottom and walls of which were covered by a layer of clay minimum 1.0 meter wide and then by polyethylene film. On the top side they were covered first by film and then by a layer of clay. Absence of acceptance certificates does not allow to assess the quality of impervious paving.

Pesticides are piled in 4 trenches sized 10 x 2 and 2.0 meters deep. A concrete bunker with reinforced-concrete floor 30 cm thick was built for highly toxic pesticides.

The owner (OJSC "The Gorodok District Agro-Industrial Service") does not have any data on the content of the buried obsolete pesticides and their quantities. It is known that 43.628 tons of pesticides fall into toxicity class I; 130.146 tons – into toxicity class III and 237.605 tons – into toxicity class IV. It can be assumed that the approximate content of pesticides is similar to that at other landfills because at that time the same pesticides were stockpiled in all regions of the country. In all landfills where pesticides have been identified, chlororganic pesticides, mostly DDT and HCCH, tend to dominate. Therefore, it is very likely that the Gorodok landfill contains a considerable amount of the obsolete pesticides classified as POPs in the form of unidentified mixtures. If there is a possibility, it is recommended to undertake the chemical and analytical laboratory analysis of the samples of unidentified mixtures of obsolete pesticides.

A landfill in the Postavy district was established in October 1971; 100 tons of pesticides were buried. There is no detailed information about the content of the obsolete pesticides in the Postavy landfill. Proceeding from the premise above, it can be therefore assumed that these mixtures of the obsolete pesticides can be regarded as potentially POPs-containing.

The Verkhedvinsk obsolete pesticides landfill is located in the Verkhnedvinsk district of the Vitebsk region 18 km away from the town of Verkhnedvinsk.

The design of the landfill was developed in 1982 by the Vitebsk Branch Office of the Project Design Institute "Selkhozproject". The landfill was intended to be located on the territory of the "Drissensky" state farm 6 km away from the village of Voznovo and 5 km away from the nearest water reservoirs. It was intended to build a concrete bunker with the capacity of 50 m^3 to isolate particularly hazardous chemicals. It was planned to stockpile less hazardous chemicals in trenches with hydro-isolation. However, the design terms were not observed during construction. Instead of being located on the territory administered by the "Drissensky" state farm, the landfill is located in Square 68 of the Saryansky forestry enterprise of the Verkhnedvinsk forestry area 500 m away from the site assigned for construction. No engineering surveys were conducted. The landfill is not indicated on plans and maps.

The site is located in the estuary of two streams flowing together into the right inflow of the Turya river flowing to the Saryanka river, which is the right inflow of the Zapadnaya Dvina. The distance between the landfill and the Turya river-bed and estuary is 500 meters and 4.5 km respectively.

The landfill has a rectangular form oriented to the north-south. The territory of the landfill is surrounded by a fence made out of barbed wire. There are signs "Danger! Pesticides landfill". A considerable part of barbed wire is destroyed. The territory of the landfill is surrounded by a hillside ditch about 1 m wide. On the eastern side the surface flow is crossed by the bed of the stream. Three surveillance wells were built across the perimeter of the landfill. They are located opposite to the north-west, north-east and south-east angles. Drilling on the territory of the landfill identified water-resistance clay up to 20 meters below the surface level. This is an indication of a fairly appropriate location of the site in terms of minimization of the environmental impact of the obsolete pesticides that are stockpiled there.

Out of 454.5 tons of the obsolete and banned pesticides in the landfill, 7.1 tons are POP-containing (DDT).

The Petrikov landfill of the obsolete pesticides is located in the northern part of the Petrikov district of the Gomel region 42 km to north-north-east from the town of Petrikov. The landfill is managed by the Oktyabrskiy inspectorate of natural resources and environmental protection. The landfill (0.6 ha) is located on the territory of the Koschevichy

forestry area. Between 1974 and 1988 the Gomel Amalgamation "Selkhoskhimiya" buried 1,423.3 tons of obsolete pesticides.

The Petrikov landfill is the largest one in Belarus. Landfill was carried out in 4 stages: in 1974, 1980, 1986 and 1988. In 1974 521 tons were buried in 7 trenches made of reinforced-concrete slabs and covered with polyethylene film and clay cap of 1 meter thick. 17 types of pesticides, mostly chlororganic pesticides, were buried. 297 and 253.7 tons were buried in 1980 and 1986. 351.6 tons of insecticides containing (up to 50 tons) unknown pesticides and mixtures were buried in 1988. In 1980, 1986 and 1988 pesticides were buried in trenches with impervious paving out of reinforced-concrete slabs, polyethylene film and clay cap of 1 meter thick.

As noted before, the inventory has found out that in the Gomel region the obsolete and banned pesticides, which were earlier stored at the storehouses of the agricultural enterprises and district agricultural services units have been transported to the **CUE "Facility for processing and burial of hazardous industrial wastes of the Gomel region"** located in the village of Dubrovka of the Chechersk district of the Gomel region. The facility is intended for extraction of valuable components out of industrial wastes, minimization of their toxicity and reduction of the stored amounts of non-recycled wastes. At present hazardous wastes are delivered to the plant for long-term storage. The storage facility for toxic industrial wastes allows stockpiling hazardous wastes in compliance with the safety regulations until their subsequent recycling. The capacity of the storage facility is 1,137 tons a year. The obsolete pesticides including those classified as POPs are delivered to the facility in sealed metal containers with the volume of 0.84 m^3, which are stored in deep reinforced-concrete bunkers. Each container is labeled and has the enclosed certificate for industrial waste transportation containing the following information: type of wastes, place of origin, toxicity class, aggregative state, chemical composition, type of packaging, amount and etc.

In the Gomel region all stocks of obsolete and banned pesticides, which were earlier stored at the storehouses, are concentrated at one disposal site. The inventory of chlororganic pesticides classified as POPs at the CUE "Facility for processing and burial of hazardous industrial wastes of the Gomel region" has revealed:

– 2.996 tons of DDT;
– 249.497 tons (solid and powder) and 38.991 tons (paste-like) of unidentified mixtures of pesticides.

The **Slonim** district of the Grodno region (the Albertinskoye forestry area, "Petushiny Gai", Square 112) also accommodates one of the largest **obsolete pesticides landfills**. They were buried in 1974. Most of pesticides are chlororganic. According to the data of the Ministry of Agriculture and Food, the landfill contains 882 tons of chemicals including 447.2 tons of DDT (74.3 % of the identified chemicals) and 1.8 tons of HCCH. The obsolete pesticides landfill was built in 1974 by Slonim branch of "Selkhozkhimiya". The design documents are not available. There is no information whether engineering surveys (topographic survey and engineering-geological survey) were conducted; there are no acceptance certificates on concealed works. Therefore, it is impossible to make a reliable assessment of the degree of protection of pesticides from atmospheric precipitates, which are a crucial factor for their solubility and migration into subsurface hydrosphere.

The Dribin obsolete pesticides landfill is located in the eastern part of the Dribin district, 11 km to south-east from the residential settlement of Dribin. On the map the landfill has a rectangular form stretching north-north-west. Its length is 140–150 meters, the width of the northern and southern borders is 35 and 67 meters respectively. The area is 2.6 ha. The adjacent territory within a radius of 2–5 km is covered by mixed forest (birch, asp, and fir). Now the surface of the landfill is covered by vegetation. There is an impassable dirt road Temny Les – Kamenka approximately 350 m away from the landfill.

Construction of the landfill involved three stages: 1974, 1983 and 1988. A separate trench sized 12 x 60 m and 4 m deep was set up at each stage. Impervious paving made of clay 0.8–1.0 m thick was placed at the bottom and walls with subsequent ramming and was then covered up with about 40 cm layer of quicklime. The bottom and walls of the trench set up in 1988 were covered with polyethylene film. After insecticides had been piled, the trenches were covered up with local soil with ramping. Insecticides in the trench set up in 1974 were covered up with 1 m layer of clay. According to the data of the Ministry of Agriculture and Food, the estimated weight of the buried pesticides is 541 tons. However, the findings of the research conducted by the RUE "CSRICUWR" suggest that only 353.737 tons have been identified including 98.74 tons of DDT.

The comparative assessment of ecological condition of the obsolete pesticides landfills in the Republic of Belarus, the outcomes of analytical studies and possibilities of pesticides migration to the environment are set forth in Tables 3.2 and 3.3.

Table 3.2
Summarized outcomes of the studies of the obsolete pesticides landfills

Obsolete pesticides landfill (District, region)	Date of landfill	Total amount of buried pesticides	POPs pesticides content *	Data of examination and monitoring	Outcomes of analytical studies		
					soil/flora	surface waters	ground waters
Brest region							
Brest district, Village Gershony	1978 1988	122 tons	About 20 tons *	The landfill was examined in 2004. The obtained data were used for the establishment of the local monitoring, which has been conducted since 2005.	Identified at the level of 1 μg/kg	Not identified	Identified at the level of 0.1–0.01 μg/dm^3
Vitebsk region							
Postavy district	1971	100 tons	Precise data are not available	Random sampling from the environmental compartments has been undertaken. Local monitoring of ground waters have been conducted since 2005.	Identified*** at the level of 1–10 μg/dm^3	Below method detection limit	Below method detection limit
Gorodok district	1973	411 tons					
Verkhnedvinsk district	1982	455 tons	More than 20 tons	The landfill was examined in 2003–2004; as a result, the affected zone for watercourses and ground waters was specified. Local monitoring of ground waters has been conducted since 2005.	Not identified	Identified** at the level of 0.01 μg/dm^3	Below method detection limit
Gomel region							
Petrikov district	1974 1980 1986 1988	More than 1,400 tons	More than 150 tons	Random sampling from the environmental compartments has been undertaken. Local monitoring of ground waters have been conducted since 2005.	Not identified	Below method detection limit	Below method detection limit
Grodno region							
Slonim district	1974	892 tons	More than 400 tons	The landfill was examined in 1998 and 2004. The obtained data are contradictory to some extent. Local monitoring of ground waters have been conducted since 2005.	Identified*** at the level of more than 10 μg/dm^3	Not identified	Identified at the level of 1–10 μg/dm^3
Mogilev region							
Mstislavl district (the Dribin landfill)	1974 1983 1988	530 tons	More than 90 tons	The ground waters have been controlled by Mogilev RCHE and HP**** since 1989. The landfill was examined in 2003-2004, the affected zone was specified. Local monitoring of ground waters have been conducted since 2005.	Identified at the level of 0.1–0.01 μg/kg	Identified** at the level of 0.01 μg/dm^3	Identified at the level of 0.1–0.01 μg/dm^3

Note: * – or unidentified;
** – Water of border drains and other technical constructions of the landfills;
*** – Data of single examinations or data, which were not affirmed at recurring studies;
**** – Regional Center of Hygiene, Epidemiology and Health Protection.

Table 3.3

Assessment of ecological condition of the obsolete pesticides landfills and the level of contamination of the adjacent territories

Obsolete pesticides landfill (District, region)	Date of landfill	Total amount of buried pesticides	POPs pesticides content *	Assessment of ecological condition of the landfill	Expert assessment of feasibility of pesticides migration to the environment	Expert assessment of the level of knowledge on the ecological condition of the landfill
Brest region						
Brest district, Village Gershony	1978 1988	122 tons	About 20 tons *	The total area is not more than 4 ha, the depth of burial is 4 m. A soil-reclamation canal is situated 1 km from the landfill. Before pesticides landfill this site was used for landfill of solid household waste.	There is a high probability of pesticides migration to the environment conditioned by the peculiarities of the landfill.	The landfill, its records and ecological condition are well-studied.
Vitebsk region						
Postavy district	1971	100 tons	Precise data are not available	Precise data are not available.	There are no precise data; project documentation is not available either.	Additional studies are required.
Gorodok district	1973	411 tons				
Verkhnedvinsk district	1982	455 tons	More than 20 tons	The pesticides were buried in the bunker of the total capacity of 50 m^3, situated at the outfall of the confluent of the river Turya (at a distance of 500 m). The infiltration rate is supposedly not high.	There is pesticides migration to the environment, which is conditioned by the peculiarities of geological and hydro-geological conditions of the landfill.	The landfill, its records and ecological condition are well-studied.
Gomel region						
Petrikov district	1974 1980 1986 1988	More than 1,400 tons	More than 150 tons	There are no precise data; project documentation is not available either.	It is rather difficult to assess the rate and direction of pesticides migration because of the absence of the systematized data on the landfill.	Additional studies are required.
Grodno region						
Slonim district	1974	892 tons	More than 400 tons	The pesticides were buried in two trenches and two concrete bunkers. The nearest natural water body is situated 7 km from the landfill.	There is pesticides migration to the environment. The data on the rate and direction of migration are rather contradictory.	Additional analytical studies of the soil on the territory of the landfill are required.
Mogilev region						
Mstislavl district (the Dribin landfill)	1974 1983 1988	530 tons	More than 90 tons	The area is 2.6 ha, the depth of the waterbearing stratum is 15 m.; the infiltration factors are comparatively high. The nearest natural water body is the river Remestvlyanka (1 km from the landfill).	There is pesticides migration to the environment, which is conditioned by the peculiarities of geological and hydro geological conditions of landfill.	The landfill, its records and ecological condition are well-studied.

Note: * – or unidentified.

Compilation of the register of pesticides classified as POPs and their disposal sites in the Republic of Belarus was a logical output of identification and quantification of the stockpiles of pesticides classified as POPs in the country. The compilation of the register was based upon the available international and national methodological guidelines on the establishment of inventories of the obsolete pesticides classified as POPs, including the Methodological Recommendations on the inventory of the obsolete and banned pesticides classified as persistent organic pollutants published by the RUE "BSRC "Ecology" of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus.

3.3. Analysis of the Data on Food Products, Drinking Water and Soil Contamination with POPs-containing Pesticides

The information provided by the Ministry of Public Health and the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus was used for the analysis of the data on contamination of food products, drinking water and soils with POPs pesticides. The primary reason is that these ministries have been assigned by the Government of the Republic of Belarus as the key agencies responsible for the implementation of the National Environmental Monitoring System and the National Social and Hygienic Monitoring System. The preliminary findings of the surveys conducted by the Republican Research and Technical Center "Ecomir" within the framework of GEF TF 053865 Project "Enabling activities related to the implementation of the Stockholm Convention on persistent organic pollutants (POPs) in the Republic of Belarus" have also been analyzed.

Food products are tested for residues of chlororganic pesticides classified as POPs within the framework of:

- The government control (the state sanitary inspection authorities, veterinary and phyto-sanitary control) of domestically produced and imported products;
- Preventive sanitary inspection within the system of the government hygienic registration and regulation;
- Plans and programs of the National Environmental Monitoring System and the National Social and Hygienic Monitoring System;
- Product certification;
- Quality control of products;
- Instructions and orders issued by the government authorities.

Drinking water and soils are tested for residues of chlororganic pesticides classified as POPs within the framework of:

- The government control (the state sanitary inspection authorities, veterinary and phyto-sanitary control) of domestically produced and imported products;
- Plans and programs of the National Environmental Monitoring System and the National Social and Hygienic Monitoring System;
- Instructions and orders issued by the government authorities.

Priority attention in the analysis of the data of the Ministry of Public Health has been given to the information provided by the laboratories of the sanitary inspection authorities. Based on this information, it has been found out that at present food products are controlled mainly for DDT and its metabolites, HCCH and its isomers (including gamma-isomer), aldrin, heptachlor and HCB. Other chlororganic pesticides classified as POPs such as endrin, mirex, toxaphene and chlordane were not controlled in food products at the moment of the inventory (The results of the laboratory tests disaggregated by regions are summarized in Table 3.4).

In 2004 the laboratory of the State Institution "Republican Research and Practical Center of Hygiene" of the Ministry of Public Health conducted 2,845 tests to measure concentration of chlororganic pesticides in food products. Testing of the samples did not detect residues of pesticides classified as POPs. However, HCCH was detected in 312 samples (11 %). The highest concentration was reported in bulb onion (0.36 mg/kg).

Table 3.4
Control of the concentration of residues of pesticides in food products, drinking water, water reservoirs and soils
(data based on the number of examinations by administrative regions)

Pesticide	2000			2001			2002			2003			2004		
	Food products	Drinking water and water reservoirs	Soil	Food products	Drinking water and water reservoirs	Soil	Food products	Drinking water and water reservoirs	Soil	Food products	Drinking water and water reservoirs	Soil	Food products	Drinking water and water reservoirs	Soil
Brest region															
DDT	1,086/1	147/0	5/0	2,477/5	104/0	23/0	3,024/7	35/0	38/0	3,510/4	530/0	45/0	3,080/4	533/0	42/0
HCCH	2,284/1	68/0	10/0	1,623/1	84/0	10/0	2,815/6	31/0	29/0	3,168/0	521/0	49/0	2,786/2	531/0	47/0
Aldrin	34/0	2/0	–	21/0	–	–	10/0	–	–	7/0	–	–	12/0	–	–
Heptachlor	17/0	–	–	3/0	–	–	8/0	1/0	–	5/0	–	–	7/0	–	–
HCB	842/0	–	–	519/0	–	–	678/0	–	–	746/0	–	–	707/0	–	–
Vitebsk region															
DDT	23/0	6/0	31/0	13/0	8/0	21/13	44/0	4/0	60/0	79/0	9/0	27/0	29/0	8/0	24/6
Aldrin	23/0	6/0	31/0	13/0	8/0	21/3	44/0	4/3	57/20	29/0	9/0	27/0	29/0	8/0	24/0
Heptachlor	23/0	6/0	31/0	13/0	8/0	12/0	44/0	4/3	57/0	79/0	9/7	27/20	29/0	8/0	23/5
Gomel region															
DDT	1,888/0	–	–	2,198/13	61/0	–	1,895/18	229/0	–	1,970/15	320/0	–	2,144/52	352/0	–
Aldrin, dieldrin	358/0	–	–	63/0	–	–	6/0	–	–	5/0	–	–	10/0	–	–
Heptachlor	411/0	–	–	83/0	–	–	16/0	–	–	5/0	–	–	6/0	–	–
HCB	33/0	–	–	–	–	–	41/0	–	–	50/0	–	–	78/0	–	–
Grodno region															
DDT	3,492/34	54/0	49/0	3,797/69	113/0	56/0	3,036/64	479/0	45/0	2,541/22	436/0	64/0	2,875/28	572/0	57/0
Aldrin	56/0	–	–	31/0	–	–	14/0	–	–	2/0	–	–	2/0	–	–
Heptachlor	210/0	–	–	104/0	–	–	56/0	–	–	2/0	–	–	2/0	–	–
HCB	1,414/1	–	–	1,394/5	–	–	949/15	–	–	760/16	–	–	713/9	–	–
Minsk region															
DDT	2,412/0	342/0	2/0	2,608/0	663/0	10/0	2,793/0	586/0	4/0	2,762/0	298/0	11/0	4,504/0	415/0	3/0
Aldrin	311/0	60/0	–	264/0	78/0	2/0	236/0	25/0	4/0	297/0	24/0	2/0	192/0	28/0	–
Heptachlor	121/0	46/0	–	133/0	18/0	2/0	104/0	13/0	4/0	151/0	24/0	6/0	82/0	19/0	–
Mogilev region															
DDT	122/3	2/0	4/0	103/2	6/0	–	215/0	87/0	–	312/34	49/1	–	518/91	99/0	–
Aldrin, dieldrin	–	–	–	–	–	–	–	–	–	–	–	–	1/0	–	–
Heptachlor	23/0	1/0	–	12/0	–	–	–	–	–	–	–	–	–	–	–
HCB	–	–	–	2/0	–	–	–	–	–	–	–	–	–	–	–

Note: in the numerator – the total number of examinations/ in the denominator – the number of examinations, in which residual quantities of POPs pesticides were identified.

In the period of 2000–2004 the laboratories of the Brest Regional Center of Hygiene, Epidemiology and Health Protection (RCHE and HP) conducted about 30,000 tests of residues of pesticides.

12,635 samples of food products were tested for DDT, of which:

- DDT was detected (within permissible level) in 21 (0.16 %) samples of food products;
- Residues of HCCH were detected in 10 out of 12,676 samples of food products;
- No residues of aldrin, heptachlor and HCB (84, 40 and 3,492 tests respectively) were detected.

Samples of drinking water, soils and water from reservoirs were also tested for residues of DDT and HCCH (no residues were detected).

Between 2000 and 2004 the laboratories of the Vitebsk RCHE and HP tested 1,092 samples of food products, water and soils to measure the concentration of DDT, aldrin and heptachlor. Of which:

- DDT was not detected in 188 food samples and 35 water samples. DDT was detected in 19 out of 163 soils samples;
- Residues of aldrin were detected in 3 out of 21 soil samples (14.3 %) in 2001 and in 20 out of 57 soil samples in 2002;
- Residues of heptachlor were detected in 20 out of 27 samples in 2003 and in 5 out of 23 samples in 2004. Aldrin and heptachlor were detected in 3 out of 4 water samples (75 %) in 2002. Residues of heptachlor were also detected in 7 out of 9 water samples in 2003.

Between 2000 and 2004 the laboratories of the Grodno RCHE and HP tested 21,450 samples of food products and raw food including 15,741 tests for DDT, 105 tests for aldrin, 374 tests for heptachlor and 5,230 tests for HCB. Residues of DDT and HCB were detected every year (0.87–1.4 %). HCB was detected in nearly 1per cent of samples (46 out of 5,230). No residues of aldrin and heptachlor were detected in food products and raw food. Soil and water were also tested for DDT and there were no detections.

Between 2000 and 2004 the laboratories of the Gomel RCHE and HP tested over 11 thousand samples of raw food and food products. No facts of the concentration of chlororganic pesticides classified as POPs being above the maximum permissible level were identified. 98 samples contained DDT within the permissible level.

Between 2000 and 2004 the laboratories of the Minsk RCHE and HP did not identify residues of DDT, aldrin and heptachlor. 15,079 food samples were tested for residues of DDT, 1,300 food samples – for aldrin and 591 food sample – for heptachlor. 2,639 tests of water samples were conducted including 2,304 tests for DDT, 215 – for aldrin and 120 – for heptachlor. Quantitative analysis of 50 soil samples was conducted; DDT was detected in 30 samples.

As seen from these data, the tests of food products, drinking water and soils for chlororganic pesticides classified as POPs are much diversified in terms of number and nature thus highlighting the need for a better coordination of testing process in future. Out of the large quantity of the tested samples, the number of detections of POPs pesticides subject to control under the Stockholm Convention is insignificant. This can be explained by the fact that the survey program does not take into account the results obtained in the previous years, the data of the territorial crop producers and land users about application of specific pesticides, their availability at the storehouses of the farms, the characteristics of the storehouses and the situation at the landfills of pesticides.

DDT is detected in food products, water sources and soils. It can be assumed, that detection of DDT in pure form in samples of local crops, drinking water, soils and water from reservoirs may be the evidence of the recent application of pesticides or their irregular use including their release into the environment in emergency situations (such as releases from a landfill, spillage during transportation and etc.). There are no unified methodologies for identification of pesticides classified as POPs corresponding to the international methodologies. The regulations on the concentration of residues of mirex, toxaphene, endrin in products and the environment are not available either.

Based on the data presented, it is virtually impossible to make unambiguous grounded conclusions about contamination of food products, drinking water, water reservoirs and soils with residues of endrin, HCB, chlordane and heptachlor because tests have not been conducted on a regular basis. However, there is an apparent heterogeneity in detections and concentration of chlororganic pesticides classified as POPs across regions: DDT and HCCH have been detected mainly in the Brest region; aldrin and heptachlor – in the Vitebsk region; DDT – in the Gomel region and DDT and HCB – in the Grodno region.

Within the framework of the environmental monitoring, in 2005 the respective structural units of the Ministry of Natural Resources and Environmental Protection launched a regular monitoring of the concentration of chlorine-containing pesticides classified as POPs in ground and subsurface waters and arable lands. As of 1 October 2005, 502 samples had been taken and tested in the Central Laboratory of the Ministry of Natural Resources and Environmental Protection including 132 samples of surface waters, 245 samples of arable lands, 71 sample of subsurface waters, 18 samples of soils taken at the landfills of pesticides, 29 soil samples and 7 samples of surface and ground waters taken at the obsolete pesticides' disposal sites. Total of 8,530 tests for chlorine-containing pesticides have been conducted. Chlorine-containing pesticides were detected in 17 % of samples; the maximum permissible concentration was exceeded in 0.6 % of samples.

3.4. Quantitative and Qualitative Assessment of the Territories in Belarus with the Highest Contamination of Soils, Drinking Water and Basic Food Products with Pesticides Classified as POPs

The quantitative and qualitative assessment of the territories with the highest contamination of soils has involved the analysis of the results obtained between 2000 and 2004 by the laboratories of the Ministry of Natural Resources and Environmental Protection and the Ministry of Public Health of the Republic of Belarus. The findings of the analysis with quantification of DDT (and its isomers), HCCH (and its isomers), HCB, aldrin and dieldrin disaggregated by regions are summarized in the Table 3.5.

Similarly, a comparative analysis of the data on contamination of water sources for the same period (2000–2004) has been conducted (Table 3.6).

Besides, in 2005 the Republican Research and Technical Center "Ecomir" analyzed water and soil samples to measure their contamination with chlororganic pesticides classified as POPs. Visible contamination was identified with respect to lindane and DDT only; these chemicals were detected in 21 out of 163 samples. The Republican Research and Technical Center "Ecomir" surveyed all seven landfills and nine sites for disposal of the obsolete pesticides across the country.

Based on the analysis of the above referred data, the following conclusions can be made about quantitative and qualitative assessment of the territories in Belarus with the highest level of contamination of soils and water sources.

The highest percentage of detections of pesticides classified as POPs in water and soils (up to 75 %) has been recorded at the landfills and disposal sites in the Vitebsk region. Concentration of DDT in soils samples above the maximum permissible level was registered at the Dribin, Slonim, Postavy and Gorodok obsolete pesticides landfills; the concentration of lindane above the maximum permissible level in soil samples was registered in the Gorodok district.

Therefore, it should be stated that the most adverse situation is observed at the landfills of the obsolete pesticides and the storehouses that have been examined. Within each of them there are spots where an excess of the maximum permissible concentration can be regarded as an indicator of potential diffusion of pollutants into the environment. To this end, an ongoing monitoring of the environment contamination with chlororganic pesticides classified as POPs should be conducted on the localities of the landfills and storehouses for the obsolete pesticides.

Table 3.5
Outcomes of analysis of soils for the content of DDT (and isomers), HCCH (and isomers), aldrin, and heptachlor (by administrative regions)

Region	Pesticide	2000	2001	2002	2003	2004	TOTAL	Contamination level, mg/kg
Brest	DDT	5/0	23/0	38/0	45/0	42/0	153/0	–
	HCCH	10/0	10/0	29/0	49/0	47/0	145/0	–
Vitebsk	DDT	31/0	21/13	60/0	27/0	24/6	163/19	0.0038–0.007
	Heptachlor	31/0	12/0	57/0	27/20	23/5	150/25	0.0087–0.0176
	Aldrin	31/0	21/3	57/20	27/0	24/0	160/23	Data not available
Gomel	–	–	–	–	–	–	–	–
Grodno	DDT	49/0	56/0	45/0	64/0	57/0	271/0	–
Minsk	DDT	2/0	10/0	4/0	11/0	3/0	30/0	–
	Aldrin	–	2/0	4/0	2/0	–	8/0	–
	Heptachlor	–	2/0	4/0	6/0	–	12/0	–
Mogilev	DDT	4/0	–	–	–	–	4/0	–

Table 3.6
Outcomes of analysis of waters for the content of DDT (and isomers), HCCH (and isomers), aldrin, HCB, and heptachlor (by administrative regions)

Region	Pesticide	2000	2001	2002	2003	2004	TOTAL	Contamination level, mg/dm^3
Brest	DDT	1,086/1	2,477/5	3,024/7	3,510/4	3,080/4	13,177/21	Data not available
	HCCH	2,284/1	1,623/1	2,815/6	3,168/0	2,786/2	12,676/10	Data not available
	Aldrin	34/0	21/0	10/0	7/0	12/0	84/0	–
	Heptachlor	17/0	3/0	8/0	5/0	7/0	40/0	–
	HCB	842/0	519/0	678/0	746/0	707/0	3,492/0	–
Vitebsk	DDT	23/0	13/0	44/0	79/0	29/0	188/0	–
	Aldrin	23/0	13/0	44/0	79/0	29/0	188/0	_
	Heptachlor	23/0	13/0	44/0	29/0	29/0	138/0	–
Gomel	DDT	1,888/0	2,188/13	1,895/18	1,970/15	2,144/52	10,085/98	0.00003–0.005
	Aldrin	358/0	63/0	6/0	5/0	10/0	442/0	–
	Heptachlor	411/0	83/0	16/0	5/0	6/0	521/0	–
	HCB	33/0	–	41/0	50/0	78/0	202/0	–
Grodno	DDT	3,492/34	3,797/69	3,036/64	2,541/22	2,875/28	15,741/217	Data not available
	Aldrin	6/0	31/0	14/0	2/0	2/0	55/0	–
	Heptachlor	210/0	104/0	56/0	2/0	2/0	374/0	–
	HCB	1,414/1	1,394/5	949/15	760/16	713/9	5,230/48	Data not available
Minsk	DDT	2,412/0	2,608/0	2,793/0	2,762/0	4,504/0	15,079/0	–
	Aldrin	311/0	264/0	236/0	297/0	192/0	1300/0	–
	Heptachlor	121/0	133/0	104/0	151/0	82/0	591/0	–
Mogilev	DDT	122/3	103/2	215/0	312/34	518/91	1,270/130	0.00003–0.0002
	Aldrin	–	–	–	–	1/0	1/0	–
	Heptachlor	23/0	12/0	–	–	–	35/0	–
	HCB	–	2/0	–	–	–	2/0	–

Note: in the numerator – the total number of examinations/ in the denominator – the number of examinations, in which residual quantities of POPs pesticides were identified.

3.5. Capacity Assessment and Development of Proposals for the Destruction of the Stockpiles of Pesticides Classified as POPs

In accordance with Article 6 d (ii) of the Stockholm Convention, each Party to the Convention shall take appropriate measures so that wastes are disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed so that they do not exhibit the characteristics of persistent organic pollutants or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option or the persistent organic pollutant content is low, taking into account international rules, standards, and guidelines. These wastes are not permitted to be subject to disposal operations that may lead to recovery, recycling, reclamation, direct reuse or alternative uses of persistent organic pollutants.

At present the international practices do not have the universal method that would give an absolute guarantee of environmentally sound destruction of obsolete pesticides including those classified as POPs. Therefore, selection of the optimal method of their disposal should proceed from their physical and chemical characteristics as POPs-containing pesticides, their quantities as well as with an account for economic and environmental considerations.

Given the requirements set forth in the Stockholm Convention, the following options of disposing of the obsolete pesticides classified as POPs can be considered in the context of Belarus:

- Landfill at the CUE "Facility for processing and burial of hazardous industrial wastes of the Gomel region";
- Export to another country where the relevant destruction facility is available;
- Establishment of a POPs destruction facility in Belarus.

One of the options of the obsolete pesticides disposal is their long-term storage at the CUE "Facility for processing and burial of hazardous industrial wastes of the Gomel region". The main disadvantage of this option is the high cost of storage: BYR 2.517 million (US$ 1,170 in equivalent) for one container with the volume of 0.84 m^3. Besides, long-term storage of obsolete pesticides does not lead to destruction of POPs and a serious potential threat of environmental contamination is still there.

Many developing countries export the stockpiles of obsolete pesticides to the developed countries for destruction. For example, one of the CIS countries – Moldova – plans to follow this option for solving the problem of destruction. However, this option is also fairly expensive because if it is followed, the cost of destruction of the obsolete pesticides classified as POPs increases considerably due to additional costs associated with repackaging, separation, transportation and other preparatory works. Besides, this option assumes immediate solution of the problem and will not contribute to the development of the national infrastructure and capacity for addressing the problem of hazardous wastes. Given that the Republic of Belarus has a fairly developed industry and that more wastes will be generated with the growth of industrial output, the optimal option for Belarus is to develop its own facility for destruction of the obsolete pesticides classified as POPs. At present there is a broad offer of commercial technologies for POPs decontamination; new technologies are being developed that will be available for commercial use in the nearest future. Taking into account research, production, social and economic capacities of the country, it is proposed to consider, within the framework of the Terms of Reference, the following technologies for destruction of the obsolete pesticides classified as POPs, which can be potentially used in the Republic of Belarus.

Two-stage incineration is the most widespread technology for destruction of obsolete pesticides in the world that has been operated on a commercial scale. Organic pesticides should be incinerated within at least 2 seconds at the temperature not lower than 1,100 ^{O}C. Efficacy depends of the type of wastes, turbulence, temperature and time of being in the zone of burning. Incineration is a very effective process and ensures 99.99 % of POPs destruction. However, the equipment adjusted in the wrong way and its inappropriate management can lead to generation of hazardous by-products, notably dioxins and furans. As a rule, this happens during gas cooling after the second burner. Modern incineration facilities are equipped with the special cooling systems allowing to quickly reduce the temperature to the level when dioxins and furans are not generated. Modern facilities are additionally equipped with dioxin suppression devices. The cost of incineration of 1 ton of POPs ranges from US$ 200 to US$ 5,000.

Different types of furnaces are used including rotary furnaces, furnaces with liquid injection, fixed furnaces, cement kilns and etc.

Incineration in rotary furnaces is the most use-proven and most commonly applicable disposal method in the world. Rotary furnaces are used in such industrially developed countries as France, USA, Germany, Denmark, Switzerland, the Netherlands, Norway, Sweden and others. Among large companies using these furnaces it is worth noting Akzo Nobel Chemikals (Denmark), Bayer AG (Germany), ABB Service GmBH (Germany), Aprochim SA Tredy, Elf Atochem, Septra (France), EMS-Dottikom AG, CH-6505 (Switzerland), Rechem Intern Ltd. (UK) and SAKAB (Sweden). A universal facility has been developed allowing to successfully solve the complex problem of environmentally sound, waste-free and, at the same time, highly productive disposal of POPs. The key pillar of POPs incineration in a rotary furnace is a construction of two-stage reactor, inside of which the conditions for reducing reaction and dissociation of chemical compounds under full high-temperature pyrolysis. Rotary furnaces consist of rotating cylindrical camera lop-sided 1–2 degree horizontally in such a way that wastes are moving horizontally and radially along the cylinder. Low rotation under 0.5–2 rotation per minute improves turbulence. Wastes are coming from the elevated side of a furnace while sludge is going away through its down side. Furnace gases are drained into an afterburner. As a rule, in case of halogenated compounds, the first camera of the rotary furnace for incineration has a temperature of 1,100 ^{O}C (up to 1,300 ^{O}C is needed for a certain type of wastes) with the duration of a cycle being at least 2 seconds and excess oxygen being at least 6 % by volume. The key products generated as a result of incineration are carbon dioxide and water as well as non-organic ash. Chlorine is transformed into gaseous hydrogen chloride, which is removed together with other compounds generated as by-products of burning. Equipment for air pollution control is used. It is suitable for almost all POPs without their separation and classification by types and origin and without limitation in terms of initial humidity. The main advantage is the creation of modules that can be developed and put into operation fairly quickly and with moderate capital investments thus ensuring quick return. These modules are environment-friendly and generate almost no own waste and releases of hazardous pollutants into the environment.

Another technology that can be used for destruction of obsolete pesticides is plasma technology creating a temperature up to 10,000 ^{O}C. Plasma technology for POPs destruction is a fairly rare thing. Only recently this method has developed from a pilot to a commercial stage. However, it is suitable for liquid waste only. The main weakness of the technology is the following. It may seem that high temperature of treatment – 5,000–10,000 ^{O}C creates enabling conditions for fission of wastes into atoms. In this case, however, it is needed to create conditions for quick cooling of the treated chemical in order to prevent its re-combination during cooling involving generation of toxic products. When the temperatures in a reactor are so high, it is very difficult to do this. In case of plasma treatment, a chemical stays in a hot zone during a very short time – 20–50 milliseconds – and, therefore, comprehensive destruction is not always achieved.

The main weakness of plasma arc method is the need for preliminary diversification of POPs. Besides, each type of POPs-containing pesticides and their wastes requires specific configuration and design of an installation and a reactor. Taking all these factors into account, commercial use of this technology in our country, given the total amount of the obsolete pesticides, is not cost-efficient. Another weakness of plasma arc methods of obsolete pesticides destruction is their low productivity.

As plasmic systems are fired by the electrical energy, the cost of destruction of pesticides and hazardous chemical wastes is very high. Among the advantages of this technology it is worth mentioning its mobility; weaknesses include suitability for liquid wastes only, low capacity and, as noted before, very high cost of destruction of pesticides compared with incineration. The cost of setting and assembling of an installation is estimated at US$ 1 million in equivalent.

