"Enabling Activities for the Development of a National Plan for Implementation of the Stockholm Convention on POPs"

GF/2732-03-4652

GF/4030-03-15

National Implementation Plan for the Stockholm Convention

Ministry of Environment and Spatial Planning of the Republic of Serbia

January, 2010

Title: National Implementation Plan for the Stockholm Convention

National project-executing organization: Ministry of Environment and Spatial Planning,
Republic of Serbia

All project activities have been supervised by the Coordinating Committee comprised of representatives from the state bodies dealing with the issues of chemical management, as well as other interested parties.

Financing:

This report was financed by the Global Environmental Facility (GEF) through United Nations Environmental Program (UNEP) as GEF implementing agency, and co-financed by the Government of Republic of Serbia.

LIST OF ABBREVIATIONS

BAT – Best Available Techniques
BEP – Best Environmental Practice
GDP – Gross Domestic Product
CAS No. – Chemical Abstracts Service Number
CIDA Canadian International Development Agency
CLRTAP – Convention on Long-range Transboundary Air Pollution
DDT – 1,1,1,-trichloro-2,2,-bis(4-chlorophenyl)ethane))
DEF – Danube Environmental Forum
EC DG Environment – European Commission's Directorate General Environment
EAR – European Agency for Reconstructio*n*
ECPA – European Crop Protection Association
EEA – European Environment Agency
EMAS – Eco-Management and Audit Scheme
EMS – Environmental Management System
FAO – Food and Agriculture Organization of the United Nations
GEF –Global Environmental Facility
GTZ – German Agency for Technical Cooperation
HACCP – Hazard Analysis and Critical Control Point
HCB – Hexachlorobenzene
IAEA – International Atomic Energy Agency
ICAO – International Civil Aviation Organization
ICPDR – International Commission for the Protection of the Danube River
IMF – International Monetary Fund
IMO – International Maritime Organization
ILO – International Labour Organization
IOM – International Organization for Migration
ISO 9001 – International standard for Quality Management Systems
IPPC – Integrated Pollution Prevention and Control
ISO 14000 – International Standard for Quality Management Systems
ITU – International Telecommunication Union
JICA - Japan International Cooperation Agency
NPEP – National Programme for Environmental Protection
PAH – Polycyclic aromatic hydrocarbons
PBT - Persistent, Bioacumulative and Toxic
PCB –Polychlorinated biphenyls
PCDD – Polychlorinated dibenzo- *p*-dioxins
PCDF – Polychlorinated dibenzofurans
PCT – Polychlorinated terpenhyl
PET – Polyethylene terephtalate
PFOS – Perfluorooctanesulfonic acid /perfluorooctane sulfonate
PIC – Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
POPs – Persistent Organic Pollutants
PSMS – Pesticides Stockpile Management System
REACH – Registration, Evaluation, and Authorisation and Restriction of Chemical substances
REC – Regional Environmental Centre for Central and Eastern Europe
SDC - Swiss Agency for Development and Cooperation
SIDA – Swedish International Development Cooperation Agency

TAIEX – Technical Assistance and Information Exchange
UNFCCC – United Nations Framework Convention on Climate Change
UNECE – United Nations Economic Commission for Europe
UN – United Nations
UNDP – United Nations Development Program
UNEP – United Nations Environmental Program
UNIDO – United Nations Industrial Development Organization
UNESCO – United Nations Educational, Scientific and Cultural Organization
UPU – Universal Postal Union
USAID – United States Agency for International Development
USD – United States Dollar
WHO – World Health Organization
WB - World Bank
WIPO - World Intellectual Property Organization
WMO - World Meteorological Organization

MARKS AND MEASURES
dm^3 **–** cubic decimetre
ha – hectare
kg – kilogram
km – kilometre
km^2 – square kilometre
kW – kilowatt
l – litre
m – metre
mm – millimetre
Mten – megaten
MW – megawatt
µg – microgram
ppm – parts per million
t – ton

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION
1.1 Goals and provisions of the Stockholm convention

The main goal of the Stockholm Convention on Persistent Organic Pollutants – POPs is to provide protection of human health and the environment from the harmful effects of POPs. The Convention prescribes a set of obligations imposed upon the member countries which require them to prohibit or restrict POPs production, trade and use, as well as to reduce i.e. eliminate emissions of 12 POPs (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorbenzene, mirex, toxaphene, PCB, HCB, PCDD/PCDF) into the environment. On the Fourth Meeting of the Conference of the Parties of Stockholm Convention held in May 2009 additional nine chemicals were proposed for inclusion in the Lists of the Convention: Chlordecone, Hexabromobiphenyl, Pentachlorobenzene, Lindane, Alpha hexachlorocyclohexane, Beta hexachlorocyclohexane, Tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial pentabromodiphenyl ether), Hexabromodiphneyl ether and heptabromodiphenyl ether (commercial octabromodiphneyl ether), Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride (PFOS).

POPs are organic compounds considered to be toxic for humans and other living organisms, bioaccumulative, persistent in the environment. In addition, it is the moderate volatility of POPs that enables their long-distance atmospheric transport. POPs have low water solubility and high lipid solubility and are therefore easily transported through phospholipids in biological membranes and later deposited in adipose tissue and other tissues with high lipid levels. All these characteristics cause POPs to be widespread in the environment, even in the regions where they have never been used.

The above stated properties of POPs make the specified chemicals one of the most important topics within the field of environmental protection, representing the issue which requires global solution. Such global solution is defined in the Stockholm Convention which entered into force in 2004.

Law on Ratification of the Stockholm Convention is adopted by the Serbian Parliament in June 2009. This document i.e. Serbia's National Implementation Plan for the Stockholm Convention provided overview on all liabilities according to this Convention and prepared good grounds for its implementation in our country.

With the financial aid provided by the Global Environmental Facility (GEF) of the United Nations and in cooperation with the United Nations Environmental Program (UNEP), the Ministry of Environment and Spatial Planning of the Republic of Serbia has developed the National Implementation Plan for the Stockholm Convention (hereinafter the NIP). The specified NIP has been developed within the scope of the project "Enabling Activities for the Development of a National Plan for Implementation of the Stockholm Convention on Persistent Organic Pollutants- POPs", hereinafter the POPs project. All project activities have been supervised by the Coordinating Committee comprised of representatives from the state bodies dealing with the issues of chemical management, as well as other stakeholders.

Closely related to the above specified project are activities carried out by the Republic of Serbia for the purpose of ratification and implementation of three protocols to the Convention on Long-Range Transboundary Air Pollution (CLRTAP), namely the Protocol on Persistent Organic Pollutants, the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (the Gothenburg Protocol) and the Protocol on Heavy Metals. In cooperation with UNECE and the Dutch Government a project has been initiated aimed to provide development of national action plans for ratification and implementation of the above named Protocols.

National Action Plan for Ratification and Implementation of the Protocol on Persistent Organic Pollutants and the NIP are closely related and the two shall jointly contribute to develop a comprehensive POPs approach and management in the Republic of Serbia.

The main goal of the POPs project is to prepare the Republic of Serbia for implementation of the Stockholm Convention, primarily through implementation of all measures defined for elimination and where possible total abandonment of POPs from use and their elimination from environmental media. The measures specified in the Stockholm Convention are the following:

- Prohibit production, use, import and export of POPs listed in Annex A, as well as restrict production and use of chemicals listed in Annex B (Article 3);
- Prevent production and use of new pesticides or new industrial chemicals which, taking into consideration the criteria defined (persistence, bio-accumulation, potential for long-range environmental transport, adverse effects) exhibit the characteristics of persistent organic pollutants (Article 3);
- Provide appropriate control of the chemicals listed in Annex C (unintentional production), with their emissions eliminated or reduced to the acceptable level (Article 5);
- Develop appropriate strategies for identification and identify POPs stockpiles consisting of or containing chemicals listed either in Annex A or Annex B, as well as products and articles in use and wastes consisting of, containing or contaminated with chemicals listed in Annex A, B or C (Article 6);
- Develop appropriate strategies and manage stockpiles in a safe, efficient and environmentally sound manner (Article 6) – stockpiles are managed in accordance with the provisions on management of POPs as waste;
- Take appropriate measures to ensure that POPs waste is destroyed in a safe and irreversible manner or when such destruction (degradation) does not represent environmentally preferable option, provide their environmentally sound disposal (Article 6);
- Take appropriate measures to ensure that POPs waste is not disposed of in a manner that enables reuse of POPs from POPs waste (Article 6);
- Identify contaminated sites and conduct appropriate remediation in an environmentally sound manner (Article 6);
- Develop a National Implementation Plan, consulting all stakeholders (Article 7);
- Carry out obligatory reporting – submit to the Secretariat statistical data on total production, import and export of each of the chemicals listed in Annex A and Annex B (Article 15);
- Carry out obligatory evaluation of Convention's effectiveness related to the activities foreseen in the Implementation Plan (Article 16).

Based on the Stockholm Convention goals, in November 2008 the Persistent Organic Pollutants Review Committee (hereinafter the Committee), established as a subsidiary body to the Stockholm Convention, has proposed a list of new POPs to be added to the list of chemicals presented in Annexes of the Stockholm Convention.

Listing of new POPs in the Annexes to the Convention is defined as a four-phase evaluation process:

- Phase 1: Preparation of proposal for listing of new chemical in the Annexes to the Stockholm Convention;
- Phase 2: Development of risk profile for the chemical proposed to be listed in the Annexes to the Stockholm Convention;
- Phase 3: Development of risk management evaluation;
- Phase 4: Recommendation of the Committee, submitted to the Conference of the Parties, for adding new POPs to the Annexes of the Convention.

During the fourth meeting of the Conference of the Parties nine new POPs chemicals (Chlordecone, Hexabromobiphenyl, Pentachlorobenzene, Lindane, Alpha hexachlorocyclohexane, Beta hexachlorocyclohexane, Tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial pentabromodiphenyl ether), Hexabromodiphneyl ether and heptabromodiphenyl ether (commercial

octabromodiphneyl ether), Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride (PFOS)) were proposed for inclusion in the Annexes of the Stockholm Convention. List of these new POPs is presented in Annex 1.

It has to be mentioned here that new POPs were not taken into consideration during the preparation of NIP, but due to great importance of new POPs, situation in Serbia regarding those chemicals should be evaluated in the future.

1.2 NIP development methodology

POPs project has been carried out in five phases:

- determination of project coordination and organization mechanisms;
- compilation of persistent organic pollutant preliminary inventory and infrastructure and capacity estimate;
- setting priorities and goals;
- development of draft NIP, as well as preparation of specific action plans;
- finalization of the NIP and its approval by all interested parties.

The main outcome of the POPs project is development of the NIP. Besides planning the measures aimed to ensure fulfilment of the obligation under the Convention, NIP shall also raise public awareness and improve the state of knowledge of employees involved in POPs management.

This document is developed in accordance with the Article 7 of the Stockholm Convention and a guidance document prepared by UNEP –"Guidelines for Developing a NIP for the Stockholm Convention" [1].

The NIP gives a set of measures aimed to enable further restriction of production, trade and use of new POPs, reduce releases of unintentionally produced POPs (herein after uPOPs), provide safe storage of obsolete pesticides, as well as gradual replacement of PCB-containing equipment. The Plan defines all activities aimed to prepare the Republic of Serbia for fulfilling the obligation under the provisions of the Stockholm Convention.

NIP is comprised of two parts. The first part provides general information on the Republic of Serbia, information on Serbian legislation in the fields of environmental protection and chemicals, with special consideration given to POPs and their estimated quantities based on the preliminary inventory compiled. The second part of the Plan contains a strategy for Convention implementation, as well as appropriate action plans. The following actions plans have been developed:

- Action plan for dealing with the obsolete pesticides (pesticide waste);
- Action plan for dealing with PCB;
- Action plan for dealing with uPOPs (PCDD/PCDF, PCB and HCB);
- Action plan considering institutional and regulatory measures aimed at Stockholm Convention implementation and reporting;
- Action plan considering monitoring;
- Action plan for contaminated areas;
- Strategy for public informing, awareness raising and education and action plan for strategy implementation.

Resulting from a decision of the Republic of Serbia to join the EU, a series of specific activities have been carried out. Above all, a set of new laws harmonised with the related EU regulations have either been adopted or prepared, providing new principles of regulation in different fields. During the process, importance of the field of environmental protection has been recognised, leading to activities aimed to systematically regulate the field specified, not only through adoption of new laws but through preparation for implementation of international conventions and development of strategic documents as well.

It is important to mention that national strategies related to other fields (e.g. energy sector, agriculture etc.) but in some manner also related to the field of environmental protection i.e. POPs issues have been taken into consideration during preparation of this document. Having in mind laws currently in force, bills, adopted and developed strategic documents have been taken in consideration, it can be stated that all aspects of POPs management in various sectors have been analysed.

This project was approved by GEF on April 10, 2003. The project was initially intended to be implemented in the Federal Republic of Yugoslavia. The official project document was signed on June 2003 with the UNEP as an Implementation Agency of the GEF, marking the start of the contractual obligations related to the project specified.

Regardless of the fact that the initial project has been intended for the State Union of Serbia and Montenegro, as a legal successor of the Federal Republic of Yugoslavia, it was necessary to establish organisational structures for conducting the project activities in each of the member states, since a division of responsibilities among the member states have placed the issues of environmental protection under the jurisdiction of both member countries – the Republic of Serbia and the Republic of Montenegro.

The first project task, establishment of organisational structure, represented the most complex task in the process of project implementation.

The specified phase of the project was completed after the Project Office, the Coordinating Committee of the Republic of Serbia, the Coordinating Committee of the Republic of Montenegro and the Joint Coordinating Committee has been established.

In addition, in the same phase of the project an introductory workshop in Montenegro was organised.

The competent ministry responsible for environmental protection contacted Prof. dr. Ivan Holoubek from Czech Republic, a coordinator of the Czech NIP development and a consultant for NIP development in Armenia, Croatia, Macedonia, Hungary, Egypt and Oman. Prof. dr. Ivan Holoubek presented the upcoming project requirements, as well as the obligations related to the implementation of the Stockholm Convention.

In this phase of the project, a method for communication with interested parties was also defined. In that respect, the project website was set up on the web portal of the ministry responsible for environmental protection. The project website is regularly updated with all documents and reports developed within the scope of the project, providing fulfilment of the main goal set for this project phase.

Following the declaration of Montenegrin independence, the Republic of Serbia has continued to carry out POPs project management.

Second phase of the project included development of the following documents:

1) National Chemical Management Profile;
2) Preliminary POPs pesticides Inventory;
3) Preliminary PCB Inventory;
4) Preliminary Inventory of uPOPs (PCDD/PCDF, PCB and HCB);
5) POPs in the Environment of the Republic of Serbia;
6) POPs – analysis methods;
7) POPs – sampling and sample preparation;
8) POPs human toxicology;
9) POPs ecotoxicology.

Development of the National Chemical Management Profile has been instrumental in raising awareness and increasing a level of knowledge, leading to large number of parties expressing their interest to participate in the strategic chemical management planning. As a result, a comprehensive consideration of the short-term and long-term actions aimed to provide integrated chemical management has been carried out.

As in other countries with economies in transition, in the Republic of Serbia there were no statistical data or assembled data bases which could have been used for inventory assembling. In addition, economic entities were not legally obliged to submit the related data. In that way the preliminary inventories have been compiled based on the distributed questionnaires analysed by project consultants. Apart from project consultants, preliminary inventories of pesticides and uPOPs have been assembled with the help of inspection bodies. Such approach has helped not only to compile preliminary inventories, but to define methodology for detail inventory assembling. In this period, a Regulation on Cadastre of Polluters has been adopted and development of information system on integral cadastre of pollutants commenced. The fact that it has been recognized that detail inventories should be an integral part of the information system was of special importance.

In the process of these inventories assembling and development of other documents the consultants were responsible to identify key problems and to propose future problem-solving actions, resulting in more efficient work activities in phase four of the project. Apart from presenting POPs field data, in accordance with project tasks, the consultants were also required to present national and EU regulations currently in force and to examine if identified problems and proposed activities had already been recommended in some of the adopted or prepared strategic documents.

The main task in the third phase of the project was determination of long-term and short-term goals directed towards accomplishing the goals of the Stockholm Convention. During this project phase it was concluded that Guidelines for Developing a NIP [1] should not be implemented entirely since it was found that it would had been more efficient to develop the following action plans: action plan for dealing with uPOPs (PCDD/PCDF, PCB and HCB); action plan for dealing with PCB; action plan for dealing with the obsolete pesticides (pesticide waste); action plan for monitoring; action plan for contaminated areas; action plan considering institutional and regulatory measures aimed at Stockholm Convention implementation and reporting; a strategy for public informing, awareness raising and education and action plan for strategy implementation. Following identification of the above mentioned action plans, selected project consultants were contacted and training on methodology for action plan development organised. The said training enabled all action plans to be developed using a unique methodology. It has been concluded that after previously mentioned activities were conducted problems identified in the compiled preliminary inventories should be reconsidered and goals and priorities redefined. In that way, long-term and short-term project goals have been redefined, providing a possibility for their later revision during and following determination of measures and activities within specific action plans, as permitted by logic matrix.

During the fourth phase of the project, in order to help the consultants in action plan development several workgroups have been assembled comprised of representatives of state bodies and interested expert organisations. Such approach provided specific individual activities to be considered by the workgroup members. In addition, workgroup members participated in determining activities proposed within the action plans.

Following development of draft action plans, a TAIEX seminar was organised, with EU experts indicating necessary directions for regulation of the filed considered, with respect to the provisions of the EU regulations. The participating experts provided suggestions for additional activities that might have been carried out, as well as suggestions for improvement of draft plans presented.

In this manner, action plans have been developed, taking into consideration all problems identified during the plan development. The main characteristic of developed action plans is their feasibility.

In this phase of the project, two additional consultants have been employed. Based on the collected information and reports prepared in the earlier project phases, the said consultants developed the NIP in accordance with the Guidelines for Developing a NIP [1].

At the end of February 2009, three foreign consultants were employed, namely dr. Roland Weber, Urs K. Wagner and John Vijgen to carry out a review of certain NIP chapters and provide recommendations and suggestions for their improvement.

In the same period local consultants have also been employed i.e. experts who carried out revision of certain sections contained within the NIP.

Upon consultations with foreign and local experts and members of assembled workgroups accepted modifications were introduced in Draft NIP. The Draft NIP was made public by the means of official website of the ministry responsible for environmental protection. The draft NIP was also submitted to the members of Coordination Committee i.e. representatives of the competent ministries for a review. After obtaining of approvals of Coordination Committee and state authorities responsible for certain activities, final version of the NIP was adopted by the Government of Republic of Serbia. Finally adopted document was then sent to UNEP and the Secretariat of the Stockholm Convention.

Key problems:

During project implementation, different problems have been encountered. Some of the problems were related to the broader social and political situation, while some resulted from insufficiently developed awareness about the importance of the project in question. In the beginning of POPs project implementation, project activities were slowly developing due to the change in the status of the State Union i.e. declaration of Montenegrin independence and frequent changes in the project management structure, causing a change of individual appointed as the project manager. During project implementation certain problems occurred due to nonexistent regulations and statistical data and especially non-established structure related to financial procedures to be carried out for donation projects in the ministry responsible for environmental protection. The specified problems have complicated and slowed down project activities.

Instead of a Conclusion:

NIP was prepared as a realistic and comprehensive document, providing a solid base for determining further activities on implementation of the provisions of the Stockholm Convention.

In addition, the POPs project was methodologically carried out in a manner which had ensured involvement of large number of interested parties and competent organizational units within the ministry responsible for environmental protection. The most valuable feature of the project is appropriate involvement of key individuals and institutions, ensuring allocation of planned activities and introduction of issues of POPs management into new regulations, education plans and other plans necessary for fulfilment of obligations under the Stockholm Convention.

Therefore, knowledge gathered during implementation of POPs project has not remained only within the project implementation unit, national focal point and project consultants engaged. In addition, the POPs project has make it possible to appropriately prescribe POPs related obligations in different laws, as well as to introduce POPs related issues in strategic documents of the Republic of Serbia.

CHAPTER 2.: INFORMATION ON THE REPUBLIC OF SERBIA AND CURRENT POPS MANAGEMENT IN THE REPUBLIC

2.1 Country profile of the Republic of Serbia

2.1.1 Geographic characteristics and socio-demographic development

Geographic characteristics. The Republic of Serbia is located in the central part of the South-East Europe, situated on the Balkan Peninsula. The country occupies an area of 88,361 km^2. The country belongs to the West European Time Zone (GMT+1). The capital of the Republic is Belgrade.

Climate. Serbia is characterised by moderate continental climate, with gradual change between the seasons of the year.

Water resources. There are three navigable rivers in the Republic of Serbia: the river Danube, the river Sava and the river Tisa (the river Velika Morava is also navigable but its potential is insufficiently exploited). The longest river is the river Danube. The course of the Danube passing through Serbia reaches a length of 588 km. The Danube basin has always been important for Serbia. The course of the Sava River passing through Serbia reaches a length of 206 km, the course of the river Drina 220 km, the river Tisa 168 km, while the length of the river Zapadna Morava equals 308 km.

Mean annual precipitation level is between 600 mm and 800 mm in the plain areas and between 800 mm and 1200 mm in the mountain regions.