It should be also noted that other available current methods of POPs decontamination, such as biological method, gasification, chemical methods (chemical oxidation, electro-chemical oxidation), steam transformation, oxidation with moist air and others have not reached the stage of commercial use. Therefore, the prospects of their use should be considered as an additional option of disposal only after this stage is reached.

Summarizing the above said, it can be concluded that the optimal option for solving the problem of obsolete pesticides disposal is the establishment of the own facility for

POPs destruction in Belarus with introduction of the commercial technology used in the EU countries or the USA. The technology to be introduced should ensure complete destruction of POPs. Two-stage incineration can be recommended as a possible technology due to the following reasons:

- Efficiency of the technology has been proved by its broad commercial use in many countries;
- Large capacity;
- The technology is suitable for different types of hazardous wastes;
- High efficiency of destruction;
- Presence of equipment for preventing generation and for recovery of dioxins and furans;
- Economic justification.

While solving the problem of choice of the environmentally sound technology for the disposal of obsolete pesticides, it is also important to take into consideration the problem of environmentally sound treatment of used containers, which are stockpiled in the course of repackaging of obsolete pesticides. Theses containers should be repackaged and disposed of as the pesticides stockpiles themselves observing all safety requirements for the repackaging procedure.

It is also worth mentioning that there are a number of industrial enterprises in the Republic of Belarus where it is possible to put the disposal technology into operation without considerable financial investments.

At the same time, in case of international technical assistance for environmentally sound disposal of the POPs obsolete pesticides stockpiles, the most appropriate variant of the POPs pesticides disposal will be transportation of the repackaged POPs pesticides to the countries, which have the industrial facilities for environmentally sound disposal of obsolete pesticides, including POPs, in accordance with the requirements of European environmental directives.

Conclusion

In the course of the inventory of the POPs pesticides stockpiles and their storage sites the group of the experts of the project GEF TF 053865 have implemented the following activities:

- Preliminary quantity and content assessment of the obsolete pesticides stockpiles in the country; quantity identification of the POPs pesticides in the Republic of Belarus; quantity definition of the unidentified mixtures of obsolete pesticides and unidentified liquids;
- Inventory of the obsolete pesticides storage sites; study of the technical condition of these sites;
- Collection and analysis of the information on all existing obsolete pesticides landfills in the Republic of Belarus, including the description of these landfills, the quantity of the buried obsolete pesticides, the conditions of burial and their impact on the adjacent environment;
- Elaboration of the register of the POPs pesticides stockpiles and their storage sites on the territory of the Republic of Belarus, which makes the base for the development of a complex electronic database on POPs obsolete pesticides stockpiles in the country;
- Analysis of the available data on contamination of food products, water and soils with POPs pesticides;
- Assessment of the existing and potential capacity for environmentally sound disposal of POPs obsolete pesticides;
- Elaboration of the proposals for the development of the section on POPs pesticides management of the National Implementation Plan of the Stockholm Convention.

Nevertheless, it is worth mentioning that the preliminary outcomes of the inventory have to be specified in the course of the repackaging of the obsolete pesticides when the pesticides are weighed.

In pursuance of control of the reliability of the data on the transfer of the POPs obsolete pesticides It is also required to define the organization at the level of the MNREP responsible for the POPs pesticides register maintenance. It is also important to approve by the mutual resolution of the three ministries – MNREP, Ministry of Public Health, and Ministry of Agriculture and Food – a temporary procedure of providing the information for the regular up-date of the register before a state POPs statistic system is put into operation.

ANNEX 4

Inventory of PCB-containing Equipment, Materials, Wastes and their Disposal Sites

Introduction

An indispensable condition of efficient PCB management in the Republic of Belarus is avail-ability of information on the quantity of the stored PCB, kinds and types of the PCB-containing equipment and materials. In connection with the above mentioned the PCB inventory taken in the framework of the project GEF TF 053865 meets one of the key provisions of the Stockholm Convention.

In accordance with the priorities identified in Part 2 of Annex A to the Stockholm Convention on persistent organic pollutants determined efforts should be made to identify, label and remove from use equipment containing greater than 10 % polychlorinated biphenyls and volumes greater than 5 litres, equipment containing greater than 0.05 % polychlorinated biphenyls and volumes greater than 5 litres. Later the endeavor should be also made to identify and remove from use equipment containing greater than 0.005 % polychlorinated biphenyls and volumes greater than 0.05 litres. [65]

According to the Interim guidance for developing a national implementation plan for the Stockholm Convention [104] the major objective relating to PCB is the assessment of the types and quantity of PCB-containing equipment in the country, ways of its use and identification of its own-ers.

The first PCB inventory in Belarus was taken in 2003-2004 in the framework of the State Scientific Technical Program “Environmental Safety”, in the course of its implementation the first PCB quantitative evaluations were obtained, the major owners of the PCB-containing equipment were identified, the types and kinds of the PCB-containing equipment were defined. At the same time the obtained data necessitated a more detailed inventory, which is conditioned by the diversity of the use of PCB-containing equipment, a great number of equipment types, the term of use (possible loss of the relevant documents), PCB risk negligence and the absence of the sustainable mechanism of PCB management regulation.

In the framework of the project GEF TF 053865 an additional PCB inventory was taken, which resulted in more precise and detailed data on PCB in the Republic of Belarus.

4.1. Scientific-Methodological Framework of the PBC Inventory in the Republic of Belarus

Principles and the Procedure of the PCB Inventory

The inventory was implemented based on the unified methodological approaches. The basic principles of the inventory are:

- A most complete identification of the power capacitors and transformers taking into account their types, ways of use, location and state;
- A most complete coverage of the kinds of activities relating to identification of potential owners of PCB-containing equipment;
- Assessment of the amount of PCBs based on the data on dielectric liquid content in the standard types of the PCB-containing equipment;
- Provision of the filled-in preliminary reporting forms by the enterprises-owners of PCB-containing equipment.

The PCB inventory was implemented by means of sending out the inquiries accompanied by a set of documents, including “Methodological guidance for PCB inventory taking”, “PCB report form”, “Guidelines for filling in the PCB report form” (approved by Order of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus of 29 December 2003 No. 538).

The lists of the addressees, which were to fill in the inquiry forms in the course of the inventory, were compiled for the following categories of enterprises and works:

- Enterprises, which did not respond in the course of the first inventory;
- Enterprises, which were covered by the inventory for the first time;
- Enterprises, whose previously provided data had to be specified, as the forms had not been filled in properly;
- Enterprises whose provided reports on the absence of PCB-containing equipment do not seem credible.

A special attention has been given to the enterprises of food industry and the provender milling enterprises as far as there is a risk of contamination of the produces with PCBs. According to the Stockholm Convention on POPs each Party assumes the obligation not to use the PCB-containing equipment on such enterprises.

All in all in the framework of the project GEF TF 053865 the inquiries were sent to 441 enterprises. To monitor the inventory and to speed up the process, the relevant ministries, agencies and the territorial departments of the Ministry of Natural Resources and Environmental Protection have been involved. The lists of enterprises covered by the inventory have been drafted and furnished to the Ministry of Architecture and Construction (the list includes 73 enterprises), Ministry of Industry (the list includes 103 enterprises) and Ministry of Agriculture including the Department of Bakery Products (the list includes 79 enterprises). The summary lists based on the findings of 2004 and 2005 inventories have been furnished to the regional departments of the Ministry of Natural Resources and Environmental Protection (the lists include 771 enterprises).

In the course of the project implementation 384 responses from enterprises were received (including responses containing information on the enterprises that had been liquidated, dissolved or had gone bankrupt, the information on the transfer of the transformer substations of the enterprises under control of the district Electricity Supply Networks (ESN)). Among these enterprises 106 own PCB-containing equipment (Table 4.1). About 3,508 additional PCB-containing power capacitors, 8 transformers, 200 small-size capacitors had been identified. The total additional amount of PCBs is estimated at 56.8 tons.

Table 4.1
General data on PCB inventory in Belarus

Indicator	Total	Including the data obtained in the course of the project GEF TF 053865
Enterprises that had reported the absence of PCB-containing equipment	1,351	218
Enterprises identified as owners of PCB-containing equipment including: enterprises having power capacitors with PCBs enterprises having power transformers with PCBs	762 748 44	106 105 4
Enterprises having reservoirs with PCBs	4	–

The analysis of the obtained data revealed that as of 1 January 2006 there are more than 27 ministries and organizations, which supervise 762 enterprises-owners of PCB-containing equipment (Table 4.2).

It was found out that most of the enterprises-owners of PCB-containing equipment are under jurisdiction of the Ministry of Agriculture and Food and the Ministry of Industry.

Table 4.2
The enterprises owning PCB-containing equipment by ministries and agencies

Ministry / agency	Number of enterprises owning PCB-containing equipment
Ministry of Agriculture and Food	155
Ministry of Industry	141
Ministry of Architecture and Construction	59
Ministry of Energy	59
Concern "Bellegprom"	55
Ministry of Housing and Communal Services	44
Ministry of Transport and Communications	36
Concern "Bellesbumprom"	35
Concern "Belgospischeprom"	29
Concern "Belmestprom"*	26
Concern "Belneftekhim"	23
Ministry of Communication and Informatization	16
Belarusian Railways**	16
Concern "Belbiopharm"	11
Other	57
TOTAL	**762**

Note: * – liquidated in accordance with Decree of the President of the Republic of Belarus of 5 May 2006 No. 289;
** – put under supervision of the Ministry of Transport and Communications in accordance with Decree of the President of the Republic of Belarus of 5 May 2006 No. 289.

Elaboration of the catalogue of PCB-containing equipment

The PCB management history and international experience reveal the complicated character of the PCB inventory problem, which is conditioned by a diversity of kinds and brands of PCB-containing equipment and products, numerous firms that have ever produced them, a wide range of use of PCB-containing equipment. As far as during the long time the use of PCBs and PCB-containing equipment was not regulated there was no unified labeling of such equipment. Therefore the PCB inventory includes the identification of PCBs and PCB-containing equipment. In order to provide methodological assistance for the PCB inventory the UNEP Chemicals elaborated the guidelines [114, 115], which contain information about the trademarks of PCBs, the firms producing PCB-containing transformers and capacitors, recommended stages of the inventory, test-methods for PCB identification. The most detailed information relates to the trademarks of the industrial PCB-containing chemicals; a complete list includes about 90 items.

However, as the national studies and international experience prove, the information on labeling of PCB-containing transformers and capacitors is the most important for the PCB inventory as it helps to identify among the diversity of the transformers and capacitors in service those, which contain PCBs.

Therefore to facilitate the identification of PCB-containing equipment the lists with the brands of power capacitors and transformers, produced at the enterprises of the former USSR and in other countries were compiled. This was done on the basis of reference guides on electrical equipment [120–122], government standards and technical specification for this equipment, literary sources [107, 110, 117, 118, 127–131], as well as full-scale studies of the electrical equipment at a number of enterprises of Belarus.

Power transformers

Power transformers are used for transforming electrical power in electrical networks and in installations for receipt and use of electrical current. Power transformers include three-phase and multiphase transformers with power of 6.3 kVA and more, one-phase transformers with power of 5 kVA and more.

According to the coolant type transformers are subdivided into the following types: dry transformers, mineral oil transformers, and fire-resistant liquid dielectric transformers. Sovtol-10 was used as a fire resistant dielectric in the former USSR. The presence of PCBs is marked by second letter H in the letter code of the trademark of the transformer. This letter stands for the fire-resistant dielectric. As a rule, the type of the coolant (mineral oil or Sovtol) and the liquid weight (in kg) are also indicated on the label of the transformer.

Among the major types of the PCB-containing transformers the most widely spread are the transformers produced by the Chirchik transformer plant (Uzbekistan).

The DL transformers manufactured by Wolta-Werke (GDR) have been identified among foreign brands of PCB-containing transformers used in Belarus.

The list of PCB-containing transformers with Sovtol coolant produced in the former USSR is given below.

Table 4.3

The list of PCB-containing transformers with Sovtol coolant produced in the former USSR

Brand	Sovtol content, kg	Brand	Sovtol content, kg
ТН3-25/10	160	ТН3-2500/10	4,440
ТН3-40/10	205	ТН3С-2500/10	4,160
ТН3П-400/10	1,380	ТНП-400/10	1,500
ТН3-630/10	1,000	ТНП-800/10	2,550
ТН3П-630/10	1,350	ТНП-800/10	2,750
ТН3-1000/10	1,676	ТНП-1600/10	3,300
ТН3П-1000/10	1,786	ТНПУ-1000/10	2,500
ТН3ПУ-1000/10	2,210	ТНПУ-2000/10	3,350
ТН3-1600/10	2,765	ТНР-420/0,5П	800
ТН3П-1600/10	2,850	ТНР-750/10	1,700
ТН3ПУ-2000/10	3,260	ТНР-1800/10	2,500
ТН3-2500/10	2,980	ТНРУ-1200/10	2,200
ТН3-2500/10	4,120	ТНРУ-2000/10	3,350

Power capacitors

Power capacitors are used for longitudinal compensation of reactance of power lines, for elevation of power factor of industrial electrical installations and inductive thermal-electric installations in power mains of high and low voltage or in power equipment of higher frequencies and other.

Depending on the function the following types of capacitors are distinguished: cosine capacitors, impact capacitors, thermal-electrical capacitors, filter capacitors, tiristor capacitors, and special capacitors. The most widely-spread are cosine capacitors of the type КС (КСК); they make 70 % of the total production of capacitors. These capacitors in their turn are subdivided into capacitors of zero, first and second dimensions (for example, КС0 – a capacitor of zero dimension, weight – 18 kg; capacitor КС1 or КСК1 – first dimension, weight 26–30 kg; capacitor КС2 or КСК2 – second dimension, weight 54–60 kg). The size of the metallic frame of these capacitors is 380 x 120 mm in foundation but they differ in height – 180, 325 and 640 mm correspondingly. All capacitors have a rectangular form and are made of sheet steel [116].

In power capacitors the following impregnating dielectrics have been used: gas-resistant oil of phenol selective purification from sulfur-bearing oils with antioxidant additive; synthetic insulating liquid containing chlorinated biphenyls (pentachlorbiphenyl, trichlorbiphenyl); technical and medical castor oils (for high voltage impact capacitors); synthetic insulating liquids containing organic silicon (polyorganic siloxane) compounds.

According to technical specifications and government standards, the second letter of the capacitor type label stands for the dielectric type, for example, C – impregnation with synthetic liquids; M – impregnation with mineral oil. Principle data on PCB-containing capacitors are set forth in Table 4.4.

Table 4.4
Principle data on the types of the PCB-containing power capacitors used in Belarus

Country	Firm, plant	Types of PCB-containing capacitors (or special indicators)	Date of production
USSR	Serpukhov Capacitor Plant (Russia)	Cosine capacitors КС0, КС1, КС2 Thermal electrical capacitors ЭСВ, ЭСВП, ЭСВК Impact capacitors ИС Tiristor capacitors ФСТ, ФС, ГСТ, РСТ, РСТО For semi-conductor transformers ПС, ПСК For electric locomotives КС, КСК	1958–1988
	Ust-Kamenogorsk Capacitor Plant (Kazakhstan)	Cosine capacitors КС0, КС1, КС2, КСК1, КСК2 Thermal electrical capacitors ЭС, КСЭ, КСЭК For filter batteries КСФ, КСКФ	1959–1990 (1992)
	Leninakan electrical technical works (Armenia)	Capacitors for luminous tubes ЛС, ЛСМ, ЛСЕ	1969–1990
GDR	VEB ISOCOND (Leipzig, Magdeburg)	Cosine capacitors BK, KC, KCI, KP, LKC, LKCA, LKCI, LKPI, LKPF, LPQI, LPXF, LPXI, LKPH, LKMI, LKUI, NKPT, NKNI, KS, KSTA	Before 1986
	VEB Electronic Gera	2018	
Poland	ZWAR	C, СЭБК, СР	1968–1982
	BK. Dymitrow/Warszawa	C	1968
Czech Republic	ZEZ	CTAE, CCAK	1980–1983
Romania	F.C.M.E. Bukareszt	CU	
England	BICC and HUNTS Capacitors	L	

Power capacitors can be used separately and in complex capacitor installations (CCI) or in batteries. CCIs have been produced in three modifications: cabinet-type, cabinetless and pole-type. Cabinet-type CCIs are made as metallic cabinets which contain generally marketed capacitors with commutation, safety and automatic regulation of reactance devices. Among CCIs there are installations of the series КУ, ККУ, УК, УКН, УКТ, УКБН, УКПН.

It has been identified that capacitor installations made in GDR are widely used in Belarus. In most cases they have PCB-containing capacitors. The labels on capacitor installations indicate the type of design (numeric and alphabetic indication) and plant-specific standard SAH-N 2065. For example 2011-42-SAH- N 2065; 2012-42-SAH-N 2065; 2013-42-SAH N 2065 and etc. in which cosine capacitors of LKC type are used. We have also identified other types of capacitor installations such as 110-X-SALH-S1001; 70-r-SALH-S1001; LB-Z-4-4 IP20 SAH; LA-7-4-4-IP-20 SAH-4 2065-0; W07E-Q-4-4-IP-20; LOGE-a-4-4IP-20 SAH 240, AKB-110 and etc. with PCB-containing capacitors of LKC type. The abbreviation of TGL standard which is normally indicated at the capacitor banks manufactured in Germany can be used to identify PCB-containing capacitors.

Small-size capacitors

Small size capacitors are capacitors of types ЛС, ЛСМ, ЛСЕ, which are used in start-controlling devices of luminous tubes as ballast for protection of filament transformers. These types of transformers were produced at the Leninakan electrical technical works before 1989; the list is set forth in Table 4.5.

Table 4.5
General data on small-size capacitors, which were produced at Leninakan electrical technical works (USSR)

Capacitor type	Total weight, kg	Estimated weight of PCB, kg
ЛС1	Data not available	Data not available
ЛСЕ-1	Data not available	Data not available
ЛСЕ1 3,0	Data not available	Data not available
ЛСЕ1 3,75	Data not available	Data not available
ЛСЕ-400-7,8 У13	Data not available	Data not available
ЛСМ-250-2,5 У1.1	0.14	0.0467
ЛСМ-250-30 У1.1	1.14	0.38
ЛСМ-250-100 У1.1	4.35	1.45
ЛСМ-400-3,8 У1.1	0.26	0.087
ЛСМ-400-7,8 У1.1	0.46	0.153
ЛСМ-400-10 У1.1	0.57	0.19
ЛСМ-400-40 У1.1	2.00	0.667
ЛСМ-400-60 У1.1	3.46	1.153
ЛСМ-400-80 У1.1	4.43	1.477
ЛСМ-400-100 У1.1	5.34	1.78

4.2. PCB Inventory Outcomes

The Quantity of PCB-containing Equipment and the Overall Quantity of PCBs

As of 01.01.2006 in the Republic of Belarus there were identified:

- 380 power transformers filled with Sovtol-10 or its foreign substitutes;
- 46,943 power capacitors containing PCB;
- 29 reservoirs with dielectric liquids containing PCB;
- 40,658 small-size capacitors.

The total amount of the identified PCBs is estimated at 1,563.8 tons (net weight), including:

- In power transformers – 862.8 tons;
- In power capacitors – 693.2 tons;
- In reservoirs – 7.8 tons.

According to the obtained data 55 % of the total amount of PCBs are contained in power transformers and 44 % – in power capacitors (Figure 4.1).

The most widely-spread type of the transformer in Belarus is ТН3 – 89 % of the total amount, the rest of types – ТН3П, ТНП и DL – make 4 %, 3 %, and 4 % respectively.

80 % of power capacitors identified in Belarus were produced at the Serpukhov Capacitor Plant and Ust-Kamenogorsk Capacitor Plant (USSR). 20 % of capacitors are of foreign origin.

Figure 4.1: Distribution of PCBs in equipment

The majority of the power capacitors produced in the former USSR are cosine capacitors КС2 and КСК2 used for elevation of the power factor of electrical installations of 50 Hz alternating current; they make up 2/3 of the total number of capacitors. КС1 and КСК1 types are 16 % of the total; capacitors of a higher frequency for thermal electrical installations of the type ЭС make up 16 %.

Analysis of PCB-containing Equipment Distribution among Ministries and Industrial Branches

The largest amount of PCBs is concentrated at the enterprises of the Ministry of Industry and the Concern "Belneftekhim" (Figure 4.2). They make up 34 and 25 % of the total amount of PCB in the country correspondingly.

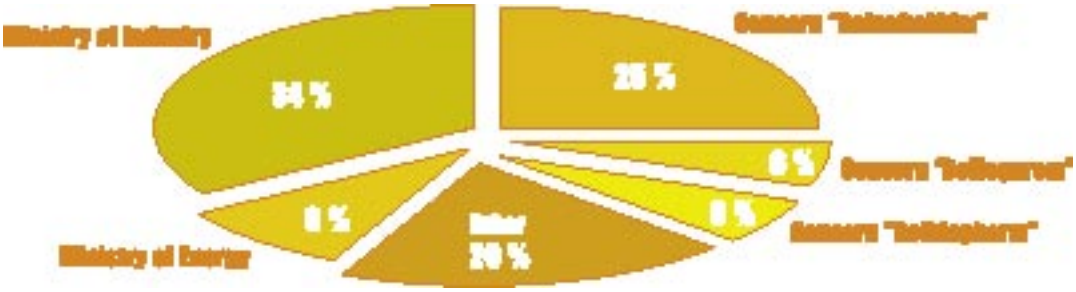


Figure 4.2: Distribution of PCBs among ministries

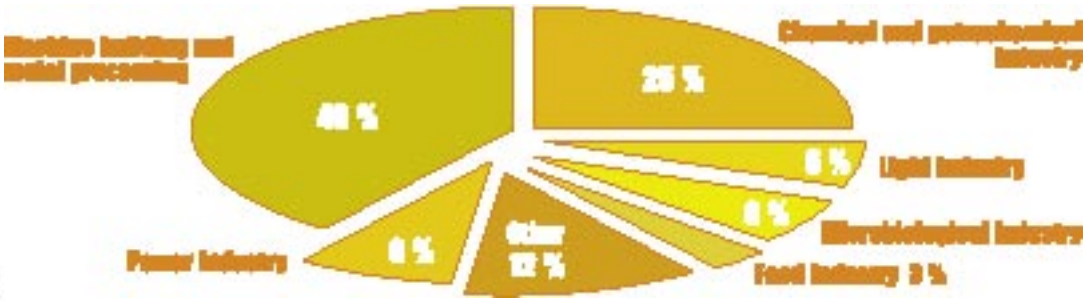


Figure 4.3: Distribution of PCB among industries

Other enterprises with considerable amounts of PCBs are subordinate to the Ministry of Energy (about 9 %), the Concern "Belbiopharm" (6.5 %) and the Concern "Bellegprom" (6 %). About 5 % of the total amount of PCBs is concentrated at the enterprises of the Ministry of Agriculture and Food, 4 % – at the enterprises of the Concern "Bellesbumprom". About 2 % of PCBs is concentrated at the enterprises of the Powder Metallurgy Concern and the Ministry of Architecture and Construction.

It was found out that PCB-containing equipment is installed at the enterprises of various types: machine building and metal processing, power industry, chemical and petroleum industry, light and food industries, housing and communal services and many others (Figure 4.3). At the same time the largest amount of PCB is concentrated at the enterprises of the machine building complex (40 %) and petrochemistry (about 25 %). The structure of PCB distribution of the total amount of PCB among branches is displayed in Figure 4.3. The share of food industry makes up about 3 per sent of the total amount of PCB (43.7 tons).

More detailed data on the distribution of PCB-containing equipment among ministries are given below.

Power transformers

380 PCB-containing transformers with the total amount of PCBs of 862.8 tons were identified in the course of the inventory. The transformers are distributed among ministries and agencies rather unevenly (Table 4.6).

Table 4.6

PCB-containing transformers and the amount of PCBs disaggregated by ministries and agencies

Ministry / agency	Number of power transformers, items	PCB amount in transformers, tons
Concern “Belneftekhim”	161	306.2
Ministry of Industry	71	255.2
Concern “Belbiopharm”	50	91.2
Ministry of Agriculture and Food	19	33.1
Concern “Bellegprom”	16	42.3
Concern “Bellesbumprom”	10	16.1
The Powder Metallurgy Concern	8	30.8
Concern “Belmestprom”	6	8.3
Ministry of Energy	6	2.8
Other	33	76.8
Total	**380**	**862.8**

The share of the Concern “Belneftekhim”, Ministry of Industry and the Concern “Belbiopharm” totals 75 % of the overall amount of the identified transformers (Figure 4.4).

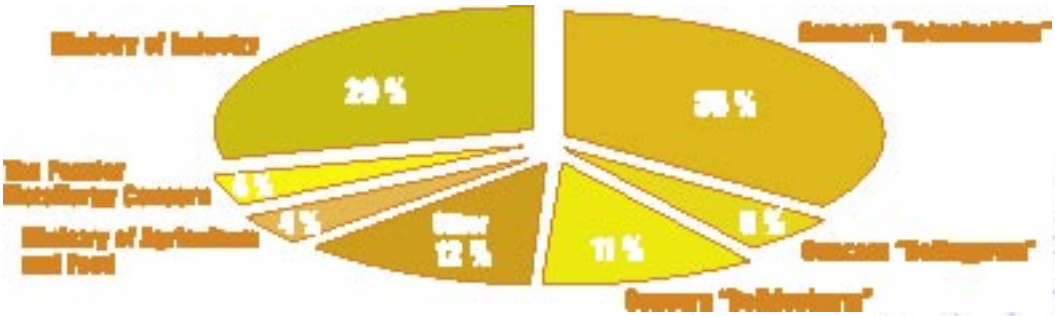


Figure 4.4: *Distribution of PCB-containing transformers among ministries and agencies*

87 % of the total number of transformers are in service. 36 transformers have been phased out, mostly at the enterprises of the Concerns "Belneftekhim", "Belbiopharm" and the Ministry of Industry (Figure 4.5).

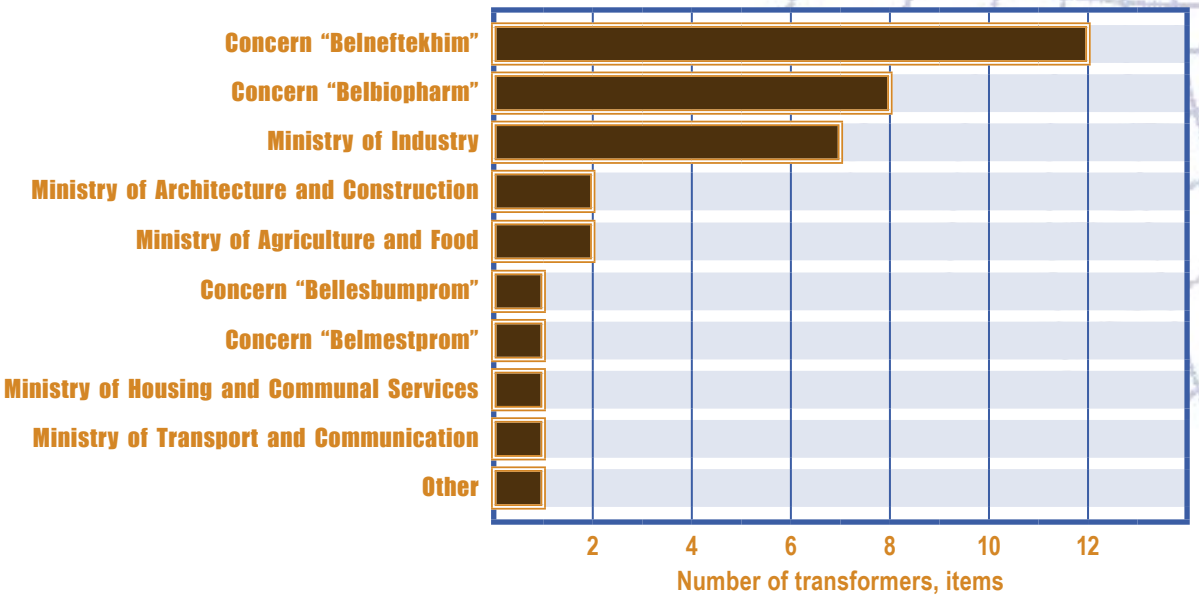


Figure 4.5: *Distribution of the phased out PCB-containing transformers*

Power capacitors

46,943 PCB-containing capacitors were identified in the course of the inventory; the total amount of PCB in them is 693.2 tons. The gross weight of the PCB-containing capacitors is estimated at 2,080 tons, which means that mainly this amount of PCB containing capacitors will have to be disposed of in the future.

Table 4.7

Distribution of PCB-containing capacitors among ministries and agencies

Ministry / agency	Number of capacitors, items	PCB amount in capacitors, tons	Capacitors weight, tons
Ministry of Industry	18,703	271.7	815.1
Ministry of Energy	9,025	136.8	410.5
Concern "Belneftekhim"	5,047	78.4	235.1
Concern "Bellegprom"	3,048	47.1	141.4
Ministry of Agriculture and Food	2,680	37.3	111.9
Ministry of Architecture and Construction	1,572	22.7	68.1
Concern "Bellesbumprom"	1,274	19.9	59.7
Ministry of Housing and Communal Services	1,116	15.5	46.5
Belarusian Railways	966	14.7	43.9
Concern "Belbiopharm"	832	9.8	29.4
Concern "Belgospischeprom"	539	7.4	22.3
Concern "Belmestprom"	286	4.4	13.2
Ministry of Communication and Informatization	236	3.5	10.6
Ministry of Transport and Communications	226	3.7	11.1
State Military-Industrial Committee	108	1.7	5.1
Other	1,285	18.6	55.7
Total	**46,943**	**693.2**	**2,079.6**

The majority of PCB-containing capacitors are concentrated at the enterprises of the Ministry of Industry (18,000 items), Ministry of Energy (more than 9 thousand items), and the Concern "Belneftekhim" (about 5 thousand items). All in all the share of the enterprises of the Ministry of Industry makes up 40 % of the total number of the PCB-containing capacitors, the Ministry of Energy – 20 %, the Concern "Belneftekhim" – 11 % (Figure 4.6).

Figure 4.6: *Structure of the distribution of the PCB-containing capacitors among ministries and agencies*

As of now about 27 % of the PCB-containing capacitors have been phased out. The major part of the phased out equipment belongs to the enterprises of the Ministry of Energy and the Ministry of Industry – 5.4 thousand and 3.7 thousand items correspondingly (Figure 4.7). About 1.5 thousand capacitors are stockpiled at the enterprises of the Concern "Belneftekhim".

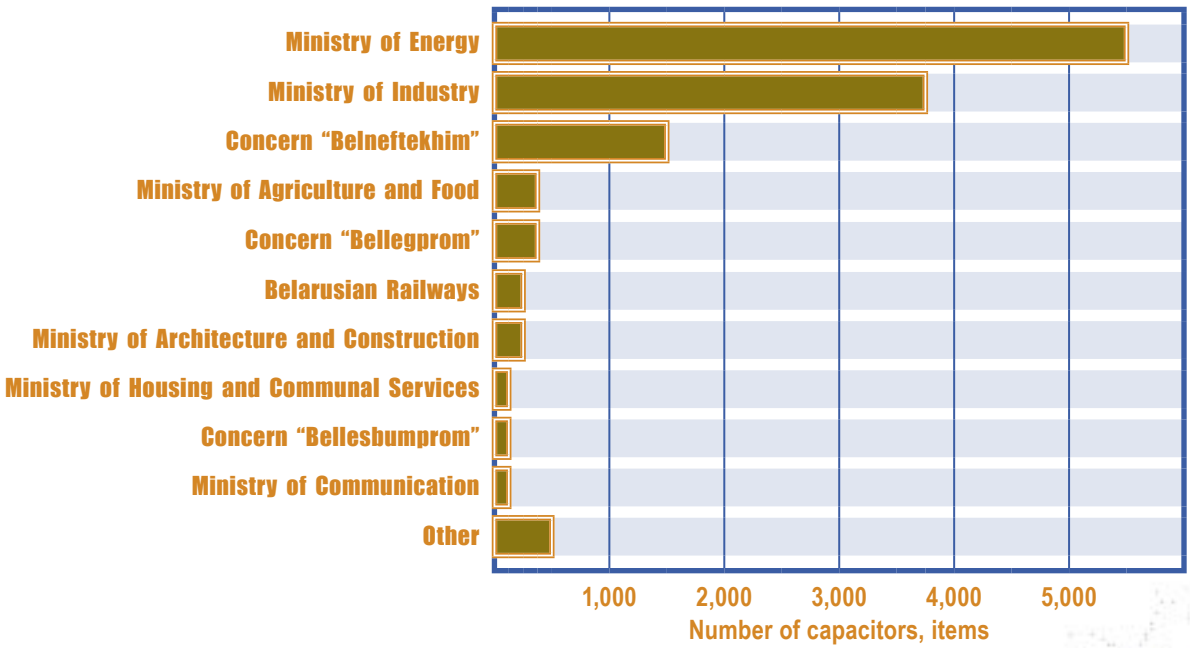


Figure 4.7: *Distribution of the phased capacitors among the ministries*

Dielectric liquids containing PCB

8 tons of liquids containing PCB (Sovtol-10 and clophen) are stored at the enterprises. The major owners of reservoirs with PCB-containing liquids are the Concern "Belneftekhim", and the Ministry of Industry (Table 4.8).

Table 4.8
Distribution of reservoirs with PCBs among ministries and agencies

Ministry / agency	Number of reservoirs with PCBs	Amount of PCBs, tons
Concern "Belneftekhim"	16	4.4
Ministry of Architecture and Construction	1	0.1
Ministry of Industry	12	3.3
Total	**29**	**7.8**

Small-size capacitors

In the course of the inventory 40,658 small-size capacitors of the type ЛС have been identified (Table 4.9).

Table 4.9
General data on the inventory of small-size capacitors

Ministry / agency	Number of items
Concern "Bellegprom"	18,393
Ministry of Industry	14,734
Ministry of Communication and Informatization	5,169
Ministry of Information	1,100
Ministry of Agriculture and Food	274
Concern "Belgospischeprom"	218
Ministry of Transport and Communications	207
Ministry of Housing and Communal Services	163
Concern "Bellesbumprom"	150
Belarusian Railways	75
Ministry of Forestry	38
Ministry of Architecture and Construction	4
Other	133
Total	**40,658**

Estimated amount of PCB identified in small-size capacitors can make up 4 tons, however small-size capacitors are not included in the summary data on the inventory since this category of equipment is not considered prior in the course of the inventory taking. It is worth mentioning that small-size capacitors are found at the enterprises of various affiliations and their number can make up thousands of items. Moreover, such types of capacitors are installed not only in working areas but also in residential buildings. According to preliminary estimates small-size capacitors in Belarus may contain about 15–25 tons of PCBs.

Analysis of PCBs distribution at the enterprises of food industry

As it was already mentioned in accordance with the Stockholm Convention [65], special attention should be given to PCB management at the enterprises of the food industry and provender milling, since there is a high risk of contamination of the produces with PCB. Thus, it seems requisite to cover by the inventory the enterprises of the food industry, including meat and milk production, bread-baking plants etc. The data on the PCB-containing equipment identified at the enterprises of the food industry are given below.

The food production enterprises can potentially belong to the following branches: the food industry, flour-and-cereals industry, feed mill industry, agriculture, microbiological industry, and other branches.

At the same time these enterprises can be affiliated to the following ministries and agencies (including executive power authorities of different levels) (Table 4.10).

Table 4.10
Structure of subordination of the enterprises belonging to the processing industry

Branch	Ministry / agency
Microbiological industry	Concern "Belbiopharm"
Flour-and-cereals and feed mill industry	Ministry of Agriculture and Food
Food industry	Belarusian Republican Union of Consumers' Cooperatives
	Concerns "Belbiopharm" and "Belgospischeprom"
	Ministry of Agriculture and Food
	Other
	Property Management Department of the President of the Republic of Belarus
Agriculture	Ministry of Agriculture and Food

This branch and affiliation fragmentation as well as territorial dispersion of the processing industry enterprises owning PCBs complicate identification, registration and handling of PCB-containing equipment.

The inventory covered 256 enterprises of the food industry, 38 enterprises of the flour-and-cereals and feed mill industry, 43 agricultural enterprises, 8 enterprises of the microbiological industry. In the framework of the project GEF TF 053865 73 responses from these enterprises were received.

The summarized data of the PCB inventory at these enterprises are set forth in Table 4.11.

Table 4.11
Summary of the PCB inventory data

Branch	Number of capacitors, items	Weight of PCB in capacitors, tons*	Number of transformers, items	Weight of PCB in transformers, tons	Total weight of PCBs, tons
Microbiological industry	126	2.19	50	91.18	93.37
Flour-and-cereals and feed mill industry	569	7.94	–	–	7.94
Food industry: Bread-baking plants	205	2.07	–	–	2.07
Meat and milk production	1,210	17.28	8	10.09	27.37
Liquor, starch, sugar, cannery, vegetable drying and other industries	1,241	14.78	4	4.76	19.54
Agriculture	86	1.32	8	18.64	19.96
Total	**3,437**	**45.58**	**70**	**124.67**	**170.25**

Note: * – data on the weight of PCB in all tables are given in rounded figures .

Flour-and-cereals and feed mill industry

Among the enterprises of flour-and-cereals and feed mill industry there are 21 owners of PCB-containing equipment and wastes. As the finding of the inventory revealed these enterprises own from 3 to 120 PCB-containing capacitors; the total number of identified PCB-containing capacitors is 569 with the overall PCB amount in them of 7.94 tons.

Food industry

Food industry is mostly represented by the following kinds of enterprises: bread-baking plants, liquor plants, starch, sugar, cannery, vegetable drying plants and other enterprises.

24 bread-baking plants were identified where from 2 to 23 capacitors with the total amount of PCB from 20 to 230 kg are used. The total number of identified PCB-containing capacitors at bread-baking plants covered by the inventory is 205, the PCB weight in them – 2.07 tons. It is worth mentioning that there are certain difficulties in the process of identification of the PCB-containing equipment at the enterprises of food industry. Firstly, the above mentioned enterprises have a complicated subordination structure (infrastructure), secondly, there is no opportunity to contact these enterprises directly, and finally, the data of the reports provided by these enterprises are not always accurate.

29 meat and milk enterprises own PCB-containing capacitors and three of them own PCB-containing transformers. The total number of capacitors is 1,210 with 17.28 tons of PCB in them. The number of identified capacitors at these enterprises varies between 1 to 88 items with the amount of PCB in them from 19 to 1,186 kg. 8 identified transformers contain more than 10 tons of PCB. Thus, the total amount of PCB at the enterprises of meat and milk production is estimated at 27.37 tons.

At the rest of the enterprises relating to liquor, starch, sugar, cannery and vegetable drying production and other branches of food industry the overall number of identified capacitors is 1,241 items with the 14.78 tons of PCB in them. 41 enterprises own PCB-containing capacitors. Most of the enterprises own from 2 to 76 PCB-containing capacitors, at that 24 enterprises have the number of capacitors varying from 2 to 20 items.

Agriculture

The number of owners of PCB-containing equipment in agriculture is relatively small – 6 enterprises, five of them own PCB-containing capacitors. In total 86 capacitors were identified, the amount of PCB in them is 1.32 tons.

Microbiological industry

126 power capacitors and 50 transformers (the maximum number among all industries covered by the inventory) were identified at the enterprises of the microbiological industry. It is significant that 48 transformers are owned by the RUE “Novopoltsk Plant of Protein-Vitamin Concentrates”. The number of identified capacitors in this industry varies from 4 to 40; the total amount of PCB in them is 93.37 tons.

Analysis of the Spatial Distribution of PCBs on the Territory of Belarus

As it was mentioned above, 762 enterprises in Belarus own PCB-containing equipment. These enterprises are dispersed on the whole territory of the country (Figure 4.8).

The largest amounts of PCBs were identified in Minsk and the Minsk region – total of 514.3 tons (32.9 % of all PCBs in Belarus) and the Mogilev region – 384.4 tons (24.6 %) (Figure 4.9). In the Gomel region 213.5 tons of PCBs were identified, in the Vitebsk region – 192.3 tons, in the Brest region – 143.5 tons, and in the Grodno region – 115.8 tons.

The PCB-containing transformers and capacitors are distributed rather unevenly on the territory of Belarus. Figure 4.10 shows the correlation of the PCB amount in capacitors and transformers in the context of the regions.

The predominant type of PCB-containing equipment in the Minsk region (including the city of Minsk), Mogilev and Vitebsk regions is the transformer. The transformers make up 75 % of the whole amount of PCBs in the Mogilev region. In the Gomel, Brest and Grodno regions the largest amount of PCBs is concentrated in capacitors. At that, the PCBs contained in capacitors constitute 97 % of the total amount of PCBs in the Grodno region.

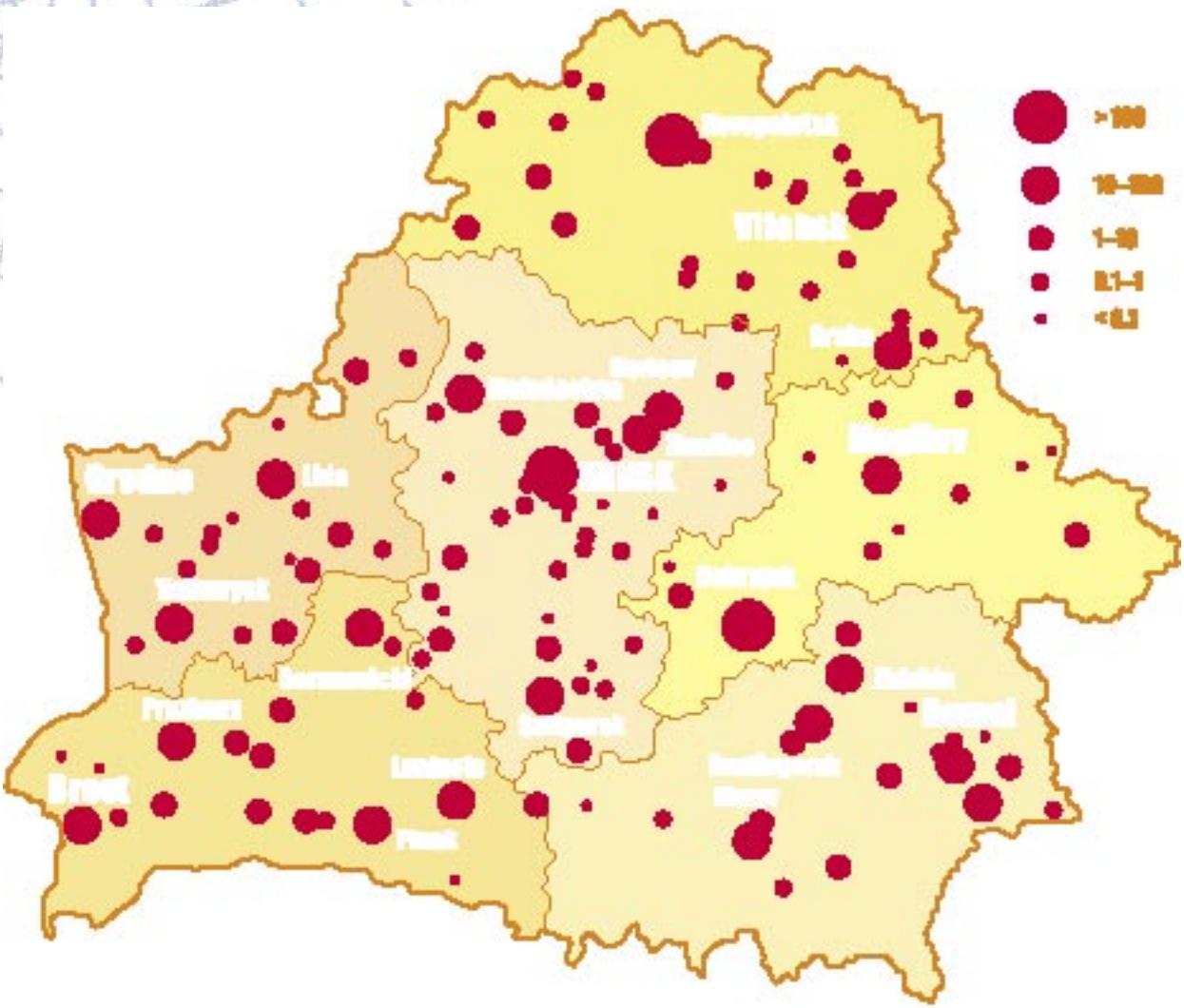


Figure 4.8: *Spatial distribution of PCB on the territory of Belarus, tons*

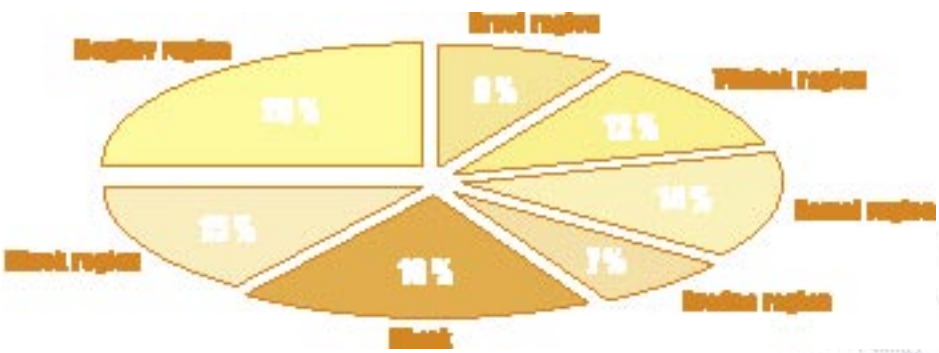


Figure 4.9: *. Distribution of PCB among administrative regions of Belarus*

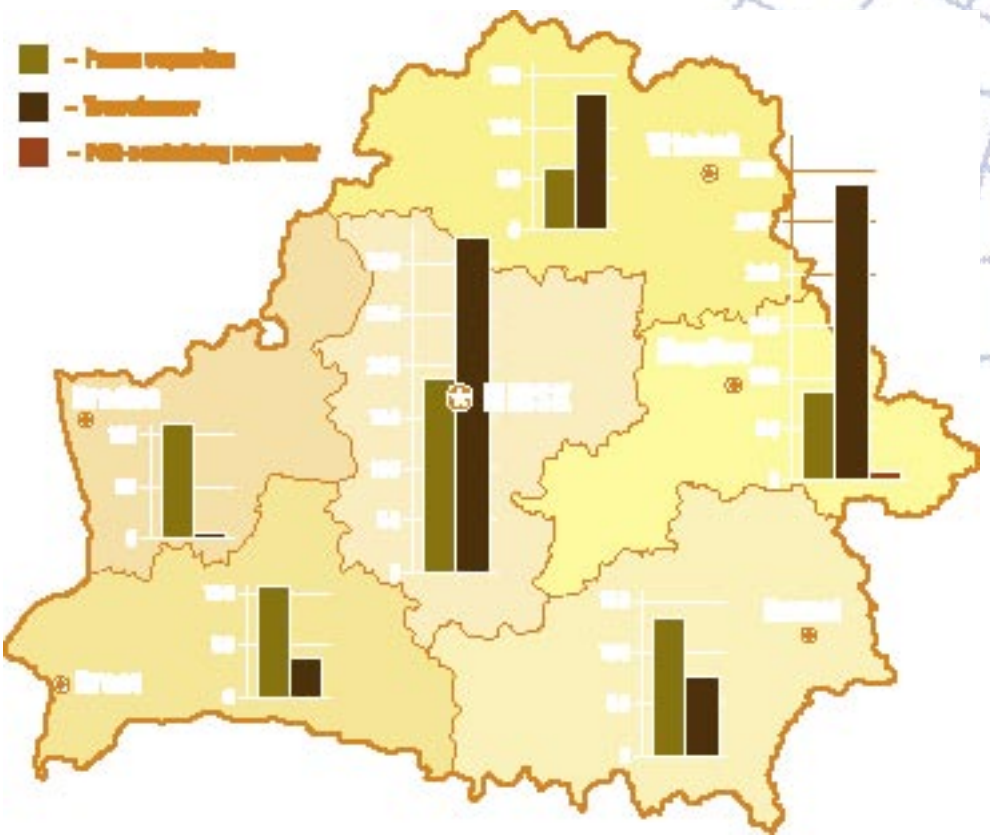


Figure 4.10: *PCBs in capacitors, transformer and reservoirs in the regions of, tons*

Analysis of the PCB Storage Conditions

During the period of establishment and intensive development of the electro-engineering industry in the USSR it was assumed that the expired and damaged PCB-containing capacitors were subject to disposal at a manufacturing plant. However, due to a number of reasons, the technology of disposal was not developed. The system of collection, storage and transportation of such equipment from numerous customers to a manufacturing plant was not arranged. The more so, the regulations on the procedure of treating PCB-containing equipment were not developed either.

Therefore, during many years when the equipment, including damaged equipment, was removed from operation, in most cases no measures to ensure its environment-friendly storage were undertaken. This equipment was often stored at the sites of its use (at substations and production units) and in some cases – in storehouses. Quite often, removal of equipment from operation did not mean its dismantling. Even now in many cases capacitors are still kept within banks of capacitors and capacitor installations though they have not been in operation for more than 10 years.

As of now a considerable part of the phased out PCB-containing equipment is stockpiled at the enterprises. The total amount of PCB in the phased out electrical equipment is estimated at 261.3 tons, 185.0 tons (70 %) are contained in capacitors and 76.3 tons (30 %) – in transformers.

It has been found out that the most of the phased out capacitors are concentrated in the Grodno region, the most of the transformers – in the Vitebsk region (Figure 4.11, a and b).

Distribution of the PCBs in the phased out transformers and capacitors in the context of administrative regions is displayed in Figure 4.12.

The following records and documents have been used to study the storage conditions of PCB-containing equipment: the findings of PCB inventories conducted in 2004 and 2005; the analysis of the report forms and random examination of transformer substations and capacitor installations.

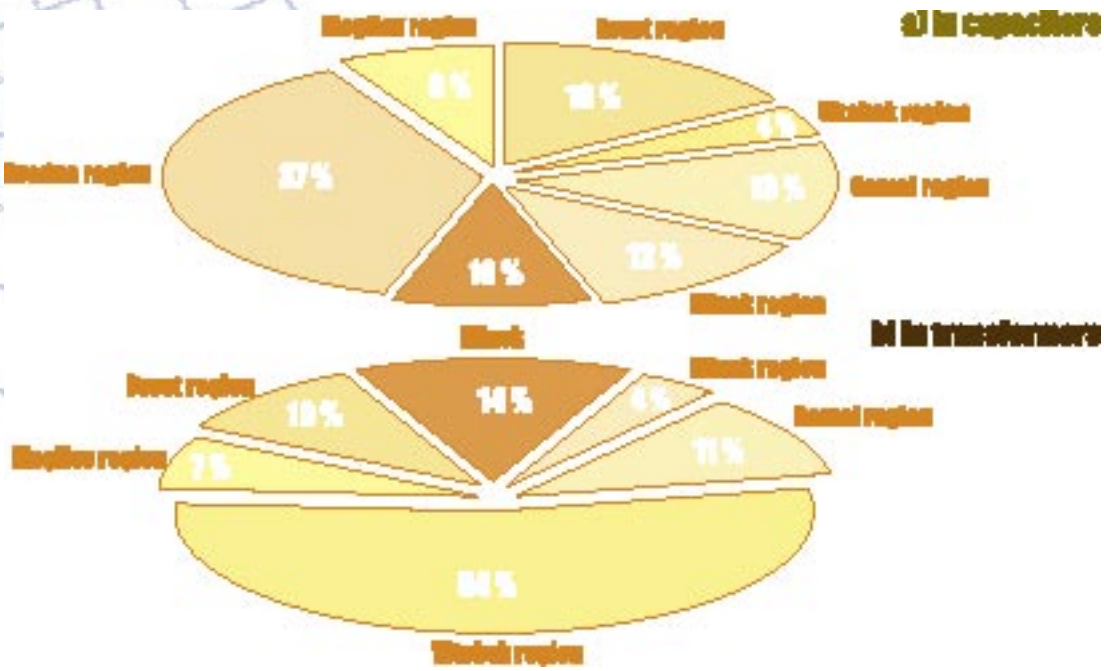


Figure 4.11: *Distribution of PCBs in the phased equipment by administrative regions: a) in capacitors; b) in transformers*

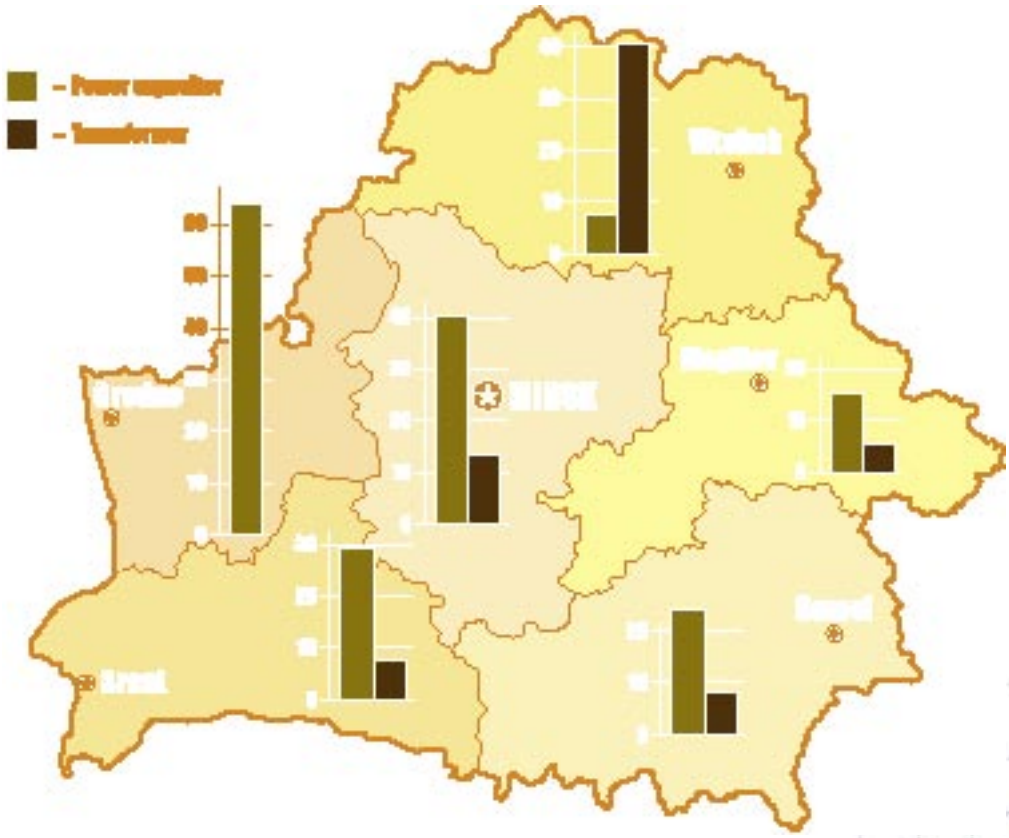


Figure 4.12: *Distribution of the PCBs in the phased out transformers and capacitors in the context of administrative regions, tons*

The initial analysis of the available data has suggested that the dismantled (and reserve) PCB-containing equipment is currently stored at the sites of three types including the open sites, sheds and indoor premises. Table 4.12 summarizes the data on the storage arrangements (types of sites) for about 55 % of the equipment removed from operation. The data are disaggregated by ministries and agencies.

Table 4.12
Storage of the phased out PCB-containing equipment

Ministry / agency	Equipment type	Site type	Number of items
Ministry of Energy	Power capacitor	Indoor premises	68
		Open sites	4,299
		Shed	57
Ministry of Industry	Power capacitor	Indoor premises	567
		Open sites	83
State Military-Industrial Committee	Power capacitor	Indoor premises	21
Concern “Bellegprom”	Power capacitor	Indoor premises	247
Concern “Belmestprom”	Power capacitor	Indoor premises	9
Concern “Belneftekhim”	Power capacitor	Indoor premises	422
	Transformer	Indoor premises	1
		Open sites	10
		Shed	1
Concern “Belbiopharm”	Power capacitor	Indoor premises	20
	Transformer	Indoor premises	6
		Open sites	2
Belarusian Railways	Power capacitor	Open sites	72

The table summarizes information on the dismantled equipment only. Given the total number of capacitors removed from operation, it is possible to make a general assessment of the current storage conditions: around 39 % of capacitors are stored at the open sites and about 61 % – in the indoor premises and under sheds. It has been found out that open sites have been established mainly at the enterprises of the Concern “Belenergo” (Ministry of Energy) and, to a lesser extent, at the entities of the Belarusian Railways. Indoor premises for storing PCB-containing equipment have been established at the enterprises of the Ministry of Industry, the Concern “Belneftekhim” and other ministries and agencies.

When the phased out capacitors and transformers are stored at the open sites the risk of PCB releases to the environment is the highest. Being constantly exposed to the environmental factors (precipitation, air temperature perturbation), capacitor and transformer shells tend to corrode and cause PCB leakages (capacitor shells are the most prone to corrosion). When the damaged PCB-containing equipment is stored in the indoor premises, there is a possibility that the premises including floors, walls and other elements may get contaminated.

It is significant that for the last two years a considerable effort has been made to improve the organization of the PCB-containing equipment storage. According to the results of the inventory of PCB-containing equipment in 2004, 45 open storage sties were identified at the enterprises of the Concern “Belenergo”, 25 of them were not organized properly. In October 2005 there were already 29 organized storage sites for the dismantled PCB-containing equipment at the enterprises of the Concern “Belenergo”. About 15 % of the dismantled capacitors were packaged in containers of different types.

In most cases the containers fail to ensure appropriate containment of the equipment. The black oil spots can be found around the containers and strong specific smell can be felt. Capacitors with the damaged shells and broken insulators are sometimes stored (packed in boxes) in a horizontal way thus causing considerable leakage of PCBs. The first metal containers (7 items) with walls 1 cm thick, which are specially designed for the storage of the damaged PCB-containing capacitors have been mounted at substation SB–330 kV “Lida” (Minoity, Brest region).

In general, the storage of capacitors in the absence of the appropriate measures to prevent leakage of PCBs results in emergence of newly contaminated territories, i.e. in addition to substations where capacitors were installed and where leakages were reported now there are storage sites with continued leakage.

4.3. Assessment of the Condition of the PCB-containing Equipment. The Forecast of the PCB-containing Equipment Phase-out and Evaluation of the Possibility of PCB Leakages

The forecast of the PCB-containing equipment phase out has been made based on the year of its production.

Power capacitors

The initial analysis suggests that about 43 % of capacitors used in Belarus were produced before 1980 and roughly the same amount – in the period between 1981 and 1986 (Figure 4.13).

It means that a considerable part of PCB-containing capacitors has exhausted operational capacity and should be removed from operation. However, by now 27 % of capacitors have been removed from operation or are kept in reserve (about 13 thousand capacitors). A major part of capacitors has been removed from operation after 1990 (Figure 4.14).

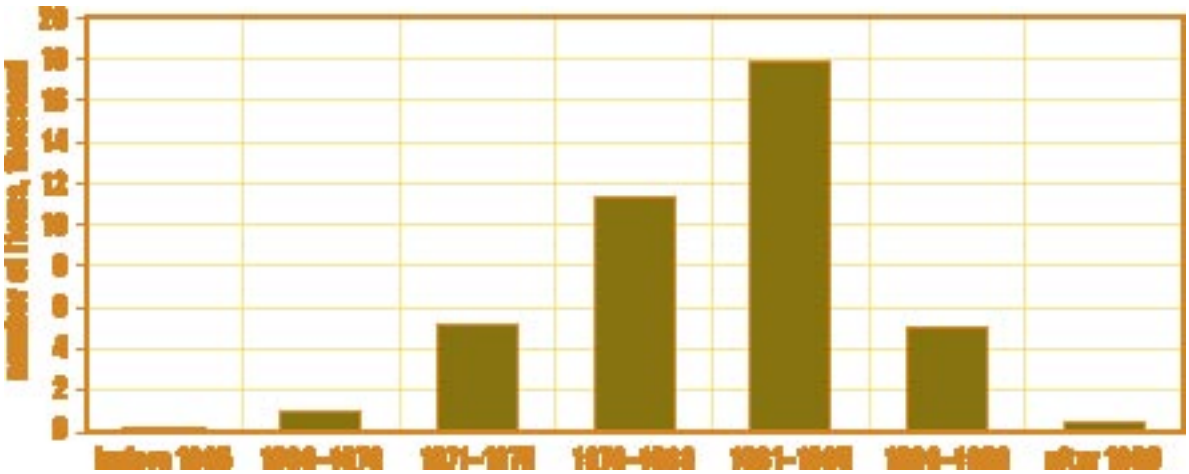


Figure 4.13: PCB-containing capacitors disaggregated by years of production

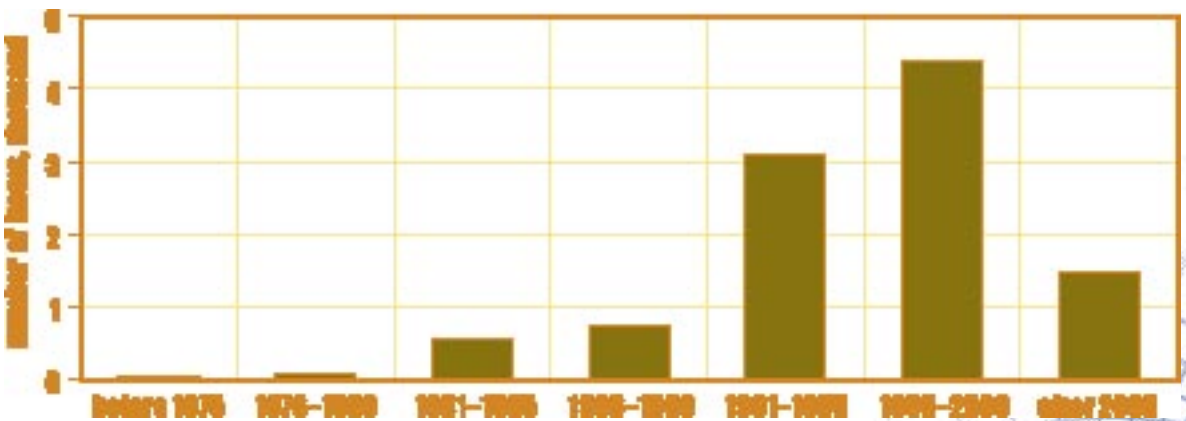


Figure 4.14: Phase-out of PCB-containing capacitors

As the findings show the condition of about 10 % of capacitors is estimated as unsatisfactory. Long period of service and consequent physical deterioration of the equipment, non-observance of the dismantling and transportation rules, absence of the specially organized storage sites – all this and other factors can cause shell corrosion, insulator damage, disassembling of the cases along the welded joints. Random examination of a number of power network substations and industrial enterprises revealed that many capacitor banks have vivid traces of PCB leakage, which can be identified by oiled shells, stains of scorched vegetation, and soaked concrete slabs under the equipment.

To assess the service life of PCB-containing capacitors and to make a forecast of their phase-out, we have used the service capacity value, which is 20 years in accordance with the data cited in the reference documents [116, 120–122]. The estimates have suggested that 87 % of capacitors have already exhausted their capacity (Figure 4.15, a), though the real period of capacitors' operation at the industrial enterprises in the indoor premises is longer than indicated in the technical specifications. However, even if capacitors are used during 30 years, almost all of them will have exhausted their capacity by 2020 (Figure 4.15, b).

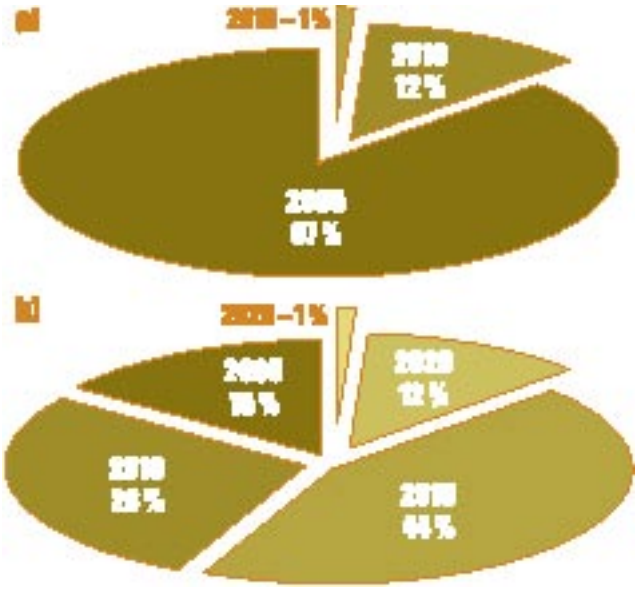


Figure 4.15: *Forecast of capacitors' phase-out depending on the duration of their operation: a – 20 years, b – 30 years*

Power transformers

Out of the total number of PCB-containing transformers that have been identified in Belarus, about 30 % were produced before 1975, about 24 % – in the period between 1976 and 1980 and 20 % – in the period between 1981 and 1985 (Figure 4.16). All PCB-containing transformers are installed in the indoor premises and this considerably increases reliability and safety of their use. By now 36 transformers (9 % of the total) have been removed from operation. However, the condition of another 20 transformers is assessed as unsatisfactory.

According to the technical specifications, the service life of transformers is about 30 years, though, similarly to capacitors, they can be used during a much longer period (up to 40–50 years according to the experts' estimates). Our estimates have proceeded from two assumptions of the duration of PCB-containing transformers' operation: 30 and 40 years (Figure 4.17).

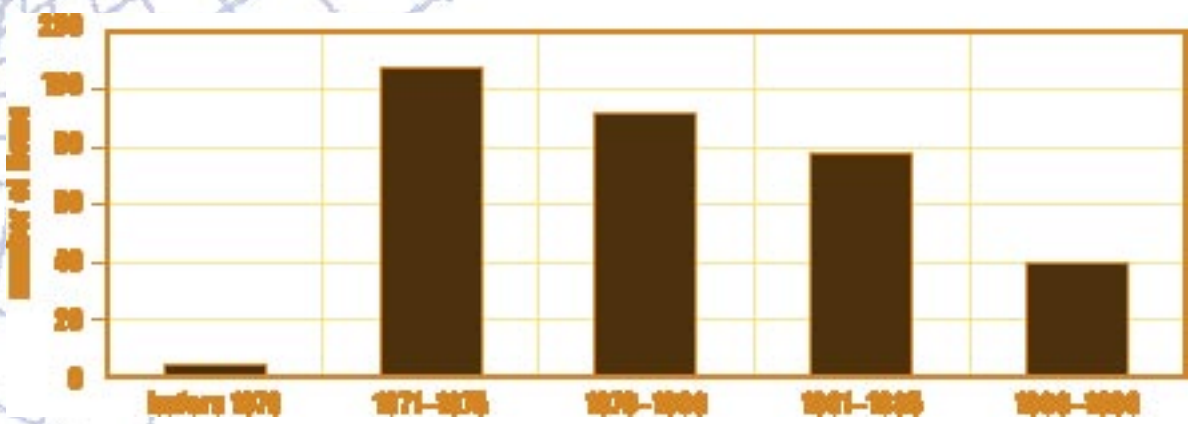


Figure 4.16: *PCB-containing transformers by the year of production*

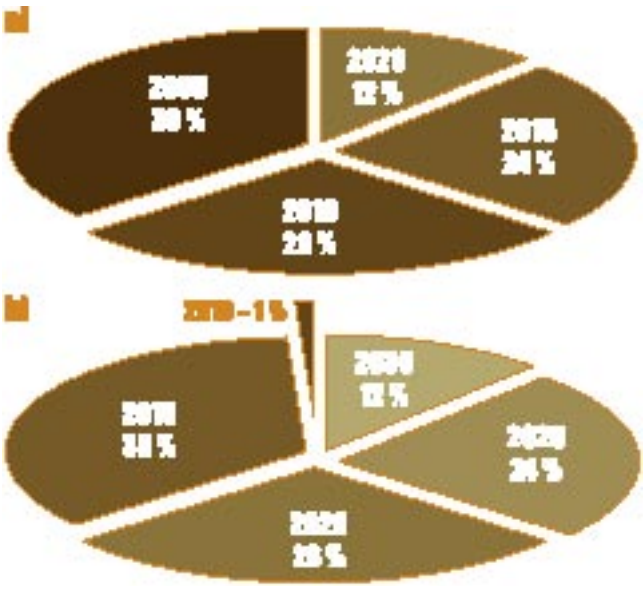


Figure 4.17: *Forecast of PCB-containing transformers phase-out depending on the duration of operation: a –30 years, b – 40 years*

4.4. Assessment of PCB Import–Export

To assess the import and export of PCBs, we have used the findings of the PCB inventory in Russia [130], the results of studies within the task 2.1.1.3 of the State Scientific Technical Program "Environmental safety" (1999) and the data summarized in publications [106–108].

It has been found out that PCBs have never been produced in Belarus.

Belarus has only one plant, which has used PCBs as a raw material (plasticizer) – OJSC "Lakokraska" (Lida, the Grodno region). The estimations suggest that the enterprise has consumed about 5 thousand tons of sovol. Most of it had been exported in final products, but certain amount deposited on the territory of Belarus through products, waste waters, wastes and emissions to air. Table 4.13 summarizes the data on the supplies of paintwork materials to one of the enterprises in Belarus – Fanipol Supply Enterprise (Dzerzhinsk district, Minsk region) but this does not mean that these materials have been used within Belarus.

Sovtol-10 had also been supplied to Belarus for transformers refilling. The data [107] suggest that sovtol-10 had been supplied to 3 plants including the OJSC "Minsk Motorbike Plant", the RUE "Minsk Automobile Plant", and the RUE "Mogilev Automobile Plant Named after Kirov". It is virtually impossible to quantify import, but in general the supplies were relatively low.

Table 4.13
Kinds of paintwork products (enamels) containing PCBs

Product	Amount, tons	Year
XB-124 light-green	5.5	1983
XB-124 khaki	7.8	1983
XB-124 grey	73	1983
XB-124 grey	56	1988
XB-124 khaki	11	1988
Total	**153.3**	

The findings of the inventory suggest that 4 enterprises had imported sovtol-10 and clophen: the RUE "Mogilev Automobile Plant", the RUE "Minsk Automobile Plant", the OJSC "Belshina" and the State Production Machine-Building Enterprise (SPMBE) "Strommash".

PCB-containing equipment has never been produced in Belarus. Power transformers and power capacitors filled with PCBs had been imported from the republics of the former USSR (Russia, Kazakhstan, Uzbekistan and Armenia) and foreign countries (mainly from GDR, Poland and Czechoslovakia).

In addition to electrical equipment, Belarus imported other PCB-containing products (electric cables with PCB-containing stuff, plastics, fire-retardants and etc.). However, at present it is not feasible to account these products unless special analytical studies are conducted.

Conclusion

The major findings of the PCB inventory taken in the course of the project GEF TF 053865 are the following:

- New owners of the PCB-containing equipment have been identified, among them 107 enterprises, including 41 entities belonging to the food industry;
- The inventory results have been specified for 31 enterprises, which previously had provided unreliable reports;
- Additional 3,058 PCB-containing capacitors, 8 transformers and 200 small-size capacitors have been identified, the total amount of PCBs in them makes up 56.8 tons;
- PCB distribution on the territory of Belarus has been mapped (taking into consideration the types of the equipment);
- The forecast of the PCB-containing capacitors and transformers phase out has been made (based on the year of production);
- Assessment of PCB stockpiles in Belarus and the analysis of its distribution by ministries and agencies have been made;
- Analysis of the PCB distribution by the enterprises of the food industry has been made for the first time;
- A register of PCB-containing equipment, materials, wastes and their disposal sites has been elaborated.

The summarized data on the PCB use in Belarus are given below.

PCBs have never been produced in the Republic of Belarus. The only enterprise, which had used PCB as a raw material (plasticizer) was OJSC "Lakokraska" (Lida, the Grodno region). The total amount of sovol used there is estimated at 5 thousand tons. Most of it has been exported in finished products however some part of it has dispersed on the territory of Belarus in finished products, waste waters, emissions in the ambient air, and wastes.

Sovtol-10 and clophen were supplied for transformers refilling to four enterprises of Belarus (the RUE "Mogilev Automobile Plan Named after Kirov", the RUE "Minsk Automobile Plant", OJSC "Belshina", and the SPMBE "Strommash"), nevertheless, the supplies were rather low.

PCB-containing equipment has never been produced in Belarus. Power transformers and power capacitors filled with PCBs had been imported from the republics of the former USSR (Russia, Kazakhstan, Uzbekistan and Armenia) and foreign countries (mainly from GDR, Poland and Czechoslovakia).

As of now 46,943 power capacitors, 380 power transformer, 40,635 small-size capacitors have been identified in the Republic of Belarus. 8 tons of PCB-containing liquid dielectric stored in reservoirs has also been identified. The total amount of PCB is estimated at 1,563.8 tons.