Land use. Agricultural land in the Republic of Serbia is spread over the area of 5,734,000 ha (0.56 ha per capita), out of which 4,867,000 ha is arable land (0.46 ha per capita). The plain regions of the country, Vojvodina, Pomoravlje, Posavina, Tamnava, Kruševačko Polje, Leskovačko Polje are suitable for cereal and vegetable crop production by utilization of agricultural mechanization. Highland and hilly regions are suitable for fruit growing, viniculture and cattle breading. Mountainous-hilly regions of Zlatibor, Rudnik, Stara Planina, Kopaonik are suitable for sheep and cattle breading and forestry.

Socio-demographic development. According to report of Serbian Environmental Protection Agency for 2007 [2] the population of the Republic of Serbia has been constantly declining since 1991. Based on the 1991 Census, the number of inhabitants of the Republic of Serbia in 1991 equalled 7,576,837, while the records from the middle of 2007 showed a decrease to 7,381,579 inhabitants, primarily as a result of decreasing birth rate observed over the years (without data for the Autonomous Province of Kosovo and Metohija).

Processes of transition and privatization have caused an increase in unemployment rate. In 2008 a number of employed men were reduced by 0.6%, while the number of employed women was increased by 0.8%. Unemployment rate recorded in October 2008 equalled 14%, based on data obtained from the Labour Poll according to the document Economic movement in Republic of Serbia [3].

Significant and continuous economic development starting from 2000, in addition to real increase in earnings (which was higher than the increase of Gross Domestic Product), increased pensions and other social transfers, as well as increase in other earnings of the population and specially increase in funds remitted from abroad, have resulted in significant poverty reduction. However, stagnation in the number of employed population and high unemployment rate has certainly reduced the overall effect of the economic growth on the poverty reduction.

Based on data obtained from the Analyses of the Standard of Living in the Republic of Serbia [4] poverty is as in many transitional countries, predominantly in rural areas. In 2007 there were 9.8% of poor households in rural areas and 4.3% in urban areas. In the period 2002-2007 a ratio of poverty index in rural and urban areas increased from 1.6 to 2.3.

The Republic of Serbia is a country with significant, long-lasting and continuing disproportions in the levels of regional economic development. Based on the recently adopted National Economic Development Strategy of the Republic of Serbia [6], regional development disparities between different regions of the Republic are the highest in Europe (ratio between the most developed and the least developed regions of the Republic, expressed as Development Vulnerability Index was 1:15 in 2005), showing a trend of continuous increase. Transition process to market-oriented economy has further deepen the existing economic differences between the regions, caused primarily by liquidation of many publicly owned enterprises, intensive market restructuring and privatisation processes. In addition to traditionally undeveloped region of South Serbia, new regions with low rate of economic development have also emerged (East Serbia and parts of Central Serbia, regional mining and industrial centres in West Serbia).

2.1.2 Political and economical profile of the country

2.1.2.1 Political profile of the country

Serbia is a democratic republic with multi-party and parliamentary system. A ruling system is based on the separation of power between legislative, executive and judicial branches.

The president of the Republic is elected in direct elections for a 5 year term. The same person cannot be elected for president more than twice. The Parliament is a legislative body representing a unicameral assembly of 250 deputies elected every 4 years. The president of the Republic proposes a candidate for a prime minister. Following a public discussion, the Parliament elects the prime minister and other ministers.

The Republic of Serbia is administratively and territorially organized in autonomous provinces, districts, municipalities, towns and the city of Belgrade. There are two autonomous provinces within the Republic of Serbia: Autonomous Province of Vojvodina and Autonomous Province of Kosovo and Metohija, both having territorial autonomy. The jurisdictions of different state authorities are split between republic, provincial and municipal bodies.

Autonomous Province of Vojvodina occupies almost one fourth of the state territory i.e. 21,506 km^2 in the north region of the country. The city of Novi Sad is an administrative, economic and cultural centre of the Province.

By the United Nations Security Council Resolution 1244 of June 10 1999, Autonomous Province of Kosovo and Metohija was placed under transitional United Nations civil and military administration. The Autonomous Province of Kosovo and Metohija occupy an area of 10,849 km^2 or approximately 12% of the state territory.

Pursuant the Constitution and its Statutes, the Autonomous Provinces regulate the jurisdiction, organization and operation of their bodies and institutions. The State Constitution regulates the following fields, within which the Provinces, in accordance with the State law, independently regulate the issues determined to be of provincial importance:

1) spatial planning and development,

2) agriculture, water management, forestry, hunting, fishery, tourism, catering, spas and health and recovery centres, environmental protection, industry and craftsmanship, road, river and railway traffic and road maintenance, fair trade organization and organization of other economic events;

3) education, sport, culture, health and social protection and public informing at the provincial level.

Apart from the abovementioned, the Autonomous Provinces are responsible for providing all conditions necessary for protection and exercise of human and minority rights, in accordance with the Law. As determined by the Constitution and the Law, the Autonomous provinces have direct revenues, they adopt the provincial budget and annual balance sheet and provide the resources for local self-government units to conduct the delegated affairs.

Local self-government represents a demonstration of the civil rights guaranteed under the Constitution which enables citizens to participate in a decision making process related to the issues of local importance, in that way achieving their local interests.

The Law on Local Self-Government[1] stipulates municipal competences over environmental protection, where municipality adopts programmes of use and protection of natural resources and environmental protection programmes, i.e., local action and rehabilitation plans in compliance with strategic documents and their interests and specific characteristics, and it also determines environmental charges and fees. Hence, the Law on Local Self-Government stipulates activities under the municipal or city jurisdiction, but it does not regulate them; this is mostly transferred to sectoral laws which more comprehensively regulate certain areas. For example, Law on

[1] Law on Local Self-Government ("Official Gazette of RS" No. 129/07)

Environmental Protection and other related laws regulate activities under municipal jurisdiction in the area of environmental protection.

All municipalities and cities in the Republic of Serbia were established by the Law on Territorial Organisation of the Republic of Serbia[2]. In order for a part of the state territory to be established as individual self-government unit it is necessary, as defined by the Law on Local Self-Government, for that territorial part to represent a naturally and geographically integral unit, an economically coherent region, to have well developed infrastructure and good communication between the settlements as well as to have a capital settlement serving as a gravitational centre.

In accordance with the Constitution, the City of Belgrade is considered to be an individual self-government unit. The status of the City of Belgrade, the capital of the Republic of Serbia, is determined by the Law on the Capital and the Statute of the City of Belgrade. The City of Belgrade has competences delegated to the municipality and the city by the Constitution and the Law. Additional competences may be delegated by the Law on the Capital. Newly adopted Law on the Capital[3] envisages special competences to be delegated to the City, primarily in the field of water management, road management, fire protection and public informing (television and radio stations, newspapers).

Territorial organization. Territorial organization of the Republic of Serbia is composed of 150 municipalities and 23 cities, and the City of Belgrade as separate territorial unit and autonomous provinces as a form of territorial autonomy.

[2] Law on Territorial Organisation of the Republic of Serbia ("Official Gazette of RS" No. 129/07)
[3] Law on the Capital("Official Gazette of RS" No. 129/07)

Figure 2.1.2.1.a: Territorial organization of the Republic of Serbia

Figure 2.1.2.1.a presents territorial organization of the Republic of Serbia which had applied by the end of 2007.

Regional development. Nowadays, a uniform regional development represents an important determinant of economic policy of most European countries. In the process of joining the EU, the Republic of Serbia is obliged to implement an appropriate regional development policy.

A key figure in implementation of this important legal provision is the Ministry of Economy and Regional Development which has developed the Law on Regional Development[4]. According to this Law, the Republic of Serbia shall comprise 7 development regions, in that way enabling direct cooperation with European regions and providing access to pre-accession funds of the European Union. Based on this Law, a region represents an integral statistical functional-territorial unit consisting of one or more areas established for the purpose of planning and carrying out regional development politics. However, a development region is not an administrative-territorial unit and therefore does not represent a legal entity.

The main goal of the above stated Law is to provide sustainable development by promoting economic development, reduction of economic disparities, reduction of negative demographic tendencies, development of market competition, and improvement of living standard.

Funds intended for uniform regional development shall be allocated based on the development level of the regions, which shall be precisely determined in cooperation with the Standing Conference of Towns and Municipalities. Development Fund of the Republic of Serbia is carrying out regional development politics, especially in the field of small and medium-sized enterprise development.

The Law on Regional Development foresees establishment of a Regional Development of National Agency for regional development as a legal successor of the Republic Agency for the Development of Small and Medium-Sized Enterprises and Entrepreneurship. The Law envisages establishment of 7 regional development agencies, as well as the National Regional Development Council.

2.1.2.2 Economic profile of the country

Economic organization of the Republic of Serbia is based on the principles of market economy, opened and free market, freedom of entrepreneurship, independence of market entities and equality of private and other forms of ownership.

The Constitutions recognizes three forms of ownership: private, corporate and public assets. Public assets may be state assets, assets of the autonomous province and assets of local self-government units. State assets, as a form of the public assets, are comprised of natural resources, goods of public interest, as well as assets used by the bodies of the Republic of Serbia.

Based on document Economic Movement Republic of Serbia [3] the most important macroeconomic aggregate, the Gross Domestic Product – GDP. Table 2.1.2.2.a which presents economic parameters for the period 2000-2006 was taken over from the document Environmental Performance Review [6].

Table 2.1.2.2.a: Selected annual economic parameters for the period 2000 - 2006

	2000	**2001**	**2002**	**2003**	**2004**	**2005[5)]**	**2006**
GDP (% change over several previous years)	4.5	4.8	4.2	2.5	8.4	6.2	5.7
GDP at current prices (mill. USD)	9,013	10,431	12,172	16,124	20,966		
GDP at current prices (mill. EUR)	26,431	13,186	16,812	18,009	19,724	21,108	
GDP at current prices	397,656	783,897	1,020,117	1,171,564	1,431,313	1,750,000	2,139,800
(mill. RSD)	6	7	7	4	3	000	00[1)]

[4] Law on Regional Development ("Official Gazette of RS" no. 51/09)

GDP at constant 2002 prices	933,534	978,750	1,020,117	1,045,570	1,133,651	1,204,065	
(mill. RSD)	4	0	7	0	1	O65	
GDP per capita (USD per capita)	1,199	1,390	1,623	2,155	2,809		
Unemployment rate (% of workforce, end of period)	22.2	23.2	25.3	27.8	25.9	26.8	27.1
						-2,681	
Export of goods and services (mill. USD)	1,558	1,721	2,075	2,755	3,523	4,482	3)
							1,3172
Import of goods and services (mill. USD)	3,330	4,261	5,614	7,473	10,753	10,461	3)
Net debt-to-export ratio (%)							
Net debt-to-GDP ratio (%)				48.1	40.4	37.3 2)	
Exchange rate: annual average (RSD / USD)		66.8	64.2	57.4	57.9	72.2	65.4
Physical production (Indexes-previous year = 100)							
A) Agriculture				92,8	119,5	94,7	99,7
B) Forest utilisation				105,6	103,1	97,8	106,1
C) Industry				97,0	107,1	100,8	104,7
Population (mill.)	7,516	7,503	7,500	7,480	7,463	7,441	7,441 4)

Sources: Statistical Office of the Republic of Serbia and EIU, State Report for Serbia and Montenegro, July 2006.

Note: [1]) UNECE estimate; [2]) MMF estimate; [3]) Since 2006, a trade with Montenegro is listed within total export/import of the Republic of Serbia; [4]) Estimate of the Statistical Office of the Republic of Serbia; [5]) Annual estimate of the Statistical Office of the Republic of Serbia.

Based on data provided by the Statistical Office of the Republic of Serbia total annual GDP in 2008, obtained as a sum of data obtained for four annual quarters, exhibits an increase of 5.4% compared to 2007.

In the first quarter of 2008 real increase in GDP compared to the year before equalled 8.5%, while the real increase in the second quarter equalled 8.5%, in the third 6% and in the forth 4.9%.

When considering different sectors the highest increase is recorded in the sectors of traffic, storage and communication, financial mediation, agriculture and trade. All other sectors also showed an increase in GDP but significantly lower than the ones mention previously.

According to the Statistical Office of the Republic of Serbia, Statistic Yearbook of the Republic of Serbia for 2008 [8], industrial production also increased in 2008 by 1.4%, primarily as a result of more intensive ore and stone extraction which have increased by 4.7%. This growth was mostly contributed by the stone and ore mining sector, which amounts to 4.7%. It is estimated that agricultural production in 2008 has increased by 9.0%. Significant and continuous economic development starting from 2000, in addition to real increase in earnings (which was higher than the increase of Gross Domestic Product), increased pensions and other social transfers, as well as increase in other earnings of the population and specially increase in funds remitted from abroad, have resulted in significant poverty reduction. However, stagnation in the number of employed population and high unemployment rate has certainly reduced the overall effect of the economic growth on the poverty reduction.

2.1.3 Main characteristics of the economic sector

2.1.3.1 Industry

According to the Statistical Yearbook of the Republic of Serbia [8], industrial productions has for a long time represented a pillar of economic development of the Republic of Serbia. However, in the beginning of the nineties industrial production has dramatically decreased by 60%, primarily due to political reasons related to the collapse of the Socialist Federal Republic of Yugoslavia (hereinafter: Yugoslavia) and resulting events, including inability of industrial sector to follow technological and structural changes occurring in the world economy at that time. Due to recent economic problems caused by global economic and financial crises in 2008, industrial production in the Republic of Serbia in February 2009 has decreased by 19.7% when compared to February 2008 and by 21.9% compared to the average production accomplished in 2008.

With respect to different sectors of the economy, comparison of data obtained for February 2009 with data representative of February 2008, has indicated the following trends:

- Manufacturing sector – a **decrease** of 23.7%,
- Ore and stone extraction sector – a **decrease** of 10.8%,
- Power, gas and water production and distribution – a **decrease** of 8.5%.

Comparison of February 2009 data on industrial production with respect to economic destination of the goods produced to the corresponding data obtained for February 2008 has indicated the following decrease in production:

- capital goods – 35.9%,
- durable consumer goods – 34.5%,
- intermediate products, energy excluded – 33.1%,
- nondurable consumer goods – 13.4% and
- energy – 8.0%.

The overall volume of industrial production in February 2009 has shown the following trends when compared to data from February 2008:

- a decrease in 28 sectors (participation with 99.9% in the overall industrial production),
- an increase in 1 sector (contribution of 0.1% to the overall industrial production).

The most significant effect on decrease of industrial production recorded in February 2009 when compared to February 2008 has had the following sectors: production of base metals, food product, non-metal mineral products, chemicals and chemical products and electricity generation [4].

Apart from non-favourable trends observed in the world market, the main reasons for previously presented decrease in industrial production are the old dated technologies based on large production systems with redundant workforce, financing based on non-favourable international loans, high custom duties and other barriers, remains of worker self-management in the state socialism and orientation mainly towards local market. In addition, old dated and “dirty” technologies which in today's industrial production participate with 53%, as well as low efficiency of energy and raw material utilisation, high-level waste generation and similar represent a huge problem with respect to environmental pollution. Based on data from report of Serbian Environmental Protection Agency [2] figure 2.1.3.1.a presents geographical distribution of industrial facilities causing the most significant air pollution, while the Figure 2.1.3.1.b shows a share of "dirty" technologies in total industrial production.

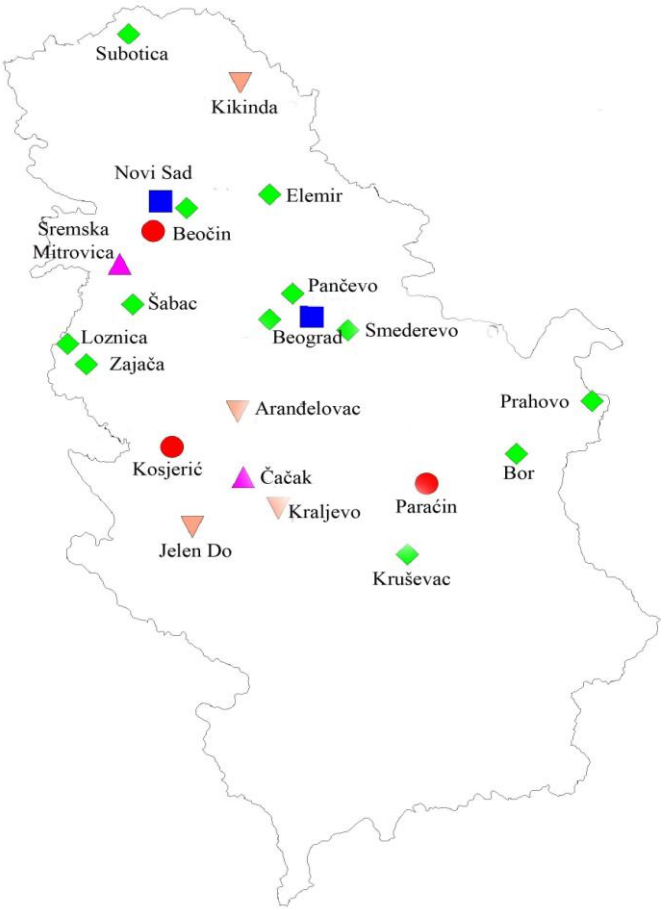
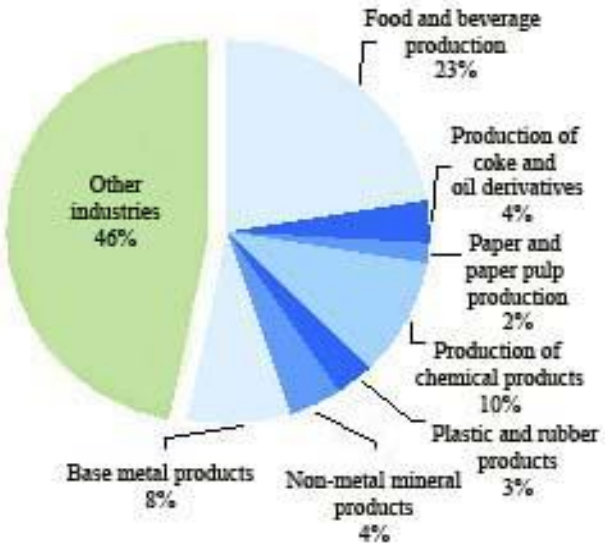


Figure 2.1.3.1.a: Geographical distribution of industrial plants causing the most significant air pollution



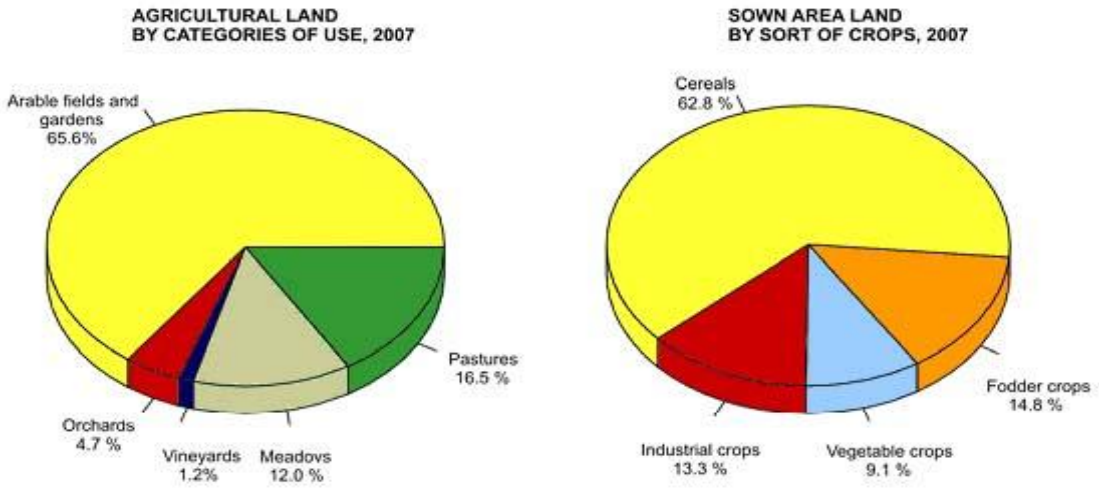
Source: Environmental Protection Agency, 2007

Figure 2.1.3.1.b: Share of "dirty" technologies in total industrial production

With respect to future industrial development of the Republic of Serbia it is especially important to mention a Strategy of Promoting and Developing Foreign Investments[5] and Strategy of Economic Development of the Republic of Serbia[6]. However, a lack of sectoral strategies considering development of different branches of industry is evident. Development of new industrial structure and its adaptation to modern market trends shall be carried out through a series of targeted and coordinated actions and stimulation measures with significant participation of technical industries, all in accordance with the National Sustainable Development Strategy [9].

2.1.3.2 Agriculture

Based on data from Statistical office for 2004 [10], agricultural land in the Republic of Serbia covers approximately 51,120 km^2 or about 66% of the state territory. Out of this area, about 35,360 km^2 or about 46% of the state territory, excluding the Autonomous Province of Kosovo and Metohija, is under permanent crops.



Source: Statistical Yearbook of Serbia for 2008. [8],

Figure 2.1.3.2.a: Agricultural land by categories of use and sort of crop grown

The most developed fields of agricultural production are cattle breading (43%) and crop growing (42%), followed by fruit growing and viniculture (12%), while the growing of all other crops participates with only 3%.

Export of agricultural products account for 20–25% in total exports of the country. The most exported cultures are sugar, berries, grains (corn and cereals). There is a significant potential to further increase export of agricultural products.

There are about 6000 villages in the Republic of Serbia. About 10.87% of the population of the Republic is considered to be agricultural population (11.01% in Central Serbia and 10.58% in the Autonomous Province of Vojvodina). The age structure of agricultural population is particularly unfavourable (about 45% of agricultural household members are older than 50 years of age). A structure of individual households is characterised by a large number of small agricultural holdings, resulting in extensive manner of agricultural production.