It has been found out that 762 enterprises subordinate to more than 27 ministries and agencies own PCB-containing equipment. The biggest quantity of PCB is concentrated at the enterprises of the Ministry of Industry, the Concern "Belnefetkhim", the Ministry of Energy (the Concern "Belenergo"), the Concerns "Belbiopharm" and "Bellegprom".

The PCB-containing equipment has been identified at the enterprises of different industries: machine building and metal processing, power industry, chemical and petrochemical, light and food industries, housing and communal services and others. The largest amount of PCB is concentrated at the enterprises of the machine building industry (40 %) and petrochemical industry (about 25 %). Considerable amount of PCB has been identified at the enterprises of the food industry, provender milling, and microbiological industry. In particular, about 77 tons of PCB (4.9 % of the total amount) have been identified at the enterprises of the food industry, agriculture, flour-and-cereals and feed mill industries; 93.4 tons (6 %) of PCB – at the enterprises of the microbiological industry.

Substations of the distributive network where capacitors are installed and operated at open sites represent the highest risk for the environment. Such substations are mostly operated at the enterprises of the Ministry of Energy and the Belarusian Railways. In particular, 100 substations where about 8.6 thousand capacitors are installed are in service at the enterprises of the Concern "Belenergo".

As of now 27.7 % of capacitors and 14 % of transformers have been phased out. The total amount of PCB in the phased out equipment is estimated at 270 tons. The largest quantity of PCBs in the phased out equipment is stored at the enterprises of the Ministry of Energy (the Concern "Belenergo"), the Ministry of Industry and the Concern "Belneftekhim".

In many cases the phased out equipment is stored at open sites or in unsuitable containers. There are also damaged transformers and capacitors, from which PCB leakages occur.

As in many countries of the former USSR the problems of PCB management in the Republic of Belarus are conditioned by a number of reasons: registration of PCB-containing equipment is not organized properly, there are no specially established storage sites for the damaged equipment and PCB-containing wastes; control over the environmentally sound PCB management is not exercised. At many enterprises technical specifications for PCB-containing equipment have been lost; the personnel handling this equipment have changed. In most cases there are no special indicators (labels) of the PCB content in the equipment. Very often the personnel handling this equipment do not know about the specificity of the PCB-containing equipment and the safety requirements for its handling. By now PCBs have not been disposed of or eliminated in Belarus.

Taking into account the above mentioned, at this stage of study it is requisite to identify the following PCB management priorities:

- Elaboration of methodological documents regulating PCB management. It seems appropriate to elaborate PCB management regulations, which will be approved by the Ministry of Natural Resources and Environmental Protection;
- Organization of environmentally sound storage of the phased out electrical equipment, which will prevent PCB leakages from the equipment (packaging of the damaged capacitors in containers, discharge of sovtol from damaged transformers);
- Labeling of PCB-containing equipment and organization of the primary registration of the equipment at enterprises;
- Establishment of the state statistical reporting on PCB-containing equipment;
- Development of a strategy for organizing the long-term storage of PCB-containing equipment, selection of a proper storage site;
- On-going inventory of PCB (identification of small-size capacitors);
- Elaboration of the PCB-containing equipment phase out plan;
- Choice of the environmentally sound and economically efficient technology of PCB disposal.

ANNEX 5

Inventory of Unintentional Releases of PCB, PCDD/PCDF and HCB to the Environment

Introduction

The inventory of unintentional POPs releases – one of the requisite obligations of the Stockholm Convention parties. Article 5 of the Stockholm Convention Measures to reduce or eliminate releases from unintentional production presupposes that each Party "…develops an action plan or, where appropriate, a regional or subregional action plan within two years of the date of entry into force of this Convention for it, and subsequently implement it as part of its national implementation plan…".

In connection with the above mentioned in framework of the project GEF TF 053865 "Enabling activities related to the implementation of the Stockholm Convention on persistent organic pollutants (POPs) in the Republic of Belarus" the inventory of unintentional releases of POPs was taken and the register of releases of PCB, PCDD/PCDF and HCB was elaborated.

The inventory of POPs releases (dioxins/ furans, HCB, PCB, and indicated polyaromatic hydrocarbons) has been taken in Belarus for a number of years within the preparation of the national data on pollutant releases for the Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air pollutants in Europe (EMEP). However, only POPs releases to air were taken into consideration.

In the framework of the project GEF TF 053865 "Enabling activities related to the implementation of the Stockholm Convention on persistent organic pollutants (POPs) in the Republic of Belarus" in accordance with the recommendations of the United Nations Environmental Programme (UNEP) POPs releases not only to air but also to other environmental compartments – water, ground, food products, wastes and residues were identified.

In the course of the inventory the following tasks were implemented:

- Analysis of the methodology for the establishment of POPs unintentional releases inventory;
- Collection of the required statistical, manufacturing and technological data for POPs releases assessment;
- Processing of information, estimation of unintentional releases of PCDD/PCDF, HCB and PCB on the territory of the Republic of Belarus to the environment based on the contemporary methodological approaches;
- Characteristics of ambiguity of POPs releases estimates;
- Elaboration of the register of unintentional releases of PCDD/PCDF, HCB, and PCB on the territory of Belarus;
- Definition of potential hot spots of unintentional releases of POPs, dispersed sources and the areas with the highest level of unintentional releases of POPs;
- Comparison of the outcomes of the inventory of unintentional releases of POPs in the Republic of Belarus with the inventory outcomes in other countries.

The report includes the summary of the inventory methodology, the procedures, the content of the data-base, discussion of the results, characteristics of the ambiguity of the releases estimates.

5.1. Methodology of the Inventory of Unintentional Releases of PCDD/PCDF, HCB and PCB

The Current State of Regulatory, Legislative, Informational and Methodological Frameworks for the Establishment of Inventory

According to the Provision on the state recording of the negative impacts on air (1982) [142], enterprises and organizations of the Republic of Belarus are supposed to maintain the initial recording of the composition and magnitude of the releases of hazardous substances (pollutants); to estimate, in accordance with the respective environmental protection instructions, the composition and magnitude of the releases of hazardous substances to air.

The data on the releases of any substances can be presumably obtained from the enterprise reports on releases and the respective summaries. However, in practice the enterprises record only the releases of substances for which the limits of maximum permissible concentration in the air and toxicity classes have been established and the methodologies of measuring concentration in releases have been developed and endorsed. Those are not available for the majority of POPs. Therefore, there are almost no statistical data on POPs releases. Apart from that most of the POPs emissions sources are not covered by the state statistical reporting.

Methodological basis of the inventory of unintentional POPs releases

A number of international organizations have issued several methodological guidelines to facilitate the inventory establishment in different countries.

Guidelines for the inventory of PCDD/PCDF

There are two basic guidance documents for the establishment of the inventory of PCDD/PCDF:

- Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases, UNEP Chemicals (2005) [140];
- Atmospheric Emission Inventory Guidebook. A joint EMEP / CORINAIR Production Prepared by the EMEP Task Force on Emission Inventories, 2002 [144].

The procedure of the inventory, according to the UNEP Toolkit, presupposes assessment of the releases to five environmental compartments: to air, to water, to land, in wastes and in products.

The basic principle of the inventory taking is the collection of statistical data describing the scale of the process, and the emission factors describing the dioxin/furan releases for a unit of activity.

According to the UNEP Toolkit the inventory includes the following stages:

1. Preparation of the screening matrix (identification of the main source categories).
2. Subcategories identification.
3. Information gathering.
4. Process classification and source quantification.
5. Compilation of inventory.

EMEP/CORINAIR Guidebook describes the assessment of the pollutant releases to air [144]. In accordance with this Guidebook there are two inventory methodologies:

a) simple (at the category level);
b) detailed (at the source level).

Simple methodology is used for the inventory taking with the involvement of the emission factors mostly on the national level; detailed methodology presupposes the inventory taking on the level of the sources by means of instrumental measurement.

As against the UNEP Toolkit the EMEP/CORINAIR Guidebook is intended for registration of emissions only to air but at the same time it contains information requisite for the establishment of the inventory of PCB and HCB.

In the framework of international programmes and agreements a number of other methodological guidelines have been elaborated. It is worth mentioning "Technical Paper to the OSPARCOM-HELCOM-UNECE Emission Inventory" (1995) [147], this document gives the guidance for the POPs inventory taking.

In the countries of the former USSR the use of the EMEP methodologies in many cases is limited by a lack of emission factors specially elaborated for the technological conditions of the region.

In Belarus a considerable effort has been made to improve the methodological framework of the inventory of POPs unintentional releases. In particular, "Methodological recommendations for identification and quantification of the sources of POPs releases" (2004) have been published [139].

Guidelines for the inventory of PCB and HCB

Methodological basis the inventory of PCB and HCB is not elaborated enough. There is no methodological guidance for identification of these substances similar to the UNEP Toolkit on dioxins. The EMEP/CORINAIR Guidebook contains only some information relating to the assessment of the PCB and HCB emission to air.

"Methodological recommendations for identification and quantification of the sources of POPs releases" published in 2004 can also be used for the inventory of unintentional releases of HCB and PCB [139].

The inventory of POPs releases in the Republic of Belarus

The inventory of POPs releases in the Republic of Belarus has been taken since 2000 in the framework of preparation of the national data on pollutant releases for EMEP [143]. Taking into account the current statistical reporting on POPs releases and the requirements of EMEP, the inventory is based on the use of emission factors. The releases of dioxins/furans, polyaromatic hydrocarbons (4 indicator compounds), HCB, and PCB are evaluated. The practical experience of preparation of the national data for EMEP and the available methodologies made it possible to undertake in the course of the NIP elaboration a more detailed inventory of POPs releases, estimating releases not only to air but also to other environmental compartments.

Methodology and Procedure of Establishing Inventories and Elaboration of the Register of POPs Unintentional Releases

With the purpose of establishing inventories of dioxin/furan unintentional releases, we have followed the methodology of the United Nations Environment Programme (UNEP) summarized in the "Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases" (2005). It presupposes as the primary task the compilation of a detailed list of source categories for releases of dioxins/furans in all environmental compartments with the quantitative indication of the releases [139]. Such list is regarded as a register of releases.

As mentioned before, there are no UNEP recommendations on quantification of PCB and HCB releases. However, the Inventory Guidebook produced by EMEP / CORINAIR contains the respective sections that have formed the basis for the inventory of these compounds [144].

The inventory (by each group of compounds) has involved the following stages:

- Identification of the release sources (compilation of the list of source categories and subcategories);
- Collection of information on releases;
- Collection of the statistical data on the source strength;
- Collection of the technological data, characterizing the processes, used raw materials, systems of purification of flue gases and their efficiency;
- Development (selection) of the emission factors;
- Calculation of releases; verification;
- Identification of potential hot spots;
- Estimation of the contribution of dispersed sources;
- Estimation of the spatial structure of releases, identification of areas with the highest level of releases.

Following the use of the screening matrix in accordance with the UNEP Toolkit, based on the statistical data on the intensity of this or that activity: production, fuel combustion, raw materials consumption and others, and following the practical experience of the inventory of dioxin/furan releases to air [106, 134–138] there have been identified subcategories – potential sources of PCDD/PCDF releases in Belarus in accordance with the UNEP classifier.

At the first stage of the inventory the statistical data were assembled and analyzed in order to specify the available information on POPs (based on the enterprise statistical records, Form No. 2-Environment (air). It has been found out that the publications of the Ministry of Statistics and Analysis do not contain the data about PCDD/PCDF, HCB and PCB releases. Therefore, special attention was given to the collection of the statistics of the enterprises and manufacturing information.

To obtain the production statistics, the respective requests have been sent to the key ministries and agencies including the Ministry of Statistics and Analysis, the State Association "Belvtormet", the Belarusian Production and Trade Concern of Forestry, Timber Processing, Pulp and Paper Industry (the Concern "Bellesbumprom"), the multiple services departments, Ministry of Housing and Communal Services, the Concerns "Bellegprom" and "Belneftekhim", the Ministry of Architecture and Construction and others.

The principle informational source was the Ministry of Statistic and Analysis.

To specify the emission factors of statistics, enterprises relating to the following release source categories were interviewed in the course of the inventory:

- Waste incineration;
- Ferrous and non-ferrous metal production;
- Production of minerals;
- Production and use of chemicals and consumer goods (pulp and paper production).

A special inquiry form was elaborated. The form comprised several entries:

1. Enterprise profile;
2. Data on production volume;
3. Information on the used inputs;
4. Information on the used fuel (for manufacturing production, for electrical and heat power production, for wastes incineration);
5. Information on the installations-sources of releases (type of kiln, type of the used fuel, type of outputs, temperature of the process, the system of powder-gas purification and its efficiency);
6. Information on the use of dissolvents and chemicals;
7. Information on waste incineration.

For several categories, in particular for enterprises producing pulp and paper we added some other entries in the form.

Sending out the inquiry forms in accordance with the recommendations of the UNEP Toolkit met the following goals:

- Collection of information on technologies in order to choose or define the emission factors used in calculations;
- Collection of production statistics, which were not available in statistical publications, from the ministries and agencies, for example, the information on the use of inputs and raw materials, their characteristics.

It is significant that the inquiry was not aimed at the establishment of the inventory of POPs releases at the level of an enterprise.

To include an enterprise in the inventory list the following criteria were used:

Category "Waste incineration":

- Total amount of the incinerated waste (more than 100 tons);
- Hazardous waste incineration (Toxicity class 2 and 3);
- Incineration of wastes of Toxicity class 2;
- Medical wastes incineration;
- Contaminated wood incineration.

Category "Ferrous and non-ferrous metal production":

- Presence of a foundry at an enterprise;
- Gross release of pollutants;
- Volume of scrap processing;
- Production volume.

Within categories "Production of minerals", "Production and use of chemicals and consumer goods", and subcategory "Pulp and paper production" the enterprises were chosen based on their productive capacity.

About 100 responses were obtained from the enterprises.

In the course of the inventory and elaboration of the register of dioxins/furans releases we used the emission factors, given in the UNEP Toolkit, taking into account the technologies used in Belarus. Other factors identified earlier within the EMEP projects were also used [106, 134–139].

The PCB and HCB releases were assessed using the emission factors recommended by EMEP [144] and part of them were also obtained within the implementation of the EMEP projects.

5.2. The Initial Results of the Inventory of Unintentional Releases of PCDD /PCDF, HCB and PCB in Belarus

This chapter contains the summarized outcomes of the inventory of unintentional releases of dioxins/furans, HCB and PCB. Assessment of releases is based on production statistics of 2004.

Category "Waste incineration"

In Belarus there are no specialized waste incineration facilities, although waste incineration takes place at many enterprises. Wastes are incinerated in special furnaces or power generation boilers. According to the forms of statistical reporting No. 2-Environment (wastes) summarized by the RUE "Belarusian Scientific and Research Centre "Ecology" a rather wide range of wastes are incinerated, among them wood and chemical wastes prevail.

In 2004 about 500 thousand tons of wastes were incinerated at the enterprises of Belarus, their distribution in accordance with the waste classifier given in UNEP Toolkit [140] is displayed in Table 5.1.

Table 5.1
Wastes incineration on the territory of the Republic of Belarus according to the wastes categories of the UNEP Toolkit

Waste category	Volume of incineration, thousand tons
1a Municipal solid waste incineration	1.0
1b Hazardous waste incineration	155.7
1c Medical waste incineration	0.008
1f Waste wood and waste biomass incineration	360.5
1g Destruction of animal carcasses *	0.8
TOTAL	**518.0**

Note: * – data for 2003.

It is worth mentioning that in the Republic of Belarus municipal solid wastes are not incinerated in centralized facilities, however according to the UNEP Toolkit this category includes the wastes produced in the course of production, commercial or agricultural activity; their overwhelming part is household and industrial rubbish. Part of household wastes which is difficult to quantify is domestically burnt.

Light-fraction shredder waste incineration and sewage sludge incineration are not practiced in Belarus.

Incineration technologies and pollution control system

In 2004, 34 of the interviewed enterprises incinerated wastes without pollution control, the emissions were purified only at two enterprises: OJSC "Mogilevkhimvolokno" (Mogilev) and RUE "State Production Association "Azot" (Grodno). These enterprises use electric filters, cyclones, and Venturi scrubbers for pollution control.

Hazardous wastes are mostly incinerated in special installations equipped with purifying systems. Medical wastes are incinerated at the Minsk crematorium with the use of an afterburner.

Emission factors used for dioxin/furan releases calculation are set forth in Table 5.2. We used the previous inventory experience for their assessment [106].

Table 5.2
Emission factors for source category "Waste incineration", µg TEQ/t

Subcategory	Air	Water	Ground	Products	Residues	
					Fly ash	Bottom ash
Municipal solid waste incineration	30	—	—	—	100	7
Hazardous waste incineration						
Solid hazardous waste incineration	350	—	—	—	900	n/e
Waste wood incineration	100	—	—	—	300	n/e
Liquid hazardous waste incineration	10	—	—	—	10	n/e
Medical waste incineration	3,000	—	—	—	n/e	20
Waste wood and biomass incineration	30	—	—	—	100	n/e
Destruction of animal carcasses	500	—	—	—	n/e	n/e

Note: in this table and further: "n/e" – releases cannot be estimated.

The calculation of the dioxin/furan releases from source category "Waste incineration" is displayed in Table 5.3.

Table 5.3
Dioxin/furan releases from source category "Waste incineration", g TEQ

Subcategory	Air	Water	Ground	Products	Residues	
					Fly ash	Bottom ash
Municipal solid waste incineration	0.029	—	—	—	0.096	0.007
Hazardous waste incineration	5.588	—	—	—	14.593	n/e
Medical waste incineration	0.025	—	—	—	n/e	0.0002
Waste wood and biomass incineration	10.816	—	—	—	36.053	n/e
Destruction of animal carcasses	0.422	—	—	—	n/e	n/e
Waste incineration	**16.88**	**—**	**—**	**—**	**50.742**	**0.0072**

In 2004 in the Republic of Belarus from source category "Waste incineration" 16.88 g TEQ of dioxins/furans were released to air, 50.749 g TEQ – in residues. There are no releases to ground, to water or in products from this category.

PCB and HCB releases

Emission factors used for the assessment of HCB and PCB releases from source category "Waste incineration" are shown in Table 5.4.

Table 5.4
Emission factors of PCB and HCB for source category "Waste incineration", mg/t

Subcategory	PCB	HCB
Hazardous waste	5	10
Contaminated wood	5	2
Waste wood and waste biomass	5	0.1
Other solid waste	5	2
Liquid waste	3.4	n/e
Medical waste	20	19

PCB and HCB releases from this source category are displayed in Table 5.5.

Table 5.5
PCB and HCB releases from source category "Waste incineration", kg

Subcategory	PCB	HCB
Hazardous waste	0.01	0.02
Contaminated wood	0.23	0.09
Waste wood and waste biomass	1.80	0.04
Other solid waste	0.01	0.004
Liquid waste	0.37	n/e
Medical waste	0.0	0.0
Waste incineration	**2.42**	**0.15**

In 2004 in the Republic of Belarus releases of PCB and HCB to air are estimated at 2.42 kg of PCB and 0.15 kg of HCB.

It is worth mentioning that waste incineration statistics are not sufficient; moreover the volumes of incineration vary from year to year.

Category "Ferrous and non-ferrous metal production"

In Belarus this source category is represented by subcategories 2c "Iron and steel production and foundries" and 2e "Aluminum production (founding mostly)". The processes from subcategory 2h "Brass and bronze production" are not widely spread in Belarus. The data on ferrous and non-ferrous metal production in the Republic of Belarus for 2004 are set forth in Table 5.6.

Table 5.6
Volume of ferrous and non-ferrous metal production in 2004 (data of the Ministry of Statistics and Analysis)

Product	Production Volume, thousand tons
Steel	1,920.0
Cast iron	255.96
Aluminum (founding)	20.484

Production technology and pollution control system

In the Republic of Belarus the major volume of steel is produced in electric arc furnaces. In the course of the interview of enterprises it was found out that the major part of iron is produced in cold-air cupolas.

For waste gases purification bag filters are mostly used in electric arc furnaces; scrubbers, cyclones, damp spark-arresters and other purification systems are used in cold-air cupolas.

Emission factors obtained in the course of the analysis of technologies and purification systems and used for calculation of dioxin/furan releases from source category "Ferrous and non-ferrous metal production" are set forth in Table 5.7.

Table 5.7
Emission factors for source category "Ferrous and non-ferrous metal production", µg TEQ/t

Subcategory	Air	Water	Ground	Products	Residues
Steel production	3	n/e	n/e	—	15
Foundry	10	n/e	n/e	—	n/e
Aluminum production	0.5	n/e	—	—	100

Releases from this source category are dispalyed in Table 5.8.

Table 5.8
Releases of dioxins/furans from source category "Ferrous and non-ferrous metal production", g TEQ

Subcategory	Air	Water	Ground	Products	Residues
Iron and steel production	5.76	n/e	n/e	—	28.8
Foundry	2.56	n/e	n/e	—	n/e
Aluminum production	0.01	n/e	—	—	2.048
Ferrous and non-ferrous metal production	**8.33**	n/e	n/e	**—**	**30.848**

8.330 g TEQ of dioxins/furans were released to air from source category "Ferrous and non-ferrous metal production" in 2004; releases in residues were estimated at 30.848 g TEQ. There are no releases from this source category to ground, to water and in products or they cannot be estimated.

Releases of HCB and PCB

Emission factors, which were used for estimation of PCB and HCB releases from source category "Ferrous and non-ferrous metal production", are set forth in Table 5.9.

Table 5.9
Emission factors of PCB and HCB for source category "Ferrous and non-ferrous metal production", mg/t

Subcategory	PCB	HCB
Steel production	3.6	—
Aluminum production (founding)	—	500*

Note: * – in case of use of hexachloroethane for degassing .

Releases of PCB and HCB from this source category are represented in Table 5.10.

Table 5.10
Releases of HCB and PCB from source category "Ferrous and non-ferrous metal production", kg

Subcategory	PCB	HCB
Steel production	6.91	—
Aluminum production	—	—
Ferrous and non-ferrous metal production	**6.91**	—

According to our estimates, 6.91 kg of PCB were released to air from source category "Ferrous and non-ferrous metal production" in Belarus in 2004.

Category "Power generation and heating"

In the Republic of Belarus coal, peat, black oil, wood, natural and liquefied gas are used as fuel for power generation and heating. Emission factors used for estimation of dioxins/furans releases from source category "Power generation and heating" are given in Table 5.11; they were obtained earlier for this sector [137].

Table 5.11
Emission factors for source category "Power generation and heating", µg TEQ/t

Power generation and heating	Air	Water	Ground	Products	Residues
Fossil fuel power plants: Coal boilers	10	n/e	—	—	14
Heavy fuel oil boilers	2.5	n/e	—	—	n/e
Light fuel oil / natural gas boilers	0.5	n/e	—	—	n/e
Wood power plants	50	n/e	—	—	15
Power generation and heating/cooking with contaminated wood	1,500	n/e	—	—	1,000*
Household heating and cooking with wood	300	n/e	—	—	10*
Coal burner	100	n/e	—	—	5,000*
Natural gas burner	1.5	n/e	—	—	—

Note: * – 1ng TEQ/kg of ash

Releases of dioxins/furans from this source category are displayed in Table 5.12.

Table 5.12
Releases of dioxins/furans from source category "Power generation and heating" in Belarus in 2004, g TEQ

Subcategory	Air	Water	Ground	Products	Residues
Fossil fuel power plants	*0.548*	n/e	—	—	*0.171*
Coal and peat boilers	0.122	n/e	—	—	0.171
Heavy fuel oil boilers	0.157	n/e	—	—	—
Light fuel oil / natural gas boilers	0.269	n/e	—	—	—
Biomass power plants	*0.651*	n/e	—	—	*0.195*
Household heating and cookign	*6.087*	n/e	—	—	*0.0002*
Contaminated wood	0.553	n/e	—	—	—
Biomass	5.534	n/e	—	—	0.0002
Heating – fossil fuel	*1.127*	n/e	—	—	*7.748*
Coal burner	1.034	n/e	—	—	7.748
Natural gas burner	0.093	n/e	—	—	—
Power generation and heating	**8.413**	n/e	**—**	**—**	**8.114**

According to our estimates 8.413 g TEQ of dioxins/furans were released to air in Belarus in 2004; 8.114 g TEQ were released in residues. There are no releases from this category to ground, to water, and in products or they cannot be estimated.

Releases of HCB and PCB

Emission factors used for estimation of HCB and PCB releases from source category "Power generation and heating" are displayed in Table 5.13.

Releases of PCB and HCB from this category are given in Table 5.14.

In 2004 releases of PCB to air were estimated at 0.47 kg and releases of HCB – at 0.096 kg from source category "Power generation and heating".

Table 5.13
Emission factors of HCB and PCB for source category "Power generation and heating", µg/t

Combustible material	HCB	PCB
Coal	30	250
Peat	30	180
Wood	30	120

Table 5.14
Releases of HCB and PCB from source category "Power generation and heating", kg

Subcategory	HCB	PCB
Power plants, household heating and cooking	*0.096*	*0.474*
Coal	0.007	0.058
Peat	0.029	0.173
Wood	0.061	0.242
Power generation and heating	**0.096**	**0.474**

Category "Production of minerals"

Most of the data on mineral production were received from the Ministry of Statistics and Analysis, additional data (on asphalt mixing production) were provided by the "Belavtodor" Department of the Ministry of Transport and Communications (Table 5.15).

Table 5.15
Production of minerals in the Republic of Belarus in 2004

Product	Unit	Production volume
Cement	million tons	2.73
Lime	million tons	0.73
Brick	million items	825.1
Glass	million m^2	1.5
Asphalt mixing (black)	million tons	2.83

Production technology and pollution control system

In the Republic of Belarus cement production is represented by two processes – dry and wet manufacturing. The pollution control system of construction materials production is equipped with electrical filters, bag filters, dust precipitation cameras, cyclones.

The emission factors used for calculation of dioxin/furan releases from source category "Production of minerals" are given in Table 5.16.

Table 5.16
Emission factors from source category "Production of minerals", µg TEQ/t

Subcategory	Air	Water	Ground	Products	Residues
Wet kilns (wet process)	0.6	—	n/e	n/e	—
Cement kilns (dry process)	0.05	—	n/e	n/e	—
Lime production	0.07	n/e	n/e	n/e	n/e
Brick production	0.2	—	n/e	n/e	n/e
Glass production	0.2	—	n/e	n/e	n/e
Asphalt mixing	0.07	—	n/e	n/e	n/e

Releases of dioxins/furans from this source category are given in Table 5.17.

Table 5.17
Releases of dioxins/furans from source category "Production of minerals", g TEQ

Subcategory	Air	Water	Ground	Products	Residues
Cement kilns	1.227	—	n/e	n/e	—
Lime production	0.051	n/e	n/e	n/e	n/e
Brick production	0.594	—	n/e	n/e	n/e
Glass production	0.021	—	n/e	n/e	n/e
Asphalt mixing	0.198	—	n/e	n/e	n/e
Production of minerals	**2.091**	**—**	**n/e**	**n/e**	**n/e**

According to our estimates, in 2004 in Belarus 2.091 g TEQ of dioxins and furans were released to air from source category "Production of minerals". There are no releases of dioxins and furans to ground, to water, in products and in residues from this source category or they cannot be estimated.

Releases of HCB and PCB from this category were not estimated.

Category "Transportation"

UNEP Toolkit (2005) suggests the use of emission factors for 4-stroke engines and diesel engines. At present in Belarus engines without catalytic converters prevail. 2-srtoke engines are not widely spread.

Emission factors used for estimation of dioxins/furans releases from source category "Transportation" are set forth in Table 5.18.

Table 5.18
Emission factors of dioxins and furans for source category "Transportation", µg TEQ/t

Fuel	Air	Water	Ground	Products	Residues
Gasoline	0.1	—	—	—	—
Diesel fuel	0.1	—	—	—	n/e

Releases from this category are displayed in Table 5.19.

Table 5.19
Releases of dioxins/furans from source category "Transportation", g TEQ

Subcategory	Air	Water	Ground	Products	Residues
4-stroke engines	0.094	—	—	—	—
Diesel engines	0.169	—	—	—	n/e
Transportation	**0.263**	**—**	**—**	**—**	**—**

According to the obtained estimates in 2004 in Belarus 0.263 g TEQ of dioxins and furans were released from source category "Transportation".

Releases of HCB and PCB

Emission factors used for estimation of HCB and PCB releases from source category "Transportation" are represented in Table 5.20.

Releases of PCB and HCB from this source category are set forth in Table 5.21.

According to our estimates in 2004 in the Republic of Belarus 0.3383 kg of HCB were released to air.

Table 5.20
Emission factors of PCB and HCB for source category "Transportation", µg/t

Fuel	PCB	HCB
Gasoline	—	0.3
Diesel fuel	—	200

Table 5.21
Releases of PCB and HCB from source category "Transportation", kg

Subcategory	PCB	HCB
4-stroke engines (gasoline)	—	0.0003
Diesel engines	—	0.338
Transportation	**—**	**0.3383**

Category "Uncontrolled combustion processes"

In 2004 in the Republic of Belarus 1,038 hectares of grassland and forests were affected by fire. The data on landfill fires, open wood burning and household waste burning are not available. Harvest residues are burnt annually at an amount of 100 thousand tons.

Emission factors used for this source category are set forth in Table 5.22.

Table 5.22
Emission factors of dioxins and furans for source category "Uncontrollable combustion processes", µg TEQ/t

Subcategory	Air	Water	Ground	Products	Residues
Forest fires	5	n/e	4	—	n/e
Grassland fires	5	n/e	4	—	n/e
Agricultural residues burning, not impacted	0.5	n/e	10	—	n/e
Accidental fires in vehicles	94	n/e	18	—	18

Releases from this source category are displayed in Table 5.23.

Table 5.23
Emissions of dioxins/furans from source category "Uncontrollable combustion processes", g TEQ

Subcategory	Air	Water	Ground	Products	Residues
Accidental fires / biomass burning	*0.129*	*n/e*	*1.063*	—	*n/e*
Forest fires	0.066	n/e	0.053	—	n/e
Grassland fires	0.013	n/e	0.010	—	n/e
Harvest residues burning	0.050	n/e	1.000	—	n/e
Accidental fires / wastes burning	*0.043*	*n/e*	—	—	*0.008*
Accidental fires in vehicles (per vehicle)	0.043	n/e	—	—	0.008
Uncontrollable combustion processes	**0.172**	**—**	**1.063**	**—**	**0.008**

According to our estimates 0.172 g TEQ of dioxins/furans were released to air, 1.063 g TEQ were released to ground and 0.008 g TEQ were released in residues from source category "Uncontrolled combustion processes" in 2004.

Releases of PCB and HCB from this source category were not estimated.

Category "Production and use of chemicals and consumer goods"

This source category includes a number of processes – sources of releases, mainly of dioxins/furans. Such substances as pentachlorophenol (PCP), PCB, chlorinated pesticides, chloranil, chlorbenzene are not produced in the Republic of Belarus, there is no PVC or chlorine-alkaline production either. In accordance with the data of the Concern "Bellegprom", the enterprises of the textile and tanning industries do not use dyes and chemicals, which can be contaminated with dioxins and furans. It is not typical for oil-refinery enterprises of Belarus to use plume combustion of waste.

Thus, the principle potential source of POPs releases from this category is subcategory 7a "Pulp and paper production".

Pulp, paper and cardboard production data for 2004 provided by the Concern "Bellesbumprom" are set forth in Table 5.24.

Table 5.24
Pulp, paper and cardboard production in Belarus in 2004, thousand tons

Product	Production volume
Pulp	61.2
Paper	37.9
Recycled paper	16.2
Cardboard	181.3

Production technology and pollution control system

Pulp (by means of sulfite process) is produced at the only plant of this kind in Belarus – Svetlogorsk Pulp and Paper Plant. All enterprises of this industry either do not use bleach or use bleach, which does not contain chlorine. Svetlogorsk Pulp and Paper Plant uses alkaline for power production, there are also bark burning boilers at this enterprise.

The emission factors are given in Table 5.25.

Table 5.25
Emission factors of dioxins and furans for source subcategory "Pulp and paper production", μg TEQ/тт

Subcategory	Air	Water	Ground	Products	Residues
Black liquor burning, sludge and wood burning	0.07	—	—	—	—
Bark burning	0.2	—	—	—	50
Sulfite paper, new technology (ClO_2) TCF	—	n/e	—	0.1	n/e
Recycling of cellulose and paper from contemporary paper	—	n/e	—	3	n/e

Releases from this source category are set forth in Table 5.26.

Table 5.26
Releases of dioxins and furans from source category "Production and use of chemicals and consumer goods", g TEQ

Subcategory	Air	Water	Ground	Products	Residues
Black liquor burning, sludge and wood burning	0.004	—	—	—	—
Bark burning	0.0001	—	—	—	0.025
Sulfite paper, new technology (ClO_2) TCF	—	n/e	—	0.004	n/e
Recycling of cellulose and paper from contemporary paper	—	n/e	—	0.046	n/e
Production and use of chemicals and consumer goods	**0.0041**	n/e	**—**	**0.049**	**0.025**

On the whole, in 2004 in the Republic of Belarus 0.0041 g TEQ of dioxins and furans were released to air, 0.049 g TEQ were released in products, 0.025 g TEQ were released in residues from source category "Production and use of chemicals and consumer goods".

HCB and PCB releases from this source category are not produced

Category "Miscellaneous"

In the course of the inventory the releases from the following subcategories were estimated: 8b "Crematoria", and 8e "Tobacco smoking". Drying of biomass and smoke houses are considered in source category "Power generation and heating". Emission of dioxins/furans in the process of dry cleaning can occur as a result of extracting them from the textile and transferring into the solvent, consequently the dioxins/furans releases depend of the content of these substances in textile. Textile products are not treated with pentachlorophenol (PCP), therefore the dioxin/furan content in them is rather low.

There is only one crematorium in the Republic of Belarus with a burning capacity of 3–5 thousand cremations per year. The crematorium is equipped with furnaces made in Czech Republic (the temperature of burning is 900 ^{O}C). The pollution is controlled by use of a triple combustion chamber to ensure good burn-out of flue gases. We used emission factor 90 μg TEQ per cremation to estimate the releases of dioxins/furans from this source category.

In 2004 in the Republic of Belarus 1,095 million cigarettes were sold. For this source category we used the emission factor 1 pg TEQ/per cigarette.

Releases from this source category are set forth in Table 5.27.

Table 5.27
Releases of dioxins/furans from source category "Miscellaneous", g TEQ

Subcategory	Air	Water	Ground	Products	Residues
Crematoria	0.407	—	—	—	—
Tobacco smoking	0.0001	—	—	—	—
Miscellaneous	**0.4071**	**—**	**—**	**—**	**—**

According to our estimates in 2004 0.4071 g TEQ of dioxins/furans were released to air from source category "Miscellaneous".

Category "Disposal/landfill"

In this category we considered subcategory 2b "Sewage/sewage treatment" and 2c "Open water dumping".

The waste water volumes according to the data provided by RUE "CSRICUWR" are given in Table 5.28.

Table 5.28
Data on waste water treatment in 2004

Factor	Volume
Mixed domestic and industrial inputs with sludge treatment, mln. m^3	824.550
Open water dumping, mln. m^3	261.0
Sludge generation, thousand tons	276.576

The sewage system in Belarus presupposes mixed domestic and industrial inputs treatment at the same works with sludge removal.

Emission factors used for this source category are displayed in Table 5.29.

Table 5.29
Emission factors of dioxins/furans for source category "Disposal/landfill", µg TEQ/m³

Subcategory	Air	Water	Ground	Products	Residues
Sewage and sewage treatment	—	0.0005	—	—	200*
Open water dumping	—	0.0002	—	—	—

Note: * – µg TEQ/t of solids.

Releases of dioxins/furans from sewage and sewage treatment were estimated based upon the volumes of sludge generation and the content of solids in them.

As far as the data on the volumes of leachate are not available the releases from source subcategory 9a "Landfills and waste dumps" were not estimated. Subcategory 9d "Composting" was not considered either, because the statistical data on this process are unavailable and the emissions of dioxins/furans in the compartments are not identified. Source subcategory 9d "Waste oil treatment" was not taken into consideration as there are no emission factors for it.

Releases from source category "Disposal/landfill" are displayed in Table 5.30.

Table 5.30
Emissions of dioxins/furans from source category "Disposal/landfill", g TEQ

Subcategory	Air	Water	Ground	Products	Residues
Sewage and sewage treatment	—	0.412	—	—	13.6
Open water dumping	—	0.052	—	—	—
Disposal/landfill	**—**	**0.464**	**—**	**—**	**13.6**

According to our estimates in 2004 in the Republic of Belarus 0.464 g TEQ of dioxins/furans were released to air and 13.6 g TEQ – in residues from source category "Disposal/landfill".

Releases of HCB and PCB from this source category are quite possible (as part of landfill leachate and sewage) but they cannot be evaluated as the emission factors are not available.

Category "Hot spots"

This source category includes such subcategories as 10a "Production sites of chlorinated organics", 10b "Production sites of chlorine", 10c "Formulation sites of chlorinated phenols", 10d "Application sites of chlorinated phenols", 10e "Timber manufacture and treatment sites", 10f "PCB-filled transformers and capacitors" and a number of others. The first two subcategories of this list are not represented in Belarus; there is no timber production with the use of PCP in the republic either.

Application sites of chlorinated phenols

The following substances contaminated with PCDD/PCDF have been identified in the Republic of Belarus: herbicide 2.4-D (reactant – 2.4 dichlorophenoxyacetic acid), herbicide luvaram (reactant – 2.4-D), herbicide luvaram-extra (reactant – 2.4-D), herbicide dezormon (reactant – 2.4-D). Their application volumes in 2004 according to the data provided by the State Inspectorate for Crop Protection are given in Table 5.31.

Given the average content of 200 µg TEQ/t of PCDD/PCDF in these pesticides, the annual releases to the environment (mostly to ground) are estimated at 0.009 g TEQ.

The sites where PCB-filled equipment is installed represent the biggest threat to the environment of Belarus. According to the inventory data as of 1.01.2006 682 tons of trichlorinated biphenyls are contained in capacitors and 867 tons of pentachlorinated biphenyls – in transformers. Given the average content of PCDD/PCDF in these substances is 42.5 and 900 µg TEQ/t correspondingly the total content of dioxins and furans in PCB is estimated at 809 g TEQ.

Table 5.31
Application of herbicides contaminated with PCDD/PCDF in 2004, t

Substance	Application volume
2.4-D 50 % water solution (luvaram)	7.51
2.4-D 60 % water solution (luvaram)	12.39
2.4-D-butyl ether	0.01
2.4-D-octyl ehter	0.00
2.4-DM, 80 %	0.29
Dezormon	23.84

Emissions of HCB from this source category were not estimated.

It is evident that PCB-filled equipment is the major source of PCB releases to the environment, however the available data are not enough to quantify PCB emissions. To estimate the scale of the process we have made approximate estimates of PCB releases based on the emission factors given in the EMEP/CORINAIR Guidebook [144]. The total amount of PCB releases to ground can make up 1,624.1 kg per year.

Table 5.32
Releases of PCB from PCB-filled electrical equipment

Electrical equipment	Emission factor, kg/t	PCB volume, t	Releases to ground, kg
Transformers	0.3	867	260.1
Capacitors	2.0	682	1,364
Total		**1,549**	**1,624.1**

Thus, according to approximate estimates more than 1.6 tons of PCB per year can be released to ground. 0.292 g TEQ of dioxins/furans can be released to ground with this amount of PCB given the average content of PCDD/PCDF in PCB mentioned above. Contamination is transferred from ground to other environmental compartments: air, surface and ground waters.

Major Outcomes of the Inventory of Unintentional Releases of POPs

In 2004 the total annual releases of dioxins/furans were estimated at 141.779 g TEQ, including releases to air – 36.559 g TEQ, to water – 0.464 g TEQ, to ground – 1.363 g TEQ, in products – 0.049 g TEQ, and in residues – 103.344 g TEQ (Table 5.33, Figure 5.1).

Table 5.33
Releases of PCDD/PCDF on the territory of Belarus (estimates for 2004)

Source category	Annual release (g TEQ/per year)				
	Air	Water	Ground	Products	Residues
Waste incineration	16.879	—	—	—	50.749
Ferrous and non-ferrous metal production	8.330	—	—	—	30.848
Power generation and heating	8.413	—	—	—	8.114
Production of minerals	2.091	—	—	—	—
Transportation	0.263	—	—	—	—
Uncontrollable combustion processes	0.171	—	1.063	—	0.008
Production and use of chemicals and consumer goods	0.004	—	—	0.049	0.025
Miscellaneous	0.407	—	0.3	—	—
Disposal/landfill	—	0.464	—	—	13.600
TOTAL:	**36.559**	**0.464**	**1.363**	**0.049**	**103.344**
TOTAL AMOUNT:	**141.779**				

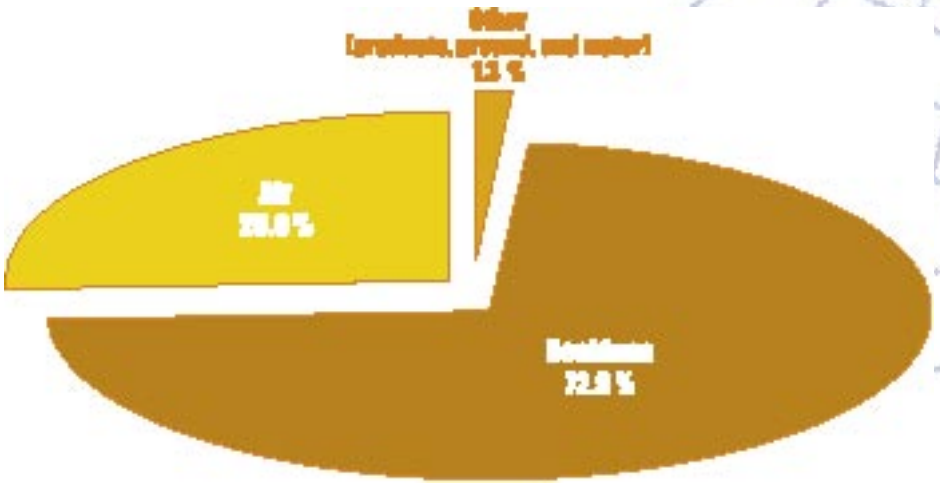


Figure 5.1: *Releases of dioxins/furans to different compartments*

Source categories "Waste incineration" and "Ferrous and non-ferrous metal production" contribute the most to the total amount of releases to air (46.2 % and 22.8 % correspondingly), source category "Power generation and heating" makes up 23 % of the total amount (Figure 5.2).

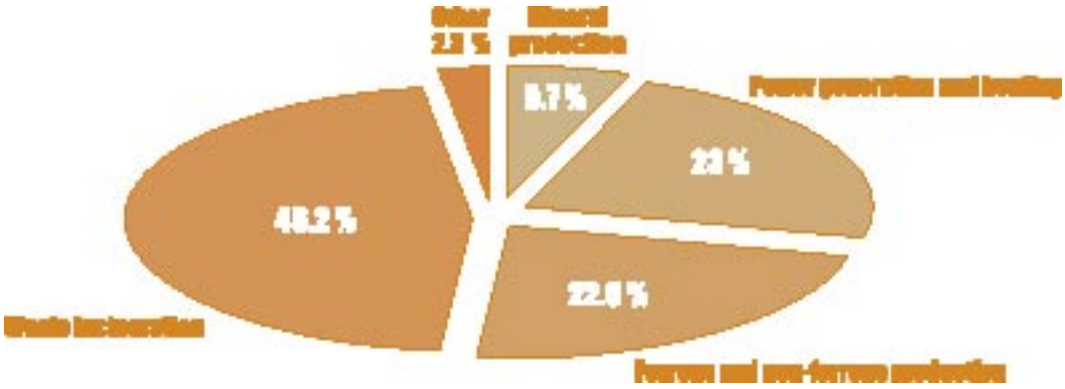


Figure 5.2: *Contribution of various source categories to the total amount of dioxins/furans releases to air*

Waste wood and waste biomass incineration makes up the biggest share of dioxins/furans releases in the category "Waste incineration"; steel production contributes the most to the total amount releases from source category "Ferrous and non-ferrous metal production"; domestic heating and cooking with wood produces the most of the releases from source category "Power generation and heating".

Releases of dioxins/furans to water are produced from source category "Disposal/landfill" – from sewage treatment.

Source category "Uncontrolled combustion processes" – grassland and forest fires, harvest residues burning – produce the major part of dioxins/furans releases to ground. In 2004 harvest residues burning produced 94.1 % of the total amount of releases to ground. Releases to ground are also produced by application of chlorinated pesticides and PCB-filled equipment, their share makes up 0.3 g TEQ per year.

Releases in products are produced from source category "Production and use of chemicals and consumer goods" (recycling paper production – 92.5 %).

The major source of dioxins/furans releases in residues is category "Waste incineration" – 49.1 %, category "Ferrous and non-ferrous metal production" produces 29.9 % of the total amount of dioxins/furans releases in residues; category "Disposal/landfill" makes up 13.2 % (Figure 5.3).

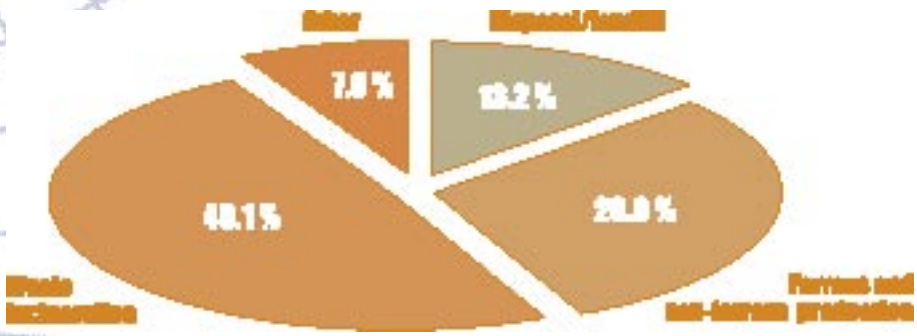


Figure 5.3: *Share of source categories in the total amount of dioxins/furans releases in residues*

In source category "Waste incineration" waste wood and biomass combustion does its biggest share for releases of dioxins/furans in residues, in category "Ferrous and non-ferrous metal production" – steel production, in source category "Disposal/landfill" – sewage treatment.

The major sources of dioxins/furans releases to the environment are "Waste incineration" – 47.8 %, "Ferrous and non-ferrous metal production" – 27.69 %, "Power generation and heating" – 11.7 %, "Disposal/landfill" – 9.94 % (Figure 5.4).

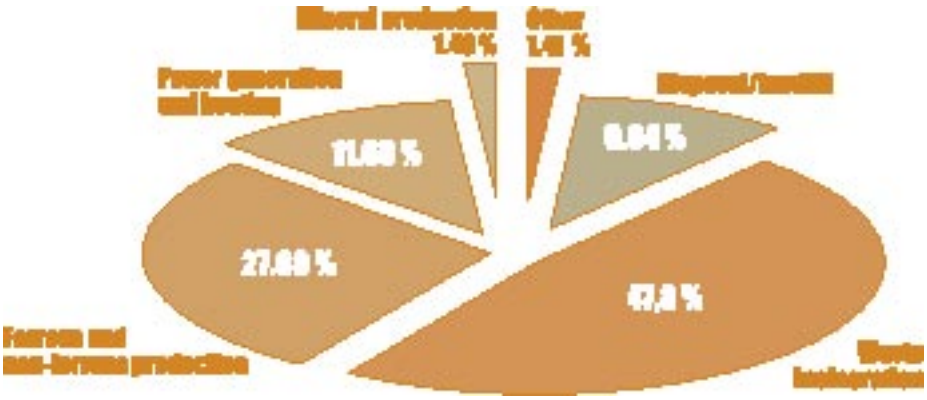


Figure 5.4: *Share of different source categories in the total amount of dioxins/furans releases to the environment*

HCB and PCB

In the framework of the inventory the following major sources of HCB and PCB releases to air were quantified (Table 5.34): waste incineration and fuel combustion, ferrous and non-ferrous metal production. The total amount of HCB releases to air is 0.59 kg, PCB – 9.8 kg per year.

Table 5.34
Releases of HCB and PCB on the territory of Belarus, kg

Source category	HCB	PCB
Waste incineration	0.15	2.42
Ferrous and non-ferrous metal production	—	6.91
Power generation and heating	0.1	0.47
Transportation	0.34	—
TOTAL	**0.59**	**9.79**

The main source of HCB releases is category "Transportation" – 58 %, category "Waste incineration" ranks the second – 25 %, category "Power generation and heating" makes up 17 % of the total amount of HCB releases (Figure 5.5).

The principle source of PCB releases to air is category "Ferrous and non-ferrous metal production" – 70 % of the total amount of releases, category "Waste incineration" ranks the second – 25 %, then goes category "Power generation and heating" – 5 % (Figure 5.6).

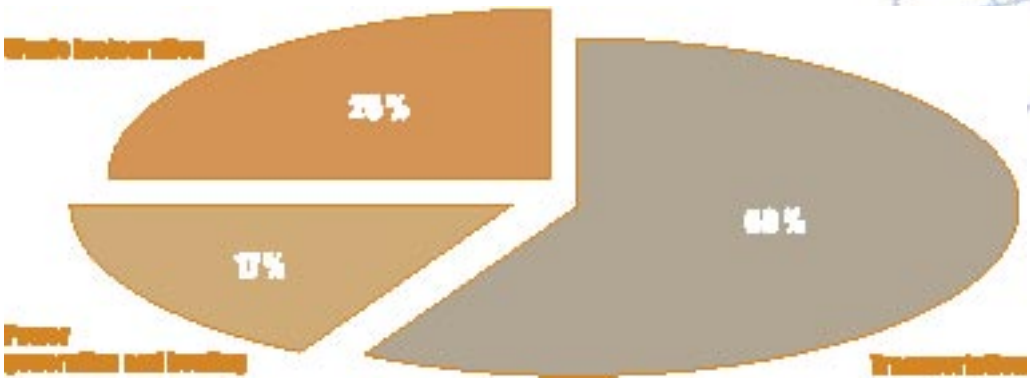


Figure 5.5: *The structure of HCB releases to air*

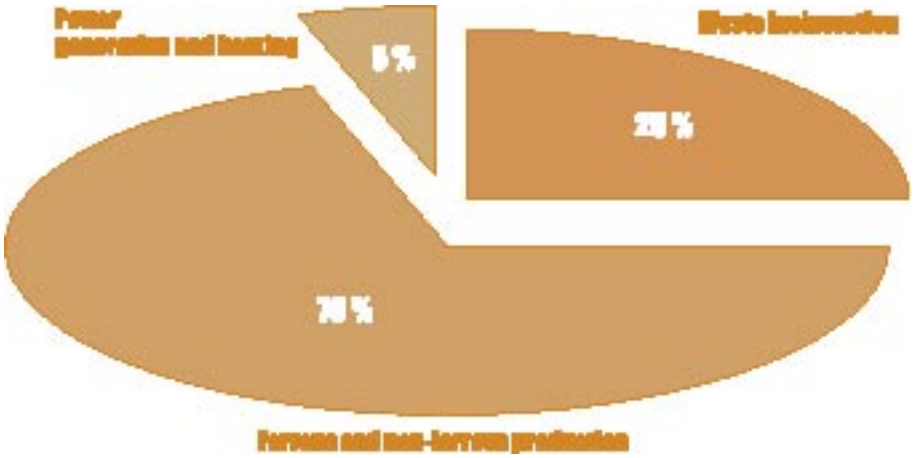


Figure 5.6: *The structure of PCB releases to air*

As it was mentioned above according to the interim estimates more than 1.6 tons of PCB can be released to ground as a result of PCB leakages from electrical equipment. At the same time other environmental compartments – air, surface and ground waters are contaminated through ground.

Characteristics of Ambiguity of Releases Estimates

The estimates of dioxins/furans release are rather vague. In this connection it would be incorrect to characterize the releases of dioxins and furans by a particular value, without identification of their accuracy (by means of characteristic of ambiguity).

The ambiguity of emission estimates is based upon vagueness of statistical data and ambiguity of emission factors; usually the contribution of the latter prevails over the former. To characterize the ambiguity of dioxin/furan emission estimates we have chosen

a range of releases by calculating the upper emission valuation and the smallest emission valuation. To calculate the smallest emission valuation we used the minimal emission factors (given in the UNEP Toolkit, EMEP Guidebook and others), to calculate the upper emission valuation we used the maximum emission factors (taking into consideration the conditions of Belarus). The results of estimation of the range of emission factors are given in Table 5.35

Table 5.35
Range of emission factors of dioxins and furans, µg TEQ

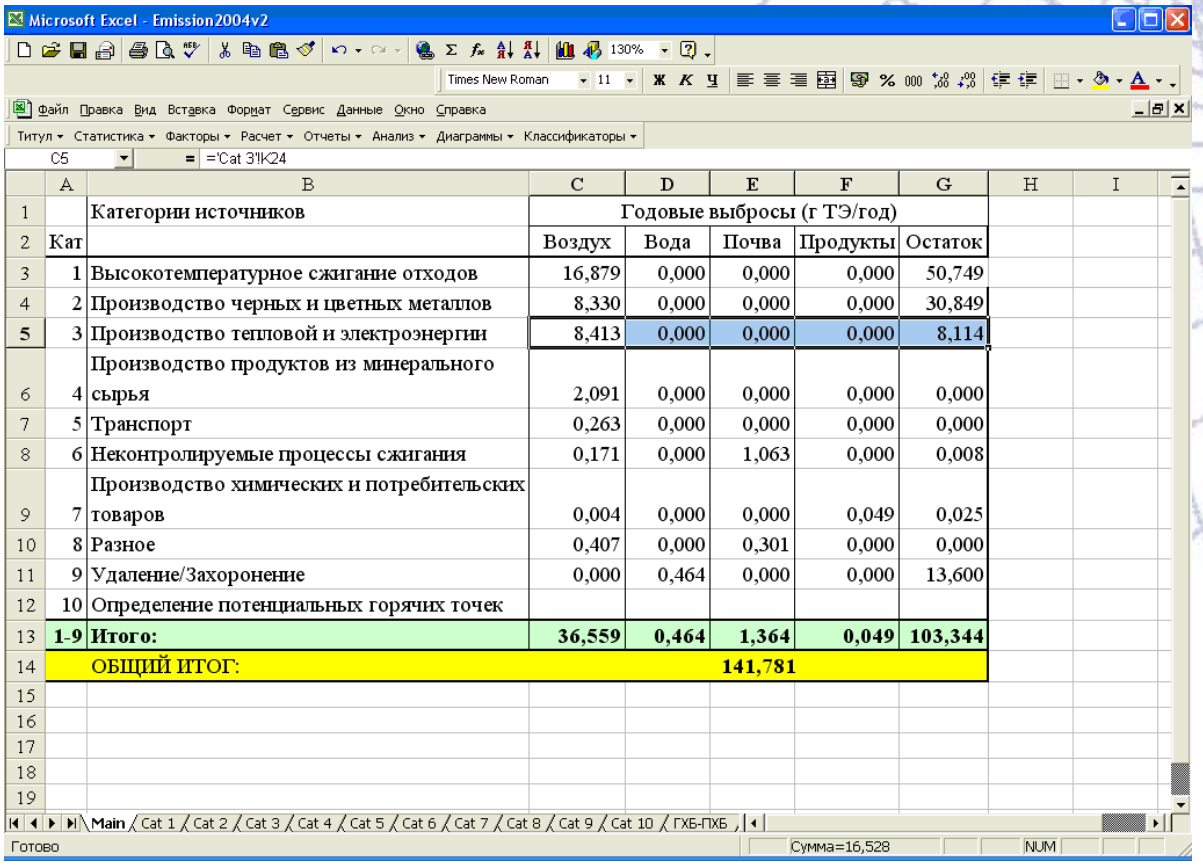
Category	Air		Water		Ground		Products		Residues	
	Smallest valuation	Upper valuation	Smallest valuation	Upper valuation	Smallest valuation	Upper valuation	Smallest valuation	Upper valuation	Smallest valuation	Upper valuation
Waste incineration	5.03	107.03	—	—	—	—	—	—	3.88	115.24
Ferrous and non-ferrous metal production	0.46	22.48	—	—	—	—	—	—	6.98	36.99
Power generation and heating	2.62	12.51	—	—	—	—	—	—	0.20	0.20
Production of minerals	0.68	21.74	—	—	—	—	—	—	—	—
Transportation	0.13	1.88	—	—	—	—	—	—	—	—
Uncontrollable combustion processes	0.17	3.12	—	—	1.06	1.06	—	—	0.01	0.01
Production and use of chemicals and consumer goods	—	—	—	—	—	—	—	0.20	0.02	0.02
Miscellaneous	—	0.20	—	—	0.3	0.3	—	—	0.01	—
Disposal/landfill	—	—	0.22	5.43	—	—	—	—	3.4	68.00
TOTAL	**9.09**	**168.96**	**0.22**	**5.43**	**1.36**	**1.36**	**—**	**0.20**	**14.5**	**220.46**

5.3. Structure of the Register of Unintentional Releases of PCB, PCDD/PCDF, HCB on the Territory of Belarus

Register of unintentional releases of PCDD/PCDF, HCB and PCB is a detailed list of process categories identified as sources of releases of these substances, with quantification of the releases of PCDD/PCDF, HCB and PCB in different compartments.

The register of unintentional releases of POPs is compiled in the format MS Excel on the basis of the calculation module for releases of dioxins and furans (UNEP Chemicals). It includes the sheets for 10 source categories and a summary sheet. There is an additional sheet for calculation of releases of HCB and PCB.

Every calculation sheet contains production statistical data for the given source category, emission factors, and the obtained estimates of releases (Figure 5.7).



Microsoft Excel - Emission2004v2

Файл Правка Вид Вставка Формат Сервис Данные Окно Справка

Титул Статистика Факторы Расчет Отчеты Анализ Диаграммы Классификаторы

C5 ='Cat 3'!K24

	A	B	C	D	E	F	G	H	I
1		Категории источников	Годовые выбросы (г ТЭ/год)						
2	Кат		Воздух	Вода	Почва	Продукты	Остаток		
3	1	Высокотемпературное сжигание отходов	16,879	0,000	0,000	0,000	50,749		
4	2	Производство черных и цветных металлов	8,330	0,000	0,000	0,000	30,849		
5	3	Производство тепловой и электроэнергии	8,413	0,000	0,000	0,000	8,114		
6	4	Производство продуктов из минерального сырья	2,091	0,000	0,000	0,000	0,000		
7	5	Транспорт	0,263	0,000	0,000	0,000	0,000		
8	6	Неконтролируемые процессы сжигания	0,171	0,000	1,063	0,000	0,008		
9	7	Производство химических и потребительских товаров	0,004	0,000	0,000	0,049	0,025		
10	8	Разное	0,407	0,000	0,301	0,000	0,000		
11	9	Удаление/Захоронение	0,000	0,464	0,000	0,000	13,600		
12	10	Определение потенциальных горячих точек							
13	1-9	**Итого:**	**36,559**	**0,464**	**1,364**	**0,049**	**103,344**		
14		ОБЩИЙ ИТОГ:			**141,781**				
15									
16									
17									
18									
19									

Main Cat 1 Cat 2 Cat 3 Cat 4 Cat 5 Cat 6 Cat 7 Cat 8 Cat 9 Cat 10 ГХБ-ПХБ

Готово Сумма=16,528 NUM

Figure 5.7: *Register of unintentional releases of PCDD/PCDF, HCB and PCB on the territory of Belarus Summary Sheet*

5.4. Stationary and Diffuse/Dispersed Sources of Unintentional Releases of POPs

Within the inventory of unintentional releases of POPs apart from the register of releases we have undertaken a preliminary assessment of releases from potential stationary sources of releases and assessment of contribution of diffuse/dispersed sources to the gross amount of releases. It is significant that the used methodology if applied to stationary sources gives rather approximate release estimates, mostly indicating the order of emission values. All sources of HCB and PCB releases were regarded as diffuse/dispersed sources.

Identification of Hot Spots of PCDD/PCDF Releases

There are no universal criteria for classifying an enterprise as a hot spot. The identification of the hot spots of PCDD/PCDF emission is based on the criteria set forth in the EMEP Guidelines and other documents. According to these documents, the release threshold, the volume (burning of fuel, waste incineration), the capacity threshold or the use of a certain process can be taken as the respective criteria.

In terms of contribution to the global releases, there are virtually no hot spots of POPs releases in Belarus if a "traditional" approach is followed, which means plants producing herbicides, waste incineration plants, and agglomeration plants that may release tens and hundreds grams of PCDD/PCDF a year. Given the production and technological specifics of Belarus, we have used a threshold of a plant's potential contribution to the gross releases of POPs of 1 g TEQ per year as the key criterion for classifying a plant as a hot spot, 0.1 g TEQ per year for classifying a plant as a stationary source. The threshold contribution of a source category to the gross releases has been taken as an additional criterion.

Category "Waste incineration"

Based on estimation of the total amount of dioxin/furan releases to all compartments for 2004 the potential hot spots sources of PCDD/PCDF releases in category "Waste incineration" are considered 12 enterprises (BRUE "Hydrolytic works", OJSC "Rogachev Furniture Factory Fandok", RUE "State Manufacturing Association "Azot", and others). Thirty-four enterprises are considered as stationary sources. The list of stationary sources in this category is not stable and varies from year to year depending on incineration volumes.

A special attention should be paid to medical waste incineration: despite the relatively small volumes of incineration but due to high emission factors these processes need special attention.

Category "Ferrous and non-ferrous metal production"

The main hot spot source of dioxin/furan releases in this category is RUE "Belarusian Metallurgic Plant", with the total volume of releases of 30–35 g TEQ, and releases to air of about 5 g TEQ. Six enterprises are classified as stationary sources.

Category "Power generation and heating"

The most widely used fuel at power plants is natural gas, thus according to the preliminary estimates in Belarus there are no power generation plants with PCDD/PCDF releases more than 0.1 g TEQ per year. Stationary sources in this category were not identified.

Category "Production of minerals"

Hot spot sources in category "Production of minerals" have not been identified. Three enterprises have been classified as stationary sources (releases from 0.1 to 1 g TEQ). Dioxins and furans in this category are mostly released to air.

Category "Production and use of chemicals and consumer goods"

There are no sources in this category which could be classified as stationary.

Category "Miscellaneous"

In category "Miscellaneous" the only source of dioxin/furan releases is cremation. The only stationary source from this category in Belarus is the Minsk crematorium.

On the whole in all sectors 16 hot spot sources and 40 stationary sources of PCDD/PCDF releases have been identified.

Assessment of PCDD/PCDF Releases from Diffuse/Dispersed Sources

We have assumed that source categories and subcategories, in which there are no stationary sources of dioxin/furan releases according to the accepted criteria, and the part of emissions not produced by stationary sources in other categories should be treated as diffuse sources of dioxin/furan releases. In category "Waste incineration" diffuse sources provide about 10 % of the total releases of dioxins/furans to all environmental compartments, in category "Ferrous and non-ferrous metal production" – about 20 %, in category "Production of minerals" – more than 40 %.

The level of HCB and PCB releases to air is rather low, therefore all identified sources of HCB and PCB emission to air are classified as diffuse sources. PCB leakages from PCB-filled electrical equipment, direct releases of HCB from storage sites or landfill of this substance can be also classified as diffuse sources of HCB and PCB releases.

According to the obtained estimates, the Gomel region does its biggest share for the total amount of dioxin/furan releases (about 35 %), the Mogilev region ranks the second with the share of 10–15 %, the Grodno and Minsk regions produce 10 and 15 % correspondingly. Considerably lower amounts of releases are produced in the Brest and Vitebsk regions and in the city of Minsk (about 5–10 % total).

Conclusion

In the course of the established inventory the levels of unintentional releases of POPs (PCDD/PCDF, HCB and PCB) have been estimated. The year 2004 was assumed as the base year.

According to the UNEP methodological recommendations we have assessed the releases to air, to water, to ground, in products, and in residues. We have also calculated the ambiguity of dioxin/furan releases estimates. The releases of HCB to air and releases of PCB to air and to ground have been evaluated.

In accordance with the estimates the total annual releases of PCDD/PCDF in 2004 were 141.8 g TEQ (the range is 25.2–396.4 g TEQ). The principle sources of dioxin/furan releases to the environment of Belarus are categories "Waste incineration" – 47.8 %, "Ferrous and non-ferrous metal production" – 27.7 %, "Power generation and heating" – 11.7 %, "Disposal/landfill" – 9.9 %.

36.6 g TEQ of dioxins/furans are annually released to air (the range is 9.1–169.7 g TEQ), waste incineration processes generate 46.2 % of the total amount of releases, ferrous and non-ferrous metal production processes produce 22.8 % of dioxin/furan releases, and power generation and heating processes make up 23 % of the total amount of the dioxin/furan releases.

Releases in residues are estimated at 103.3 g TEQ (the range is 14.5–220.3 g TEQ). The considerable part of releases in residues is produced by source category "Waste incineration" – 49.1 %, the source category "Ferrous and non-ferrous metal production" produces 29.9 % of the total amount of releases in residues, 13.1 % of releases in residues are produced by source category "Disposal/landfill".

Releases to water, to ground, and in products constitute 1.87 g TEQ, at the same time the major part of releases from all these categories is produced by sources of one subcategory (releases to water – from category "Disposal/Landfill", to ground – from "Uncontrolled combustion processes", in products – from "Production of chemicals and consumer goods").

Releases of HCB to air are estimated at 0.75 kg. The major sources are categories "Waste incineration" and "Transportation".

Releases of PCB to air make up 9.8 kg. Principle sources of releases to air are ferrous and non ferrous production, waste incineration, power generation and heating. However, the amount of unintentional releases of PCB to air is insignificant if compared to releases from PCB-filled electrical equipment. According to preliminary estimates about 1.6 tons of PCBs are released annually (mostly to ground).

The input of Belarus to European releases of dioxins/furans to air makes up about 1.5 %, releases of HCB – about 0.01 %, PCB – about 0.4 %.

One of the outcomes of the inventory of unintentional releases of POPs is the identification of the stationary sources of PCDD/PCDF releases. The regions with the highest level of PCDD/PCDF releases have been identified: the highest level of unintentional releases of POPs is observed in the Gomel region.

The established inventory of unintentional releases of POPs forms the basis for elaboration of the section on unintentional releases of POPs of the National Implementation Plan of the Stockholm Convention.

ANNEX 6

Assessment of Environmental Contamination by Persistent Organic Pollutants in the Republic of Belarus

6.1. Assessment of the Scale of Environmental Contamination by Persistent Organic Pollutants

The state of the environmental compartments (ambient air, soil, surface and ground waters) has been assessed based on the data of the National Environmental Monitoring System (NEMS) [178] of the Republic of Belarus, the findings of research [179–193], the outputs of the international projects implemented in Belarus and the random survey of the territories potentially contaminated by pesticides which was conducted within the framework of the project GEF TF 053865 "Enabling activities related to the implementation of the Stockholm Convention on persistent organic pollutants in the Republic of Belarus".

It should be noted that NEMS envisages the most systemic approach to organization of environmental monitoring in light of potential impact of POPs. NEMS incorporates the monitoring of potential contamination of surface and ground waters, lands and soils resulting from anthropogenic economic activity and the monitoring within the reference network. Monitoring of persistent organic pollutants is organized, to various extent, within the monitoring of surface waters, monitoring of ground waters, monitoring of lands and local monitoring.

Assessment of the Environmental Contamination by Chlororganic Pesticides

Assessment of ambient air contamination

The findings of the analysis of the available data suggest that at present there is no evidence indicating the presence of pesticides in ambient air in Belarus.

Assessment of soil contamination

The results of chemical tests of soil samples over the last five years have been used to assess the degree of land/soil contamination (most of analytical studies have been performed in the accredited laboratories of the Department for Analytical Control Organization of the Ministry of Natural Resources and Environmental Protection, the Republican Research and Technical Center "Ecomir" and the State Institution "Control and Toxicological Laboratory of the Central State Inspection on Seed-Growing, Quarantine and Crop Protection").

In addition to NEMS data, the findings of the random survey of pesticide storage sites conducted within the framework of the GEF POPs EA project have been used for assessment of soil contamination by POPs pesticides.

Thirty four soil samples were tested by the specialists of the laboratory "Ecomir" in 2005. DDT traces have been detected in 4 samples (12 %), the concentration ranged from 3.1 to 80 μg/kg in absolute figures.

The data on contamination of agricultural lands by the traces of DDT, heptachlor and endrin for the period of 2003–2005 are summarized in Table 6.1. It should be noted, however, that the currently available data are not sufficient for reliable assessment of the level of agricultural land contamination by the residues of POPs pesticides listed in the Stockholm Convention.

The data obtained at the benchmark stations suggest that there are POPs residues in soils. DDT was detected in 34 % of the tested soil samples in 2003 and in 33 % – in 2004.

The findings of the random survey of the Belarusian territories conducted within the framework of this project suggest that out of 163 samples DDT was detected in 44 (27 %), endrin was detected in 21 (13 %), dieldrin – in 6 (4 %), chlordane – in 11 (7 %), aldrin – in 8 (5 %) and heptachlor – in 12 (8 %). The tests identified the presence of the residues of 6 POPs pesticides in soils.

Table 6.1
Data on contamination of agricultural lands by POPs pesticides in 2003–2005

Regions	Content, µg/kg					
	DDT (maximum permissible concentration – 100 µg/kg)		Heptachlor (maximum permissible concentration – 50 µg/kg)		Endrin (approximate permissible concentration – 1 µg/kg)	
	average	maximum	average	maximum	average	maximum
Brest region	10.8	43.0	not detected	not detected	**4.3**	**6.4**
Vitebsk region	4.6	7.0	13.15	17.6	**7.0**	**11.6**
Grodno region	27.1	**151.4**	not detected	not detected	not detected	not detected
Gomel region	8.5	17.6	1.16	1.20	**8.2**	**8.2**
Minsk region	13.98	79.9	1.3	1.3	not detected	not detected
Mogilev region	59.9	**342.5**	not detected	not detected	**3.46**	**4.3**

The territories of the obsolete pesticide landfills are the most contaminated. For example, in the vicinity of the Slonim obsolete pesticides landfill the maximum concentration of DDT in soil is 9.5 times higher than the maximum permissible concentration, the concentration of dieldrin is 20 times higher than the approximate permissible concentration; at the Dribin obsolete pesticides landfill the approximate permissible concentration of endrin is exceeded by 50 units, the maximum permissible concentration of DDT – by 2. Similar situation is observed at all obsolete pesticides landfills including the Postavy obsolete pesticides landfill (the concentration of DDT is 2.5 times higher than the maximum permissible concentration), the Gorodok obsolete pesticides landfill (2 times higher than the maximum permissible concentration of DDT; the approximate permissible concentration of endrin is exceeded by 4,500 times). It is worth noting that chlordane was also detected in soil samples (according to some data, this pesticide has never been used in the Republic of Belarus). At 5 obsolete pesticides landfills (the Dribin obsolete pesticides landfill, the Gorodok obsolete pesticides landfill, the Postavy obsolete pesticides landfill, the Slonim obsolete pesticides landfill and the Verkhnedvinsk obsolete pesticides landfill) the detected concentration of chlordane varies from 0.47 to 19.2 µg/kg.

Assessment of surface waters contamination

The assessment of surface waters contamination by chlororganic pesticides was based on the data of NEMS, international projects involving monitoring of the transboundary rivers Dnieper, Zapadny Bug, Zapadnaya Dvina and Pripyat as well as the findings of the random survey of water bodies, which was conducted within the framework of this project in the area of potential impact of obsolete pesticides landfills.

It should be noted that within NEMS the concentration of chlororganic pesticides in water is measured depending on the category of water bodies at the regional network of monitoring of surface waters. Monitoring is conducted at the time of high water and in summer time.

The tests detected the traces of the following chemicals in the surface water samples:

DDT – up to 10 ng/dm^3 (the Nieman River; the Grodno river station);

dieldrin – from 40 to 100 ng/dm^3 (the upper limit of detection is 4.6 ng/dm^3) – the Pravaya Lesnaya River (the Zapadny Bug river basin);

heptachlor – from 5.3 to 39.4 ng/dm^3 (the upper limit of detection is 4.8 ng/dm^3); the Kotra River (the Nieman river basin); the Ptich River (the Pripyat river basin); Lake Chervonoye; the Dnieper River, station near the town of Orsha; Lake Lukomolskoye, the town of Novolukoml; Lake Lepelskoye, the town of Lepel; the Nieman River, the station near Stolbtsy; the Osipovichi reservoir, the town of Osipovichi; Lake Senno, the town of Senno; the Pravaya Lesnaya River (the Zapadny Bug river basin); the Lesnaya River (the Zapadny Bug river basin); the Lva River station near the village of Olmanskaya Koshara (the Pripyat river basin); the Prostryr River, the Pinsk district (the Pripyat river basin); the Zapadnaya Dvina River, the town of Surazh; the Dnieper River, the village of Sarviry, 4.2 km from the Russian border;

endrin – up to 100 ng/dm^3 (the upper limit of detection is 9.9 ng/dm^3): the Svisloch River, the village of Khmelevka and the Moroch River, the village of Yaskovichi (the Dnieper river basin); the Soligorsk reservoir; the Yaselda River, the village of Beryoza (the Pripyat river basin); Lake Vygonoschanskoye; the Pravaya Lesnaya River (the Zapadny Bug river basin).