Size of individual agricultural households represents a serious obstacle for further agricultural development. An average size of agricultural household in the Republic of Serbia in terms of land area is somewhat larger than 2.5 ha. In Central Serbia an average size of agricultural

[5] Strategy of Promoting and Developing Foreign Investments ("Official Gazette of RS" No. 22/06)
[6] Strategy of Economic Development of the Republic of Serbia until 2012 ("Official Gazette of RS" No. 55/08)

household equals 2.1 ha, while the average size of agricultural household in the Autonomous Province Vojvodina equals 3.38 ha. As a comparison, the average size of agricultural household in the EU countries equals 18.7 ha. Additional problems and difficulties are associated with inadequate agricultural mechanization, as well as poor access to other markets.

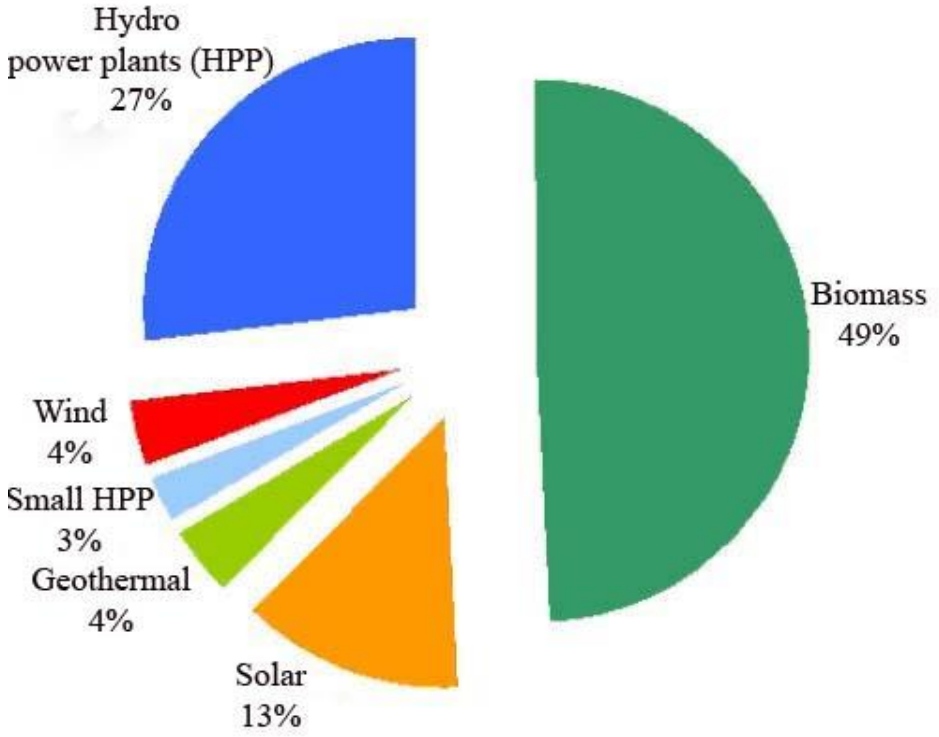
In spite of the evident natural advantages, the main problems preventing development of the agricultural sector in the Republic of Serbia are unfavourable age structure of the population living in the individual agricultural households, unfavourable ownership structure, as well as inadequate transfer of knowledge in the field of biotechnology, marketing, economy and ecology. Majority of the existing food processing plants is old dated and requires significant investments in order to fulfil export standard requirements and obtain ISO 9001 and HACCP accreditation which is one of the requirements to be met if goods are to be exported to the international market.

In order to provide sustainable development of the agricultural sector, the main goal is to organise profitable and environmentally sound agricultural production which would represent a backbone of rural development.

2.1.3.3 Energy

The Republic of Serbia is considered to be poor with respect to its own energy resources, importing about 40% of necessary energy sources. Oil, gas and high quality coal are imported, while electricity can still be produced using the national energy resources.

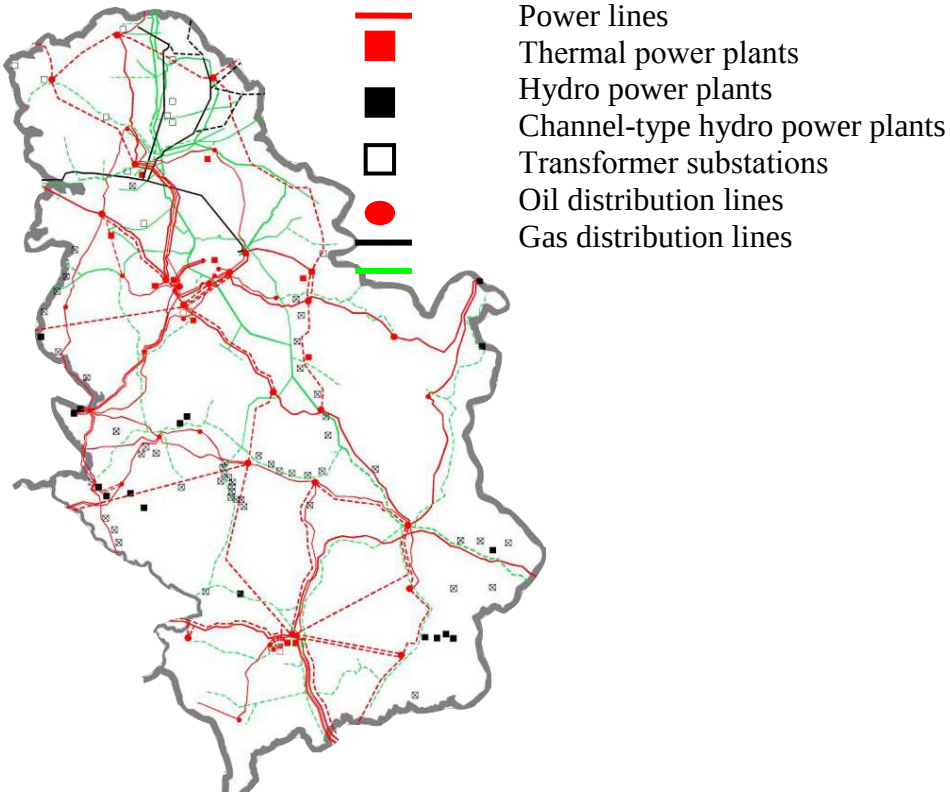
The Republic of Serbia may potentially produce about 4.89 M ten of energy annually from renewable resources i.e. a half of its total production of primary energy. However, currently only 0.86 M ten is produced annually from renewable, representing only 18% of the potential specified. The said almost fully refers to the electricity production in large hydro power plants (over 10 MW of installed capacity).



Source: Official website of the Ministry of Energy and Mining (http://www.mem.sr.gov.yu/)

Figure 2.1.3.3.a: Share of renewable that may potentially be used for electricity production in the Republic of Serbia

The main producer and distributor of electricity in the Republic of Serbia is a state-owned Public Utility Company – Electric Power Industry of Serbia ("Elektroprivreda Srbije" – EPS). Initially operating as an integral company, over the last couple of years EPS has been conducting its business through two individual companies: Public Utility Company – Power Industry of Serbia ("Elektroprivreda Srbije" – EPS) and Public Utility Company – Power Transmission Network of Serbia ("Elektromreža Srbije" – EMS). Total length of power transmission lines equals 9,864.08 km, while the total rating of power production capacities equals 8,355 MW.



Source: Environmental Protection Agency, 2007

Figure 2.1.3.3.b: Energy infrastructure

Period 2002-2007 was characterised by an increase in energy consumption of approximately 10%, as well as dominant role of fossil fuels (coal, oil and gas) in energy production. When compared to the energy consumption from the year before, data gathered for 2007 shown an increase of energy consumption of 3.5%. The highest increase in energy consumption is observed in the sector of traffic, about 22% when compared to 2002 and about 8% when compared to 2006. With respect to energy consumption in 2007, the largest consumers were households, agriculture, public and commercial services, participating with approximately 40% in total energy consumption. Industry accounted for 35% and traffic with 25% of the total energy consumed. When compared to 2006, energy consumption per different sectors remained almost unchanged.

As for oil processing, main producer, processor and distributor of oil and oil derivatives "PE NIS-OIL INDUTSRY OF SERBIA" Novi Sad has been divided into three parts, on the basis of the Government's decision:

- Public enterprise for transport of oil through oil pipelines and transport of derivatives through product pipelines, Belgrade;

- Public enterprise for transport, storage, distribution and trade in natural gas, Novi Sad;
- Joint Stock Company for research, production, processing, distribution and trade in oil and oil derivatives and research and production of natural gas, Novi Sad.

With respect to environmental protection from negative effects of pollutant emissions released from large energy production plants, the Republic of Serbia is far behind the developed countries and EU standards. For that reason it is planned to focus energy politics in the following three years towards the use of renewable energy resources, implementation of energy efficiency programme, implementation of the rational energy use program and similar.

2.1.4 Current state of the environment in the Republic of Serbia

Industrial production in the Republic of Serbia is characterised by old dated technologies, low energy and raw material utilisation efficiency and high-level waste generation. These factors significantly contribute to environmental pollution and degradation. Cleaner production concept, as well as a concept of best available techniques has just been recently started to be implemented.

In addition, environmental pollution may result from activities carried out in all sectors of energy production and in all phases of energy production and consumption cycles – starting with production up until the energy consumption. With respect to energy protection measures carried out to prevent or reduce environmental pollution, the Republic of Serbia is far behind the developed countries and the EU standards. In addition, certification of the environmental management systems is currently at low level.

Traffic is another human activity greatly contributing to the increase of green house gas concentrations in ambient air. In addition, road transport represents the main identified source of PAH in the Republic of Serbia. Significant air pollution results from the use of leaded petrol and high-sulphur diesel.

Agriculture, as an important economic sector in the Republic of Serbia, significantly affects natural resources through the use of water, mineral fertilizers and pesticides, in that way affecting the soil and water quality and producing emissions of green house gases. Pesticides mainly pollute the soil and ground waters. Additionally factors that contribute to environmental pollution are the lack of education in agricultural companies, small size of individual agricultural households, as well as insufficient financial resources since the principles of "good agricultural practice" are not implemented.

2.1.4.1 Current situation – air

Ambient air quality in urban areas is related to emissions of SO_2, NO_x, CO, soot, particles, organic and non-organic substances resulting from the operation of thermal power plants, industry, traffic, fuel combustion in individual boiler houses etc. Thermal power plants, oil refineries, chemical industry and metallurgical complexes represent large air polluters. Ambient air quality in towns is also related to population increase and an increase in the number of used vehicles and industrial production, as well as the type and number of pollution sources. Also, significant air pollution results from the use of leaded petrol and high-sulphur diesel.

Thermal power plants in Obrenovac, Kolubara and Kostolac, oil refineries in Pančevo and Novi Sad, chemical industry and metallurgical complexes in Pančevo, Kruševac, Šabac, Bor and Smederevo represent large air pollutants. Cumulative air pollution occurs due to the activities of petrochemical and oil refinery complexes and fertilizer plant "HIP-AZOTARA" concentrated in the area of the town of Pančevo.

Identified reasons contributing to environmental pollution are releases of untreated waste gases or low efficiency of waste gas treatment devices installed in industrial and power generation

plants, use of old dated technologies with low energy efficiency, absence of measures for encouraging emission reduction, absence of rational traffic management, poor maintenance and control of vehicles, poor fuel quality.

2.1.4.2 Current situation – water

Complex geological composition and favourable hydrogeological characteristics resulted in abundance of mineral and thermo mineral water resources in the Republic of Serbia. Based on the quantities and diversity of physical and chemical properties of those waters, the Republic of Serbia may be classified as one of the areas with the most abundant water resources in Europe. However, there are significant shortcomings in water management practiced in Serbia, especially related to wastewater treatment. For example, sewage systems are significantly less developed than water supply systems. Only 5.3% of total municipal wastewaters are appropriately treated before being released into the recipients. It is estimated that diffuse pollution sources contribute with more than 50% to total water pollution. Only about half of the households (55.6%) are connected to the central sewage systems (75% of urban households and 9% of the rural households).

In the previous period not enough attention has been paid nor sufficient resources allocated to solving the issues of wastewater treatment, resulting in degradation of water quality in water streams i.e. the recipients. Additional risk arises from uncontrolled releases of untreated waste waters into small local water streams and ravines or inadequate sewers, causing danger to the ground water resources. Water protection measures are rarely carried out. Due to such attitude towards water resources, a large number of water streams in summer months can be used only for irrigation, but not even at all times. In some water streams flora and fauna are endangered.

Current situation with respect to water resources in the Republic of Serbia cannot be deemed satisfactory.

2.1.4.3 Current situation - soil

Soils of the Republic of Serbia are very heterogeneous, primarily as a result of diverse geological composition, climate, vegetation and pedofauna. In order to preserve diversity within the integral environmental protection system, soil characteristics and land use are regularly monitored, sensitive and highly loaded areas identified and soil pollution level determined.

Of all identified industrial locations with registered soil pollution, the majority is related to oil industry (59.2%), chemical industry (15.2%) and metal processing industry (13.3%).

In 2007 an increase in the number of programmes and locations where soil characteristics are monitored has been observed. A progress has also been made in public availability of data collected. Areas where soil quality is monitored include the areas of southeast Serbia, the city of Belgrade, towns of Novi Sad, Kragujevac and Užice.

The main reason preventing comprehensive analysis of soil pollution in the Republic of Serbia and comparison of the results collected during the past years is the absence of systematic soil quality monitoring which would enable harmonization of sample collection and analysis, as well as presentation of the results obtained. In addition, legislation in the field of soil quality monitoring and protection in the Republic of Serbia is not sufficiently developed.

2.1.4.4 Environmental risk factors

2.1.4.4.1 Waste

Inadequate waste management represents one of the most significant environmental problems. Only about 60% of municipal waste is collected in an organised manner and only in urban areas. Waste disposal at waste disposal sites which are not organised in accordance with relevant standards and are considered to be waste dumps is the only manner of waste disposal. There are a large number of illegal waste dumps. The main challenges with respect to waste management in the Republic of Serbia are related to provision of proper coverage of the state territory and capacities needed to conduct waste collection, transport and sanitary disposal.

There is no plan with respect to biodegradable waste management, while the packaging waste management system is not established in spite of the constantly increasing packaging quantities, primarily resulting from the increasing quantities of non-returnable packaging, mainly polyethylene terephthalate (PET) packaging and cans. Current recycling or waste utilization activities are insufficient.

In the Republic of Serbia there is no disposal site intended for hazardous industrial waste disposal. Hazardous waste is temporarily stored in inappropriate storages, some of them several decades old. In addition, special waste flows, including waste oils, old vehicles, batteries, electronic and electrical waste and waste tires are insufficiently managed.

The following problems have been identified as the most important: insufficiently developed infrastructure causing soil and surface and groundwater pollution, joint disposal of municipal and hazardous waste, lack of data on waste composition and waste flows, absence of waste management permit issuing, absence of waste storage facilities, hazardous waste treatment plants and hazardous waste storage facilities, inadequate handling of medical waste, PCB-containing waste, slaughterhouses waste etc.

2.1.4.4.2 Chemicals

Chemical industry plays an important role in the overall industrial production and export of the Republic of Serbia (18%).

The following problems have been identified as the most important: lack of database and systematic monitoring of chemical lifecycle i.e. effects which certain chemicals may cause on health and environment insufficiently equipped laboratories carrying out qualitative and quantitative chemical analysis, absence of a system for comparing laboratory work with good laboratory practice, poor chemical industry infrastructure, lack of funds for investing in cleaner technologies, improper chemical storage, insufficient cooperation between different state authorities competent for various stages of chemical lifecycle management.

2.1.4.4.3 Accidents

Republic of Serbia is burdened by bad condition of many chemical facilities inherited from the previous period, their transformation, uncontrolled urbanization, inadequate implementation of prevention and preparedness measures, as well as inadequate response to accidents at all levels (starting from the individual companies up to the Republic of Serbia).

2.2 Legal and institutional framework

2.2.1 Environmental protection policy and legislation

Strategic development directions for the field of environmental protection are being achieved through adopted legislation, as well as regulative documents which are currently in different phases of the legal procedure for adoption.

Adopted National Sustainable Development Strategy of the Republic of Serbia [9] defines, among other, strategic directions in environmental protection development. However, Draft National Environmental Protection Programme - NPEP, although developed in 2005, has still not been adopted. The specified programme represents the basic strategic document for determining future directions of environmental protection. Having in mind that new draft NPEP has been used for National Sustainable Development Strategy [9] development, it is assumed that the adopted strategy specifies the basic principles of environmental development. In addition, National Waste Management Strategy [11], adopted in 2003 and containing a program aimed to ensure compliance with the EU standards, although partially out-dated and currently being prepared for a revision, represents one of the documents addressing the issue of POPs management. The Strategy regulates waste, hazardous waste and PCB waste management.

Apart from the above specified documents, environmental protection is also considered in policies defined in the Agricultural Development Strategy [12], Energy Sector Development Strategy until 2015 [13] and other strategies developed for different sectors in the Republic of Serbia. However, integration of environmental protection issues into those strategies requires additional work. Harmonization of national legislation with the EU legislation shall support the integration process, since implementation of EU legislation also provides implementation of strategic environmental protection goals defined in different sectoral policies of the EU.

National Sustainable Development Strategy of the Republic of Serbia [9] is harmonized with the following, already adopted national regulations: National Strategy for the Accession of Serbia-Montenegro to the European Union [14], Poverty Reduction Strategy [15], National Economic Development Strategy for the period 2006-2012 [6], as well as different sectoral development strategies, primarily the Agricultural Development Strategy of the Republic of Serbia [12] and Energy Sector Development Strategy for the period up to 2015[13].

National Sustainable Development Strategy [9] identifies the key national priorities of the Republic of Serbia for achieving envisioned sustainable development until 2017. It should be pointed out that National Sustainable Development Strategy [9] defines the following two environmental protection priorities:

1. **EU membership** - In order to achieve its main strategic and political goals i.e. participation in the processes of European integration, EU accession and later the full EU membership, the Republic of Serbia is obliged to fulfil numerous complex and interrelated requirements set out in the EU more that 10 years ago, including:
   - establishment of longstanding and stable institutions, guaranteeing democracy, rule of law and respect and protection of human rights and the rights of the minorities;
   - development of market economy, able to cope with the pressure resulting from the EU market competition;
   - harmonization with EU legislation and acceptance of all obligations resulting from the EU membership.
2. **Environmental protection and improvement** and rational use of natural resources, preservation and improvement of environmental protection systems, environmental pollution reduction, use of national resources in a manner that enables their availability for future generations, requiring:

- sustainable production and consumption planning and reduction of waste generation per unit produced;
- protection and conservation of biodiversity.

Therefore, achievement of sustainable development in the Republic of Serbia, with respect to environmental protection and improvement and rational use of natural resources, requires integration and harmonization of all goals and measures defined in various national development strategies and policies set out for different sectors, harmonization of national regulations with EU legislation, as well as their full implementation. In addition, it is important to point out that National Sustainable Development Strategy [9] defines specific goals for sustainable development of different sectors. Only the goals directly related to the NIP shall be specified hereinafter. It should be emphasized that each of the below identified target goals indicate that for the purpose of harmonization of national legislation with the EU legislation, new set of regulations should be developed and existing regulations revised.

1. Goals set up for **air** quality preservation and improvement include:
   - reduction of the energy sector and industry related air pollution;
   - fuel quality improvement and gradual abandonment of leaded petrol and high sulphur diesel fuel use;
   - improvement of air quality monitoring systems in towns and capacity increase of air quality analysis laboratories;
   - improved access to public information related to air quality and actions aimed at raising public awareness.
2. Goals set up for sustainable use of **water resources** include:
   - increased availability of good quality water, to be accomplished by water-supplying larger share of the population from public water distribution systems;
   - loss reduction in water distribution systems;
   - protection and improvement of water quality in accumulations used for water supply;
   - improved stream water quality, primarily by waste water treatment plant construction and more efficient operation of existing waste water treatment plants, as well as controlled use of fertilizers and plant protection products;
   - polluted water streams recovery and remediation;
   - economic valuation of water and water related services, through implementation of "polluter pays" and "consumer pays" principles;
   - implementation of appropriate institutional and territorial organization in the water resources sector;
   - determining the legal status and ownership transformation of water management companies;
   - solving the problem of municipal water management in accordance with a public-private partnership (PPP) model, to be applied in larger towns and through government investment initiatives for smaller settlements;
   - regulatory function establishing;
   - enabling participation of the public and consumer involvement in all phases of water management.
3. Goals set up for sustainable **soil** use include:
   - prevention of further soil deterioration and preservation and improvement of soil quality, primarily carrying out appropriate industrial, mining, energy, traffic related and other activities;
   - protection from soil degradation and land use changes, as well as agricultural land arrangement.
4. Goals set up for **fossil fuel use** include:

- exploitation of non-renewable natural resources in a manner that provides the best long-term security of energy supply and the least possible environmental degradation, without imposing risks to human health;
- discovery of new fossil fuel reserves and sustainable use of non-renewable natural resources in the most efficient and rational manner;
- use of modern methods in oil and gas research, together with the use of BAT for research related waste disposal, modernisation of refineries in order to satisfy current and planned requirements related to quality, distribution and trade of petroleum products, and taking into account all environmental regulations in the fields of treatment, distribution and trade of petroleum products;
- replacement of conventional fossil fuels with renewable, including provision of certain economic stimulation measures.

5. Goals set up for **renewable energy sources** include:
   - intensifying research of renewable potential, aimed at verification and more accurate balancing of renewable sources;
   - determining technologies for which stimulation measures are justifiable and carrying out comparative analysis of possible stimulation mechanisms;
   - adopting regulations which promote the use of energy generated from renewable sources (tax reductions, favourable pricing of electricity generated from renewable etc.);
   - increasing the use of renewable energy sources;
   - education programs and public awareness rising for the purpose of promoting a greater use of renewable.
6. Goals set up with respect to **climate change** include:
   - institutional adaptation needed for active implementation of climate protection policies and fulfilment of obligations under international agreements (United Nations Framework Convention on Climate Change - UNFCCC, Kyoto Protocol and others);
   - adaptation of economic entities from the sectors of energy, industry, transport, agriculture, forestry and municipal utility-housing activities to the climate change policies and fulfilment of obligations imposed by international agreements;
   - action plan development for adaptation of economic entities to climate change;
   - design, development and implementation of appropriate response of the public health protection system to the global climate change.
7. Goals set up for **waste management** include:
   - development of regional and local waste management plans;
   - construction of municipal and hazardous waste handling infrastructure (regional waste disposal sites, waste treatment plants for different waste types, composting and anaerobic digestion plants, hazardous waste treatment plants, facilities for energy utilization from waste etc.);
   - rehabilitation of existing municipal waste landfills and hazardous waste disposal location;
   - education programs and public awareness rising aimed at solving waste management related problems.
8. Goals set up for **chemicals management** issues include:
   - reduction of human health and environmental risks resulting from the use of specific chemicals, as well as appropriate replacement of hazardous substances, specially PBT chemicals, with less hazardous ones;
   - development and improvement of chemicals management information system;

- implementation of activities related to education and public awareness raising about chemical related human health and environmental risks;
- introducing supporting measures for implementation of good agricultural practice.

9. Goals set up for **chemical accident prevention** and limitation of related environmental impacts and impacts on human life and health include:
   - carrying out chemical accident prevention, preparedness and response measures at all levels (starting from individual companies up to the state level);
   - development of chemical accident information and management system for the entire territory of the Republic of Serbia, as one of the elements of integrated protection and rescue system from the impact of natural disasters, storms and other large accidents;
   - personnel, organizational and institutional reinforcement of bodies, organizations and institutions aimed at improved implementation of legal obligations in the chemical accident related field;
   - preparation and implementation of appropriate activities providing integration of national response system into regional and broader accident response system in case of the accidents with transboundary effects.
10. Goals set up for sustainable **industrial development** with respect to environmental protection issues include:
   - construction and/or reconstruction of environmental protection related industrial infrastructure (waste gas and waste water treatment, waste treatment);
   - reconstruction or modernization of existing technological processes, system establishment for integrated permit issuing for industrial facilities and related activities in accordance with the Law on Integrated Environmental Pollution Prevention and Control[7], applying BAT and BEP;
   - remediation of polluted industrial sites;
   - introducing cleaner production and increased energy efficiency and more efficient use of raw materials, together with reduced waste generation;
   - implementation of corporate environmental management standards ISO 14000, EMAS system
   - development of the Integral Cadastre of Polluters, monitoring and self-monitoring programs.
11. Goals set up for sustainable development of the **energy sector** include:
   - promoting the use of renewable energy sources;
   - adopting and implementing international agreements related to air pollution, climate change and ozone layer depletion;
   - stimulating more rational use of natural resources, reducing air polluting releases, reducing waste generation, as well as better waste utilization;
   - reducing the risks of air pollution and ozone depletion;
   - solving problems related to waste manipulation in the energy sector;
   - building and raising public awareness, as well as improving public access to environmental and energy sector related information.

[7] Law on Integrated Environmental Pollution Prevention and Control ("Official Gazette of RS", no. 135/04)

12. Goals set up for the sector of **agriculture** include:
    - promoting investments aimed at reducing pollution from the agricultural sector, preserving agrodiversity and traditional (combined) farm systems in order to enable preservation of biodiversity, from landscape to species scale, in sensitive agro-ecological conditions, developing an animal welfare protection system, reducing erosion, as well as providing overall environmental preservation and improvement;
    - increasing the land used for organic farming and other environmentally acceptable agricultural production;
    - raising and developing awareness of agricultural producers on environmental problems, taking into account biodiversity protection and principles of animal welfare.
13. Goals set up for sustainable **traffic** development include:
    - reducing the contribution of traffic sector to air pollution and noise emissions by improving the fuel and vehicle quality and reducing the use of fossil fuels.
14. Goals set up for **cleaner production** include:
    - introducing and/or improving efficient, sustainable and cleaner production and more efficient energy use;
    - construction of cleaner production infrastructure – realisation of investment projects (studies and development programs, as well as construction of industrial facilities);
    - development of industrial and technology parks, clusters, innovation centres and incubators;
    - waste management system establishing, especially considering possibilities for reduction of waste generation and use of waste as energy source and raw material;
    - accelerated completion of corporate restructuring and privatisation;
    - reconstruction and improvement of existing technological processes, along with mandatory harmonization with appropriate BATs;
    - improvement of corporate environmental management systems (EMS);
    - education related to the field of environmental protection, implementation of clean technologies and energy efficiency policies.

Besides the National Sustainable Development Strategy [9], another very important strategic document is the **National Waste Management Strategy** [11] which provides conditions for rational and sustainable state-level waste management. Implementation of basic waste management principles set out in the strategic framework i.e. resolving waste related problems at the very location of waste generation, implementation of waste prevention principle, separate waste collection, hazardous waste neutralisation, regional waste disposal solution and waste dump rehabilitation, provides implementation of basic EU waste management principles and prevents further environmental threats, enabling its preservation for the future generations. National Waste Management Strategy [11] foresees implementation of the following measures aimed at POPs waste management system establishing:

1. Construction of regional storage facilities to be used for receiving, packing (re-packing), labelling and storage of potentially hazardous waste intended to be treated in the Republic of Serbia or exported to be treated/recuperated abroad. In addition, development of strategic plans for construction of regional hazardous waste incineration plants and their construction. Apart from the above, furnaces of the cement factories and ironwork plants are to be utilized for incineration of some hazardous waste types, due to high operating temperatures and residence times appropriate for intended purposes. However, suitable gas treatment facility is required to be constructed. Having in mind extreme importance and urgency of the considered issue (currently there are no hazardous waste treatment facilities in the Republic of Serbia), construction of regional waste treatment

facility should be a priority. Specified waste treatment facilities must be constructed in accordance with the provisions of the IPPC Directive.

2. Replacement of all PCB/PCT containing devices until 2015.

3. Development of a plan for closing inappropriately managed waste landfills and waste dumps, reducing generation of unintentional POPs releases resulting from waste burning. In some cases the specified measures are already being implemented.

4. Examine possibilities for continuing use of existing waste landfills until the construction of regional waste disposal sites and waste treatment facility. For that purpose, certain waste landfills are to be rehabilitated, reducing the environmental risks to a minimum. Improperly managed waste dumps are to be closed and overall number of waste disposal dumps is to be reduced.

In addition, a very important strategic document used for development of the NIP is a **Draft NPEP (2009-2018)**. The Programme defines strategic environmental protection goals, as well as specific goals related to protection of specific environmental media (air, water, soil) and different business sectors i.e. their environmental impact (industry, energy, agriculture, mining, traffic etc.). Moreover, the Programme determines priority goals related to each environmental medium and business sector and proposes necessary regulatory reforms required for the achievement of specified goals. Changes proposed include reforms of regulatory instruments, economic instruments, monitoring and information system, environmental financing, institutional issues and requirements related to environmental infrastructure. The Programme is developed for the purpose of modern environmental policy development in the Republic of Serbia during the next decade.

A **Cleaner Production Strategy** of the Republic of Serbia [16] should also be mentioned since it represents elaboration of strategic documents, especially the National Sustainable Development Strategy [9] and Draft NPEP of the Republic of Serbia. The Cleaner Production Strategy [16] elaborates the national sustainable development concept by promoting implementation of cleaner production principle.

The basic environmental regulation in the Republic of Serbia is the Law on Environmental Protection[8]. The Law contains the following chapters: General Provisions, Management of Natural Resources, Environmental Protection Measures and Conditions, Environmental Monitoring, Public Informing and Participation, Economic Instruments, Environmental Pollution Liability, Supervision, Penalties and Transitional and Concluding Provisions.

The section titled Environmental Protection Measures and Conditions provides a basis for determining emission and imission limit values for pollutant emissions to air, water and soil, as well as conditions for plant operation and related activities. In addition, basic procedures for determining the endangered status of the environment are also defined, as well as appropriate remediation procedures. The section also provides fundamentals of the National Environmental Protection Programme, appropriate implementation action plans, also defining jurisdictions for development and implementation of remediation plans. The section of Environmental Monitoring defines basic issues related to continuous environmental control and monitoring, information system and data acquisition, Integral Cadastre of Polluters, as well as reporting on the state of the environment.

Apart from the **Law on Environmental Protection**, the following laws regulate specific environmental protection issues:

- Law on Strategic Environmental Impact Assessment[9];
- Law on Environmental Impact Assessment[10];
- Law on Integrated Environmental Pollution Prevention and Control[11].

[8] Law on Environmental Protection ("Official Gazette of RS" No. 135/04)
[9] Law on Strategic Environmental Impact Assessment ("Official Gazette of RS" No. 135/04)
[9] Law on Integrated Environmental Pollution Prevention and Control ("Official Gazette of RS" No. 135/04)

Apart from the above specified legislations, the entire set of laws was adopted in May 2009, including:

- Law on Waste Management[12];
- Law on Packaging and Packaging Waste[13];
- Law on Plant Protection Products[14];
- Law on Air Protection[15];
- Law on Chemicals[16];
- Law on Biocidal Products[17];
- Law on Amendments on the Law on Environmental Protection[18].

[11] Law on Integrated Environmental Pollution Prevention and Control ("Official Gazette of RS" No. 135/04)
[12] Law on Waste Management ("Official Gazette of RS" No. 36/09)
[13] Law on Packaging and Packaging Waste ("Official Gazette of RS" No. 36/09)
[14] Law on Plant Protection Products ("Official Gazette of RS" No. 41/09)
[15] Law on Air Protection ("Official Gazette of RS" No. 36/09)
[16] Law on Chemicals ("Official Gazette of RS" No. 36/09)
[17] Law on Biocidal Products ("Official Gazette of RS" No. 36/09)
[18] Law on Amendments of the Law on Environmental Protection ("Official Gazette of RS" No. 36/09)

2.2.2 Roles and responsibilities of different ministries, agencies and other institutions in **POP**s management

Table 2.2.2.a: Roles and responsibilities of different ministries, agencies and other institutions in POPs management

Obligations under the Convention	National legislation	Institutions responsible for implementation of the Convention
Article 3 Prohibited production, use, export or import of the chemicals listed in Annex A to the Convention and restricted production and use of the chemicals listed in Annex B to the Convention. Preventing production and use of new pesticides or new industrial chemicals which do not fulfil defined POPs criteria.	Law on Chemicals Law on Biocidal Products Law on Waste Management Law on Plant Protection Products	Ministry of Environment and Spatial Planning Department of Waste Management Chemicals Agency Ministry of Agriculture, Water Management and Forestry Directorate of Plant Protection Department of Fertilizer and Plant Protection Products. Ministry of Finance-Customs Administration
Article 5 Measures to reduce or eliminate releases of the chemicals listed in Annex C to the Convention (unintentional production). Action plan development in order to identify, describes, and sanction release of the chemicals listed in Annex C. Promote implementation of available, feasible and practical measures for efficient emission reduction or source elimination. Promote development and use substitute or modified materials, products and processes. Promote the use of best available techniques for new source categories identified in Part II of Annex C.	Law on Air Protection Law on Integrated Environmental Pollution Prevention and Control. Law on Strategic Environmental Impact Assessment Law on Environmental Impact Assessment Law on Amendments on the Law on Environmental Protection Law on Waste Management Rulebook on Methodology for Compiling the Integral Cadastre of Polluters Law on Waters	Ministry of Environment and Spatial Planning Department of Integrated Pollution Prevention and Control Sector of Air Protection Department of Accident Procedures Department of Impact Assessment Department of Water and Soil Protection Department of Waste Management Serbian Environmental Protection Agency Group for Integral Cadastre Compiling Ministry of Agriculture, Water Management and Forestry Directorate of Waters
Article 6 Management of stockpiles consisting of chemicals listed in Annex A, B and C, as well as waste including products and articles upon becoming waste, consisting of, containing or contaminated with some of the chemicals listed in Annex A, B and C, in a manner protective of human	Law on Amendments on the Law on Environmental Protection Law on Waste Management Law on Environmental Protection	Ministry of Environment and Spatial Planning Department of Waste Management Department of Water and Soil Protection Serbian Environmental Protection Agency Group for Integral Cadastre Compiling

health and the environment. Development of appropriate strategies for identification and management of stockpiles in a safe, efficient and environmentally sound manner. Taking appropriate measures aimed at safe and irreversible destruction of POPs waste, or, when destruction (degradation) does not represent the environmentally preferable option, its disposal in environmentally sound manner. Ensuring prohibition of POPs waste disposal in a manner that may lead to POPs reuse. Identification of contaminated sites and their remediation in environmentally sound manner.		
Article 7 National Implementation Plan for the Stockholm Convention.		Ministry of Environment and Spatial Planning
Article 11 Carrying out POPs monitoring.	Law on Environmental Protection Law on Amendments on the Law on Environmental Protection Law on Integrated Environmental Pollution Prevention and Control Law on Air Protection Law on Waters Law on Chemicals Law on Waste Management Rulebook on Methodology for Compiling the Integral Cadastre of Polluters, Law on Food Safety Law on Plant Protection Products	Ministry of Environment and Spatial Planning Sector of Air Protection Department of Water and Soil Protection Department of Waste Management Serbian Environmental Protection Agency Group for Integral Cadastre Compiling Ministry of Health Ministry of Agriculture, Water Management and Forestry
Article 15 Obligatory reporting – each of the signatories to the Convention is obliged to submit to the Secretariat statistical data on totally produced, imported and exported quantities of each of the chemicals listed in Annex A and Annex B.	Law on Chemicals Law on Biocidal products Law on Plant Protection Products	Ministry of Environment and Spatial Planning Chemicals Agency Serbian Environmental Protection Agency Ministry of Agriculture, Water Management and Forestry Directorate for Plant Protection

Article 16 Obligatory evaluation of Convention's effectiveness related to the activities foreseen in the Convention implementation plan.		Ministry of Environment and Spatial Planning Chemicals Agency Department of Waste Management Sector of Air Protection Department of Water And Soil Protection Ministry of Health Ministry of Agriculture, Water Management and Forestry Directorate for Waters

2.2.3 Relevant international agreements

The Republic of Serbia is a member of numerous international organisations, such as:

- United Nations (UN)
- World Bank (WB)
- International Monetary Fund (IMF)
- United Nations Industrial Development Organization (UNIDO)
- United Nations Educational, Scientific and Cultural Organization (UNESCO)
- International Labour Organization (ILO)
- International Maritime Organisation (IMO)
- World Health Organisation (WHO)
- International Civil Aviation Organization (ICAO)
- International Telecommunication Union (ITU)
- Universal Postal Union (UPU)
- International Atomic Energy Agency (IAEA)
- World Intellectual Property Organization (WIPO)
- Food and Agriculture Organization of the UN (FAO)
- International Organization for Migration (IOM)
- World Meteorological Organization (WMO).

The Republic of Serbia has ratified various international agreements addressing the issues of chemicals and waste. The provisions of those agreements have been confirmed in the following national laws and regulatory documents:

- Law on Ratification of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal ("Official Gazette of FRY – International Contracts", No. 2/99);
- Law on Ratification of the Montreal Protocol on Substances that Deplete the Ozone Layer ("Official Gazette of SFRY – International Contracts", No. 16/90, "Official Gazette of Serbia and Montenegro – International Contracts", No. 2/04);
- Law on Ratification of the Vienna Convention on the Protection of the Ozone Layer, with Annex I and II ("Official Gazette of SFRY – International contracts", No. 1/90) ;
- Law on Ratification of Agreement on Pollution Protection of the River Tisa and its Tributaries ("Official Gazette of SFRY – International Contracts", No. 1/90);
- Law on Ratification of the Convention on Long-Range Transboundary Air Pollution ("Official Gazette of SFRY – International Contracts", No. 11/86);
- Law on Ratification of the Protocol of the Convention on Long-Range Transboundary Air Pollution on Long-Term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP) ("Official Gazette of SFRY – International Contracts", No. 2/87);
- Regulation on Ratification of the Convention on Protection against Hazards of Poisoning Arising from Benzene ("Official Gazette of SFRY – International Contracts", No. 16/76);

- Law on Ratification of the Convention on Prevention and Control of Professional Risks Caused by Cancerous Substances and Reagents ("Official Gazette of SFRY – International Contracts", No. 3/77);
- Regulation on Ratification of the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction ("Official Gazette of SFRY – International Contracts", No. 43/74);
- Law on Ratification of the Convention on the Protection of Workers against Occupational Hazards in the Working Environment Due to Air Pollution, Noise and Vibration ("Official Gazette of SFRY – International Contracts", No. 14/82);
- Law on Ratification of the Convention concerning Occupational Safety and Health and the Working Environment ("Official Gazette of SFRY – International Contracts", No. 7/87);
- Law on Ratification of the Convention on Occupational Health Services ("Official Gazette of SFRY – International Contracts" No. 14/89);
- Law on Ratification of the Convention on the Safe Use of Asbestos ("Official Gazette of SFRY – International Contracts" No. 4/89);
- Law on Ratification of the Convention on the Prohibition of Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction ("Official Gazette of Serbia and Montenegro – International Contracts" No. 2/00);
- Law on Ratification of the Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in international trade with amendments ("Official Gazette of Serbia – International Contracts" No. 38/09);
- Law on Ratification of the Stockholm Convention on Persistent Organic Pollutants ("Official Gazette of Serbia – International Contracts" No. 42/09).

Besides cooperation within the specified international organisations, the Republic of Serbia actively cooperates with United Nations Environmental Programme (UNEP), United Nations Development Programme (UNDP), United Nations Economic Commission for Europe (UNECE), European Commission Directorate General for Environment (EC DG Environment), European Environment Agency (EEA), International Commission for Protection of the Danube River (ICPDR), European Agency for Reconstruction (EAR), German Agency for Technical Cooperation (GTZ), Swedish International Development Cooperation Agency (SIDA), Swiss Agency for Development and Cooperation (SDC), United States Agency for International Development (USAID), Canadian International Development Agency (CIDA) and Japan International Cooperation Agency (JICA).

A number of environmental projects regarding capacity buildings are carried out by the Ministry of Environment and Spatial Planning with financial aid of European Commission, as well as other bilateral donors.

2.2.4 POPs related legislation and regulations

A list of Laws regulating environmental protection issues and laws regulating chemicals as a group with significant environmental impact are shown in Table 2.2.4.a. All of the Laws specified below refer to the POPs as well.

Table 2.2.4.a: Legislation addressing the POPs issues

Legislation	**Harmonized with EU Directives and Regulations**	**Competent Authority for implementation of the legislation**
Law on Environmental Protection ("Official Gazette of RS", No. 135/04 and 36/09)	- Regulation No. 1210/1990 - Regulation No. 761/2001 - Regulation No 166/2006 - Regulation No 1013/2006 - Regulation No. 1980/2000 - Directive 91/692/EC - Directive 2003/35/EC - Directive 2003/4/EC - Directive 2004/35/EC - Directive 96/82/EC - Recommendation 75/436/Euratom	Ministry of Environment and Spatial Planning
Law on Integrated Pollution Prevention and Control ("Official Gazette of RS", No. 135/04)	- Directive 96/61/EC - Directive 2003/35/EC	Ministry of Environment and Spatial Planning
Law on Strategic Environmental Impact Assessment ("Official Gazette of RS", No. 135/04)	- Directive 2001/42/EC - Directive 2003/35/EC	Ministry of Environment and Spatial Planning
Law on Environmental Impact Assessment ("Official Gazette of RS", No. 135/04)	- Directive 97/11/EC - Directive 2003/4/EC - Directive 2003/35/EC	Ministry of Environment and Spatial Planning
Law on Waste Management ("Official Gazette of RS", No. 36/09)	- Directive 96/59/EC - Directive 2006/12/EC - Directive 2006/66/EC - Directive 94/31/EEC - Commission Decision 2000/532/EC - Directive 2006/121/EC - Directive 99/31/EC - Directive 94/62/EC - Directive 2000/76/EC - Instructions from Basel Convention Technical Guidelines related to disposal sites - Directive 2002/95/EC - Directive 2002/96/EC - Directive 2000/53/EC	Ministry of Environment and Spatial Planning

	- Directive 2000/532/EC - Directive 91/692/EEC - Regulation No. 807/2003 - Regulation No. 2006/1013/EC - Regulation No. 850/2004 - Commission Decision 2005/270/EC - Commission Decision 1997/622/EC - Council Decision 2003/33/EC - Regulation No. 2150/2002 - Directive 2008/98/EC	
Law on Chemicals ("Official Gazette of RS", No. 36/09) Law on Biocidal Products ("Official Gazette of RS", No. 36/09)	Law on Chemicals partially harmonized with: - Regulation No. 689/2008 - Regulation No. 1907/2006 (REACH) - Regulation No. 648/2004 - Regulation No. 1272/2008 - Directive 67/548/EEC - Directive 2004/42/EC - Directive 1998/45/EC - Directive 76/769/EEC Law on Biocidal products partially harmonized with: - Directive 98/8/EC	Ministry of Environment and Spatial Planning
Law on Plant Protection Products ("Official Gazette of RS" No. 41/09)	- Directive 91/414/EEC - Directive 2002/63/EEC - Regulation 396/2005/EEC	Ministry of Agriculture, Water Management and Forestry Directorate of Plant Protection
Law on Air Protection ("Official Gazette of RS" No. 36/09)	- Directive 2008/50/EC - Directive 2004/107/EC - Directive 94/63/EC - Directive 2001/80/EC - Directive 1999/32/EC - Directive 93/12/EEC - Directive 2003/17/EC - Directives 98/70/EC - Directives 2001/81/EC - Directives 1999/13/EC - Directive 2004/42/EC - Directive 96/62/EC - Commission Decision 2004/224/EC - Directive 1999/30/EC - Commission Decision 2004/839/EC - Directive 2000/69/EC - Commission Decision 2004/461/EC - Directive 2005/33/EC	Ministry of Environment and Spatial Planning

Law on Occupational Health and Safety ("Official Gazette of RS" No. 101/05)	- Directive 89/391/EEC	Ministry of Labour and Social Policy Directorate of Occupational Health and Safety
Law on Food Safety ("Official Gazette of RS" No. 41/09)	- Regulation No. 178/2002 - Regulation No. 882/2004 - Regulation No. 852/2004 - Regulation No. 854/2004 - Regulation No. 183/2005 - Regulation No. 258/97 - Regulation No. 1829/2003	Ministry of Health Ministry of Agriculture, Water Management and Forestry

Following legislations addressing POPs issues should be harmonized with EU legislation: Law on Waters ("Official Gazette of RS "No. 46/91, 53/93, 67/93, 48/94, 54/96), Law on Veterinary Medicine ("Official Gazette of RS" No. 91/05), Law on Fire Protection ("Official Gazette of SRS" No. 37/88, "Official Gazette of RS" No. 53/93, 67/93, 48/94), Law on Meteorological Affairs Important to the State ("Official Gazette of SFRY" No. 18/88 and 63/90).