The presence of controlled POPs in excess of the maximum permissible concentration was not detected.

Since 2005 in the framework of NEMS the samples of water and bottom sediment have been collected at 35 stations for transboundary monitoring of surface waters to be tested for the POPs pesticides content. The data are currently available at 22 stations for transboundary monitoring of surface waters in the basins of the Zapadny Bug, the Zapadnaya Dvina and the Dnieper.

In the Zapadny Bug river basin 9 out of 15 samples (60 %) contained traces of heptachlor, endrin and dieldrin in concentration from 5.1 to 13 ng/dm^3. The inflow of the Bug River (the Pravaya Lesnaya river station) turned to be the most contaminated – 44 ng/dm^3 (a total of HCCH, aldrin, endrin and heptachlor).

The findings of the monitoring of the Dnieper, the Zapadny Bug, the Zapadnaya Dvina and the Pripyat within the framework of the international projects involving monitoring of transboundary rivers suggest that at the majority of the Dnieper river stations and its inflows the concentration of the monitored POPs is, as a rule, at the threshold of detectability of the gas chromatography method. Trace amounts of DDT decay were detected in the Dnieper river downstream the town of Rechitsa, in the Sozh river upstream and downstream the town of Krichev and downstream the city of Gomel, as well as in the Iput, the Styr, the Slovechno and the Pripyat rivers downstream the town of Mozyr. Bottom sediments collected in the Sozh river upstream of the town of Krichev turned to be the most contaminated – the aggregate concentration of HCCH and DDD was about 30 µg/kg. Monitoring of biota (fish) in the Dnieper river basin identified the presence of traces of 4.4 DDE. In the Dnieper river basin the samples of bottom sediment and fish contained almost all pesticides listed in the Stockholm Convention (the highest concentration of DDE (one of the metabolites of DDT) in fish was up to 12 µg/kg).

The data obtained in 2001 during the implementation of the TACIS Project "Monitoring and Assessment of the Quality of Water in the Zapadny Bug River Basin at Poland – Belarus Border" indicated that the concentration of DDT and DDE in all samples was 0.02 µg/kg and 0.005 µg/kg respectively.

The assessment of the quality of water and bottom sediment conducted by the TACIS Project "Management of Water Resources and Ecological Situation in the Zapadnaya Dvina River Basin" revealed the presence of DDT and its metabolites, aldrin, dieldrin, endrin and heptachlor in concentration from 1 to 10 µg/kg.

The results of chemical and analytical tests of the samples of surface waters collected in the locality of obsolete pesticide landfills and storage sites within the framework of the random survey suggested that in some cases the presence of POPs pesticides had been detected. The presence of pesticides was detected in 50 % of the samples. However, the excess of the maximum permissible concentration was detected just in 2 cases (9 %). The concentration of pollutants in water bodies used for fishery made up 1.16 of the maximum permissible concentration for DDT and 1.8 of the maximum permissible concentration for heptachlor. The presence of chlordane in surface waters was detected in two cases (14.9 and 16.2 µg/dm^3). The presence of chlordane was detected in Lake Dolzhe, which is located at a distance of 1,100 meters from the Postavy obsolete pesticides landfill. The presence of the pesticide in the lake is an indication of migration of pesticides to the environment.

DDT, its metabolites, heptachlor and aldrin in amount less than the maximum permissible concentration were detected in surface waters (the Serebronsky stream, its length is about 7 km, the left inflow of the Ptich River flowing into the Pripyat River) near the Petrikov obsolete pesticides landfill. The tests also detected dieldrin and endrin, for which the approximate permissible concentration has not been established in Belarus yet.

In 2005 insignificant concentration of chlororganic pesticides (DDT) was periodically detected in the streams and the Turya River close to the Verkhnedvinsk obsolete pesticides landfill.

No POPs-containing pesticides were detected in the surface waters at other obsolete pesticides landfills.

The tests of the surface water samples collected in proximity to obsolete pesticide storage sties did not detect any POPs-containing chemicals.

Assessment of surface water contamination

Assessment of surface water contamination by POPs pesticides in the Republic of Belarus is conducted in the localities of obsolete pesticides landfills and at the largest disposal facilities for industrial and household wastes, which are regarded as potential sources of environmental pollution.

The tests and analytical measurements of surface waters in the localities of obsolete pesticides landfills detected the presence of endrin, DDT and its isomers, aldrin, chlordane and heptachlor in the samples of surface waters.

The concentration of DDT (116 mg/l) in surface waters at the Verkhnedvinsk obsolete pesticides landfill exceeded the established maximum permissible concentration in drinking water (for DDT – 100 mg/l). An insignificant (from 101.6 to 120 %) excess of the maximum permissible concentration of heptachlor in surface water was detected at the Dribin obsolete pesticides landfill. Ten-fold excess of the maximum permissible concentration of aldrin was detected in surface waters at the Slonim obsolete pesticides landfill.

The currently available monitoring data indicate the presence of the traces of heptachlor and DDT in surface waters near the Petrikov obsolete pesticides landfill.

The detected traces of pesticides in the samples of ground waters collected at downstream monitoring wells located a few kilometers away from the obsolete pesticides landfills (the Petrikov and the Dribin obsolete pesticides landfills) are an indication of both vertical migration of pesticides from the obsolete pesticides landfill and their horizontal movement and potential long-range contamination of the environment.

At the same time, in order to obtain more reliable data for the assessment of the environmental impacts of the obsolete pesticides landfills, a number of organizational measures should be undertaken ranging from the improvement of access roads to the obsolete pesticides landfills to the supply of equipment for monitoring wells at all obsolete pesticides landfills to enable long-term monitoring.

Analytical testing of the samples of surface waters collected at the large waste disposal facilities detected no pesticides in surface waters.

Assessment of Environmental Contamination by PCBs

Studies of environmental contamination by PCBs were initiated in the Republic of Belarus only in the late 1990s.

In 1999–2000 the samples of dust, fly ash and soot were collected and analytical measurement of PCB concentration was performed within the framework of the Government Research and Technical Program "Natural Resources Management and Environmental Protection".

In 2003–2004 experimental studies aimed at identification of the sources and potential pathways of PCBs to the environment and assessment of the level of soil contamination at the sites where PCB-containing equipment is installed and stored were performed within the Government Research and Technical Program "Environmental Safety". Furthermore, the concentrations of PCBs for background territories have been measured. Bottom sediment in some water bodies and waterways were examined to identify dispersed sources of PCBs.

The concentration of PCBs in ground waters in the localities of the sites producing adverse impact on the environment has been measured in Belarus since 2003. As of 1 January 2006 about 50 sites were subjected to observation and measurement.

The concentration of PCBs in soils, bottom sediment and fish have been measured within the framework of a number of studies [195].

This project has involved reconnaissance surveys at some industrial enterprises owning PCB-containing equipment. Forty samples of soil have been collected and tested for the PCB content identification.

Assessment of ambient air contamination by PCBs

There are no data about the concentration of PCBs in the ambient air. The concentration of PCBs in the air can be estimated based on the calculations made by the Meteorological Synthesizing Center "Vostok" (Moscow) and the measurements performed in the neighboring countries.

According to the calculations [196], in the late 1990s the concentration of PCBs in the ambient air in Belarus were estimated to be 0.10–0.13 ng/m^3. It is assumed that in 1970–1978 the concentration of PCBs in air was considerably higher, notably 0.45–0.62 ng/m^3.

It can be expected that PCB concentration will be higher at the sites for operation and storage of PCB-containing equipment and at the sites contaminated by PCBs.

In general, calculated values are within the range, which is typical for the territories remote from the main sources of impact.

Assessment of surface waters contamination

In the early 2000s surface waters were tested for the presence of pollutants including PCBs within the framework of a number of UNDP projects involving the monitoring of transboundary rivers (the Dnieper, the Zapadny Bug, the Zapadnaya Dvina and the Pripyat). No PCBs were detected in the collected samples.

In 2003 special sampling equipment and membranes were used to collect a sample from the Svisloch River, which was tested in Umea University (Sweden). The findings suggested that a total of 7 isomers of PCBs in the sample amounted to 2 ng/dm^3.

Tests for the PCB content definition in water at transboundary monitoring points have been conducted since 2005. The tests of 22 samples have not detected the presence of PCBs.

There have been single cases of detecting PCBs in bottom sediment [197].

The tests of bottom sediment in the Gaina and the Podveina rivers (The Logoisk district), the Chernitsa River (the Minsk district), the Vileika reservoir (total of 5 samples) have suggested that a total of 8 isomers of PCBs varies from the quantities below the threshold of detectability to 63.6 μg/kg of solid substance [197].

In bottom sediment of the waterways and water bodies of Minsk (5 samples) the concentration of PCBs range from 22.6 to 1,029.9 μg/kg. Trichlorbiphenyls tend to prevail.

Similar concentration in the bottom sediment was detected in the samples collected in the Lida reservoir and the Lideika River, at the watershed of which the OJSC "Lakokraska" is located (Sovtol was used as plasticizer at this enterprise for 30 years). The detected concentration of PCBs in 3 samples ranged from 0.612 to 23.2 μg/kg.

The data on the PCB concentration in the bottom sediment of waterways and water bodies in Minsk and Lida indicate that there is a relatively high accumulation of PCBs. The detected concentration in some cases are considerably higher than the so-called lower level of possible effect – 70 μg/kg [198] and the maximum permissible concentrations established in some countries (Germany, the Netherlands and Canada) – 20–34 μg/kg [199].

Assessment of ground waters contamination

The concentration of PCBs in ground waters have been measured within the framework of the local monitoring of ground waters since 2003. In 2003–2005, the PCBs concentration was measured in almost 400 samples collected at 50 sites including purifying facilities, industrial and household waste disposal facilities, sludge beds and etc. It was found out that in most cases the concentration of PCBs in ground waters is below 5 ng/dm^3 (threshold of detectability); traces of PCBs were detected in 2 % of samples. There are isolated cases of PCBs concentration ranging from 14 to 58 ng/dm^3. It should be noted that the maximum

permissible concentration of PCBs for ground waters has not been established in Belarus. According to the studied data [199], the maximum permissible values of PCBs concentration range from 0.01 to 1 μg/dm^3.

In some cases PCBs have been detected in ground waters in the impact zone of sludge storage facility and sludge beds of the OJSC "Polimir" (Novopolotsk), the industrial waste disposal facility of the OJSC "Steklovolokno" (Polotsk), sludge beds of the fish farm "Volma" and household waste disposal facility of the housing and utility department of Kobrin and others.

Based on the findings of monitoring of PCBs in ground waters and the inventory of PCB-containing equipment, it can be assumed that the most likely areas of ground waters contamination include the storehouses of PCB-containing equipment and the sites where PCB leakages can occur, such as SS-330 "Lida", village Minoity, Lida district (an open site for storage of capacitors containing over 30 tons of PCBs) and OJSC "Polimir", Novopolotsk (an open site for storage of transformers containing about 28 tons of PCBs).

Assessment of soil contamination

As of now, the available results of the tests of more than 200 soil samples which, to one or the other extent, allow to estimate the concentration of PCB accumulation in soils of different type (forest lands, agricultural lands, urban and industrial areas) and at the sites where PCB-containing equipment is installed and stored as well as to identify the environmental compartments the most susceptible to PCB contamination.

Nine isomers of PCBs – 8, 28, 52, 101, 118, 138, 153, 180 and 203 – have been measured in most samples. A total of PCB isomers has been measured in a number of samples.

The available data suggest that within the background areas of Belarus (the Berezina Biosphere Reserve and adjacent forests in the Lepel, Dokshitsy and Borisov districts as well as the Naroch National Park) the concentration of PCBs in soils vary from the values below the threshold of detectability to 60 μg/kg (a total of 6 isomers: PCB-10, 28, 52, 138, 153, 180). The average concentration of a total of the referred isomers of PCBs for surface humus horizon of sod-podzol soils and peatbog soils is 0.02 mg/kg. The estimated average concentration of PCBs in mineral soils (sand and clay sand) is 0.008 mg/kg, in bedding – 0.04 mg/kg. Trichlorbiphenyls in the form of PCB-28 isomer tend to prevail in almost all soil samples. It should be noted that these are the first measured background concentrations for the conditions of Belarus and in general they are similar to the values reported in other regions of Europe: 0.002–0.04 mg/kg [200]. These findings are consistent with the model calculations made by the Meteorological Synthesizing Center "Vostok" [201] indicating that the estimated background concentrations of PCBs in the soils of Belarus are 0.01–0.03 mg/kg.

The available data on PCB concentration in agricultural lands remote from the main sites where PCB-containing equipment is installed and stored suggest that the concentration of PCBs range from the values below the threshold of sensitivity to 222 μg/kg. The average concentration of a total of 8 isomers (PCB– 8, 10, 28, 101, 118, 138, 153, 180) of PCBs is about 50 μg/kg. In general, in 70 % of cases the concentration of PCB is below 50 μg/kg, which is close to the background level. Trichlorbiphenyls (mostly PCB-28) tend to prevail in all cases. The share of PCB-28 in some cases is almost 100 %.

There are single samples of agricultural lands adjacent to power stations Mir, Korelichi and Minoity, in which PCB concentration varies from 200 to 1,200 μg/kg. PCB concentration in soils near the power station in Pleschenitsy (Logoisk district) is 306 μg/kg. In all these cases the concentration of PCBs is many times higher than the approximate permissible level established for soils – 20 μg/kg.

The results of isolated measurements (about 10 samples) of soil of different functional zones in urban areas including recreation territories and land plots close to industrial enterprises suggest that the concentration of PCBs in soils (a total of 8 isomers) vary from the values below the sensitivity threshold of the method to 7,880 μg/kg. In most samples a total of PCBs is below 50 μg/kg.

The soils of the sites where PCB-containing equipment is installed or stored are the most contaminated.

The specialists of the IPUNRE NASB have tested the soils of the Lida, Pinsk, Molodechno, Borisov, Oshmyany, Smorgon and other power supply stations, the traction substations in Kolosovo, Smolevichy and Pomyslische and at some sites where PCB-containing equipment is stored. It has been found out that at the sites for operation and storage of PCB-containing equipment the concentration of PCB accumulation in soils reaches milligrams and even grams per kilogram of soil, which is ten and hundred thousand times higher than the background levels. PCBs are detected in all cases and their concentration varies considerably differing by orders of values within one meter. It has been found out that PCB distribution in soils depends on the source of PCB release to the environment while the ratio of isomers depends on the type of technical mixtures of PCBs, age of leaks, soil type and etc.

The maximum concentration of PCBs in soils (lands) is 2–11 g/kg has been recorded in the places where the leakages from the PCB-containing equipment (capacitors) occur. Most often elevated concentrations are typical for organic substrata or heavy soils.

The highest concentration of PCBs has been recorded at the sites for storage of the damaged equipment. The concentration of PCBs in soil around the storage grounds varies considerably: for example, outside the zones of evident leaks it ranges from 9.5 to 406 mg/kg. Obviously, PCB-based dielectrics largely penetrate deep into soils and soak in concrete slabs. For example, a total of 6 isomers of PCBs in soil collected near a concrete slab, on which capacitors are placed, amounts to 13 g/kg.

High concentration of PCBs is typical for the upper (as a rule, up to 10 cm) horizons of soils. In some cases high concentration of PCBs is detected at a depth of up to 50 cm. This is quite understandable as even if one capacitor is damaged, up to 6–11 kg of PCBs (depending on its model) can flow out and penetrate into soil.

As for the structural composition of PCB compounds in soils of the sites where PCB-containing capacitors are installed or stored, PCB-28 isomer (the group of trichlorbiphenyls) clearly prevails.

Soils at the sites where PCB-containing transformers are located get contaminated, as a rule, after the equipment is removed from use and is stored at the open grounds. At the two storage grounds – owned by OJSC “Polimir” and the Minsk Tractor Plant – a total of 6 isomers at the places with PCB leaks range from 14–21 g/kg to 72–105 g/kg. These numbers are more than 100 times higher than 500 mg/kg threshold requiring measures for clean up of the territory with removal of the soil and arrangement of its storage as a PCB-containing substratum.

PCB contamination of soils within the territory of industrial enterprises is recorded in 52.5 % cases; the concentration of PCBs vary from the values below the sensitivity threshold of the method to 31.5 g/kg of soil. A total of 7 isomers ranges from the values below the detectability threshold of the method to 14.4 g/kg.

The findings of the assessment of soil contamination by PCBs suggest that the list of heavily contaminated sites is fairly extensive. Leakage of PCBs and, consequently, plots (spots) with heavily contaminated soils are reported at almost all sites for operation and storage of PCB-containing equipment. It means that soil contamination may occur almost at all power supply substations of the Concern “Belenergo” (about 100 sites), at traction substations of the railways (5 sites) and within the territory of many industrial enterprises.

Environmental contamination by PCBs at wastewater sludge and household waste disposal facilities can be tens and hundreds times higher than the background level. PCBs in wastewater sludge and waste ash are represented by highly chlorinated compounds. The highest range of PCB values is reported for wastewater sludge: the figures can vary from the values below the sensibility threshold of the method to 0.103 g/kg. The highest concentration of a total of 8 isomers of PCBs has been recorded in wastewater sludge accumulated at the fish farm “Volma”. High concentration of PCBs has also been recorded in wastewater sludge collected at filter beds of the Minsk Tractor Plant, purifying facilities in Bolbasovo and Orsha.

As for distribution by isomers, low chlorinated compounds, particularly trichlorbiphenyls, clearly prevail.

Assessment of Environmental Contamination by PCDD/PCDF

So far measurements of dioxins/furans concentration in the environment have not been performed in Belarus. The available data are based on the calculations made by the Meteorological Synthesizing Center "Vostok" for modeling of transboundary transfer [202].

The findings suggest that the average concentration of dioxins/furans in the ambient air is 2.05 fg TEQ/m^3 compared to 623 in Germany, 23.65 in the Czech Republic, 12.85 in Slovakia and 2.98 fg TEQ/m^3 in France. As the calculation of dioxin/furan concentration in the ambient air is based on the data on their releases, the highest concentrations are recorded in the regions with the highest emissions. In general, the concentration of dioxins/furans in the European countries varies from 0.1 to 25 fg TEQ/m^3 while the average value for EMEP countries is 2.5 fg TEQ/m^3.

According to the calculations made by the Meteorological Synthesizing Center "Vostok" [196], the highest concentrations of PCDD/PCDF in air were recorded in 1978–1982 and are estimated to be 3.5 fg TEQ/m^3.

As for the regional profile, the calculations clearly point out to the influence of the western transboundary transfer: the highest concentrations of dioxins/furans in the ambient air and soils are recorded in the west and south-west part of Belarus.

The estimates of concentration of dioxins/furans in natural waters and bottom sediment in Belarus are not available either.

The data of the Meteorological Synthesizing Center "Vostok" suggest that the calculated average concentration of dioxins/furans in soils in Belarus is 0.27 pg/g (ng/kg) (the average level for the European countries for surface horizon is 0.3 pg TEQ/g.) The calculated concentrations are within the range of 0.01–3 pg TEQ/g. The calculations performed by the Meteo-rological Synthesizing Center "Vostok" suggest that dioxins/furans tend to accumulate in soil; though the most apparent trend had been observed before 1994 [196].

Summary of Conclusions

In summary, it can be concluded that the Republic of Belarus pays considerable attention to the monitoring of POPs in the environmental compartments. Sizeable experience has been gained in the process of POPs environmental monitoring.

However, there are certain gaps in terms of organization of POPs monitoring in some environmental compartments. Summarizing the available data on environmental contamination by persistent organic pollutants, the following conclusions can be made:

1. Presence of sources (actual and potential) of POPs releases to the environment increases the likelihood of contamination of the environment by persistent organic pollutants. Though a considerable amount of work has been carried out, the available data on POPs concentrations in the environment does not allow to make a reliable assessment of the state of the environment and the changes induced by the surveyed sources of POPs releases. There are no data of instrumental measurements of the concentration of pesticides, PCBs, PCDD/PCDF in the ambient air. The number of measurements of POPs in surface waters, bottom sediment and dredge is insufficient. There have been almost no studies of the processes of POPs accumulation in biotic components.
2. To a larger extent, monitoring focuses on testing of the environmental compartments for the presence of chlororganic pesticides. The findings suggest that the most contaminated are the samples of waters and soils collected in the zones of direct impact of the obsolete pesticides burial and storage sites (presence of the most of POPs listed in the Stockholm Convention is reported). More often the maximum permissible concentration of DDT (and its metabolites) is exceeded. At the same time, concentrations of persistent organic pollutants in samples of surface and ground waters collected in places located a few kilometers from the residential settlements in proximity to the obsolete pesticides landfills, if detected, did not, as a rule, exceed the trace amounts.

3. In Belarus lands (soils) contain, to a varying degree, the traces of POPs pesticides and PCBs. Contamination of lands/soils by pesticides is concentrated: the soils at the sites for storage and burial of pesticides are the most contaminated. Six pesticides controlled by the Stockholm Convention have been detected in soils, notably DDT, endrin, dieldrin, chlordane, aldrin and heptachlor.
4. Concentration of pesticides in soil samples, most often, is just a fraction of the established norms (the maximum permissible concentration and the approximate permissible concentration). However, in some cases concentrations are fairly high: up to 28 times of the maximum permissible concentrations for DDT; up to 0.5 times of the maximum permissible concentrations for heptachlor; up to 2,880, 150 and 4 times of approximate permissible concentration – for dieldrin, endrin and aldrin respectively. Concentration of chlordane ranges from 0.47 to 19.2 μg/kg.
5. Presence of POPs pesticides was detected in 31.5 % samples of agricultural lands in 2003, 24 % in 2004 and 12 % in 2005; and 34 % in 2003 and 33 % in 2004 for the background territories. The number of samples containing POPs pesticides tends to decrease.
6. Random surveys of the pesticide burial and storage sites have indicated that 27 out of 100 soils samples contained DDT, 13 – endrin, 8 – heptachlor, 7 – chlordane, 5 – aldrin and 4 – dieldrin. The concentration of pesticides in the soils of the impact zones of large storehouses sometimes exceeds the concentration of pollutants in the localities of the obsolete pesticides landfills.
7. The maximum concentrations of PCBs in soils are recorded in places where leakages from the PCB-containing equipment occur. Distribution of PCBs in soils is highly diversified: “spots” with extremely high concentrations of PCBs are localized, most often the size is about 20–30 cm in diameter; the highest concentra-tions are recorded in surface horizons of soil (0–10 cm).
8. PCB-28 isomer (the group of trichlorbiphenyls) clearly prevails in the structural composition of PCB compounds in the soils of sites where PCB-containing capacitors are installed or stored.
9. The presence of pesticides is periodically detected in surface waters. The detected concentrations of pesticides in water, as a rule, are within the establi-shed norms.
10. Almost every third water sample collected at transboundary monitoring points contains insignificant concentrations of POPs pesticides. The presence of POPs in surface waters subject to transboundary monitoring exceeding the maximum permissible concentration has not been identified.
11. The most contaminated are the surface waters located close to the obsolete pesticides landfills. Most often, an excessive concentration of DDT is recorded. When pesticides are detected in water, it is not always feasible to identify the source of surface waters contamination.
12. The presence of endrin, DDT and its isomers, aldrin, chlordane and heptachlor are periodically detected in surface waters in the localities of the obsolete pesticides landfills. Except for isolated cases, the concentrations of pesticides detected in ground waters in the localities of the obsolete pesticides landfills exceed the norms established in Belarus.
13. The absence of the data on the concentration of pesticides at the background network of surface waters monitoring within NEMS does not allow to make any conclusions about the extent of surface waters contamination by POPs pesticides.
14. In the current situation it seems reasonable to study the condition of the environmental compartments (soil, surface and ground waters, bottom sediment, dredge, biota) in the localities of the largest stockpiles of POPs. The findings should form a basis for justification of the Comprehensive Program for Monitoring of POPs in Belarus.

6.2. Analysis of the Existing Capacity for POPs Monitoring in the Republic of Belarus

Analysis of the Current Regulatory and Methodological Framework for Measuring Persistent Organic Pollutants in the Environment

The current methodological framework for measuring POPs in the environmental compartments incorporates the international and national standards as well as the methodologies of measurements, which are used by the laboratories for monitoring and control of POPs content in the environment.

The available data suggest that Belarus does not have standardized methods for sampling of ground waters, ambient air, releases from stationary sources and suspended particles for subsequent measurement of POPs.

The most elaborated is the methodological framework for sampling of surface waters (there are standards СТБ ГОСТ Р 51592–2001 "Water. General sampling requirements (based on ISO 5667, part 1–6)" and СТБ ИСО 5667-14. "Quality of water. Guidelines for ensuring the quality of collecting and handling water samples") and bottom sediment (the standards РД РБ 0212.1–2002. "Temporary guidelines for sampling bottom sediment" and ГОСТ 17.1.5.01–80 "Environmental protection. General requirements to bottom sediment sampling in water bodies for analysis of contamination". The situation with soil sampling is similar: Belarus has established the standards ГОСТ 17.4.3.01–83. "Environmental protection. Soils. General sampling requirements" and ГОСТ 17.4.4.02–84. "Environmental protection. Soils. Methods of collection and preparation of samples for chemical, bacteriological and helminthological analysis". Some of the listed methodologies have been adapted to the international standards.

Similar situation is reported for the preparation and purification of samples (Table 6.2).

Table 6.2
List of the current methodologies for sample preparation and purification in Belarus

POPs	Environmental compartment	International standards and measurement methods	Current standards and measurement methods in Belarus
Pesticides (aldrin, dieldrin, endrin, chlordane, DDT, toxaphene, mirex, heptachlor, hexachloro-benzene) **PCB** (10, 28, 52, 118, 138, 153 and 180) **PCDD/PCDF**	Water matrix (surface and ground waters)	**US EPA. Method 3520.** Preparation of samples of water matrix using the method of extraction "liquid-liquid".	**Analogue of the US EPA 3520 method** permitted for use by the State Committee for Standardization of the Republic of Belarus. Methodology of preparation of samples of water matrix by the method of extraction "liquid-liquid".
	Solid matrix (bottom sediment, suspended particle, soils)	**US EPA. Method 3540.** Preparation of samples using Soxhlet extractor. **US EPA. Method 3541.** Automatic extraction with Soxhlet apparatus.	**Analogue of the US EPA 3540 method** permitted for use by the State Committee for Standardization of the Republic of Belarus. Methodology of extraction of semi-volatile organic compounds from solid matrix using Soxhlet extractor.
		ISO 11464:1994 Soil quality. Initial preparation of soil samples for subsequent physical and chemical tests.	**РД РБ 0212.1–2003.** Methodology of preparation of samples of solid matrix for separation of organic compounds using the method of extraction with the shaking device.
		US EPA. Method 3600 B. Methods of purification of extracts for testing for the presence of organic substances.	Generalized analogue is not available. Purification is described in the national standards and MM for POPs detection.

While there are accepted standards for soils and water, the methodologies for air are not available.

To enable monitoring of POPs in ambient air and assessment of POPs releases, Belarus needs to adapt the international standardized methodologies for detection of pesticides, PCBs and dioxins, which also include collection and preparation of samples.

Given the expected abolishment of the standards of the former Soviet Union since 2007, soil sampling methods should be also updated in the nearest future.

The analysis of the international methodological framework suggests that the method of gas chromato-graphy with electronic capture detector (Table 6.3) is used for detection of pesticides and certain PCBs in all environmental compartments. A method of gas chromatography of high resolution with mass-spectrometric detection of high or, much more rarely, low resolution is used for detecting dioxin-like PCBs and PCDD/PCDF. The most reliable method of detecting PCDD and PCDF in various matrices is the method of isotopic dilution with detection by means of chromato-mass-spectrometry of high resolution ensuring very high sensitivity and selectivity, which are required for such analysis. It should be noted that this method is fairly labor-intensive and requires special personnel training.

Given the results of POPs measurement (in most cases trace concentrations have been detected) in the environmental compartments, the main constraint of all methods of POPs detection is the procedure of preparing samples for analysis, which includes the extraction of target components from the samples and their purification from concomitant elements. The reliability of the results would depend on whether this stage of the methodology is correctly and successfully performed. Almost all international methodologies listed in Table 6.3 provide for the use of methods of classical organic chemistry for soil preparation and purification. The more contemporaneous method described in US EPA 3550 A is a method of POPs extraction from solid samples by means of microwave radiation. However, automatic and semi-automatic methods are used in daily practices for soil preparation. These methods increase the degree and selectivity of extraction of target components with simultaneous reduction of time and considerable saving of solvents. The methods of solid-phase and microsolid-phase extraction are widely used for water samples; vapor-phase automatic extraction and microwave radiation extraction as well as low-temperature (cryogen) extraction are used for solid samples.

It is also worth mentioning the standardized methodologies for extraction and analysis of PCDD/PCDF developed in the Russian Federation. These methods are listed in the register of the State Standardization Committee of the Russian Federation and allow to measure PCDD and PCDF concentrations in samples of drinking water, surface natural waters and treated wastewaters using the method of chromato-mass-spectrometry – ПНДФ 14.1:2:4.124–97; ambient air – ПНДФ 13.3.9–97; gaseous releases to atmosphere – ПНДФ 13.3.10–97; soils – ПНДФ 16.1.7–97; sludge – М7/97; fish – М10/97; waste mineral oils and petroleum products – М11/97. Similar methods for ambient air are registered by the Sanitary Epidemiological Control Department (МУК 4.1.023–95). Methodologies include sampling, application of isotopic tracer labeling standards (method of isotopic dilution), extraction, purification at the column with activated carbon, multi-layer (asid-base) column, alumina column and chromato-mass-spectrometry itself. The methods have been developed based on the international experience (including such methodologies as US EPA 1613, 8280, 8290, 1668 and etc.); considerable improvements and changes have been made.

Persistent organic pollutants are alien compounds for the environment. Therefore, setting of norms of POPs concentrations in the environment is one of the essential pillars of the assessment of the condition of the environmental compartments. That is why the countries use different criteria of the assessment of the hazard (level) of contamination of the environment. The maximum permissible concentrations of POPs established in various countries often differ by orders of values.

Table 6.3
List of methodologies for POPs measurement in the environmental compartments

POPs	Environmental compartment	International standards and measurement methods	Current standards and measurement methods in the Republic of Belarus
Pesticides (aldrin, dieldrin, endrin, chlordane, DDT, toxaphene, mirex, heptachlor, hexachloro-benzene) **PCB** (10, 28, 52, 118, 138, 153 and 180) **PCDD/PCDF**	Surface and ground waters	**ISO 6468–1996** Water quality. Detection of chlororganic pesticides, polychlorinated biphenyls and chlo-robenzene. Gas chromatography method after extraction "liquid-liquid" (DIN EN ISO 6468-1997).	**СТБ ИСО 6468–2003.** Water quality. Detection of chlororganic pesticides, polychlorinated biphenyls and chlorobenzene. Gas chromatography method after extraction "liquid-liquid".
		US EPA. Method 8270. Detection of semi-volatile organic compounds using gas chromatography method.	**Analogue of the US EPA 8270 method** permitted for use by the State Committee for Standardization of the Republic of Belarus. Methodology of measuring semi-volatile organic compounds using chromato-mass-spectrometry method.
		ISO/TS 11370:2000. Detection of certain organic substances for crop treatment/protection using automatic technique of preparation.	**РД 52.24.66-88.** Methodological guidelines on detection of galogenoorganic pesticides and their metabolites in surface waters.
	Soil, bottom sediment, suspended substances, wastes (insulating liquids)	**ISO 10382:2002.** Soil quality. Detection of chlororganic pesticides and PCBs. Gas chromatography method with ECD.	Measurement method **МВИ № 3.1.3-4; 3.1.6-7.** List of measurement methods permitted for application …. T.1. Methods of measurement of concentration of HCCH, DDT and DDE using gas-liquid chromatography.
			РД 52.18.578–97. Methodological guidelines. Mass share of a total of PCB isomers in soil samples. Gas-liquid chromatography measurement method.
		US EPA. Method 8080 A. Detection of chlororganic pesticides and PCBs using gas chromatography method.	**МВИ.МН 2126–2004** Method of measurement of PCB concentration in soil using gas-liquid chromatography.
		US EPA. Method 8270. Detection of semi-volatile organic compounds using chromato-mass-spectrometry method.	**Analogue of US EPA 8270 method** permitted for use by the State Committee for Standardization of the Republic of Belarus. Methodology of measuring semi-volatile organic compounds using chromato-mass-spectrometry method.
		IEC 651619:1997. Insulating liquids. Contamination by PCBs. Detection at capillary column using gas chromatography method.	**СТБ/МЭК 651619–2003.** Insulating liquids. Contamination by PCBs. Detection at capillary column using gas chromatography method.
		US EPA. Method 8280. Detection of PCDD/PCDF using high resolution gas chromato-graphy method / low resolution mass spectrometer (HRGC/LRMS).	**Analogue of US EPA 8270 method** permitted for use by the State Committee for Standardization of the Republic of Belarus. Methodology of measuring semi-volatile organic compounds using chromato-mass-spectrometry method (HRGC/LRMS).
		US EPA. Method 8270. Detection of semi-volatile organic compounds using chromato-mass-spectrometry method.	**Analogue of US EPA 8270 method** permitted for use by the State Committee for Standardization of the Republic of Belarus. Methodology of measuring semi-volatile organic compounds using chromato-mass-spectrometry method.

The findings of the analysis of the current regulations (for ambient air – ГН 2.1.6.12.-46–2005, for water – СанПин 10-124 РБ 99, ГН 2.1.5.10-21–2003; for soils – ГН 2.1.7.12-1–2004, ГОСТ 17.4.1.02–83) have sug-gested that the norms of POPs concentration in the environmental compartments are set with regard to the following POPs:

aldrin – *in ambient air* in residential areas the approximate safe level of exposure is 0.5 μg/m^3;
the maximum permissible concentration *in drinking water* is 0.002 mg/l;
the approximate permissible concentration *in soil* is 0.0025 mg/kg;
WHO recommended norms of aldrin concentration *in drinking water* – 0.03 μg/l (total of the components of aldrin and dieldrin);

dieldrin – *in soil* the approximate permissible concentration is 0.0005 mg/kg;
WHO recommended norms of the concentration *in drinking water* – 0.03 μg/l (total of the components of aldrin and dieldrin);

endrin – *in soil* the approximate permissible concentration is 0.001 mg/kg;
WHO recommended norms of endrin concentration *in drinking water* – 0.6 μg/l;

hexachlorbenzene – *in ambient air* in residential areas the approximate safe level of exposure is 13 μg/m^3;
in soil – 0.03 mg/kg (the approximate permissible concentration);
in drinking water – 0.05 μg/l;

DDT (total of isomers) – the maximum permissible concentration *in drinking water* is 100 μg/dm^3;
the maximum permissible concentration *in water used for fishery* – 100 μg/dm^3;
the maximum permissible concentration *in soil* is 0.1 mg/kg;
WHO recommended norms of the concentration of DDT (total of isomers) *in drinking water* – 1 μg/l;

heptachlor – the maximum permissible concentration *in drinking waster* is 0.05 mg/l and mg/kg respectively;
the maximum permissible concentration *in water used for fishery* – 1 μg/dm^3;

toxaphene – the approximate permissible level *in drinking water* is 0.005 μg/l;

PCB – the approximate permissible concentration in soil for a total of isomers is 0.02 mg/kg;
PCB 28 and 52 – 0.001 mg/kg; PCB 101, 118, 138, 153 and 180 – 0.004 mg/kg;
the approximate safe level of exposure of trichlorbiphenyls *in the air in residential settlements* is 0.001 mg/m^3;
the maximum permissible concentration of PCBs *in the air at workplaces* is 1 mg/m^3;
the maximum permissible concentration of trichlorbiphenyls and pentachlor-biphenyls *in the water bodies used for water supply* is 0.001 mg/dm^3;

PCDD/PCDF – the approximate permissible level *in drinking water* is 0.035x10^{-3} μg/l.