As shown in Table 2.2.4.a and additional text, most of the national legislation is harmonized with EU legislations, but there is some legislation that will be harmonized with EU legislations in the future.

In this chapter, beside laws which were in force during the NIP preparation, draft laws as well as proposals, i.e. drafts of recently adopted national laws harmonized with the EU legislation, which were in the adoption process at the time, were also considered.

Article 3 of the Convention – Measures to reduce or eliminate releases from intentional production and use of chemicals: Obligations stated in Article 3 Paragraph 1 (a) and (b) of the Convention, related to prohibited production and use i.e. import and export of chemicals listed in Annex A, as well as limited production and use of chemicals listed in Annex B, are regulated by existing national legislation.

Accordingly, the old Law on Production and Trade of Poisonous Substances, provides a List of Poisonous Substances Whose Production, Placement on the Market and Use are Prohibited. Apart from POPs pesticides, the list also includes PCB.

In addition, the old Law on Plant Protection as well as newly one, adopted in June 2009, defines an obligation for obtaining a special permit for placing a pesticide on the market. For pesticides listed in Annex A and B to the Stockholm Convention upon the expiry of issued permits, new permits were not to be issued. In that way, the presence of those substances on the market has been eliminated.

The above named obligations are also regulated by the new Law on Chemicals which replaced Law on Production and Trade of Poisonous Substances, in the section related to restriction of production, placing on the market and use. Namely, the specified section of the Law quotes the provisions stated in Annex XVII to EU Regulation 1907/2006 on Registration, Evaluation, Authorisation and Restriction of Chemicals - REACH, as well as prohibitions stated in the EU Regulation 850/2004. In this way, an obligation is imposed for preparation of special sub legal act stating all restrictions in force in the EU. The Law also allows the scope of current restrictions to be extended in accordance with newly adopted EU regulations-REACH.

In accordance with the specified restrictions, the chemicals from the lists shall not be produced nor imported, since the Law defines that placing on the market of the chemicals includes their import as well. In addition, the prohibition of export is also regulated in a strict manner. Namely, the Chemicals Agency, established by the new Law on Chemicals, defines a list of hazardous substances and products, including POPs, whose export is strictly prohibited. In that manner, the provisions of the EU Regulation 689/2008, concerning the export and import of dangerous chemicals, are being implemented. In addition, a section of the Law defines a preliminary informing procedure and Prior Informed Consent (PIC) procedure, in that way implementing the provisions of the Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in international trade. Besides, export of chemicals, especially pesticides whose purity is lower than prescribed and whose use period expires 6 months after their export date, is prohibited.

In addition, the Law also regulates inspection related to implementation of legal restrictions. Supervision and inspection controls are carried out by the environmental protection inspectors.

Legal framework for implementation of the obligations from the Stockholm Convention with respect to PCB is adequately addressed in new Law on Waste Management (adopted in May 2009). According to the Law, PCB is defined as PCB, PCT, monomethyl-tetrachlorodiphenyl methanes, monomethyl-dichloro-diphenyl methanes, monomethyl-dibromo-diphenyl methanes or any other mixture which contains one or more of these substances in concentration higher than 0,005 % by weight. Article 100 of the Law on Waste Management sets out transitional provisions for disposal and decontamination of PCB-containing equipment, as well as for disposal of PCB contained in that equipment. According to this Article, equipment containing more than 5 dm^3 of

PCB will be disposed of or decontaminated until 2015 at latest. The same applies for disposal of PCB contained in that equipment. By the way of derogation, holder of equipment that contain between 0.05%- 0.005% by weight of PCB shall ensure its decontamination or disposal when such equipment cease to be used.

It should be considered that Article 3 Paragraph 1 of the Convention is fully implemented within existing national legislation. Restriction of new POPs will be implemented by adoption of rulebook as a bylaw in accordance with Law on Chemicals.

Obligations prescribed in Article 3 Paragraph 2 of the Convention specify that each chemical listed in Annex A and B is imported only for the purpose of environmentally sound disposal or for a use or purpose which is permitted for a specific country under Annex A and B. Also, a chemical listed in Annex A and Annex B for which any production or use specific exemption or acceptable purpose is in effect, taking into account any relevant provisions in existing international prior informed consent instruments, is exported only for the purpose of environmentally sound disposal or for a use or purpose which is permitted for a specific country under Annex A and B – are included into national legislation through the provisions of previously mentioned old Law on Production and Trade of Poisonous Substances, old Law on Plant Protection, as well as new Law on Chemicals. Taking into account that there are no permits for placement on the market of chemicals referred to in Annex A and Annex B, i.e. that production and placement on the market, as well as their import have been prohibited, and as there is not capacity for hazardous waste disposal in the Republic of Serbia, specified chemicals cannot be imported not even for the purpose of their environmentally sound disposal. However, if stockpiles of prohibited chemicals are found, they are to be treated as waste and handled in accordance with provisions of the new Law on Waste Management. The specified new Law is harmonized with the provisions of the Basel Convention, signed by Serbia in 1999. Pursuant to the Law on Environmental Protection an import of hazardous waste is prohibited. Thus, export of chemicals listed as prohibited is permitted only as waste, and only for the purpose of their environmentally sound disposal.

Due to previously described prohibition of production, placing on the market and use of chemicals listed in Annex XVII of the EU Regulation REACH and the EU Regulation 850/2004, as well as their prohibited export, POPs production and use will be prohibited, so special conditions for export to the country which is not a Party to the Convention is not necessary because such situation will not be possible.

It should be considered that Article 3 Paragraph 2 of the Convention is fully implemented within existing national legislation.

Obligations prescribed in Article 3 Paragraph 3 of the Convention referring to the regulatory measures aimed at preventing the production and use of new pesticides or new industrial chemicals which, taking into consideration the criteria in Paragraph 1 of Annex D, exhibit the characteristics of persistent organic pollutants*,* are defined in several national laws.

New Law on Chemicals does not define procedure for evaluation of new industrial chemicals, since the process of registration, evaluation and authorisation is centralised for the entire EU i.e. is not carried out by individual member countries.

With respect to new industrial chemicals, the law relies on the knowledge obtained in the EU during the registration and authorisation processes and for that reason imports all restriction (including those related to PBT chemicals) in force in the EU, as well as all obligations determined during the authorisation process (Annex XIV of REACH- List of substances subject to authorisation). Namely, the law defines that chemicals of concern, including PBT chemicals, are to be controlled. With that respect, the Chemicals Agency identifies a chain of supply and is authorised to prescribe risk reduction measures related to the use of specific substances. In addition, new Law on Chemicals provides a basic ground for preparation of sublegal act which shall define

criteria for identification of PBT substances. This means that prohibitions defined in the EU legislations have been introduced into the national legislation and that control of chemicals raising concerns is a step in gradual accession to the related chemical authorisation process in the EU.

With respect to pesticides regulated by the new Law on Biocidal Products and new Law on Plant Protection Products, which are both harmonized with EU legislation, the specified laws define procedures for fulfilment of prescribed obligations i.e. PBT pesticide control. Namely, both laws define an active substance registration procedure, as well as procedures for registration of biocides and plant protection products. In addition, prohibited and limited production, import and use of pesticides are defined as well. The said means that obligations specified in Article 3 Paragraph 3 of the Convention shall be regulated by national legislation.

Since a list of prohibitions and limitations is to be taken from the EU legislation, and due to the fact that chemicals listed in Annex A and B are prohibited from being produced, used, exported and imported into Serbia i.e. are not permitted to be placed on the market, also adding that POPs are prohibited by Stockholm Convention, and finally stating that POPs associated health and environmental risks are well recognized in Serbia, it is concluded that there is no need to prescribe the obligation stated in Article 3 Paragraph 6 of the Convention in the national legislation.

As three very important laws are adopted, which establish necessary system for implementation of Article 3 Paragraph 3, it could be concluded that this part of the Convention will be fully implemented once Serbia adopts necessary bylaws in accordance with new laws on chemicals, biocidal products and plant protection products.

Article 5 of the Convention – Measures to reduce or eliminate releases from unintentional production: According to Article 5 of the Convention, each Party to the Convention is obliged to take measures to reduce total releases derived from anthropogenic sources of each of the chemicals listed in Annex C, with the goal of their continuing minimization and, where feasible, ultimate elimination.

One of the measures is development of an Action Plan (***Article 5 Paragraph (a) of the Convention***).

National legislation does not prescribe an obligation for Action Plan development. However, provisions of ratified conventions are integrated into the national legislation and can be directly applied, while the Law on Environmental Protection and specially the new Law on Air Protection appoint the Ministry of Environmental Protection as the authority responsible for defining and implementing measures for reduction or elimination of uPOPs. Hence, the ministry responsible for environmental protection can directly assume the responsibility for action plan development.

Although an authority responsible for action plan development has been identified, numerous laws regulating different sectors do not define the mandatory action plan development or the time base for the plan preparation and elements of the plan. However, instruments enabling identification, description and sanctioning of releases of chemicals listed in Annex C do exist.

Based on the Law on Environmental Protection, a Rulebook on Methodology for Compiling the Integral Cadastre of Polluters has been published[19]. The Rulebook defines the content of the Cadastre i.e. types of data, deadlines and a manner of data submission. The Cadastre contains data on sources, types and quantities, manner and locations of pollutant releases to air and water, as well as quantities, types, composition, treatment and disposal of waste. The Cadastre contains relevant data on POPs i.e. chemicals listed in Annex C of the Convention. The Cadastre has been established at the end of 2007 and its content has been accorded with the Protocol on Pollutant Release and Transfer Register (PRTR) of the Aarhus Convention. Operators are obliged to submit relevant data for the Cadastre keeping and maintaining.

[19] Rulebook on Methodology for Compiling the Integral Cadastre of Polluters has been published ("Official Gazette of RS" No. 94/07)

In addition, the new Law on Air Protection foresees development of Air Protection Strategy and an Action Plan for Strategy implementation which, among other, defines priority measures, as well as measures for reduction or elimination of uPOPs production. The ministry responsible for environmental protection is the authority responsible for the Action Plan development. The Government issues the Plan for a four year period.

In addition, the Law on Integrated Pollution Prevention and Control also provides instruments for reduction or elimination of releases from unintentional production. The Law defines that ministry responsible for environmental protection shall ensure that any new plant shall not commence the operation without the integrated permit issued by the ministry and that existing plants shall take appropriate measures to comply with the provisions of the considered Law. The Law defines that integrated permit shall contain conditions set out for plant operation and related activities and operator obligations with respect to the nature of conducted activities and their environmental impact. Hence, the permit shall prescribe, among other, application of the best available techniques or other technical conditions or measures, as well as pollutant emission limit values, determined for the facility in question.

Strategy content is defined by the previously specified laws. It is extremely important for all developed strategies to include obligations imposed by the considered Convention, even knowing that such action is not strictly required by the law. Such action would provide a solid basis for the Action Plan development by the ministry responsible for environmental protection.

Inspection related to implementation of legal provision is carried out by the Environmental Protection Inspection Body.

An obligation of promoting the application of available, feasible and practical measures that can expeditiously achieve a realistic and meaningful level of release reduction or source elimination (Article 5 Paragraph (b) of the Convention) is included in previously specified national laws.

In this way, new Law on Air Protection, apart from obligation of Air Protection Strategy and related Implementation Action Plan development, which represent the state instrument for promoting the measures defined, also prescribes an obligation of operator to prepare a plan for emission reduction from stationary plants. In addition, the law prescribes preparation of bylaw on air quality standard and pollutant emission limit values. The foreseen measures also include operation permit issuing to stationary air pollution sources for which integrated permit issuing i.e. environmental impact assessment is not required, as well as prohibition of their operation if not in a possession of valid operation permit. Air quality monitoring, as well as related conditions, is also addressed in the Law.

In addition, an operator is obliged to submit to the ministry data on each reconstruction of any pollution source, to provide measurements, keep a record on the types and quality of used raw materials and fuels, as well as waste generated in the combustion process, keep a record on operation of polluting emission prevention or reduction devices.

The Law on Integrated Pollution Prevention and Control also defines measures for reduction or elimination of pollutant releases in all environmental media, primarily through integrated permit issuing. Apart from that, application of best available techniques is promoted through obligation of operator to apply the best available techniques and other technical measures. Such requirements are defined in the Integrated Permit, which also states the obligation of the ministry not only to control operating conditions defined in the permit, but to keep track of all innovations related to best available techniques developments as well.

The Law on Integrated Pollution Prevention and Control addresses the release sources of different capacities. Existing plants are obliged to assume responsibilities under this law until 2015.

One of the measures aimed at reduction or elimination of pollutant releases represents a requirement for Environmental Impact Assessment i.e. specification of assessment measures, as

defined by the Law on Environmental Impact Assessment. The Law on Environmental Impact Assessment prescribes that Environmental Impact Assessment is mandatory for industrial, mining, energy, traffic, agriculture and forestry related projects.

New Law on Waste Management also foresees measures for environmentally friendly waste management.

Development of Waste Management Strategy and national plans for individual waste flows is foreseen in new Law on Waste Management. The strategy and the plans are adopted every 10 years, with an obligation to be revised or updated every five years.

The measures include a waste management organisation, as prescribed by the above named Law, starting from conditions for construction and operation of waste storage, treatment and disposal facilities, through waste collecting and transport, storage, treatment and reuse of waste. The Law also regulates waste management permit issuing.

Report on current waste management represents a basis for determining the current situation and prescribing appropriate measures.

All of the above laws specify mandatory inspection related to implementation of legal obligations, as well as appropriate penalties, which also represent one of the measures aimed at reduction and elimination of pollutant releases.

It should be pointed out that the Law on Waters from 1991 does not contain appropriately developed measures for reduction and elimination of pollutant releases. However, the Law does foresee development of a Water Pollution Protection Plan, which, among other, defines measures for prevention or limitation of introduction of hazardous and harmful substance into waters, measures for generation prevention and disposal of waste and other substances in areas where such generation and disposal could cause water quality deterioration. The Plan also defines a party responsible for carrying out the measures prescribed, deadlines for pollution reduction, as well as responsibilities and authorization related to implementation of protection measures.

In addition, the Law also authorises development of sublegal act which would regulate the hazardous and harmful substances in waters.

New Draft Law on Water Protection, currently being prepared, shall be harmonized with EU legislation and shall appropriately regulate the filed in question.

Soil protection measures are principally defined in the Law on Environmental Protection and Law on Amendments on the Law on Environmental Protection. The measures shall be more precisely defined in the law regulating soil protection.

Based on the above, it is concluded that legislation of the Republic of Serbia prescribes the obligations resulting from Stockholm Convention and related to implementation of available, feasible and practical measures which can result in efficient and practical POPs emission reduction or source elimination. However, the legislation does not specifically define that the measures are envisaged for POPs.

Specifically, water and soil protection issues should be addressed because these issues are still not adequately regulated, although the new Law on Water Protection is being prepared.

Obligations stated in Article 5 Paragraph (e) of the Convention refer to: 1) promotion, in accordance with the action plan implementation, of best available techniques (BAT) use for the sources listed in the categories defined in the Action Plan, with special attention paid to the source categories listed in Part II and III of Annex C; 2) implementation of BAT for new sources which is to be phased in as soon as practicable but no later than four years after the entry into force of the Convention for the signatory country concerned; 3) use of best environmental practices in the specified processes.

As mentioned earlier, national legislation do not prescribe mandatory action plan development, meaning that the BAT implementation phases for new sources are not defined.

However, as stated in the Law on Integrated Pollution Prevention and Control, one of the conditions for Integrated Permit issuing is the application of BAT for the source considered. In addition, the ministries have the obligation to keep track of all innovations related to best available techniques, as well as to control monitoring activities carried out by the operators.

For existing sources, it is prescribed that a special program for harmonization of different sectors with the provisions of the Law on Integrated Pollution Prevention and Control has to be developed and temporary emission limit values to air and water for the first five years of harmonization process determined. This programme has not yet been developed. The deadline for Integrated Permit issuing for existing facilities is set to 2015.

Since not all source categories or their capacities are covered by the Integrated Permit (IPPC permit), the Law on Environmental Impact Assessment defines that during approval of Environmental Impact Assessment application of BAT for other sources addressed in the Assessment may be considered.

Article 6 of the Convention – Measures to reduce or eliminate releases from stockpiles and wastes: In order to ensure that stockpiles consisting of or containing chemicals listed either in Annex A or Annex B and wastes, including products and articles upon becoming wastes, consisting of, containing or contaminated with a chemical listed in Annex A, B or C, are managed in a manner protective of human health and the environment, Article 6 of the Convention prescribes the following obligations:

1. ***Development of appropriate strategies for identifying stockpiles and waste;***
2. ***Identification, based on the specified strategies, of stockpiles consisting of or containing chemicals listed in Annex A or Annex B;***
3. ***Management of stockpiles which have been, based on the provisions of the Convention, identified as waste;***
4. ***Taking appropriate measures to ensure that the identified wastes, including products and articles upon becoming wastes, are handled in accordance with obligations specified in Article 6 Paragraph (d) of the Convention.***

Legal system of the Republic of Serbia does not foresee development of a stockpile and waste identification strategy, as defined in the Convention, although new Law on Waste Management does anticipate development of Waste Management Strategy and national plans for individual waste flows, including POPs containing waste. These instruments are not totally comparable with the strategy whose development has been prescribed by the Convention. It is therefore concluded that identification of stockpiles and waste can be performed based on the national plans, providing that the plans are developed for each one of different waste flows, as defined in the Convention, or that POPs stockpiles and waste identification is determined by a sublegal act specified below.

With respect to demand for conducting waste management in a manner prescribed by the Convention, new Law on Waste Management provides a basis for proper management of hazardous waste, PCB and PCB waste. In this way, the Law authorises development of special regulation which would more precisely define a list of POPs, manner and procedure for POPs waste management, maximum permissible POPs concentrations related to disposal of POPs containing of contaminated waste.

The Law specifies that the following is necessary to be prescribed in the Rulebook:

- content and form of the label and manner of labelling of PCB-containing equipment and room or facility where such equipment is located, as well as of decontaminated devices;
- manner of PCB or PCB waste disposal, decontamination of PCB-containing equipment and methods for the analysis of PCB content;

- content of data submission form and register on PCB-containing equipment in use and PCB waste;
- content of request form for issuing of permit for decontamination of PCB-containing equipment.

The said means that legal framework for proper waste management has been set out, but that sublegal regulations which would more precisely regulate the considered are in process of development. The Law prescribes that sublegal acts must be adopted not later than one year after the entry into force of the Law.

Obligations prescribed in ***Article 6 Paragraph (d) (i) of the Convention, related to handling, collecting, transport and storage of waste in environmentally sound manner***, are defined in new Law on Waste Management, in section referring to waste management organisation and management of special waste flows.

It should be pointed out that new Law on Waste Management regulates a transport of specified waste types outside the Serbian borders in a manner accordant with the provisions of Basel Convention.

Obligations prescribed in ***Article 6 Paragraph (d) subparagraphs (ii) and (iii) of the Convention***, shall be regulated by previously specified sublegal acts.

Article 6, point (e) of the Convention defines that Party to the Convention are obliged to develop appropriate strategies for identifying sites contaminated by chemicals listed in Annex A, B or C; if remediation of those sites is undertaken it shall be performed in an environmentally sound manner. Law on Environmental Protection and specially the new Law on Amending to the Law on Environmental Protection provide some basis for implementation of specified obligation. The specified new Law defines that "soil protection and sustainable use of soil are provided through measures of systematic soil quality monitoring, monitoring of indicators enabling soil degradation risk assessment, as well as remediation programs for elimination of effects resulting from soil contamination and degradation whether occurring naturally are caused by human activity".

Besides, this Law provides basis for the Government to adopt sublegal act which would prescribe criteria for determining the status of the endangered environment and priorities for recovery and remediation. The ministry responsible for environmental protection, according on those criteria, determines status of the endangered environment and priorities for recovery and remediation for areas of importance for Republic of Serbia. However, remediation and recovery activities are a responsibility of legal or physical entity which caused environmental degradation, in accordance with projects for recovery and remediation. These projects must be approved by the ministry. According on this Law sublegal regulation regarding methodology for development of projects for recovery and remediation will be prepared.

There is no legislation in place in the Republic of Serbia that in a precise manner identifies and lays down procedure and conditions for defining of the liability for the environmental damage, when responsibility lies on the company that is an object of privatization (or generally subjected to any procedure of change in ownership).

Article 11 of the Convention – Research, Development and Monitoring: Article 11 Paragraph 1 of the Convention defines that all signatory countries shall, within their capabilities, undertake appropriate research, development, monitoring and cooperation pertaining to POPs and related to their:

- ***Sources and releases into the environment;***
- ***Presence, levels and trends in humans and the environment;***
- ***Environmental transport, fate and transformation;***

- ***Effects on human health and the environment;***
- ***Socio-economic and cultural impacts;***
- ***Release reduction and/or elimination and***
- ***Harmonized methodologies for making inventories of generating sources and analytical techniques for the measurement of releases.***

The Law on Environmental Protection adopted in 2004, enables governmental bodies of the State, Autonomous Province and municipalities to organise environmental monitoring and authorise monitoring programme development. In addition, the Law on Environmental Protection provides basis for determining the content and a manner of carrying out monitoring activities, as well as conditions prescribed for authorised organisations allowed to conduct monitoring.

In addition, obligations of the operators are defined in the Law on Environmental Protection as well.

Special laws regulating air, water and soil protection shall more precisely define monitoring related issues, specifying special requirements for monitoring of each environmental medium and prescribing penalty for violation of legal provisions.

Monitoring related issues are also addressed in the Law on Integrated Pollution Prevention and Control. The specified Law defines that an operator, obliged to obtain Integrated Permit, must, among other things, plan the environmental emission monitoring in accordance with conditions set out in the Permit.

Based on the Law on Sanitary Control of Food and Articles of Common Use, adopted in 1991, a sublegal act has been prepared and adopted, prescribing the quantities of pesticides, metals, metalloids and other poisonous substances, chemotherapeutics, anabolics and other substances which can be found in food. The specified regulation defines maximal permissible concentrations of POP pesticides (obsolete list), as well as PAH and PCB, for different food categories. However, the said list is out of date and must be updated in accordance with the EU legislation.

It could be concluded that the Republic of Serbia, made big changes related to environmental legislation adopted very important laws but this process is not finished as a lot of sublegal acts should be developed.

2.3 Current POPs management in the Republic of Serbia

2.3.1 Introduction

Assessment of current POPs management in the Republic of Serbia is based on preliminary inventories of: pesticides, PCB and uPOPs (PCDD/PCDF, HCB and PCB).

In addition to previously specified preliminary inventories, this Chapter also presents information on current POPs stockpiles, contaminated areas and waste, data on remediation of contaminated areas, POPs levels in different environmental media, prediction of future POPs production, use and release, POPs monitoring in the Republic of Serbia, as well as current information level, knowledge and education levels of each target group, mechanism for exchange of information with other parties of the Convention.

During assessment of current POPs management, all new POPs chemicals were not taken into consideration, except lindane. Namely, while collecting data for preliminary pesticides inventory data on new POPs chemicals i.e. lindane was collected.

2.3.2 Current practices related to POPs, other obsolete pesticides and pesticide packaging management

2.3.2.1 Pesticide production and trade with special overview on POPs pesticides

This section provides data on pesticide production, as well as information on decisions made with respect to their registration, import and export. In addition, production, import and export of POPs pesticides are specially taken into consideration. The last part of this section addresses issue related to biocidal products.

2.3.2.1.1 Pesticide production

Production of pesticides in the previous century in the Republic of Serbia has to be considered within the scope of pesticide production in former Yugoslavia. Namely, pesticide production in former Yugoslavia had started after the World War One, when mostly pumice stone had been produced, together with considerably smaller quantities of other copper compounds, arsenic compounds, nicotine, DNOC and sulphur, while mercury, barium and arsenic compounds were imported, as well as sulphur powder.

During the sixties of the last century, following the trends of the time in agricultural and food industry development in Serbia, considerable investment effort had been made to built several new and modern facilities for chemical fertilizer and pesticide production (active substances and formulated products). Apart from the existing production in the factories "Župa" in Kruševac, and "Zorka" in Šabac, pesticide production had been initiated in "Galenika–Fitofarmacija" in Zemun, "Prva Iskra" in Barič and "Zorka" in Subotica. Until the early eighties of the last century, the industry of Yugoslavia had synthesized 18 pesticides, including six herbicides (atrazin, simazin, prometrin, ametrin, propachlor and EPTC), nine fungicides (zineb, ciram, tiram, copper-oxychloride, copper-sulphate, barium-polysulphide and three organic compounds (mercury based substances), one insecticide (lindane), one nematocide (methane sodium) and one rodenticide (zinc phosphide). The production had reached its peak in the eighties, achieving production of over 6000 t/a of active substances and over 25000 t/a of fabricated products, as well as a trade surplus.

Besides being the biggest national producer, "Župa" in Kruševac had during the eighties of the 20th century become one of the most important pesticide producers in the Balkans, producing

approximately 400-500 t/a of insecticides, 900-1000 t/a of herbicides and more than 1000 t/a of fungicides. "Župa" was a strong leader in the field of fungicide (70%) and herbicide (40%) production in Serbia. However, during the early years of 21st century, the company have faced a crisis caused by an ownership transformation and resulting in reduced production and loss of dominant position in the Serbian market. Since 2004, "Župa" Kruševac conducted its business as a joint stock company. Starting from February 2005, following an unsuccessful privatisation, a 70% ownership of the company holds the Share Fund of the Republic of Serbia.

Apart from the above mentioned company, the company "Zorka-plant protection" was also considered a significant pesticide producer, with production capacities located in Šabac and Ruma. The company oriented its production towards sulphuric preparations, triazine and other active chemicals used in herbicide formulations. Other production capacities included the company "Agrohem" in Novi Sad with somewhere considerably developed herbicide production (about 200 t/a) and company "Zorka-Klotid"in Subotica, primarily oriented towards insecticide production (more than 200 t/a).

Today, the company "Galenika–Fitofarmacija" in Zemun has the largest insecticide, herbicide, fungicide and rodenticide production capacities; rated at about 15000-20000 t/a.

Table 2.3.2.1.1.a: Production and sale of plant protection products in a period 1994 - 2005 (in tonnes)

YEAR	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Production	9369	7833	8286	10721	11275	9768
Sale	9284	8379	8101	9813	10313	9055
YEAR	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Production	10479	10985	11085	9238	6702	7355
Sale	9399	9260	10133	9318	-	6243

Source: Directorate of Plant Protection

Table 2.3.2.1.1.b: Production of different categories of plant protection products in a period 1998 - 2005 (in tonnes)

YEAR	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Insecticides	1722	1965	2580	1941	2151	2556	1537	1449
Fungicides	2673	1945	2567	2692	2730	2163	572	629
Herbicides	4012	2947	2871	4295	4073	3665	4327	4773
Other	2868	2910	2461	2057	2131	854	402	504

Source: Directorate of Plant Protection

Today, pesticides are produced in about twenty Serbian companies, including several private entrepreneurs offering exclusively formulated products. Total domestic production of plant protection and nourishment products is estimated to approximately 60000 t/a (excluding capacities producing copper-sulphates and other copper compound based plant protection products). However, utilization of available pesticide production capacities in Serbia is currently not satisfactory, due to the fact that some registered pesticide producers have discontinued their pesticide production ("IHP Prahovo", Prahovo, "Agrohem" in Novi Sad, "Zorka-Mineral Fertilizers" in Šabac); in other production capacities privatization has failed to produce expected results ("Župa" in Kruševac, "Zorka-Plant Protection" in Šabac), while some producers are currently in the process of restructuring or are filing for bankruptcy ("Zorka Klotid Agrotehnohem" in Subotica). In addition, pesticide production i.e. utilization of production capacities depends on the raw material supply, (active substances and coformulants) having in mind that domestic production is based on the imported raw materials and foreign technology. In the same time, placement of pesticides on the market is oriented towards domestic market, where strong international competition is encountered. A list of pesticide producers is given in Table 2.3.2.1.1.c.

Table 2.3.2.1.1.c: Pesticide producers

	PESTICIDE PRODUCER	ADDRESS	TOWN
1	Agrohem jsc	Ribarska 3	Novi Sad
2	Agrostemin ltd.	Kralja Milutina 26	Belgrade
3	Bio-Ecological Centre jsc	Petra Drapšina 15	Zrenjanin
4	Rudarsko-topioničarski basen Bor- TIR ELEKTROLIZA	Đorđa Vajferta 20-24	Bor
5	Chemical Agrosava	Palmira Toljatija 5/IV	Belgrade – new town
6	jsc Ciklonizacija	Primorska 76	Novi Sad
7	Delta Agrar ltd.	Milentija Popovića 7b	Belgrade
8	Ekofit ltd.	Sterijina 10	Vršac
9	Ekosan ltd.	Autoput 2	Belgrade
10	Exol lubricants ltd.	Branka Krsmanovića 14/32	Niš
11	Galenika-Fitofarmacija jsc	Batajnički drum bb	Zemun
12	VHI Hemovet ltd.	Bulevar oslobođenja 2	Vršac
13	Jugohem ltd.	Nova industrijska bb	Leskovac
14	HI Poljotoplica - Pesticidi ltd.	Topličkog partizanskog odreda 151	Niš
15	SIGO ltd.	Kadinjača	Belgrade
16	Simpec	Nade Dimić bb	Bor
17	Timings ltd.	Rige od Fere 4	Belgrade
18	Veterinarski Zavod Subotica	Ivana Milutinovića 123	Subotica
19	Zorka Klotid Agrotehnohem ltd.	Edvina Zdovca 8	Subotica
20	Zorka - Mineralna đubriva jsc	Narodnih heroja 1	Šabac
21	Zorka - Zaštita bilja	Narodnih heroja 1	Šabac
22	HI Župa jsc	Šandora Petefija bb	Kruševac

Source: Journal "PLANT DOCTOR" published b y Serbain Plant Protection Association

Productions of plant protection products, as one of the strategic branches of food production industry, is able to satisfy domestic demands and direct a portion of the production towards export, but only if conditions related to investing in new technologies and equipment, aimed at new formulation production development and harmonization with European standards, are met.

2.3.2.1.2 Pesticide trading

Until new Law on Chemicals and Law on Plant Protection Products was adopted (May 2009), plant protection products (pesticides) could be placed on the market of the Republic of Serbia only if they were registered i.e. if the ministry responsible for agriculture has issued a permit for their use based on Decision of the expert commission, Commission for pesticides, made after the consideration of physical chemical properties and biological effectiveness. This permit could only be issued if the Ruling on Classification of poisons into groups of poisons has been issued by the ministry responsible for environmental protection based on Decision of the expert commission i.e., Commissions for poisons. For the purpose of issuing of this Decision, the Commission for Poisons considers toxicological and ecotoxicological characteristics of active substances and preparations.

However, registration system, post-registration control (formulations and residues), as well as production and trade control of plant protection products, as defined in national regulations in force in that period, was not harmonized with registration procedure currently established in the EU or in other countries in the world. The said was mainly due to frequent changes in state administration, discontinuity in decision making process, inadequate level of cooperation within each ministry and between different ministries, inadequate and old dated regulations, as well as

small number of ministry personnel dealing with the issues of plant protection products and necessity for their improvement of professional knowledge.

Registration process of plant protection products did not include determination of maximum permissible residue concentrations in food of plant origin. In addition, systematic control of maximum permissible residue concentrations in food of plant origin was not conducted (post-registration control – *surveillance monitoring* and *enforcement-follow up monitoring*).

Table 2.3.2.1.2.a: Number of registered active substances and products in a period 1992-2004

YEAR	NUMBER OF ACTIVE SUBSTANCES	NUMBER OF PRODUCTS
1992	269	615
1994	253	579
1996	218	497
1998	226	590
2000	235	675
2002	242	641
2004	235	526

Source: Directorate of Plant Protection

Table 2.3.2.1.2.b: Number of products registered until 30/04/2007

PESTICIDES	NUMBER OF REGISTERED PRODUCTS
Herbicides	298
Growth regulators	9
Fungicides	205
Insecticides	153
Pheromones	5
Acaricides	3
Nematocides	3
Limacides	2
Rodenticides	27
Adjuvants	5

Source: Directorate of Plant Protection

In accordance with previous Law on Plant Protection, if use-by date stated on declaration of a specific product has expired, and the preparation could not be reformulated and re-traded, the product had to be destroyed in a prescribed manner. In addition, products whose permit for placement on the market has expired, while their use-by date specified on declaration is still valid, are permitted to be placed on the market during a six month period following a date of permit expiry.

The same Law defined that the ministry responsible for agriculture issues a Ruling on Limited Use or Cessation of the Permit for Placing the Product on the Market if during the product's use it is determined that:

- product has negative or harmful effects on human health and the environment,
- product is not sufficiently effective for the purposes stated in the Permit,
- toxicological evaluation (re-evaluation) of active substance and related preparation has not been conducted.

Pursuant to above mentioned Law, Ministry responsible for agriculture published data on preparations holding a valid permit for placing on the market, as well as those whose permit has expired, in the Official Gazette of the Republic of Serbia

Based on the above specified provisions of old Law on Plant Protection, it was possible to determine when a pesticide becomes waste i.e. when pesticides should be treated in accordance with the provisions of old Law on Waste Material Handling. However, the said was not quite precisely defined.

Specific type of non-agricultural pesticides (biocides) such as products used for public hygiene maintaining (rodenticides, insecticides and disinfectants) was allowed to be placed on the

market by special Ruling issued by the ministry responsible for environmental protection, in accordance with the provisions of old Law on Production and Trade of Poisonous Substances. The specified Ruling was issued based on toxicological and efficiency evaluation, determined by authorised organisations as well as on the bases of the Decision of the Commission for Poisons which evaluated those evaluations.

For the purpose of establishing a modern system for placing of the biocidal products as well as plant protection products on the market, new Law on Biocidal Products and new Law on Plant Protection Products, harmonized with relevant EU legislation, have been adopted.

In accordance with international findings and recommendations issued over the past twenty years related to the unsafe use of certain pesticides, pesticides identified as potentially unsafe have been prohibited from placing on the market in the Republic of Serbia by detracting the permits allowing their placement on the market i.e. preventing their reissuing. In such manner, trade of the following pesticides have been prohibited: leptophos (1980), dinoseb and dinoterb (1987), cyhexatin (1988), mercury compounds (2000), DNOC (2003) and others.

In 2000, pesticides whose permits for placement on the market have been revoked have been listed in the List of Poisonous Substances Whose Production, Placement on the Market and Use are Prohibited.

In addition, in 2002 preparation containing malathion have been prohibited from further use in public hygiene by the means of their sprinkling from aircrafts in inhabited areas.

Furthermore, starting from March 2005 and until the end of 2007, the Directorate of Plant Protection, in cooperation with the ministry responsible for environmental protection, had conducted a National Programme for abandoning placement of plant protection products containing active substance not included in the Annex I to Directive 91/414/EEC on Serbian market. This Programme had considered 27 active substances i.e. preparations containing the specified active substances.

The National Programme for abandoning the placement on the market of 27 active substances prohibited in the EU contains a decision on each one of the above mentioned active substance i.e. preparation containing that active substance. Placement on the market and use of certain active substances for which an adequate substitute could not be found, have been allowed to be continued but only for specific essential use. Other active substances have been completely banned, but the remaining quantities have been allowed to be used. The third group of active substances have been banned, but were allowed to be placed on the market and used until the expiry of their respective Ruling.

2.3.2.1.2.1 Import of plant protection products

During the last decade of the 20th century, business accomplishments in the pesticide production sector had been quite bad, leading to continual production reduction. As a result, Serbia has quickly from pesticide exporter become a growing importer.

In 2002, the value of imported plant protection products (active substances and preparations) amounted to about 26 million USD, in comparison to only 3 million USD of export revenues (preparations), while in 2004 import of solely insecticides reached 28.3 million USD (active substances and preparations).

Table 2.3.2.1.2.1.a: Import of plant protection products in 2007

	Imported quantity (t)
ACTIVE SUBSTANCE	
Herbicides	2802,395
Protectants	55,310
Fungicides	251,105
Insecticides	277,685
TOTAL	**3386,495**
PRODUCTS	
Herbicides	962,629
Adjuvants and wetters	105,876
Growth regulators	35,600
Fungicides	1287,196
Insecticides	498,786
Insecto-fungicides	110,982
Acaricides	3,920
Insecto-acaricides	1,450
Nematocides	12,220
Rodenticides	39,110
TOTAL	**5057,769**

Source: Directorate of Plant Protection

2.3.2.1.2.2 Export of plant protection products

In 2005, Serbia had imported about 5000 t of preparations, valued at 57 million USD. It should be mentioned that starting from July 26 2005, when the new Law on Customs Tariff[20] entered into force, providing a nomenclature harmonized with the combined nomenclature of the EU, apart from final products, import and export data also include pre-concentrates.

The products were mainly imported from Germany, France, Holland, Switzerland, Italy, USA, Belgium, Austria, Israel, China, Croatia and Slovenia.

In 2005, Serbia had exported 960 t of plant protection products, valued at 5,2 million USD, mainly to Bosnia and Herzegovina and Macedonia.

Data on import and export of final products in 2005 are shown in Table 2.3.2.1.2.2.a.

Table 2.3.2.1.2.2.a: Import and export of final products in 2005

	I M P O R T		**E X P O R T**	
CHEMICALS USED IN AGRICULTURE	(t)	(USD)	(t)	(USD)
Insecticides	970	9953000	264	1261000
Herbicides	2510	3346000	495	2495000
Fungicides	1202	12003000	148	1233000
Rodenticides	31	300000	33	112000
Other (plant growth regulators and other)	203	1007000	19	91000
T O T A L:	**4916**	**56726000**	**959**	**5192000**

Source : Serbian Chamber of Commerce

[20] Law on Customs Tariff ("Official Gazette of RS" No. 62/05)

2.3.2.1.3 Production of POPs pesticides

POPs pesticides are a group of chemicals that in the period from the forties to the sixties of the last century had had an important worldwide role as insecticides. As it has been mentioned earlier, POPs production in the previous century in Serbia has to be considered within the scope of pesticide production in former Yugoslavia.

Production of POPs pesticides, started in 1947, in the beginning included only production of DDT in "Zorka - Zaštita bilja" in Šabac. In the early fifties POPs pesticides were also produced in "Chromos" in Zagreb (Republic of Croatia). Production capacities were dimensioned for annual production of 600 t, while the quantity of produced technical product in the period 1947–1960 is shown in Figure 2.3.2.1.3.a.

Figure 2.3.2.1.3.a: Production of DDT in Yugoslavia in a period 1947–1960
Total capacities: 600 t
Producers "Zorka - Zaštita bilja" in Šabac, "Chromos" in Zagreb, Croatia

In addition, product from the following companies in Slovenia, Croatia and Macedonia have also been used in Serbia:

- "Pinus" in Maribor, Slovenia - aldrin, DDT, dieldrin, endrin:
- "Chromos" in Zagreb, Croatia - aldrin, DDT, dieldrin, endrin:
- "OHIS" in Skoplje, Macedonia - DDT, lindane, dieldrin, heptachlor.

During the fifties and the sixties of the last century, only DDT had been synthetically produced in Serbia ("Zorka- Zaštita bilja" in Šabac) and its production had ceased in the early seventies. Other compounds (aldrin, dieldrin, endrin, toxaphene, chlordane, heptachlor and hexachlorobenzene) were imported as technical products and preparations were formulated from them in factories "Zorka - Zaštita bilja" in Šabac, "Župa" in Kruševac and "Galenika–Fitofarmacija" in Zemun. The production of plant protection products was discontinued in accordance with Rulings on prohibited use and trade of preparations based on the above specified active substances (Table 2.3.2.1.3.a).