Equipment and Analytical Capacity for POPs Environmental Monitoring in the Republic of Belarus

The analysis of the technical capabilities of the laboratories suggests that at present the best technical capabilities for POPs measurements in Belarus are available in two laboratories: the Department of Analytical Control Organization of the Ministry of Natural Resources and Environmental Protection and the laboratory of the Republican Research and Technical Center “Ecomir”. For measuring POPs these laboratories have 2 chromato-mass-spectrometers manufactured by Agilent Technologies (chromatographs HP 6890 and HP 5890 with mass-detectors series 5972A and electronic capture detectors) which were produced in 1994–1995.

It should be noted that in 2004 the Department of Analytical Control Organization of the Ministry of Natural Resources and Environmental Protection was registered in the Laboratory Network of POPs Global Monitoring. Besides, both laboratories are certified by method СТБ ИСО/МЭК 17025–2001 for performing analytical testing of the presence of chlororganic pesticides and PCBs in waters, soils, wastes, transformer oils in accordance with the internationally accepted methods (СТБ ИСО 6468–2003, СТБ МЭК 61619–2003, СТБ ИСО 5667-14–2002, US EPA 8270, 3540, US EPA 3510).

Summary of Conclusions:

1. The regulatory methodological framework for measuring persistent organic pollutants in the environment has been established and applied in the Republic of Belarus. Some methodological approaches and the methodological framework for POPs measurement in the environmental compartments have been aligned with the international standards.
2. There are no standardized methods of collecting samples of surface waters, ambient air, releases from stationary sources and suspended particles.
3. Hygienic norms pertaining to all persistent organic pollutants controlled by the Stockholm Convention should be approved in Belarus to enable comprehensive monitoring of POPs in the environmental compartments and assessment of the degree and extent of contamination.
4. Though the country has certain technical capacity and skilled personnel for the measurement of POPs (especially in terms of the analysis of chlororganic pesticides and polychlorinated biphenyls in the environmental compartments and technical products (surface, ground and drinking water, bottom sediment and biota, soil and wastes, transformer oil), at present there are no technical capabilities (devices, technical regulations and skilled personnel) for detecting toxaphene, mirex, dioxins and furans in the environmental compartments.

ANNEX 7

Assessment of the Problems in the Sphere of Healthcare and Environmental Protection in Connection with the POPs Impact

Introduction

The group of persistent organic pollutants comprises dioxins and dioxin-like compounds – polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs), polychlorinated biphenyls (PCBs), polyvinylchloride (PVC) and a number of other substances containing the atoms of chlorine in their molecule. In the organisms of the warm-blooded POPs first get into adipose tissues and then redistribute accumulating mainly in the liver and afterwards in thymus and other organs.

POPs are highly toxic even in small concentrations, they are universal cellular poisons and characterized by ubiquity of their distribution in the environmental compartments, persistency to chemical and biological decomposition; they are capable of preserving in the environment for dozens of years and they are transported through food chains.

Highly chlorinated PCDDs have a comparative time of semiejection from the human organism of about 3–6 years.

There have been described a number of symptoms provoked by POPs and resulted from both professional contact and environmental influence. They are the following:

1) Skin manifestations – chlorine acne, hyperpigmentation, hyperkeratosis, hirsutism, elastosis;
2) System effects – hepatic fibrosis, elevated cholesterol content, lack of appetite and loss of weight, digestion disorder (vomiting, nausea, intolerance to alcohol and fat food), aches in muscles, joints, feebleness in limbs, lymphatic glands augmentation, disorders of cardiovascular system, urinary tracts, respiratory tract, pancreas, elevated content of transaminase and triglycerides in blood;
3) Neurological effects – sexual disorders (lack of libido, impotency), headaches, neuropathy, deafness, lack of smell, taste, eyesight disorder;
4) Psychic effects – insomnia, depression, inertia, unmotivated fits of aggression.

Major diseases are chlorine acne and liver disorders. Chlorine acne – is a severe form of acne disfiguring the face. The disease can persist for years and it is practically incurable.

Carcinogenesis. The question whether dioxins cause oncological diseases in human beings is not solved yet. Research conducted in Sweden and Finland reveals minute augmentation of oncological risk but at the same time there are no data on the content of TCDDs and other dioxins in the tissues of the working people, i.e. on the absorbed dose. Research of American scientists (study of the state of health of the Vietnam war veterans) did not confirm higher figures of mortality from oncological pathology in this group. Epidemiological studies of carcinogenesis in human population under the dioxins effect are rather rare, which is quite the opposite about the experimental studies on animals, which prove a significant potentiation effect of dioxins on carcinogenesis.

Other effects of POPs:

- Neurobehavioral changes and changes of the function of the thyroid in infants, who were fed by breast milk in comparison with artificially fed babies;
- Prominent cumulative effect (intake of even minute doses of 1-3 ng/kg can lead to the condition of secondary immunological deficiency);
- Gonadotoxic, embriotoxic and mutagenic effects (the influence of dioxins on the genetic level is identified);
- Physical and mental developmental lagging;
- Reduction of a life span.

The problems caused by DDT and other chlorinated pesticides can be summarized as follows:

1) Development of resistance in pests to these chemicals;
2) Persistence of pesticides in the environment and their accumulation on growing concentrations in organisms;
3) Rebirth of pests and repetitive outburst of their number;
4) Growing expenses for the use of pesticides;
5) Negative impact on the environment and human health.

Pesticides are one of the reasons of extinction of species. Being a selection factor they are capable of damage of the genetic system of a cell and mutation infliction. Even inconsiderable evolutionary displacement leads in the end to the changes of the genetic system of an organism and then to the change of behavior, which eventually can influence further evolution. DDT suppresses photosynthesis of green algae, impairs the quantity of some microorganisms, and this can influence the species diversity and disrupt food chains. Repetitious application of DDT can evoke persistence of a number of bacteria. DDT and its metabolites are highly toxic for fish; they disrupt the processes of development and behavior, produce mutagenic and carcinogenic effects. It has been proved that DDT, in particular its major metabolite DDE conditions the thinning of egg shell of the mallard, the bald eagle, the Japanese quail and a number of other birds. A considerable reduction of the wild birds' population has one more consequence – secondary effect of the augmentation of a number of rodents, which are killed mainly by these species of birds. DDT can also cause sex inversion.

The influence of DDT on people's health is especially dangerous and less studied. It is significant that during a decade, from 1970 to 1980 the DDT poisoning rate grew up to 250 %. In humans as in other mammals DDT is accumulated mostly in adipose tissue, but it can also exude with breast milk and even penetrate through placental barrier.

If exposed to DDT people can be affected by hormonal disfunction, kidneys disorder, central and peripheral nervous system disorder, cirrhosis, and hepatitis. Regardless the practical absence of genotoxicity DDT belongs to group 2B of cancer risk. Thus, DDT should be regarded as an agent with a high level of hazard to the environment and human health.

DDT hazard as well as other pesticides hazard, conditioned mainly by their long-lasting persistence in the environment, is still paramount nowadays, despite that at the beginning of the 1970s production and use of several pesticides were banned. At the same time ban of DDT is not universal. In Australia and China it is still used for fruit gardens and plantations treatment, and it is still being produced in India.

Thus, there is no doubt that POPs are present in the environment almost everywhere and they are capable of negative impact upon the environment and people's health.

This analytical review contains the available information on the POPs impact on the environment and population of Belarus.

7.1. Analysis of the Available Data on the Estimated Level of Contamination of the Environment (Soils, Surface Waters, Drinking Water and Food Products) by Chlororganic Pesticides

The concentration of chlororganic pesticides has been monitored since 1960s and to a certain extent this allows to make a judgement on the change of their concentration in food products and the environment.

The concentration of pesticides listed as POPs in the environment has been measured on a regular basis by nature conservation authorities since 1996 within the framework of the monitoring of anthropogenically contaminated lands and within the framework of surface waters monitoring carried out by the sanitary inspection authorities.

The analysis of the available data suggests that DDT and its metabolites were registered in most samples of soils of arable lands during the whole surveyed period. However, based on the data for 2004, it should be noted that the highest average concentration of the residues of this POP in soils was reported in the Grodno region. The highest concentration of DDT in soils (1.68 of maximum permissible concentration for soil) was recorded at the "Rutkevichi" reference point (the Schuchin district of the Grodno region).

DDT, its metabolites and HCCH (4 isomers) are included in the program of regular monitoring of surface waters' hydro-chemical content covering 83 water reservoirs of the country (over 100 monitoring sites). During the last five years the tests have not identified the referred POPs in the samples of surface waters.

To support the efforts on the improvement of monitoring of hydro-chemical content of surface waters, tests for DDT and HCCH have been carried out since 2005 at 35 points located at the transboundary segments of rivers.

Field tests conducted in 2001–2002 within the framework of the international projects in the basins of the Zapadny Bug, the Dnieper and the Zapadnaya Dvina formed a sound basis for the development of approaches to organizing and maintaining a regular monitoring of hydro-chemical content of surface waters at the transboundary segments of rivers.

Three field surveys intended to assess the quality of water and bottom sediment of the Bug River were conducted within the framework of the Bug River monitoring on the territory of Belarus. The list of chemicals to be measured included, among others, chlorine-containing pesticides (notably aldrin, DDT and its metabolites, dieldrin, heptachlor and hexachlorbenzene) and PCBs. The report summarizing the survey findings noted that concentration of pesticides and PCBs detected in water and bottom sediment samples was lower than the threshold of detectability.

The tests of bottom sediment and fish conducted in the Dnieper River basin registered almost all pesticides listed in the Stockholm Convention. For example, the DDE content (one of the DDT metabolites) in fish made up 12 μg/kg.

Chemical and analytical tests of the bottom sediment samples taken from the Zapadnaya Dvina in the course of a monitoring expedition registered DDT and its metabolites, aldrin, dieldrin, endrin, heptachlor and polyaromatic hydrocarbons at a level of 1–10 μg/kg.

Isolated data obtained during the field surveys cannot be a sound basis for the assessment of the condition of water in the referred river basins. At the same time the findings allow to state that measurement of POPs should not be limited to rivers and lakes only. As all POPs demonstrate potential for bio-accumulation associated with high ability of dissolving in organic environment as well as lipids and relatively low water solubility, in future it would be reasonable to employ eco-system approaches to the monitoring of surface waters.

At present measurement of the concentration of POPs listed in the Stockholm Convention does not make a part of surface waters monitoring.

However, beginning from 2005, local monitoring in the Republic of Belarus envisages establishment of a list of natural resource users who are obliged to monitor the condition of ground waters near the sources producing an adverse environmental impact. Thus, the list of chemicals to be tested within the monitoring of ground waters around the obsolete pesticides storage sites includes aldrin, endrin, dieldrin, heptachlor and hexachlorbenzene, DDT and its metabolites as well as other toxic organic chemicals which are not currently listed in the Stockholm Convention.

Since 2005 more than 50 natural resource users are supposed to organize and conduct local monitoring of chemicals including POPs. The findings will be presented in the Annual Information and Analytical Review "National System of Monitoring in the Republic of Belarus: Findings of Observations 2005".

The findings of the extensive scientific research and monitoring have made a valuable contribution to the development of criteria for identification of the natural resource users who are supposed to organize and conduct local monitoring of ground waters.

Since the mid-1990s the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus has implemented a number of research projects aimed at the assessment of the level of environmental contamination with POPs around the sites for stockpiling and landfill of obsolete pesticides.

The level of contamination of the environment has been assessed around the largest obsolete pesticides landfills: the Dribin landfill (the Mogilev region), the Slonim landfill (Albertin forestry, the Grodno region), the Brest landfill (Gershony, the Brest region) and the Verkhnedvinsk landfill (the Vitebsk region).

The findings of the analytical studies have demonstrated that some samples of water, soil, surface and ground waters contain chlororganic chemicals including aldrin, endrin, dieldrin, HCCH, DDT and its metabolites and heptachlor. In most samples the concentration did not exceed the maximum permissible level.

However, the water samples taken near the Verkhnedvinsk obsolete pesticides landfill contained endrin, DDT and its isomers as well as heptachlor and γ-HCCH (lindane) and their concentration exceeded the maximum permissible levels (0.014 mg/l of heptachlor while the maximum permissible concentration is 0.001 mg/l and 0.0067 mg/l of γ-HCCH while the maximum permissible concentration is 0.002 mg/l).

The annual research monitoring programs have been implemented since 2002. In spring and summer 2002 samples of soil, surface and ground waters were taken around the pesticides storage sites in Molodechno (the "Usha" site of OJSC "Agrokhimiya"); in Slutsk (a storehouse for mineral fertilizers of OJSC "Agrokhimiya"); in Borisov (a storehouse for mineral fertilizers of OJSC "Agrokhimiya") and in Lyuban (a storehouse for insecticides of OJSC "Agrokhimiya"). The tests detected heptachlor, aldrin, dieldrin, DDT metabolites and endrin in some samples. The concentration of heptachlor in the soil sample taken in Slutsk was three times higher than the maximum permissible level (0.146 mg/kg of soil while the maximum permissible concentration is 0.05 mg/kg of soil).

In 2003–2004 contamination of the environment was measured around municipal solid waste disposal sites and sludge beds of municipal sewage water treatment facilities in the regional capitals and large industrial cities including the "Trostenets", "Severny" and "Prudische" municipal waste disposal sites (Minsk). Pesticides and polychlorinated biphenyls listed in the Stockholm Convention were not detected.

As noted before, the state sanitary inspection authorities have monitored the concentration of chlororganic pesticides in water, soil and food products for quite a long period, since the times when the use of these pesticides was allowed in Belarus.

Over 37 thousand tests for DDT, hexachlorane and other chlorine-containing pesticides were conducted in Belarus between 1967 and 1971. The percentage of contamination of food products by chlororganic pesticides averaged 13.4 % – 3.8 % (in 1967 and 1971 respectively) including in excess of the maximum permissible concentration – 7.8 % and 2.1 % [report on Scientific Research Work "Survey of Contamination of Food Products with Pesticides across Regions". – Belarusian Research Institute of Sanitary and Hygiene, 1972.]. The highest concentration of the residues of chlororganic pesticides was detected in potatoes. This can be explained by the extensive use of DDT against Colorado beetle. In 10 % of samples the detected concentration exceeded the maximum permissible concentration. The excess of the maximum permissible concentration was registered in other vegetables, milk (associated with fodder contamination and use of chlororganic pesticides (aldrin, DDT and hexachlorane) in veterinary practice), and eggs.

At present food products are tested mainly for DDT, its metabolites, and HCCH.

In 2004 the laboratories of the sanitary inspection authorities tested 32,760 samples of which 17 failed to meet the sanitary norms and requirements. The laboratory of the Republican Center of Hygiene, Epidemiology and Public Health made 2,845 tests for pesticides. HCCH was detected in 312 samples (11 %). The highest concentration was detected in onion (0.36 mg/kg).

According to the data of the Brest Regional Center of Hygiene, about 30,000 tests for residues of pesticides have been made since 2000. 12,635 samples of food products, 1,349 samples of drinking and surface water, and 153 samples of soil have been tested

for DDT. It should be noted that 21 (0.16 %) samples of food products contained DDT but its concentration was within the permissible level. The percentage of detection is not high but the fact of detection of DDT itself is a reason for concern. Taking into consideration that the use of DDT in the country has been banned for about 20 years already, it is fairly difficult to explain its current presence in food products. Most likely the tests have detected the products of its decay. Out of 12,676 samples of food products tested for HCCH, the residues were detected in 10 samples. Tests for the residues of aldrin, heptachlor and hexachlorbenzene (84, 40 and 3,492 tests respectively) proved the absence of these chlororganic pesticides in food inputs and products. The tests did not detect the residues of DDT and HCCB in drinking water, water reservoirs and soils. It is worth noting that the number of tests increases every year and there are significant variations. For example, 35 water samples were tested for DDT in 2002 and 533 – in 2004. On the one hand, the increasing number of tests ensures a more extensive control of chlororganic pesticides, but on the other hand this is the evidence of the lack of recommendations on how to select locations for sampling including identification of contaminated areas and control of the daily intake by age groups and segments of the population. Elaboration of such recommendations can be a subject for targeted studies within the framework of the development of social and hygienic monitoring system.

According to the data of the Vitebsk Regional Center for Hygiene and Epidemiology, 1,092 tests of samples of food products, water and soil for DDT, aldrin and heptachlor were made between 2000–2004. The tests of 188 samples of food products and 35 samples of water did not detect DDT. Nevertheless, it was detected in 19 out of 163 samples of soil (11.7 %). Detection of pesticides in the soil of the region subject to monitoring is relatively high. In 2001, 3 out of 21 (14.3 %) soil samples contained aldrin; in 2002 nearly half of the tested samples (20 out of 57) contained the residues of aldrin. In recent years heptachlor has been frequently detected in soils: in 2003 three out of four tested samples (20 out of 27) contained heptachlor; in 2004 it was detected almost in each fifth sample (23 tests, 5 detections). In 2001 DDT was detected in over half of the tested soil samples (21/13); and in each fourth tested sample (24/6) in 2004. In the Vitebsk region chlororganic pesticides were also detected in drinking water. In 2002 aldrin and heptachlor were detected in 3 out of 4 tested samples (75 %). In 2003, 7 out of 9 tested samples contained heptachlor.

In the period of 2000–2004, 21,450 samples of food inputs and products were tested in the Grodno region, including 15,741 tests for DDT, 105 tests for aldrin, 374 tests for heptachlor and 5,230 tests for hexachlorbenzene. Every year residues of DDT and hexachlorbenzene were detected in some samples. For example, the percentage of DDT detection averaged 1.4 % ranging from 0.87 % (2003) to 2.10 % (2002). Hexachlorbenzene was detected in nearly 1 % of samples (46 out of 5,230). No residues of aldrin and heptachlor were detected in food inputs and products. Samples of soils, drinking and surface water were tested for DDT. 1,654 water samples and 271 soil samples were tested and no residues of DDT were registered.

The results of laboratory analysis of drinking water for DDT conducted in the period of 2000–2004 in the Gomel region suggest that no residues of pesticides were detected in 710 samples. Over 11 thousand samples of food inputs and products have been tested for the last five years; the concentration of residues of chlororganic pesticides and their metabolites did not exceed the permissible levels. Permissible concentration of DDT was detected in 98 samples.

In the period of 2000–2004 no residues of DDT, aldrin and heptachlor were detected in the Minsk region. For the last five years 15,079 samples of food products have been tested for DDT, 1,300 samples – for aldrin and 591 sample – for heptachlor. Out of 2,639 water samples, DDT was detected in 2,304 samples, aldrin – in 215 samples, and heptachlor – in 120 samples. The content of 50 soil samples was examined, 30 samples contained DDT.

2,946 tests (mainly for DDT – 2,846) have been conducted for the last five years in the Mogilev region.

The analysis of the data on monitoring of the residual content of chlororganic pesticides conducted by the sanitary inspection authorities can be summarized as follows:

- During the surveyed period (over 30 years) both the concentration and percentage of detections of pesticides classified as POPs in food products tend to decrease;
- In most cases the list of chemicals subject to monitoring is limited to DDT, aldrin and heptachlor;
- Methods of laboratory testing vary depending on the equipment available in the centers;
- Magnitude of testing demonstrates considerable variations across regions (32,353 in the Brest region and 1,092 in the Grodno region) and in terms of the structure of testing (samples of food inputs and products account for 90% while contamination of soils is tested very rarely);
- Residues of chlororganic pesticides have been detected in the Brest, Vitebsk, Gomel, Grodno and Mogilev regions; detection of DDT and HCCH tends to prevail in the Brest region; aldrin and heptachlor – in the Vitebsk region; DDT – in the Gomel region, DDT and hexachlorbenzene – in the Grodno region;
- Percentage of detections vary across regions (ranging from 0 in the Minsk and the Vitebsk region to 1.2 in the Grodno region), type of samples (food products, water and soil), and surveyed periods (in the Grodno region the percentage of detections vary from 2.1 % to 0.9 % depending on the surveyed annual period);
- The highest percentage of detection of pesticides classified as POPs in water and soil (up to 75 %) has been recorded in the Vitebsk region. This is attributed to the specifics of sampling (locations of the obsolete pesticides landfills).

Concentration of Pesticides Classified as POPs in Food Products across Regions

The tests conducted within the framework of the state sanitary inspection give an idea of the general situation with food contamination. However, it does not provide a detailed systematic analysis of contamination of the food products by POPs in all the regions of Belarus. Research studies in the individual regions and surveys of a daily diet of various groups of the population (for example, pregnant women and nursing mothers) can give a better picture of the contamination of food products. Research studies and surveys have been conducted by the Republican Center for Expert Assessment of Food Quality and Safety.

The research was intended to quantify the residues of chlororganic pesticides in basic food products consumed by households in the Mogilev region (Mogilev, the Bobruisk, the Krichev, the Slavgorod, the Osipovichi, the Bykhov, the Kostyukovichi and the Krasnopolie districts) and the Gomel region (Gomel, Svetlogorsk, Vetka, Mozyr, the Bragin, the Narovlya, the Kormyany, the Khoiniki and the Chechersk districts). The survey covered locally produced food including bread (rye-bread and white bread), milk, meat (beef, pork, chicken) and vegetables (potatoes and sugar-beet).

Certain concentrations of chlororganic pesticides including aldrin, HCCH and its isomers (α-isomer, β-isomer, γ-isomer), heptachlor, DDT and its metabolites (DDD and DDE) have been identified.

Heptachlor, aldrin and DDT have not been detected in tested food products. There are food products which virtually do not contain chlororganic pesticides, for example apples (4 samples have been tested), drinking water (7 samples, of which 4 samples contained DDE < 0.01 μg/l), sugar-beets (1 out of 11 samples contained DDE in the amount of 0.03 μg/kg), potatoes (6 out of 11 samples contained DDE in the amount of 0.03-0.1 μg/kg). The concentration of DDT metabolite – DDE – in carrots and cabbage was 0.05–0.2 μg/kg and 0.01–0.1 μg/kg respectively.

The highest concentration of DDE was registered in rye-bread and white bread (0.06–0.15 μg/kg). Dairy products contained DDE and α-, β- and γ-isomers of HCCH: the concentration of α-, γ-isomers was 0.03–0.2 and β-isomer – 0.1–0.7 μg/kg. As a rule, milk samples contained one of the monitored isomers. DDE residues were detected in milk (0.05–0.3 μg/l).

The concentration of chlororganic pesticides in fat-rich food products was a bit higher, which can be explained by the lipophilic nature of chlororganic pesticides. Concentration of chlororganic pesticides in sour cream and butter is much higher than in milk: the concentration of DDE ranged from 0.3 to 0.8 μg/kg and from 0.1 to 2.5 μg/kg respectively.

Unlike milk, two and more isomers of HCCH were simultaneously detected in butter.

Small amount of DDE (0.05–4 μg/kg, 1.5–3 μg/kg and 0.1–1.5 μg/kg respectively), as well as residues of HCCH isomers were detected in chicken, beef and pork.

9 samples of eggs were tested. DDE and HCCH isomers were detected in all samples (the concentration ranged from 0.2 to 1 μg/kg).

Samples (80) taken in various districts of the Gomel region contained no residues of γ-HCCH, DDT, heptachlor and aldrin. The residues of α-HCCH were detected in one sample of milk (1 μg\kg) and one sample of pork (16 μg/kg) from the Khoiniki district.

The residues of hexachlorbenzene (HCB) were detected in 6 samples including one sample of milk from the Khoiniki district (5.5 μg/kg); sample of milk from the Narovlya district (0.3 μg/kg), two samples of chicken (7 μg/kg from the Chechersk district and 0.4 μg/kg from the Narovlya district), samples of beef and pork from the Bragin district (0.4 and 2 μg/kg respectively). The residues of β-HCCH were detected just in one sample of milk from the Narovlya district.

Almost all tested samples (79 out of 80) contained the residues of DDE. The residues of DDE in the tested samples of milk (19 samples) ranged within 0.08–0.3 μg/kg. One sample of milk from the Narovlya district contained DDE residues in the amount of 5 μg/kg, which is within the permissible concentration. In addition to DDE, this sample contained the residues of β-HCCH (1 μg/kg), and HCB (0.3 μg/kg).

The highest concentration of DDE residues in the samples of rye-bread was 0.8 μg/kg.

DDE residues in meat (beef, pork, chicken) ranged within 0.4–2 μg/kg, 0.5–5 μg/kg and 0.8–2 μg/kg respectively.

The concentration of DDE residues in samples of potatoes and sugar-beet ranged within 0.03–0.4 μg/kg and 0.06–0.6 μg/kg respectively.

The monitoring of changes in concentration of the residues of chlororganic pesticides in food products (within 3–5 years) has demonstrated that both the number of detections and the content of chlororganic pesticides tend to reduce.

It can be therefore concluded that:

- DDE residues have been registered in almost 100 % of the tested samples and food products;
- The percentage of detection of HCCH isomers is 28 %;
- No residues of aldrin, DDT and heptachlor have been registered in the samples;
- The detected concentration is considerably lower than the permissible levels; however, in some samples the concentration of DDE residues reaches the permissible level and there are also residues of other chlororganic pesticides;
- The findings of the long-lasting monitoring suggest that the number and concentration of detected chlororganic pesticides tend to reduce;
- Food products of vegetable origin contain less residues of chlororganic pesticides than fat-rich food products.

The above referred data give an idea of contamination of domestically produced food with chlororganic pesticides. However, given the expansion of trade, food import has increased both in terms of product range and magnitude. The Belarusian households can be exposed to chlororganic pesticides contained in the imported products.

Food products categorized in accordance with “Medical and Biological Requirements and Sanitary Norms of Food Inputs and Products Quality” were tested. The following categories were distinguished: grain and cereals; sugar and confectionery; fats; tea and spices; baby food; meat products; fish, fish products and seafood.

The tests of 66 samples of grain and cereals (flour, buckwheat, rice and macaroni) imported from Poland, Hungary, the USA and other countries (16 countries altogether) identified DDE in different amounts in all samples. The highest concentration was

registered in rice imported from Czech Republic (6 μg/kg which is 3.3 times lower than the permissible level). 17 samples (25.8 %) contained γ-HCCH within the permissible levels. The highest concentration of γ-HCCH was registered in macaroni imported from Hungary (0.001 mg/kg).

The residues of DDE, α- and γ-HCCH were detected in 9 samples of sugar (imported from Ukraine) or in 45 % of the tested samples (20). Concentration of DDE in 3 samples was close to the permissible level; in one sample the concentration reached the permissible level.

280 samples of confectionery imported from Germany, Syria, Hungary, the USA and other countries (14 countries altogether) were tested within the framework of the studies. 169 samples of chocolate and sweets contained insignificant amount of DDE (< 1 μg/kg). 22 samples (13 %) contained the residues of γ-HCCH. 111 samples of biscuits and cookies contained derivatives of chlororganic pesticides in the amount much lower than the permissible level and, as a rule, it was DDE.

100 % of samples of vegetable oil imported from Poland, Belgium, Egypt and other countries (13 countries altogether) contained the residues of chlororganic pesticides of DDT group (the concentration was lower than 6 μg/kg). 4 samples (13.3 %) contained α-HCCH (4 μg/kg); 5 samples (16.7 %) contained γ-HCCH (2 μg/kg).

Testing of tea samples (57 out of 95 tests of samples under the category of "tea and spicery") identified up to 5 chlororganic pesticides (DDE, DDD, α-, β- and γ-HCCH). The detected concentrations were within the permissible levels. All metabolites of DDT and all isomers of HCCH were registered in samples of spicery. For example, pepper imported from Germany contained α-HCCH (1 μg/kg), DDE (2 μg/kg) and DDT (13 μg/kg).

75 samples of baby food imported from Germany, Russia, Poland and Bulgaria as well as samples of domestically produced baby food have been tested, including 40 samples of blends imported from Germany. All samples contained DDE metabolite (the concentration ranged between 1–5 μg/kg). Concentration of DDE in one sample was 5 μg/kg, which equals the permissible level. No products with the concentration of DDT and its metabolites above the permissible level have been identified. 16 out of 40 tested samples of dry milk blends contained γ-HCCH (1 μg/kg). 13 samples of canned meat for babies produced in Russia and Belarus have been tested. All samples contained DDE and the concentration was lower than the permissible level. Canned fruits for babies (12 samples of canned fruits for babies imported from Poland and Bulgaria) also contained DDE. In 100% of samples the concentration was within the range of 1–5 μg/kg.

To examine the concentration of chlororganic pesticides in meat and meat products, 2 samples of chicken legs (USA) were tested. HCCH (2 μg/kg) and DDE (3 μg/kg) were detected. Tests of 38 samples of sausage imported from Poland, Germany, Netherlands, Finland and Russia detected DDE (up to 18 μg/kg). Certain samples contained the residues of β-HCCH.

The highest concentration of chlororganic pesticides was registered in fish and fish products. 95 samples of fish and fish products, mainly canned products, imported from Poland, Germany, Bulgaria, the Baltic states and other countries (9 importing countries) were tested. It should be noted that the tests frequently detected DDE and DDD and, in some cases, the whole group of DDT as well as HCCH isomers. Most often α- and β-isomers have been detected (3–14 μg/kg). The concentration of residues of chlororganic pesticides was below the permissible level, but fish and fish products contained more chlororganic pesticides and in larger concentration than other products. For example, concentration of DDT metabolites in 3 out of 10 samples of cod liver ranged between 0.29 and 0.40 mg/kg.

It can be, therefore, concluded that:

- All groups of imported food products including baby food contain metabolites of chlororganic pesticides which is the evidence of their global spread;
- Detected concentrations do not exceed the permissible levels. However, in some samples the concentration of DDT metabolites equals the permissible level;
- Fish and fish products have proved to be the most contaminated in terms of the concentration and variety of metabolites of chlororganic pesticides;
- Aldrin and heptachlor have not been detected in the tested samples.

7.2. Analysis of the Data on the Level of Contamination of the Environment (Sediments, Surface Waters, Drinking Water, Food Products) with PCBs

Belarus has not yet accumulated sufficient data on the level of contamination of the environment with PCBs for assessing the impacts. Fragmented testing of water (the Bug River and its inflows), sediments and soils around disposal sites for solid municipal wastes in Minsk including "Trostenets", "Severny" and "Prudische" has not detected PCBs.

It should be noted, however, that no systemic testing of water biota intended to detect PCBs, to identify potentially contaminated water reservoirs and to assess their ecological condition has been conducted. Development of the relevant research is one of the priorities for elaboration of the efficient measures for elimination of PCBs and prevention of their adverse impact on the environment and human health.

There are fragmented data of the quantitative analysis of PCBs in water from surface reservoirs used for drinking water supply. 16 water samples of surface reservoirs used for drinking water supply and 10 samples of drinking water supplied from surface water sources chlorinated for decontamination purposes were tested for PCBs. The water of the Vileika–Minsk water supply system and drinking water supplied from this system contained no PCBs. Testing of samples of the water taken in March from the river Sozh and extracted from 3 liters detected 4 fractions of polychlorinated biphenyls: PCB-52, PCB-101, PCB-138 and PCB-153 with the concentration of 0.97 μg/dm^3, 1.06 μg/dm^3, 0.91 μg/dm^3, and 1.24 μg/dm^3 respectively. Tests conducted at the pumping plant of the second level of the river water intake of Gomel detected the same fractions of PCBs in higher concentrations and extracted from 1 liter: 5.29 μg/dm^3, 5.05 μg/dm^3, 4.77 μg/dm^3, 5.87 μg/dm^3 respectively. It should be noted that PCBs were detected at one point of the distri buting network (Konezavod) in concentration of 3.73 μg/dm^3, 3.53 μg/dm^3, 3.38 μg/dm^3, 4.35 μg/dm^3 for PCB-52, PCB-101, PCB-138 and PCB-153 respectively. PCBs were detected in the river water also in May but the concentration was lower: 0.74 μg/dm^3, 0.67 μg/dm^3 of PCB-52 and PCB-101 respectively.

Some samples of water taken from the Sozh river at the pumping plant of the second level and from the distributing network contained PCBs in low concentration. Concentration of PCBs in water decreased with time. No PCBs were detected in samples taken in summer and in spring. The findings let us assume that inflows during snow melting and other precipitations are the source of PCBs in surface waters. Detection of PCBs in surface waters highlights the need for monitoring.

7.3. Analysis of Contamination of the Environment by Dioxins

At present instrumental testing of the content of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (dioxins/furans) in the environmental compartments in Belarus is isolated and fragmented. The samples of water taken from surface reservoirs used for drinking water supply, samples of drinking water and selected food products have been tested for dioxins and furans.

The development of the regulatory and methodological framework for the analysis and monitoring of dioxins and furans began in 2004. At present it is possible to quantify 17 highly toxic PCDDs and PCDFs and their isomers 2.3.7.8-tetraCDD; 1.2.37.8-pentaCDD; 1.2.3.4.7.8-hexaCDD; 1.2.36.7.8-hexaCDD; 1.2.3.7.8.9-hexaCDD; 1.2.3.4.6.7.8-heptaCDD; octaCDD; 2.3.7.8-tetraCDF; 1.2.3.7.8-pentaCDF; 2.3.4.7.8-penta CDF; 1.2.3.4.7.8-hexaCDF; 1.2.36.7.8-hexaCDF; 2.3.4.6.7.8-hexaCDF; 1.2.37.8.9-hexaCDF; 1.2.34.6.7.8-hepta CDF; 1.2.34.7.8.9-heptaCDF; octaCDF in food products and drinking water.

The country does not have a regulatory framework establishing the permissible concentration of dioxins and furans. The methodological guidelines on monitoring of these POPs in the environment are not available either.

The releases of dioxins into the environment quantified in accordance with the methodology recommended in the Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP Chemicals, 2001) are set forth in Table 7.1.

Table 7.1.
Dioxin/furan releases to the environment, g TEQ per year

Source category	1990	1995	1997
1. Fuel combustion stationary sources (energy sector, industrial and agricultural sectors, residential sector)	13.878	9.786	10.650
2. Production of metals, construction materials and etc.	4.48	2.169	3.288
3. Mobile sources	3.924	1.894	2.453
4. Waste disposal and landfill	0.021	0.011	0.011
TOTAL:	**22.303**	**13.860**	**16.402**

For comparison, the releases of dioxins to the environment (quantified based on the same methodology) in 1997 in Ukraine totaled 517.5 g TEQ per year, in Lithuania – 5.944 g TEQ per year; in the European regions of the Russian Federation – 441.2 g TEQ per year.

The specialists of the SI "RSPCH" have conducted selected testing of concentration of dioxins in food products available in the retail trade network of Minsk and testing of food samples taken at a private farm located within the area of impact generated by the potential source of dioxins. Samples taken in the retail trade network included milk, cottage cheese, mackerel, chicken and salmon; samples taken at food production factories included carp, pike and eggs; samples taken at a private farm (the village of Yakubovichi, the Minsk district) included eggs, meat and milk.

The results of the tests have demonstrated that samples of pork, chicken, milk, cottage cream and eggs obtained from the retail outlets and food production factories contained no dioxins and furans in concentrations exceeding the device's threshold of detectability.

The samples of eggs taken at a private farm (the village of Yakubovichi, the Minsk district) located near the crematorium contained 1.2.3.4.6.7.8-heptachlordibenzodioxin, octachlordibenzodioxin, tetrachlordibenzofuran, hexachlordibenzofuran and octachlordibenzofuran. The concentration was lower than the upper permissible level and the dioxin equivalent was 0.035 pg/g.

To quantify dioxins in drinking water and water in surface reservoirs used for drinking water supply, 15 samples of water concentrated out of 1, 3, 5 and 50 liters were tested. None of the tested samples contained dioxins and furans in concentration exceeding the threshold of detectability. In general, this corresponds to the international experience. Biological monitoring should be established to control contamination by dioxins.

7.4. Identification of POPs Migration Vectors in Nature

POPs penetrate the environment either as a result of their practical use as targeted products (pesticides, PCBs) or as unintentionally produced side products of several technological processes (dioxins/furans). At the same time, a number of their common physical-chemical qualities define the similarity of their distribution and accumulation in the environment.

There exist a number of regional and local programs conducting the monitoring of POPs, one of the objectives of which is the identification of the time dynamics of concentrations and POPs migration routes in the global environment, for example, joint monitoring programs of the United Nations Economic Commission for Europe, EMEP initiatives in pursuance of the UNECE Convention on Long-range Transboundary Air Pollution. Nevertheless, at present as far as a unified monitoring methodology is not available it is unfeasible to give an accurate account of POPs distribution and its dynamics on a global scale. In this connection admitting unavailability of the mechanism of integrating the data obtained by application of various methods and POPs monitoring programs the UNEP Chemicals has launched a project on the Global Monitoring Network on Chemicals.

At the same time, due to realization of some long-term programs of POPs complex monitoring in a number of European countries (Germany, Norway, Czech Republic) there were defined major distribution flows and chemicals circulation in the environment.