Table 2.3.2.1.3.a.: POPs pesticides produced in Serbia

PRODUCT	PRODUCER	PERIOD OF TRADING AND USE
ALDRIN		
Aldrin P 2,5	Zorka, Šabac	1960-1970
Aldrin powder Župa	Župa, Kruševac	1960-1971
DDT		
Pepein S-50	Zorka, Šabac	1960-1971
Diditin	Zorka, Šabac	1957-1971
Fitosan E-25 Župa	Župa, Kruševac	1966-1971/76
Pepein P-5	Zorka, Šabac	1964-1971
Pepein G-5	Zorka, Šabac	1968-1971
Aerosol 20	Zorka, Šabac	1957-1966
Aerosol 15	Zorka, Šabac	1960-1971/86
Aerosol 12	Zorka, Šabac	1962-1966
Aerosol 6	Zorka, Šabac	1962-1966
Pepein 53	Zorka, Šabac	1957-1971
Dilicid E-16 Župa	Župa, Kruševac	1966-1971/76
Rapein 53	Zorka, Šabac	1957-1971
Diliden	Zorka, Šabac	1957-1971
Dilicin P-5 Župa	Župa, Kruševac	1966-1970
Zoralin	Zorka, Šabac	1960-1971
Neosol 6	Zorka, Šabac	1957-1971
Neosol 10	Zorka, Šabac	1958-1971
Galodit	Galenika–Fitofarmacija, Zemun	1964-1970
DIELDRIN		
Dieldrin S-50	Zorka, Šabac	1966-1971
Dieldrin E-20	Zorka, Šabac	1966-1971
Dieldrin P-2	Zorka, Šabac	1962-1971
HEPTACHLOR		
Heptachlor G-5	Zorka, Šabac	1968-1973
CHLORDANE		
Chlordane E-40	Zorka, Šabac	1962-1971
TOXAPHENE		
Toxaphene Župa	Župa, Kruševac	1957-1982

2.3.2.1.4 Trade of POPs pesticides

It should be stressed out that pesticides listed in the Stockholm Convention were prohibited from agricultural trading and use in Serbia during the seventies and the eighties of the last century. Use of DDT in the sector of public health had ceased in the early nineties of the last century. Time periods of POPs pesticide trading in Serbia are shown in Table 2.3.2.1.4.a.

Table 2.3.2.1.4.a: Periods of POPs pesticides use and trading in the Republic of Serbia

ACTIVE SUBSTANCE (generic name)	**PERIOD OF TRADING AND USE**	**PROHIBITION DATE/YEAR (trading permit expired)**
Aldrin	1957-1972	06/09/1976
Dieldrin	1957-1972	1972
Endrin	1957-1989	29/05/1989
DDT	1944-1989	28/12/1989
HCB	1962-1980	11/07/1980
Heptachlor	1956-1973	1973
Chlordane	1955-1971	1971
Toxaphene (camphechlor)	1957-1982	27/04/1989
Mirex	never traded	
Lindane	since 1944	Used since 2001. Until 31/12/2007 used only for wood protection.

Apart from chemicals shown in the table, hexachlorocyclohexane ($C_6H_6Cl_6$) isomer mixture known as HCH, out of which one isomer is known as lindane (gamma-HCH), has also been traded and used in Serbia. Preparations containing lindane have been used as wood coatings and treatment for ectoparasites in veterinary medicine, but also as treatment for head lice in human medicine. Another chemical from the group of organochlorine compounds known as endosulfan ($C_9H_6Cl_6O_3S$) has also been traded in Serbia. After 31/12/2007, the specified chemical and related preparations had been withdrawn from the market and use. Until then, their limited use is allowed.

In Serbia, trade and use of POPs pesticides, apart from lindane, have been banned starting from the early eighties. Importers and distributors of POPs pesticides are not of interest for record keeping, due to the fact that they conducted their business not only in the Republic of Serbia, but in the entire former Yugoslavia as well. In addition, during the last 20 years pesticide importers and distributors located in Serbia either went through bankruptcy or were sold or subjected to some kind of ownership transformation.

Table 2.3.2.1.4.b: Import of lindane and endosulfan in the period 2004-2006 (in tonnes)

IMPORT		**2004**	**2005**	**2006**
LINDANE (active substance)		0,40	/	/
ENDOSULFAN	active substance	8,20	/	/
	Product	31,92	46,73	41,30

Source: Directorate of Plant Protection

Aldrin, dieldrin, heptachlor and chlordane preparations listed in Table 2.3.2.1.4.a are completely banned in the Republic of Serbia. Endrin and DDT were not permitted to be used in agriculture in the period 1971-1973. In 1980 and 1982, agricultural use of HCB and toxaphene (camphechlor) were banned. Use of endrin (as a rodenticide) and DDT (in forestry) were banned prohibited in 1989. Since mirex was never traded and used in Serbia, previously mentioned decisions completely prevented the use of POPs pesticides in agriculture and forestry. Until 1994 DDT was still partially used in the sector of public health, but was soon abandoned. In accordance with Ruling dated 31/12/2007, issued by a competent state authority, use of lindane is also abandoned.

2.3.2.2 Results of preliminary pesticide inventory

2.3.2.2.1 Introduction

Preliminary inventory of POPs pesticides has been compiled in the period May-October 2007. During the specified period, the following data had been collected:

- data on POPs pesticides;
- data on other pesticides including obsolete, out-of-date, unknown pesticides (pesticide waste); and
- pesticide packaging.

Obsolete pesticides are those containing active substances which are no longer produced due to variety of reasons (effectiveness, toxicological and eco-toxicological danger).

Out-of-date pesticides include preparations with expired use-by date, banned pesticides, damaged and degraded products, unusable preparations and packaging, unidentified products, empty contaminated packaging and old equipment used for pesticide application, other contaminated materials and containers, buried pesticides and containers, contaminated areas – soil (visual inspection).

2.3.2.2.2 Inventory compiling methodology

Preliminary pesticide inventory has been compiled based on the following:

- submitted questionnaires;
- information gathered through direct contact with waste producers;
- inspection findings.

The questionnaires have been sent to the following target groups:

- pesticide producers;
- pesticide distributors or importers;
- pesticide users.

In the group of the pesticide users, the following sub-groups have been targeted:

- Agricultural producers;
- Agrocombines;
- Institutes of public health;
- Institutes of disinfection, disinsection and rodent control;
- Scientific institutions.

In total, 124 filled-in questionnaires have been collected from the above defined target groups, out of which 92 were filled by pesticide users, 22 by pesticide producers and 10 by pesticide importers. Since there are 22 pesticide producers registered in the Directorate of Plant Protection, it is concluded that all pesticide producers have participated in the conducted survey.

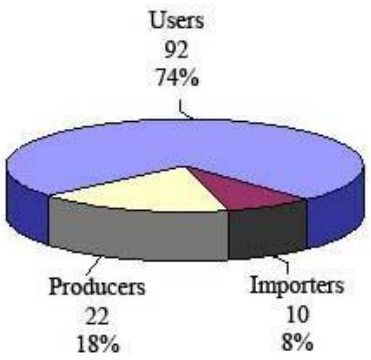


Figure 2.3.2.2.2.a: Questionnaire structure

Number of questionnaires collected from different organizations is shown in Table 2.3.2.2.2.a.

Table 2.3.2.2.2.a: Number of questionnaires submitted by different organizations

ORGANIZATION	**NUMBER OF QUESTIONNAIRES**
Forest households	19
Veterinary stations	8
Producers - (industry)	18
Institutes	3
Agricultural stations	2
Health centres, health institutes	9
DDD institutes	10
Agricultural cooperates	7
Users (industry)	6
Agricultural properties – farms	7
Other	35
TOTAL	**124**

Data obtained from the questionnaires were used to create a database on POPs pesticides, pesticide waste and pesticide packaging.

Environmental protection inspectors, as well as phytosanitary inspectors have been involved in the process of pesticide inventory compiling from the very beginning. Such engagement was based on the fact that inspectors had been conducting their activities in different districts in the Republic of Serbia, in that way covering all parts of the country. In addition, inspectors were well informed about individual pesticide users, as well as the manner of pesticide use. In this way, inspectors have not only assisted in filling out the questionnaires, but have also gathered other valuable information used for inventory compiling.

2.3.2.2.3 Inventory results

2.3.2.2.3.1 Introduction

Database on POPs pesticides, pesticide waste and pesticide packaging contains data on:

- Quantities of pesticide waste and POPs pesticides;
- Types of active substances, including a year of production and name of the producer;
- Types and characteristics of storage facilities;
- Types and assortment of packaging, as well as manner of its storage and destruction.

2.3.2.2.3.2 Pesticide waste and POPs pesticides

Based on 124 collected questionnaires, it has been concluded that 119 organizations had filled out the questionnaire correctly, while 5 of them had answered the questions both in a role of pesticide producer and a role of pesticide importer. Among previously specified 119 organizations, presence of waste pesticides has been detected in 65 organizations, while presence of POPs pesticides has been registered in 14 organisations (Table 2.3.2.2.3.2.a.)

Table 2.3.2.2.3.2.a: Number of organizations holding pesticides

WASTE	**NUMBER OF ORGANIZATIONS**
POPs pesticides (lindane, DDT)	14
Other pesticide waste	65
Pesticide free	40
TOTAL	**119**

Due to the fact that quantities of identified pesticide waste were specified either in mass or volume units (kg or l), for the purpose of this preliminary inventory were used mass unit (kg) assuming specific weight of a liquid pesticide of 1 kg/dm^3 (Table 2.3.2.2.3.2.b).

Table 2.3.2.2.3.2.b: Inventory of pesticide waste

QUANTITY OF PESTICIDE BASED ON ITS STATE OF AGGREGATION	**solid** (kg)	**liquid** (l)	**estimated quantity (kg)**
POPs pesticides	2310	3940	**6250**
Obsolete pesticides	122371	45009	**167380**
Unidentified pesticides	36415	6520	**42935**
Total	**161096**	**55469**	**216565**

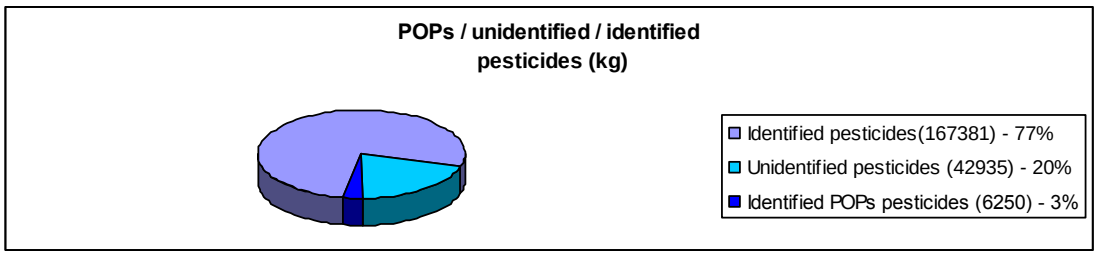


Figure 2.3.2.2.3.2.a: Structure of detected pesticides (kg)

POPs pesticides have been detected in 14 locations, in quantities presented in Table 2.3.2.2.3.2.c.

Table 2.3.2.2.3.2.c: Quantities of detected POPs pesticides

QUANTITY OF POPs PESTICIDE	solid (kg)	liquid (l)	estimated quantity(kg)	number of storage units
DDT	250	200	450	2
Lindane	2060	3740	5800	12
TOTAL	**2310**	**3940**	**6250**	**14**

List of companies holding POPs pesticides are shown in Table 2.3.2.2.3.2.d.

Table 2.3.2.2.3.2.d: List of companies holding POPs pesticides

No.	ORGANIZATION	POPs	solid (kg)	liquid (l)	estimated quantity(kg)
1	Public Company PK "KRAJINA" Holding, Negotin	lindane	1	0	1
2	Public Company "Srbijašume", Belgrade, Forest households "Timočke šume" Boljevac, Šumska uprava Boljevac	lindane	80	0	80
3	Public Company "Srbijašume", Belgrade, Forest households "Timočke šume" Boljevac, Šumska uprava Bor, RJ Rasadnik – Selište	lindane	8	0	8
4	PIC "Južni Banat" jsc	lindane	166	0	166
5	Public Company "Srbijašume", Belgrade	lindane	0	560	560
	Forest households "Rasina", Kruševac	lindane	4	0	4
6	Public Company "Srbijašume" Forest households "Stolovi" Kraljevo	lindane	47	0	47
7	Public Company "Vojvodinašume" Petrovaradin - Forest households "Banat", Pančevo	lindane	3200	0	3200
8	jsc "Agrounija", Inđija	lindane	16	0	16
9	Public Company PK "Krajina" Holding, Negotin	lindane	1	0	1
10	"Seme Sombor", Sombor	lindane	17	0	17
11	Agricultural cooperates "Fruška Gora"	lindane	0	1,500	1,500
12	PAD "Nova Budućnost"	lindane	200	0	200
TOTAL LINDANE			**3740**	**2060**	**5800**
13	"Zorka - Zaštita bilja" jsc, Šabac	DDT	0	250	250
14	"Stefanović Saša", private entrepreneur, Svrljig	DDT	200	0	200
TOTAL DDT			**200**	**250**	**450**
TOTAL POPs pesticides			**3940**	**2310**	**6250**

Quantities of pesticide waste and pesticide packaging determined in different districts is shown in Table 2.3.2.2.3.5.b.

2.3.2.2.3.3 Quantities of pesticide waste resulting from implementation of National Program for Abandoning the Use of Active Substances which are not placed on the EU market

Pursuant to the decision stated in the National Program for Abandoning the Use of Active Substances Which are not placed on the EU Market, bans for placement on the market of some plant protection products shall come into force. This shall lead to their stockpiling, and could later create a serious problem arising from the necessity of their safe storage, disposal or treatment. Such plant protection products, listed in Table 2.3.2.2.3.3.a together with determined quantities, have also been included in the preliminary inventory.

Table 2.3.2.2.3.3.a: Quantities of prohibited plant protection products depending on the state of aggregation

QUANTITY	**Solid (kg)**	**liquid (l)**	**estimated quantity(kg)**
Atrazine	509	1492	**2001**
Bensultap	2	0	**2**
DNOC	42	16	**58**
Endosulfan	0	234	**234**
EPTC	17000	125	**17125**
Mercury compounds	690	100	**790**
Malation	1096	1939	**3035**
Metalaksil	11	0	**11**
Metidation	0	54	**54**
Metolachlor	0	68	**68**
Monocrotofos	7000	255	**7255**
Parathion	0	22	**22**
Permethrin	514	2223	**2737**
Prometrin	514	1689	**2203**
Propham	43	0	**43**
Simazine	357	2	**359**
Triforin	0	84	**84**
Fentin Acetate	203	0	**203**
Phorat	2570	0	**2570**
Cikloat	0	379	**379**
Cineb	118	0	**118**
TOTAL	**30669**	**8681**	**39350**

2.3.2.2.3.4 Pesticide waste storage facilities

Total of 128 pesticide waste storage facilities has been identified. Characteristics of identified storage facilities are shown in Table 2.3.2.2.3.4.a. Total of 14 POPs pesticide waste storage facilities has been identified. List of companies holding POPs pesticides are shown in Table 2.3.2.2.3.2.d.

Table 2.3.2.2.3.4.a: Data on pesticide waste storage facilities

APPEARANCE OF STORAGE FACILITY				
unregulated area	solid masonry	storage area with overhung roof	open plateau	other
6	109	13	7	6
SECURITY OF STORAGE AREA				
fenced area	guarded area	marked area		
72	55	52		
TEMPORARY STORAGE FLOORING				
concrete	Asphalt	earth	gravel	other
99	1	8	0	6

2.3.2.2.3.5 Pesticide packaging

Since data provided in collected questionnaires with respect to pesticide packaging have been expressed in different units i.e. kilograms, litres, pieces etc., for the purpose of preliminary inventory compiling it was estimated that mass of a barrel equals approximately 15 kg, while mass of a bottle equals approximately 0,1-5 kg.

Data on pesticide packaging, manner of related storage and handling is shown in Table 2.3.2.2.3.5.a. Quantity of pesticide waste and packaging determined in each Serbian district is shown in Table 2.3.2.2.3.5.b.

Table 2.3.2.2.3.5.a: Pesticide packaging

EMPTY PACKAGING per type (pc/kg)	**Pieces**	**App. Mass (kg)**	**Storage in temporary storage facilities**	**Treatment – recycling**	**Export to other countries**	**Sale to other entities in the country**	**Disposal in municipal landfills**	**Stored at industrial sites**	**Other**
Bags	0	0	0	0	0	0	2	0	0
Cardboard	450	450	1	0	0	1	0	0	1
Metal	9690	88350	10	2	0	0	0	0	4
Plastic	9767	1987	12	1	0	0	10	0	8
Glass	39	8	0	0	0	0	0	0	1
Metal + cardboard		15000	1	0	0	0	0	0	1
Plastic + glass	233	35	1	0	0	0	1	0	0
Plastic + metal	14	28	1	0	0	0	0	0	0
Plastic + cardboard	1512	377	3	0	0	0	3	0	0
Plastic + metal + bags	220	573	0	0	0	0	0	0	0
Unknown + various	5268	5268	2	0	0	1	9	2	3
Total	***27193***	***112076***	***31***	***3***	***0***	***2***	***25***	***2***	***18***

Table 2.3.2.2.3.5.b: Overview of pesticide waste and pesticide packaging determined in different districts

	POPs		Obsolete Pesticides		Unidentified pesticides		All pesticides per district			Packaging		
DISTRICT	**solid (kg)**	**liquid (l)**	**solid kg)**	**liquid (l)**	**solid (kg)**	**liquid (l)**	**solid (kg)**	**liquid (l)**	**estimated quantity (kg)**	**pieces**	**kg**	**Note**
Bor	0	10	53675	3066	2000	100	55675	3176	58851	4067	3058	metal and plastic
Braničevo	0	0	0	15	0	0	0	15	15	0	0	cardboard and unknown
Belgrade	0	200	1918	1434	0	5	1918	1639	3557	5	15	5 pieces - metal and plastic, 15 tonnes - metal and cardboard
Jablanica	0	0	3	85	13	156	16	241	256	91	9	Plastic
South Bačka	0	0	0	519	0	0	0	519	519	220	573	plastic, metal and bags
South Banat	0	3366	1012	4606	107	193	1119	8165	9283	138	1048	metal and plastic
Kolubara	0	0	0	1960	0	0	0	1960	1960	0	0	
Mačva	250	0	1974	11963	22000	6000	24224	17963	42187	9607	5326	plastic, metal and cardboard
Moravica	0	0	215	5	0	15	215	20	235	25	25	Unknown
Nišava	0	200	0	0	0	0	0	200	200	5000	75000	Metal
Pčinja	0	0	0	0	0	0	0	0	0	0	0	

DISTRICT	POPs		Obsolete Pesticides		Unidentified pesticides		All pesticides per district			Packaging		
	solid (kg)	liquid (l)	solid kg)	liquid (l)	solid (kg)	liquid (l)	solid (kg)	liquid (l)	estimated quantity (kg)	pieces	kg	Note
Pomoravlje	0	0	288	0	0	0	288	0	288	0	0	
Rasina	560	4	2292	4580	0	0	2852	4584	7436	49	9	plastic and glass
Raška	0	47	136	175	0	0	136	222	358	0	0	
North Bačka	0	0	38480	24	12090	0	50570	24	50594	790	5550	metal and cardboard
Middle Banat	0	0	0	5	0,0014	7	0	12	12	14	28	plastic and metal
Srem	1500	33	11179	6369	0	0	12679	6402	19081	5266	5543	Various
Šumadija	0	0	2265	1607	5	44	2270	1651	3921	100	100	Plastic
Zaječar	0	80	7246	3153	200	0	7446	3233	10679	1582	736	plastic, metal and cardboard
West Bačka	0	0	1610	5444	0	0	1610	5444	7054	239	37	plastic and glass
Zlatibor	0	0	79	0	0	0	79	0	79	0	0	
TOTAL	**2310**	**3940**	**122371**	**45009**	**36415**	**6520**	**161096**	**55469**	**216565**	**27193**	**112076**	
ESTIMATED QUANTITY(kg)	**6250**		**167380**		**42935**		**216565**			**112076**		

2.3.2.3 Institutional and legal instruments pertaining to pesticide management

2.3.2.3.1 Institutional framework for pesticide management

Pesticide management in the Republic of Serbia is regulated through a series of Laws and is under a jurisdiction of two Ministries:

- Ministry of Agriculture, Forestry and Water Management – Directorate of Plant Protection; and
- Ministry of Environment and Spatial Planning.

2.3.2.3.2 Legislation

Having in mind that POPs related legislation has been analysed in Chapter 2.2.4, only pesticide related legal acts shall be mentioned hereinafter. As it is true for other fields and related regulations, regulations addressing pesticides and related issues are old dated and therefore not harmonized with EU regulations. However, a set of new regulations was adopted in May and Jun 2009.

Until May and Jun 2009, when set of new laws were adopted, the field of pesticide management had been regulated by two main Laws which are:

1. **Law on Plant Protection** [21] and sublegal acts regulating conditions for pesticide registration, production, trade and use.
2. **Law on Production and Trade of Poisonous Substances**[22] and sublegal acts regulating classification of poisonous substances, pesticides among others, as well as their labelling and conditions for their production and trade.

Based on the provisions of the above mentioned laws, issues related to plant protection products were under the jurisdiction of two ministries. In accordance with provisions of the Law on Production and Trade of Poisonous Substances, the ministry responsible for environmental protection was issuing a Ruling on Classification of Pesticides into a Group of Poisonous Substances. This Ruling was based on the Decision of the expert commission (Commission for Poisons), made after the consideration of toxicological characteristics of poisonous substance. These toxicological evaluations were made by the authorised professional organisations. In addition, this Law was also regulating the prohibitions related to all poisonous substances, including pesticides. Based on this Ruling as well as other conditions prescribed by old Law on Plant Protection, the ministry responsible for agriculture was issuing a permit allowing pesticide trading.

Apart from the two laws specified above, a number of other laws also addressed the pesticide management issue. The most important was the **Law on Waste Material Handling**[23] which is not in force since May 2009. This law was regulating waste material handling, its collection, treatment and storage, as well as environmental protection measures preventing negative environmental impact of waste material.

However, legal provisions and basic approach of above mentioned laws resulted in certain problems with respect to pesticides handling upon becoming waste, primarily related to jurisdictions of environmental and phytosanitary inspection.