Hence:

- **Ambient air** does not only intake POPs emissions in most cases but it is also the principle route of POPs migration and their global distribution. At the same time, POPs get into ambient air in sorbed state on the surface of cinder particles, as a composite part of aerosols or grains of sand from the territories of agricultural lands or industrial sites. The level of POPs content in air differs for urban, industrial and countryside territories. Moreover, in the course of the research certain seasonal fluctuations of the content of some POPs were revealed.

During the last decade one of the most developed techniques has been the method of bioindication for defining the area exposed to the impact of polyaromatic hydrocarbons, PCBs, and dioxins from air. For example, in Austria they use pine needles as a bioindicator. It was found out that the concentration of dioxins in the pine needles of the trees growing in industrial areas is three times higher than in the pine needles of the trees growing in the countryside (0.5 and 1.7 pg TEQ/g respectively). The obtained findings were also proved by the similar research in Germany and in Poland.

These data confirm that the specificity of air as an environmental compartment is that it is rather the way of POPs distribution than the object of POPs accumulation.

- **Atmospheric precipitates (including snow)** as an environmental compartment exposed to POPs influence is least studied at the moment. The research findings reveal different levels of POPs content in precipitates for different latitudes and ambient air temperatures.

  For example, during 1991–1992 in ten samples of atmospheric precipitates of the Baltic region the DDT content with a concentration of 0.15 ng/dm^3 and the PCB content with a concentration of 10–15 ng/dm^3 were registered. Hence, it is presupposed that atmospheric precipitates are a major way of POPs transfer from air into aquatic and terrestrial ecosystems.

- The major sources of POPs emission to **aquatic ecosystems** are precipitation, waste waters of cities and industrial enterprises, lixiviation from the surface of the contaminated sites.

  All POPs listed in the Stockholm Convention have a rather low soluble capability. Nevertheless, being sorbed in the suspension particles these substances gradually accumulate in bottom sediment, water flora and fauna. Therefore the concentrations of these chemicals are higher in bottom sediments and biota than in water itself. For example, the content of DDT and PCB in the waters of the Baltic sea is 0.1–0.01 ng/dm^3, and the PCB content in the meat of the Baltic herring reaches 2,800 ng/g.

  Such pattern of POPs accumulation in various elements of eco-systems has been confirmed by the findings of the field surveys of the condition of water eco-systems of the Dnieper River basin on the territory of the Republic of Belarus. Testing of bottom sediment and fish samples identified almost all pesticides listed in the Stockholm Convention; for example concentration of DDE (one of the DDT metabolites) in fish was up to 12 μg/kg while water samples contained no pesticides.

  For the last 20 years there have been implemented numerous national and sub-regional monitoring projects aimed at the study of the level of contamination of freshwater and sea aquatic systems by POPs. Thus, at present the amount of data and the level of knowledge on the processes of POPs circulation and bioaccumulation in waters are the most complete in comparison with the results of the study of these processes in other types of eco-systems. Moreover, it is widely acknowledged that due to more active mass transfer and migration in aquatic ecosystems rather than in terrestrial ecosystems, aquatic biota (micro- and macro-phytes, animals) is exposed to a more intense POPs impact and consequently represents the most vulnerable environmental constituent.

- **Terrestrial ecosystem** is an appropriate matrix for accumulation of persistent and lipophilic organic substances including those regulated by the Stockholm Convention. The major sources of POPs releases in soil are the use of POPs for the chemical treatment of the territories (agricultural territories, forests etc.), the use of waste water sediment and compost as fertilizers, precipitation, waterlogging of the flood-lands, air and water erosion.

As a rule, the level of POPs content in soil reflects the basic contamination level of the considered region/ area, at the same time industrial and urban areas are characterized by a higher pollution level than the countryside.

Nowadays DDT, HCB and PCB are considered to be the most studied POPs from the point of view of territorial distribution and contamination level gradation. Since the beginning of the 1990s in practically all countries of Central Europe different national programs for monitoring of agricultural lands contamination with DDT have been realized. In a number of countries (Czech Republic, Slovakia, Poland) in the course of implementation of these programs there have been identified the territories characterized by a high level of contamination by DDT (from hundreds to thousands ng/g of soil).

The speed of POPs penetration and the level of their content in flora (including agricultural produces) very much depend on the level of soil contamination, its agrochemical condition, and geo-climatic conditions of the region of vegetation.

Based on the longstanding observations, analysis of production volumes and national expert assessments, penetration and distribution of several chemicals in the European region (EMEP/MSCE-POP) have been evaluated and modeled. Figures 7.1–7.3 show the models elaborated in relation to PCB, HCB and dioxins/ furans penetration and distribution in the environment.

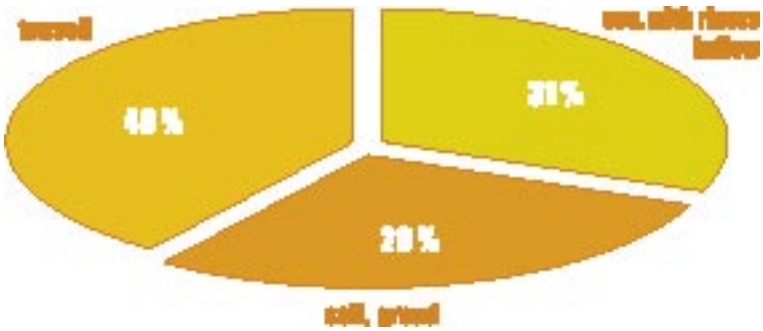


Figure 7.1: *PCB: model of penetration and distribution in the environment (Based on the results of observations of 1970–1998)*

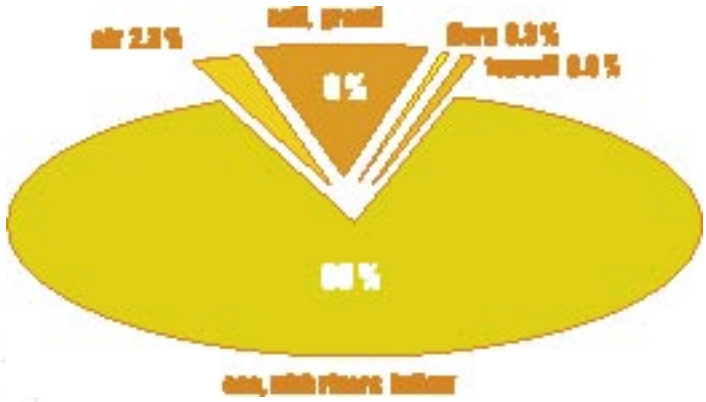


Figure 7.2: *HCB: model of penetration and distribution in the environment (Based on the results of observations of 1970–1998)*

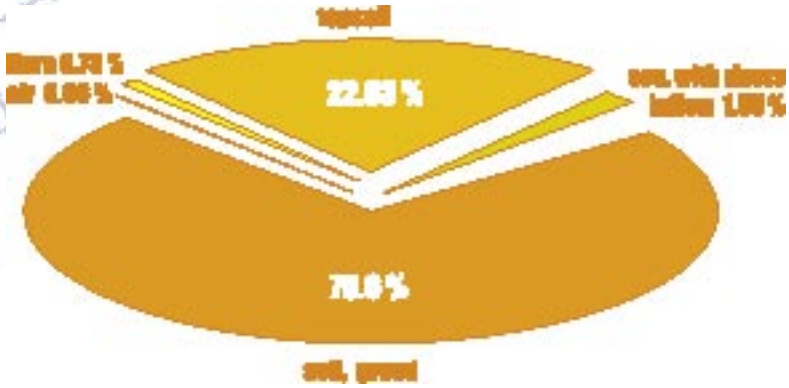


Figure 7.3: Dioxins/furans: model of penetration and distribution in the environment (Based on the results of observations of 1970–1999)

It is worth mentioning that each substance (class of chemicals) depending on its characteristics has its peculiarities of distribution and circulation in the environment. For the last 10–20 years comparatively detailed studies have been conducted relating to several POPs only. Penetration and distribution of the chemicals, which were produced and used in relatively small quantities (for example, mirex, chlordane), are less studied as the studies are rather occasional and conducted only in relation to some environmental compartments.

7.5. Assessment of the POPs Impact on the Environment Based on the Findings of the Study

As noted above, no high concentration of chlororganic pesticides, PCBs, dioxins and furans in water, soil and bottom sediment has been registered in Belarus. However, the tests have identified considerable contamination of biota (fish) with chlororganic pesticides. Contamination has also been identified in certain localities (samples of soil at the "Rutkevichi" reference site). The laboratories of the sanitary inspection authorities have identified samples of water and soil containing residues of chlororganic pesticides. Insignificant concentration of chlororganic pesticides has been recorded in foodstuffs made of domestic raw food. The findings reveal the presence of POPs in Belarus in various concentrations which, through the process of biomagnifications (accumulation in food chains) may damage biota and disturb biocenose.

7.6. Assessment of POP-related Efforts, Regulations and Resolutions of the Ministry of Public Health

The Ministry of Public Health monitors POPs in the environment (drinking water, water reservoirs, soil and food products) through the sanitary inspection authorities (including territorial and republican centers of hygiene and epidemiology and research and practical centers).

Chlororganic pesticides are currently covered by regular monitoring.

Quantitative analysis of chlororganic pesticides is carried out by the sanitary inspection authorities within the framework of regular and preventive sanitary control.

The legislative framework regulating the activities and defining responsibilities of the sanitary inspection authorities in the field of protection of population from adverse environmental impacts includes:

- the Law of the Republic of Belarus "On Health Care" (dated 11 January 2002) declaring (Article 5) the right of people to favorable livelihoods and labor environment to be ensured also by means of environmental protection;
- the Law of the Republic of Belarus "On Sanitary and Epidemiological Safety of the Population" (dated 23 November 1993 No. 2583-XI with subsequent amendments of 23 May 2000 No. 397-3 and 29 June 2003 No. 217-3) establishing legal and

organizational frameworks for prevention and elimination of the adverse environmental impacts on human health, including impact of chemicals and defining requirements for the hygienic registration and regulation, expertise of production sites, technological processes etc. and information of the population about health and environmental contamination related issues;

- the Law of the Republic of Belarus "On Quality and Safety of Food Inputs and Products for Human Life and Health" (dated 29 June 2003 No. 217-3 with subsequent amendments of 05 July 2004 No. 302-3) regulating relations in the field of ensuring safety of raw food and food products as well as laboratory monitoring of the concentration of hazardous substances in food products and establishing requirements for food products' labeling;
- the Law of the Republic of Belarus "On Drinking Water Supply" (dated 24 June 1999 No. 271-3) establishing requirements for the quality and safety of drinking water, use of crop protectants, fertilizers and chemicals in the zones of sanitary protection of surface and ground water sources.

The activities of the sanitary inspection authorities are regulated by the following resolutions of the Council of Ministers of the Republic of Belarus:

- Resolution "On approval of provision on sanitary inspection in the Republic of Belarus" (dated 10 August 2000 No. 1236) defines the tasks of the sanitary inspection, particularly with regard to registration and regulation of chemicals, monitoring of the environment and human health and establishes the powers of officials pursuant to issuing permits to use crop protectants;
- Resolution "On Improvement of the system of State hygienic regulation and registration of chemical and biological substances, materials and inputs thereof, consumer and industrial goods, agricultural inputs and food products, as well as materials and articles used for production, packaging, storage, transportation, sale and other forms of distribution and use of agricultural inputs and food products subject to hygienic regulation and registration" (dated 14 December 2001 No. 1807 with subsequent amendments of 21 February 2004 No. 197 and 6 October 2004 No. 1243) bans distribution of chemicals and food products until a hygienic registration certificate is obtained in accordance with the stipulated procedure.

The procedure of verifying compliance with the norms is regulated by the following Sanitary Norms and Regulations:

- СанПиН 10-124 РБ 99 "Drinking water. Hygienic requirements for the quality of water in centralized water supply systems";
- СанПиН 11-63 РБ 98; "Hygienic requirements for the quality and safety of food inputs and products";
- СанПиН 42-123-5317-91 "Sanitary and hygienic norms pursuant to the maximum permissible concentration, notional safe level of the impact of pesticides in water and supply sources of water used for drinking and household needs and methods of their establishment";
- ГН 7-68 РБ 98 "Hygienic norms of the concentration of pesticides in the environment".

Regulation ГН 7-68 РБ 98 "Hygienic norms of the concentration of pesticides in the environment" contains information on the permissible daily intake (which is, in some cases, different for children and adults) and establishes permissible concentration of pesticides in soil, water reservoirs, air in working premises, outdoor air and products.

Regulation СанПиН 11 63 РБ 98 "Hygienic requirements to the quality and safety of food inputs and products" establishes hygienic norms of the quality and safety of food inputs, food products and meals as well as compliance requirements. Item 5.5.3 establishes general requirements with regard to the concentration of pesticides including HCCH (α-, β-, γ-isomers), DDT and its metabolites in all types of food inputs and products. Monitoring of other pesticides (actual or intended use) is maintained by regulation ГН 7-68 РБ 98. Pesticides, fertilizers and other chemicals which have not been registered in accordance with the stipulated procedure shall not be allowed for use in crop cultivation. The norms of pesticides' concentration have been established for the following product groups: meat and meat products, poultry, eggs and foods thereof; milk and dairy products; fish and foods thereof (additional norms for PCB concentration have been established);

grain (seeds), flower, cereals and bakery products (additional norms for HCB concentration have been established); sugar and confectionery; fruits and vegetables; oils and fats; beverages and other foodstuffs. Norms for heptachlor and aldrin concentration in biologically active food supplements have been established. There are also norms for PCB concentration in fish-based biologically active food supplements.

Regulation СанПиН 10-124 РБ 99 "Drinking water. Hygienic requirements for the quality of water in centralized water supply systems. Quality control" summarizes requirements for the quality of water supplied through centralized water supply system and intended for drinking and household needs, for the use in raw food processing and food production, their storage and distribution as well as for production requiring the use of drinking water. The regulation establishes the norms of concentration of HCCH, its γ-isomer, DDT, heptachlor, dichlor-, trichlor- and pentachlordiphenyls in water.

Thus, the existing legislation and regulations have established requirements for the quality of food products, drinking water, air in working premises and outdoor air mainly with regard to one chlororganic pesticide listed in the Convention, notably DDT and its metabolites as well as to HCCH, which demonstrates the properties of a persistent organic pollutant but is not listed in the Stockholm Convention. Norms of hexachlorbenzene concentration have been established only for flour, cereals and bakery products; norms of heptachlor and aldrin concentrations have been established for food supplements. Norms of PCB concentration have been established for fish and fish products and, to a certain extent, for drinking water. There are no regulations pursuant to the concentration of dioxins and furans.

In the period of 2000–2004 the samples of crops, meat and meat products, milk and dairy products, water and soil samples taken at crop protectants' disposal sites, soil samples taken near storehouses for crop protectants as well as samples of crops taken at farms were tested. In most regional centers (the regional and zonal centers of hygiene and epidemiology) the list of chemicals to be tested is limited to three POPs listed in the Stockholm Convention: DDT, aldrin and heptachlor. The concentration of hexachlorbenzene in food products and raw food is monitored in the Brest, the Grodno and the Gomel regions. In most regions a wider range of pollutants is monitored in food products only. Drinking water, water in reservoirs and soils are monitored only for DDT except for the Minsk and the Vitebsk regions where three pollutants are monitored in water and soils. Development of the methods of laboratory monitoring of the residues of dieldrin, endrin, toxaphene and mirex was scheduled for 2005.

The available data do not let us make a conclusion about the aggregate intake of chlororganic pesticides listed in the Stockholm Convention. DDT and HCCH are most often controlled and analyzed in Belarus. However, all pesticides listed in the Convention should be monitored, firstly because there are unidentified mixtures at the storehouses and sites for pesticides' landfill and, secondly, given the fact that food products and raw food are imported from other regions, including far-abroad countries.

The methods used for quantity control of the residues of pesticides have been recommended by the SI "RCHEPH" (Table 7.2)

Table 7.2
Methods of pesticides residues analysis

Method of analysis	Application for pesticides residues control		
	DDT	Aldrin	Heptachlor
ГОСТ 23452–79. Milk and dairy products. Methods of identifying the residues of chlororganic pesticides.	+	+	+
Methods of identifying micro-quantities of pesticides in food products, fodder and environment. Volume 1. – Moscow: KOLOS, 1992.	+	+	+
ГОСТ 30349–96. Fruits, vegetables and products thereof. Methods of identifying the residues of chlororganic pesticides.	+		+
Methods of identifying micro-quantities of pesticides in food products, fodder and environment. – Moscow: KOLOS, 1977.	+	+	+

In addition, the regional laboratories follow other methodological guidelines depending on financial, technical and professional capacities. For example, the Gomel Clinical Center of Hygiene and Epidemiology, the Brest and the Grodno RCHEPH follow other guidelines including:

- Methodological Guidelines on identification of micro-quantities of pesticides in food products, fodder and environment No. 2142-80 of 18 January 1980 // Methodological Guidelines on quantification of chlororganic pesticides in water, food products, fodder and tobacco by means of chromatography in thin layer. – Moscow, 1981;
- Methodological Guidelines on identification of chlororganic pesticides and polychlorinated biphenyls in case of their joint presence in the environment No. 1790 of 18 November 1977 // Methodological Guidelines on identification of micro-quantities of pesticides in food products, fodder and environment. Part 9. – Moscow, 1978;
- Methodological Guidelines on identification of pesticides in crops, soils and water // Gas-chromatographic method of identifying polychlorinated biphenyls in vegetation, soil and water. – Leningrad, 1989;
- СТБ ГОСТ Р 51209-2001 "Drinking water. Method of identifying chorine-containing pesticides by means of gas-liquid chromatography".

The residues are tested by the laboratories depending on the accreditation area. However, the unification of methods would let us obtain representative data enabling to compare the level of territorial contamination and to make appropriate decisions.

Based on the findings of the overview of the current legislative, regulatory and methodological frameworks, the **following recommendations** can be made:

- Align methodological approaches to the establishment of the norms and monitoring of persistent organic pollutants with the international approaches and systems;
- Substantiate the national norms pursuant to the concentration of persistent organic pollutants in the environment (including polychlorinated biphenyls, polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans) given the environmental, hygienic and public health realities;
- Unify the methods of laboratory monitoring of the concentration of chlororganic pesticides in drinking water, surface water reservoirs, soils and food products;
- Develop the methods of laboratory monitoring of PCBs in food products, drinking water, surface water reservoirs, soil and air for their subsequent use in daily practices of the sanitary inspection authorities;
- Develop scientifically-grounded methodological guidelines on selection of sites for testing, sampling points and system of monitoring of food products, drinking water and water reservoirs within the social and hygienic monitoring framework;
- Develop methodological guidelines on monitoring of dioxins and furans in the environment.

7.7. Assessment of the Data on the Impact of POPs and POP-containing Chemicals on Mammals

The analysis of the publications and materials available in archives has demonstrated that no experimental studies of chlororganic pesticides listed in the Stockholm Convention have been carried out in Belarus. At the same time testing of chlorine-containing chemicals used as pesticides for accumulation, gonadotoxicity and embriotoxicity has identified effects peculiar to DDT and HCCH which are presumably attributed to the presence of dioxin admixtures in pesticides [reports on Scientific Research Work "Study of potential delayed aftereffects resulting from the impact of chlorine-derived phenoxyacids", "Study of toxicity and establishment of hygienic norms of the concentration of new pesticides". – Belarusian Research Institute of Sanitary and Hygiene, 1978].

Accumulation of chlororganic pesticides in water organisms in natural conditions was studied in the late 1970s. As for chlororganic pesticides classified as POPs in the Stockholm Convention, their accumulation in water organisms (fish) was registered and identified in over 3 % of samples. Other chlororganic pesticides (not listed in the Stockholm Convention) proved to have magnification effect (an increase of concentration across food chain "water-plants-mollusks-fish"). Besides, it was identified that chlororganic pesticides negatively affected self-cleaning processes in water reservoirs [report on Scientific Research Work "Study of insecticides' accumulation by water organisms in rivers and lakes in BSSR". – Belarusian Research Institute of Sanitary and Hygiene, 1977].

7.8. Assessment of the Impact of POPs on Public Health Based on the Findings of the Study (Inborn Pathologies, Malignant Tumors, Immune and Reproductive Disorders and etc.) and Biological Monitoring Data

Analysis of the Daily Intake of Chlororganic Pesticides

The fact of identification of residues of chlororganic pesticides in food products even if the concentration is insignificant is the evidence of their presence in the environment corroborating the need for monitoring. However, the estimation of health impact is more objective if the intake with foodstuffs (daily food consumption) is quantified for the general population or individual groups of households.

The first studies intended to identify the daily intake were carried out by the specialists of the Belarusian Research Institute of Sanitary and Hygiene in 1974–1975 [report on Scientific Research Work "Study of the contamination of daily diets with pesticides". – Belarusian Research Institute of Sanitary and Hygiene, 1975.]. It was found out that the main dose contributors were milk, dairy products, meat and meat products. Daily intake did not exceed the international standards. However, cumulative effects were not studied at that time (no studies of concentration in liquid secretion were conducted), but the fact of accumulation of chlororganic pesticides by livestock (milk and meat are most contaminated) allows to make an assumption about existence of similar patterns in humans.

In 2000–2002 the specialists of the Republican Research and Practical Center for Expertise of the Quality and Safety of Food Products examined a daily diet of pregnant and breastfeeding women and made the analysis of the concentration of chlororganic pesticides in consumed food products to estimate an average daily intake of chlororganic pesticides with food. The choice of this particular category of the population was based upon the specifics of biological impact of chlororganic pesticides during pregnancy and the potential of intake with milk during breastfeeding and, consequently, of an adverse impact of chlororganic pesticides on babies.

To estimate the permissible daily intake of chlororganic pesticides by pregnant and breastfeeding women, the residues of α-, β-, γ-isomers of HCCH, aldrin, heptachlor, DDT and its metabolites in 8 daily diets in hospital No. 7 of Minsk, maternity clinic No. 2 of Vitebsk and basic foodstuffs in Soligorsk were measured.

The findings suggested that concentration of DDT and its metabolites in daily diet of pregnant and breastfeeding women in hospitals of Minsk and Vitebsk totaled 0.03–0.07 μg/kg, which is 71–167 times lower than the permissible level (0.005 mg/kg).

In general, the findings are comparable with the data of other researchers. The data of the studies carried out in the Krasnodar region (Russia) registered the concentration of 0.007–0.7 μg/kg.

The data obtained in other countries point out to the presence of chlororganic pesticides in daily diets in varying concentrations. The average content of DDT may range from the trace amount to 0.1 mg/kg. For example, the study of daily diets of agricultural sector workers working in fields in Moldova identified the presence of DDT (0.024–0.037 mg/kg), DDE (0.055 mg/kg) and HCCH (0.25–0.49 mg/kg). The studies of daily diets conducted between 1976 and 1979 in the USA identified 19 pesticides simultaneously, including chlororganic pesticides.

No studies of concentration of chlororganic pesticides in daily diets in dynamics have been conducted in Belarus. However, the research findings in other countries (Japan, the USA) have indicated their considerable reduction over the last 20 years. Between the mid-1980s and the mid-1990s the daily intake of DDT metabolites and HCCH decreased by 40 % and 29.44 % respectively. This is a direct result of the ban on the use of chlororganic pesticides in many countries. However, though the ban has been in place for such a long time, chlororganic pesticides in various concentrations are still registered in food products and negatively affect human health.

Concentration of Chlororganic Pesticides in Breast Milk in Selected Regions and Estimation of the Daily Intake by Children under One Year of Age

The findings of the estimation of chlororganic pesticides concentration in food products and daily diets give an idea about their potential intake. Due to lipophilic properties and extremely low water solubility, chlororganic pesticides tend to cumulate in tissues rich in lipids and are then discharged with milk during breastfeeding as well as with urine and other secretion. During breastfeeding chlororganic pesticides accumulated in a woman's body are discharged with milk and create a risk of intake by a child. Therefore, the analysis of breast milk is the only objective indicator of the contamination of a body with chlororganic pesticides allowing to assess the risk of breastfeeding for a child and to adjust the diet of a mother and a child.

To identify contamination of breast milk, 84 samples of milk of breastfeeding mothers from Mozyr, 16 samples – from Svetlogorsk, 32 samples – from Soligorsk and 15 samples – from Dokshitsy of the Vitebsk region were tested for chlororganic pesticides.

The results suggest that all tested samples contained DDT in the form of DDE metabolite, which is more stable than DDT. The tests registered β-HCCH in all samples. Heptachlor, aldrin and DDD were not identified in milk. The concentration of HCCH in the samples of breast milk varies across Mozyr, Svetlogorsk, Soligorsk and Dokshitsy being 2–65, 2–80, 0.5–35, 2–30 μg/l respectively; the concentration of DDT+DDE in the tested samples varies within the range of 2–125, 3–50, 0.4–120, 8–58 μg/l respectively. In Mozyr, Svetlogorsk, Soligorsk and Minsk the concentration of HCCH in breast milk is 5, 15, 28.2 and 19 % of the samples was within the permissible level established for adapted milk blends. 5, 20, 10.3 and 27.1 % of the samples in these cities are within the permissible concentration of DDT metabolites meaning that the number of samples failing to meet the norms is much higher than those meeting the standards.

Dependence between discharge of chlororganic pesticides with milk and duration of breastfeeding is fairly complex but as a rule no considerable reduction during the surveyed period (327 days) was recorded.

Accumulation of chlororganic pesticides in adipose tissue tends to increase with the age of a woman. Discharge of chlororganic pesticides with breast milk increases accordingly. This dependence is clearly evident for women living in Minsk and Mozyr.

Daily intake of chlororganic pesticides per kilogram of child's weight was estimated based on the data on concentration of chlororganic pesticides in breast milk and children's weight. Daily intake of HCCH exceeded the permissible levels in Mozyr and Soligorsk in 5 % of cases and in 2 % of cases in Minsk. Concentration of DDT metabolites (DDT+DDE) in excess of the permissible levels was reported in 39 % of cases in Mozyr, 32 % – in Soligorsk and 48.2 % – in Minsk.

Therefore, the problem of the impact of chlororganic pesticides on human health is still acute despite the fact that their use has considerably decreased everywhere. The data on the concentration of chlororganic pesticides in breast milk can be taken as a criterion for the estimation of the associated contamination of food products and as a basis for development of measures to reduce the impact of pesticides on children under one year of age taking into consideration that the impact of other POPs, radionuclides and nitrates reinforces the adverse impact produced by chlororganic pesticides.

Environmental situation in Belarus in terms of the impact produced by chlororganic pesticides is not critical but it can hardly be assessed as favorable given the data on the concentration of chlororganic pesticides in breast milk and the associated impact on children under one year of age.

Estimation of the Daily Intake of PCDD and PCDF

The basis for normalization of dioxins/furans content and definition of the integral factor of their penetration in organism is acceptable daily intake (ADI) converted to TEQ. Using the data obtained in the course of quantity monitoring of dioxins and furans in food products, it is feasible to define the daily intake for an average person taking into consideration the quantity of consumed food products depending on sex, age, and body weight.

Daily intake of dioxins and furans for a person is calculated based on the actual consumption of the food products included in the daily diet and the content of dioxins in them (converted to TEQ)

$$N = \Sigma C \times P ,$$

where, N – daily intake PCDD/PCDF, pg;
C – concentration of pollutants in the food product (converted to TEQ), pg/kg ;
P – the quantity of the food product consumed daily, kg.

There are three different approaches to definition of the TEQ and daily intake:

- Taking into consideration only those congeners, which were identified in the food products and raw food in concentration higher than detection limit;
- Taking into consideration all congeners admitting that congeners, which were not identified are present in the intake doze making 50 % of the detection limit in accordance with the applied method, the detection limit of the device;
- Taking into consideration all congeners admitting that congeners, which were not identified, are present in the intake doze making 100 % of the detection limit in accordance with the applied method, the detection limit of the device.

The use of the two latter calculation methods presupposes a particular degree of admission; however, they let us consider the possibility of dioxins content in the intake dozes below the detection limit and their contribution to formation of the negative burden for the organism.

Assessment of the results is made as compared with the acceptable daily intake recommended by WHO, which makes 1–4 pg/kg of the body weight.

Estimation of the Impact of Dioxins on Workers' Health

At present there is no information about the studies intended to estimate the risk of impact of chlororganic pesticides and PCBs on workers directly contacting with these chemicals. The use of chlororganic pesticides in Belarus is banned (DDT was banned in 1970; HCB has not been used since 1990, toxaphene was banned in 1991, aldrin – in 1972, HCCH was used until 1996, chlordane was used between 1966 and 1980). Therefore, at present it is not feasible to estimate their impact on health of workers directly contacting with these chemicals.

There are isolated data, which can be used for estimating the risk of PCDD and PCDF impact on workers. However, for a number of reasons it is not feasible to make final conclusions on the basis of these data about the adverse health impacts attributed to the presence of dioxins and furans in working premises. Firstly, the quantitative data on contamination of working premises with dioxins and furans are not available in Belarus and production processes that can discharge dioxins and furans to the environment and can involve a direct contact with dioxins and furans have not been identified. Secondly, lengthy period of surveys and targeted assessment of health status including biological monitoring data are needed because they can be taken as an indicator of the contamination of human body and will let us track causal connection of contamination and the degree of health deterioration. Thirdly, the studies of all potential pathological manifestations of the contact with dioxins and furans are required for the assessment of impact on human health.

However, in 2005 the researchers of the SI "RSPCH" of the Ministry of Public Health of the Republic of Belarus made an attempt to estimate the impact on health of dioxins and furans, which can be by-products of a technological cycle employed at the

OJSC "Polimir" (Novopolotsk) and associated with thermal treatment of vinyl chloride. Copolymer was produced at the installation consisting of 5 reactors through copolymerization, in emulsion of acrylic acid nitrile, of vinyl chloride and natrium p-styrenesulfonate (A-1) or natrium 2.2-acrylamido-2-methylpropanesulfonate with subsequent coagulation, heat treatment and drying of copolymer. Vinyl chloride was regenerated through its distillation from reaction mixture or emulsion with subsequent catching and distillation. Taking into consideration that the technological process involves thermal treatment of vinyl chloride which, as suggested in publications, can produce dioxins, the authors made an assumption about potential generation of dioxins and their impact on workers.

Retrospective surveys of reproductive health of female workers (spontaneous abortion, abdominal pregnancy and underdeveloped pregnancy), health status of newborns (asphyxia, hypoxia, premature birth, stillbirth, inborn pathologies and oncologic morbidity) have been conducted to assess health impacts. The findings have not demonstrated any apparent differences in reproductive health indicators and health status of infants including inborn pathologies.

The survey of the oncologic morbidity has identified higher oncologic morbidity rates among the "Polymir" employees (4 times versus the country average of 1.75) especially in terms of lungs cancer (4–5 times in different years versus the country average of 1.33). In general, oncologic morbidity trends are compatible with the country-wide trends. A marked increase in lungs cancer and carcinoma was recorded in the last surveyed year (2004). Emergence and development of other malignant tumors (kidney, thyroid gland) has been recorded.

Therefore, the available data suggest that there is no extremely high risk of dioxins' impact on workers' health. On the other hand, however, due to the above referred reasons these data do not allow to track causal connection of changes in health status of workers and PCDD impact.

Epidemiological Surveys of Health Impacts

The epidemiological surveys of the impact of dioxin releases on the population have been conducted in a number of residential settlements in Belarus. The localities to be surveyed were selected based on the information on the presence of potential sources of dioxin releases. The emission data suggest that the major sources of dioxin releases in Belarus are fuel combustion installations for residential heating. These sources are located virtually in all residential settlements of the country. It should be noted that there is a considerable difference in emission factors for fuel combustion. The emission factor is the highest for coal, peat and wood combustion. As the use of these fuels is more extensive in rural environments, it can be assumed that the environmental and health impacts will also be higher. On the other hand, the volume of releases is determined by the emission factor and the amount of combusted fuel, which is obviously higher in cities. It can be therefore assumed that distribution of releases generated by fuel combustion installations for residential heating is relatively even across the country.

Steel production is a significant source of dioxin releases. The key enterprise employing electric furnace steelmaking technology is the Belarusian Metal Production Plant (located in Zhlobin). For this reason the dwellers of Zhlobin who are potentially exposed to dioxins have been selected for the analysis of the incidence of inborn pathologies and malignant tumors. The dwellers of Krasnopolie have been selected as another population cohort for disease incidence studies because there is a cement production plant in the town. The crematorium located in Minsk can be a hot spot of dioxin releases. Households living close to the crematorium have been chosen for a study of morbidity patterns. Food grown at individual household plots located in the vicinity of the crematorium has also been tested.

Transparent manifestations of the impact (inborn pathologies, reproductive health disorders, incidence of malignant tumors) have been identified as a surveyed pathology, the development of which can be attributed to dioxins and furans as an etiologic factor. Abortus feti, feti and new-born children from families living on the territories exposed to higher risk of POPs impact, general data on oncologic diseases, stomach cancer, lungs cancer, mammary gland cancer, skin carcinoma and kidney cancer have been selected as subjects of the

study. It has been identified that there was no statistical difference in population frequency of the aggregate indicators of inborn pathologies during 9 years (1997–2004) between the Zhlobin and the Lepel districts. Comparison of the annual frequency and the aggregate frequency for certain nosologies is not informative due to small numbers of birth in the surveyed districts.

No teratogenic effect of persistent organic pollutants has been registered based on the analysis of the data available for Zhlobin and Lepel for the period between 1996 and 2004. At the current stage similar studies in Minsk have not proved an apparent adverse effect of dioxins.

The analysis of malignant tumor incidence covered the period of 10–20 years and involved comparison of the time periods before and after potential sources of dioxin releases were put into operation as well as assessment of differences in morbidity patterns in the surveyed regions and nationwide. Based on the findings it has been concluded that the structure and dynamics of malignant tumor in Zhlobin and Krasnopolie do not demonstrate a marked difference from similar country-wide patterns and from the patterns observed among the urban population of the Gomel and the Mogilev regions where these towns are located. Therefore, it can be stated that the environment of Zhlobin and Krasnopolie does not contain any specific agents negatively affecting the oncologic morbidity patterns in these towns.

At this stage the findings of the studies let us conclude that there is no extremely high risk of dioxin exposure for the population of the country. However, there may be population groups exposed to risk. Special studies are needed to identify these groups and to assess the impact on human body (immunological, endocrine, bio-chemical and other status).

7.9. Priority Areas (Scientific Research, Development and Establishment of the Monitoring Systems and etc.) for Identification and Assessment of POP-related Health Care and Environmental Protection Concerns

The analysis of the available data about health and environmental impacts of POPs, availability and level of impact-related quantitative data let us identify the following priority areas for further scientific research and development of monitoring systems:

- Justification of the national standards and norms of POPs concentration in the environmental compartments (air, water, soil, food products) taking into account their health and environmental impacts;
- Justification of the permissible daily intake;
- Justification of the criteria for selecting population groups for detailed examination of health status;
- Identification of significant sources of dioxin and furan releases;
- Establishment of the register of production processes involving potential impact on workers;
- Development of analytical methods of POPs monitoring in the environmental compartments, including biological methods;
- Search for bio-chemical, immunological, genetic, and endocrine markers of the impact of chemicals;
- Justification of the need for efficient health monitoring system in light of the impact of POPs;
- Justification of a rational system of health monitoring in connection with the POPs impact.

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Производственно-практическое издание

The National Plan
of the Republic of Belarus for the Implementation of its Obligations under the Stockholm Convention on Persistent Organic Pollutants for the period of 2007–2010 and until 2028

НАЦИОНАЛЬНЫЙ ПЛАН
выполнения обязательств, принятых Республикой Беларусь по Стокгольмской конвенции о стойких органических загрязнителях, на 2007–2010 годы и на период до 2028 года

(на английском языке)

Технический редактор С.Н. Беляковский

Сдано в набор 17.11.2006 г. Подписано в печать 20.11.2006 г. Формат 60x84/8.
Бумага мелованная глянцевая 80 г/кв.м. Гарнитура Arial Narrow. Печать – офсет.
Усл. печ. л. 21,5. Уч.-изд. л. 16,3. Тираж 500 экз. Заказ 329.

Специальное разрешение (лицензия) No 02330/0056792
на право осуществления издательской деятельности от 01.04.2004 г.

Издательство – ООО "Белсэнс"
Республика Беларусь, 220029, г. Минск, ул. Чичерина 19, офис 006
тел./факс (017) 293-43-78 e-mail: belsens@open.by

Специальное разрешение (лицензия) No 02330/013510
на право осуществления полиграфической деятельности от 02.05.2005 г.

Типография – ООО "Принт плюс"
Республика Беларусь, г. Минск, ул. Рыбалко, 9
тел./факс (017) 298-20-34