Namely, the Law on Plant Protection did not precisely define when a pesticide becomes waste, while the Law on Waste Material Handling did not regulate collection of pesticide waste, specifically its collection from physical entities using pesticides in agriculture for their own needs.

[21] Law on Plant Protection ("Official Gazette of FRY" No. 24/98, 26/98)
[22] Law on Production and Trade of Poisonous Substances ("Official Gazette of FRY" No. 15/95, 28/96 and 37/02)
[23] Law on Waste Material Handling ("Official Gazette of RS" No. 25/96, 26/96)

However, new Law on Plant Protection Products, which repeals Law on Plant Protection, defines when a pesticide becomes waste, while new Law on Waste Management defines responsibilities and obligations in the area of waste management and regulates hazardous waste management system, including pesticides waste. This system primarily relates to legal entities i.e. agro combines, but problem of pesticide waste collecting from physical entities using pesticides in agriculture for their own needs shall remain unsolved.

This problem could be suppressed through establishment of an efficient household hazardous waste collection system which would, among other, include pesticide waste collecting.

In order to facilitate establishment of hazardous waste collection system, as well as to facilitate implementation and enforcement of newly adopted laws and development of secondary legislation, it is necessary to establish institutional cooperation among governmental ministry responsible for environmental protection and ministry responsible for agriculture.

Beside above mentioned laws, the following laws and subsidiary legislation was indirectly addressing the pesticide issue:

– **Law on Sanitary Control of Food and Articles of Common Use**[24] defines criteria for sanitary control of food quality; based on defined criteria, food containing pesticides are considered to be sanitary unsafe;

– **Regulation on the quantities of pesticides, metals, metalloids and other poisonous substances, chemotherapeutics, anabolics and other substances which can be found in food**[25] defines permissible concentrations of pesticide residues, including POPs pesticides in food;

– **Regulation on maximum permissible levels of harmful substances and constituents of animal feed**[26] defines maximal permissible concentrations of aldrin and dieldrin (expressed as total dieldrin), DDT and derivatives (expressed as total DDT), endrin, heptachlor and heptachlorepoxid (expressed as total heptachlorepoxid), HCH, HCH (alpha + beta + delta), lindane, (gamma HCH) in animal feed.

In the meantime, in June 2009 new Law on Food Safety[27], repealing Law on Sanitary Control of Food and Articles of Common Use, was adopted. Two mentioned regulations will be replaced by new harmonized with EU legislations within 2 years.

[24] Law on Sanitary Control of Food and Articles of Common Use ("Official Gazette of SFRY" No. 53/91, "Official Gazette of FRY" No. 24/94, 28/96, 37/02, "Official Gazette of RS" No. 101/05 and 79/05)

[25] Regulation on the quantities of pesticides, metals, metalloids and other poisonous substances, chemotherapeutics, anabolics and other substances which can be found in food ("Official Gazette of FRY", No. 5/92)

[26] Regulation on maximum permissible levels of harmful substances and constituents of animal feed ("Official Gazette of SFRY", No. 2/90, 27/90)

[27] Law on Food Safety ("Official Gazette of RS" No. 41/09)

2.3.2.4 Conclusion

There are more than 20 registered pesticide producers in the Republic of Serbia. POPs pesticides have mainly been formulated in 3 plants. In addition, DDT was synthesized in the plant "Zorka – Zaštita bilja" in Šabac until the early seventies. The production was later ceased. Other compounds (aldrin, dieldrin, endrin, toxaphene, chlordane, heptachlor and hexachlorbenzene) were imported and used for production of plant protection products in the plants "Zorka – Zaštita bilja" in Šabac, "Župa" in Kruševac and "Galenika-Fitofarmacija" in Zemun. The plants mentioned are considered **the main POP pesticide producers** and as such require **comprehensive investigations to be carried out at locations where POP pesticides are produced**, as well as at locations where POP pesticides might have occurred (local disposal sites and similar). For the above reasons it is necessary to initiate and carry out a demonstration project which would analyse just one of the above mentioned production locations. This Project would serve as a base model for future projects dealing with the identification of locations contaminated with POPs and other pesticides. In addition, the project will have an educational character in the Republic of Serbia, providing information on proper ways to handle POPs pesticides at the production location until their ultimate elimination. The project will also be used as demonstration one in training of state authorities on methodologies employed for identification of contaminated locations, risk estimates, remediation/treatment techniques, remediation plans, preparation of bidding documentation for pesticide removal and location clean-up, organisation of bidding procedures. In addition, the project will enable training of parties from the pesticide-producing industry sector in the Republic of Serbia on proper and environmentally sound production management.

Demonstration project shall be carried out in the following phases:

1) Historic investigation of the state of production facilities and near-by locations starting from the construction up to date time, carried out for the above mentioned plants "Zorka – Zaštita bilja" in Šabac, "Župa" in Kruševac and "Galenika-Fitofarmacija" in Zemun (Belgrade) and determination of exact location of earlier POP pesticide production/formulation. The specified investigation should be carried out by contacting and interviewing different target groups such as inspectors responsible to carry out control of the pesticide production at specified locations over the past years, comparing current situation with photographs of the surrounding terrain, using historical archives, as well as interviewing employees and state inspectors in order to obtain an insight into total quantities of pesticides produced and location of POPs waste disposal. In addition, data that can be collected from old permits and contracts awarded for disposal of waste generated during pesticide production in certain municipal areas or disposal sites can also be useful.

2) Based on the results of the preliminary investigation, a detail investigation shall be carried out considering quantities of waste POPs pesticides generated at production facilities and surrounding locations.

3) A degree of environmental contamination shall be determined, with special consideration of soil and water contamination.

4) Risk assessment development, aimed to determine urgent actions that need to be carried out in order to eliminate present and future environmental dangers and negative effects affecting the population.

5) Action plan development aimed at waste, polluted soil and polluted water rehabilitation.

6) Preparation of documentation necessary for issuing bidding documentation for awarding contract for pollution elimination and production site clean-up.

7) Carrying out production site clean-up.

8) Monitoring the cleaned-up location.

Preliminary investigation of total quantities of POPs and obsolete pesticides (inventory) has indicated that there were 216 t of related waste. Preliminary investigation has provided a solid basis for further inventorying to be carried out. Obviously, this is only the beginning of problem identification in the Republic of Serbia. In order to fully and comprehensively analyze current situation in the country, it is proposed firstly to carry out the above mentioned demonstration project of detail inventory compiling in the selected district and later to extend detail inventorying to the entire country. Within the scope of the inventory compiling, it is necessary to investigate locations where POPs pesticides used to be produced.

Demonstration project shall result in the integral inventory assembled for selected district and shall contribute to increased public awareness. Demonstration inventory assembled for selected district shall be compiled using the plan and experience gained during the preliminary inventory assembling carried out within the scope of the POPs project. Experience gained during the preliminary inventory assembling has indicated that intense public awareness campaign needs to be organized before starting the inventory compiling, especially considering the agricultural sector. Experience obtained from the foreseen investment project shall be used to assemble inventories for all other Serbian districts i.e. to compile an integral inventory for the entire country. During the preliminary inventory assembling it has been confirmed that standard inventory assembling system of the FAO (Food and Agriculture Organization of the United Nations) could bee used for detail inventory assembling. The use of FAO PSMS (Pesticides Stockpile Management System) [17], with data access provided directly from the FAO server, is recommended. The system elements include risk assessment methodology, determination of priorities, as well as selection of temporary storage facilities and collection centres.

The system shall include detection of total quantities of POPs pesticides, pesticide stockpiles, empty pesticide packaging and similar materials such as contaminated construction material, spraying equipment, contaminated soil. Preliminary inventory assembled have not taken into account debris of contaminated construction materials, spraying equipment and contaminated soil in spite of the fact that the specified quantities may represent a significant portion of total pesticide-contaminated materials.

PSMS shall also contribute for the waste pesticide generation prevention strategy to be developed, aimed to prevent formation of new obsolete pesticide stockpiles. In this manner, quantities of waste pesticides stored in storage units could be managed at a district level.

Besides the above two identified problems, additional problem in Serbia represents the absence of **strategy for waste pesticide generation and empty pesticide packaging management.** This strategy should, jointly with new Law on Plant Protection Products and new Law on Packaging and Packaging Waste which are adopted recently, contribute dealing with problem of waste pesticide generation and empty pesticide packaging management.

Proposed activities aimed to prevent the use of obsolete pesticides are the following:

1. Education program intended to educate agricultural producers on the issues of waste, soil and water management, stockpile management, integrated pest control, certification of agricultural producers and good agricultural practice.

2. General stockpile management for pesticides in use, with implementation of PSMS. This FAO system available on the Internet enables: registration of pesticides placed on the market following the issuance of appropriate permit, stockpile management, data updating, information on pesticide consumption and their use-by dates, easy specific pesticide locating, standardized and simple information format, promotion of cooperation between districts as well as cooperation at a regional level between different countries.

With respect to **empty packaging management**, it is important to mention that the specified program aims to bring together all interested parties dealing with the issues of empty packaging, primarily in order to establish national organisations competent for the issues of empty pesticide

and other packaging management. The said represents a precondition for future steps aimed at adequate empty packaging management system design and implementation.

The main goal is to impose obligation upon pesticide producers to carry out pesticide packaging management i.e. a "cradle-to-grave" liability for the products produced. In order to establish an appropriate packaging management system, it is of the uppermost importance to provide involvement and adequate financial support to all interested parties.

In addition, it is also important to provide a technical solution for packaging recycling/destruction in the Republic of Serbia. One of possible options involves analysis of possible incineration of washed empty packaging in cement kilns. This option should be considered together with possible destruction of POPs and obsolete pesticides in cement kilns.

A system providing an adequate solution to the problem of pesticide packaging should be based on experience gained by other countries in the region (Hungary, Poland) and the ECPA Container Management Guideline [18] adjusted for the country-specific conditions in the Republic of Serbia. The program also foresees the launch of awareness raising campaign in the agricultural sector.

2.3.3 Status of the PCB quantities

2.3.3.1 History

Polychlorinated biphenyls (PCB) are organochlorine synthetic compounds from the group of long-term industrial pollutants, listed in Annex A, Part II to the Stockholm Convention.

Chlorination of biphenyls in the presence of catalysts (such as iron-chloride) results in formation of PCB containing different concentrations of chlorine and providing 209 PCB congeners with different characteristics. However, only 130 out of 209 PCB congeners are present in PCB-based fluids intended for commercial use. 78 out of 209 PCB congeners can exist as enantomers. 19 PCB, out of which 9 are components classified as commercial products, are mostly stable at room temperature.

PCB are used in fluids intended for various applications and for that reason their chlorine mass content, depending on the application, ranges from 21% to 68%. PCB are defined by a CAS number 1336-36-3.

In the period 1929-1989, total world production of PCB (including production in SSSR) equalled 1,5 million tonnes. This means that average annual production of PCB in the considered period equalled 26000 tonnes. Although in 1977 PCB production and distribution was prohibited, in the period 1980-1984 approximately 16000 t/a of PCB had been produced, while the production in the period 1984-1989 equalled 10000 t/a. However, it is considered that equipment produced after 1979 does not contain PCB. Various PCB containing transformers and condensers, depending on their country of origin and common commercial names of fluids containing PCB, are shown in Tables 2.3.3.1.a and 2.3.3.1.b.

Table 2.3.3.1.a: Countries of origin of large PCB-based fluid manufacturers and commercial names of produced fluids

COUNTRY OF ORIGIN	COMMERCIAL NAME
France	Non-Flamol, Olex-sf-d, Orophene, Pheaoclor, Pheneclor, Pyraclor, Pyralen, Plastivar, Polychlorinateddiphynyl, Prodelec, Pydraul, Pyraclor, Pyralene
Italy	Abestol, Aceclor, Adkarel, ALC, ApirolioDiarol, Dicolor, Diconal, Disconon, DK, Elinol, Eucarel, Euracel, Fenclor, Fenchlor
Japan	Intertenn, Kanechlor, Kaneclor, Kennechlor, Santosol, Santotherm
Germany	Ask/Askarel/Askael, Auxol, Bakola, Biclor, Blacol, Biphenyl, Clophen, Chlorphen, Crophene, Chorextol, Chorinol, Clophen/Clophenharz, Cloresil,
Poland	Chlorfin, Chlornal/Chlorinol, Chlorinated Biphenyl, Chlorinated Diphenyl, Dyknol, Educarel, EEC-18, Elaol, Sovtol, Tarnol
Slovakia	Decachlorodiphenyl, Delofet O-2, Delor, Delorene, Delorit
USA	Apirorlio, Areclor, Arochlor, Arochlors, Aroclor/Arochlor(s), Arubren, Asbestol, Cloresil, Chlophen, Chloretol, Chlorextol, Diaclor, Ducanol, Dykanol, Electrophenyl, Elemex, , Fenocloro, Gilotherm, Hexol, Hivar, Hydelor, Hydol, Hydrol, Hyrol, Hyvol, Inclor, Inerteen, Kenneclor, Leromoll, Magvar, MCS 1489, Montar, Monter, Nepoli, Nepolin, Niren, NoFlamol, Pyronol, Pyroclor, Safe-T-Kuhl, Saft-Kuhl, Sa-T-Kohl, Saf-T-KuhlP
SSSR	Santothern, Santovac, Sat-T-America, Siclonyl, Solvol, Sorol, Soval, Sovol

Table 2.3.3.1.b: Different commercial names of fluids containing PCB

COMMERCIAL NAMES OF PCB-BASED FLUIDS		
Aceclor	Diaclor	PCB
Adkarel	Dicolor	PCB’s

ALC	Diconal	PCBs
Apirolio	Diphenyl, chlorinated	Pheaoclor
Apirorlio	DK	Pheneclor
Arochlor	Duconal	Phenochlor
Arochlors	Dykanol	Plastivar
Aroclor	Educarel	Polychlorinated biphenyl
Arochlor	EEC-18	Polychlorinated biphenyls
Arubren	Elaol	Polychlorinated diphenyl
Asbestol	Electrophenyl	Polychlorinated diphenyls
Ask	Elemex	Polychlorobiphenyl
Askarel	Elinol	Polychlorobiphenyls
Askael	Eucarel	Prodelec
Auxol	Fenchlor	Pydraul
Bakola	Fenclor	Pyraclor
Biphenyl, chlorinated	Fenocloro	Pyralene
Chlophen	Gilotherm	Pyranol
Chloretol	Hydol	Pyroclor
Chlorextol	Hyrol	Pyronol
Chlorinated biphenyl	Hyvol	Saf-T-Kohl
Chlorinated diphenyl	Inclor	Saf-T-Kuhl
Chlorinol	Inerteen	Santosol
Chlorobiphenyl	Inertenn	Santotherm
Chlorodiphenyl	Kanechlor	Santothern
Chlorphen	Kaneclor	Santovac
Chorextol	Kennechlor	Solvol
Chorinol	Kenneclor	Sorol
Clophen	Leromoll	Soval
Clophenharz	Magvar	Sovol
Cloresil	MCS 1489	Sovtol
Clorinal	Montar	Terphenychlore
Clorphen	Nepolin	Therminal
Decachlorodiphenyl	No-Flamol	Therminol
Delor	NoFlamol	Turbinol
Delorene	Non-Flamol	
	Olex-sf-d	
	Orophene	

2.3.3.1.1 Use of PCB-based fluids

Commercial PCB-based fluids are mixtures of approximately 50 PCB congeners. PCB are used in fluids intended for various applications and for that reason their chlorine mass content, depending on the application, ranges from 21% to 68%.

PCB-based fluids were used in the following equipment:

- transformers;
- condensers (high voltage and low voltage);
- liquid cooled electric motors;
- hydraulic systems;

- heat transfer systems;
- electromagnets;
- fluorescent light connectors;
- liquid filled cables;
- gaskets;
- switches;
- voltage regulators;
- vacuum pumps;
- microwave ovens;
- electrical equipment;
- pesticide and lubricant additives;
- carbon free copying paper;
- plastics and plastic based product additives etc.

Physical/chemical and thermal properties (state of aggregation, density, hydrophobic properties, resistance to alkali and acids, lipophilicity, flammability), as well as electrical properties (electroconductivity) of PCB enabled their use in transformers, condensers, hydraulic devices and equipment, heat exchangers etc. In addition, significant quantities of PCB have been used in other applications, such as plastic material, polymers, coatings and paint manufacturing. Special category represents a PCB use in various devices of common use such as copy machines.

Approximately 1 million tonnes of PCB (60% of total worldwide quantities) are used as dielectric cooling fluids in electrical equipment such as transformers, condensers, rotor resistors and similar.

In the Republic of Serbia PCB were mainly used as dielectric fluids in transformers and condensers.

Use of PCB-based fluids can be classified into three groups:

- use in closed systems;
- use in partially closed systems;
- use in open systems.

Such classification indicates that there is a possibility of PCB escape into the environment, in accordance with location of their use.

2.3.3.1.2. Transformers

Transformers represent necessary pieces of equipment used in electricity production and distribution. Depending on their intended use, they are produced in a wide range of dimensions. Transformer is comprised of closed iron or steel housing and two magnetic coils (copper wire) placed in a magnetic field inside the housing. Number of coils is determined by the intended transformer use (to increase or decrease the voltage). Insulation in transformers produced in the sixties and the seventies of the last century was mainly provided by the means of transformer oils such as PCB, usually called pyralen transformer oils.

Figure 2.3.3.1.2.a: Typical transformer

Mass of dielectric fluid in a transformer is directly proportional to transformer capacity, in accordance with the following equation:

1 kVA = 1 litre of dielectric
Density of dielectric fluid equals 1, 56 kg/l

Although a mass of PCB in transformers in industrial use ranges from 200 kg to 4100 kg, the common relations between transformer capacity and quantity of dielectric fluid is shown in Table 2.3.3.1.2.a.

Table 2.3.3.1.2.a: Quantities of dielectric oil corresponding to different transformer capacities

TRANSFORMER CAPACITY (kVA)	MASS (kg)	VOLUME (l) (density 1,56)
100	140	90
160	215	138
200	295	189
250	295	189
315	300	192
400	450	288
500	425	272
630	615	394
800	575	369
1000	670	430
1250	800	513
1600	1130	724
2000	1300	833

All transformers must be equipped with appropriate nameplate stating the basic information on the manufacturer and the product itself. Transformers containing PCB must be additionally labelled (Figure 2.3.3.1.2.b and 2.3.3.1.2.c).

Figure 2.3.3.1.2.b: Nameplate on imported transformer

Figure 2.3.3.1.2.c: Nameplate on transformer produced in Serbia

Table 2.3.3.1.2.b: Transformers containing PCB

COUNTRY OF ORIGIN	**TRANSFORMER TYPE**
France	Alsthom, Alsthom, Alsthom (1000 kVA), Alsthom (800 kVA), Alsthom Savasione (1600 kVA), Alsthom Savasione (400 kVA), Alsthom Savasione (800 kVA), ISITHP, Maxivar, Maxivar, Metz, MiTR, OTP1/400/6, Rhone Alber Elec. (100 kVA), TP, TXP, UNELEC (250 kVA), TP 1800, TP 800, TN 1000, TN 244, TN 2870, TNE 4300, TNE 6260, TNE 7320, TR 1000 - TRANSFO OTP1/ 400/6
German Democratic Republic (East Germany)	DL-2500/10, Trafo TAM-1000, Trafo TM3 – 1000, Trafo TM-750, Trafo TMA -1000, Trafo TLM-750,

Germany VOLTAWER E, Germany	AEG (1000 kVA), AEG (1250 kVA), AEG (1600 kVA), AEG (25 kVA), AEG (315 kVA), AEG (500 kVA), Asea Lepper (1600 kVA), Asea Lepper (800 kVA), Elektromekanik (1250 kVA), Of. Elec. Tech. (25 kVA), Oy Stromberg (400 kVA) DL-500/20, DL-800/20, Volta Werke (960 kVA)
Italy	BBC (100 kVA), BBC (1250 kVA), BBC (630 kVA), ITALTRAFO 1250kVA , ITALTRAFO 1600kVA, ITALTRAFO 2000kVA, Marelli (750kVA), Marelli (900 kVA),
Japan	Mitsubishi (2000 kVA)
England-Monsanto ltd.	LL1651-26689
Sweden ASEA-Lepper GMBH – SE, Sweden	ABB (1665 kVA) TOHR 1000/15.75
Turkey	AEG ETİ (125 kVA), AEG ETİ (1600 kVA), AEG ETİ (400 kVA), AEG ETİ (630 kVA),
USA	General Elect. (750 kVA), General Electric (1250 kVA), Rectifier Transf. (2250 kVA), Westinghouse (750 kVA)
SSSR	TMZ 1000/10, TMZ 1000/10, TMZ 1600/10, TMZ 1600/10-75U3, TMZ 630/6/0,4, TNZ 2500/10-75UZ, TNZ-1000/10, TNZ-1000/10-71U3, TNZ-1600/10, TNZ-1600/10-71U3, TNZ-25/10, TNZ-2500/10, TNZ-40/10, TNZ-40/10-U3, TNZ-630/10, TNZP 1600/10, TNZP-1000/10, TNZP-1600/10, TNZP-400/10, TNZP-630/10, TNZPU-1000/10, TNZPU-2000/10, TNZS-2500/10, TNP 800/10, TNP-1600/10, TNP-400/10, TNP-800/10, TNPU-1000/10, TNPU-2000/10, TNR-1800/10, TNR-420/0,5P, TNR-750/10, TNRU-1200/10, TNRU-2000/10
Czechoslovakia	PTK, PTP, PTN
Poland	TO, TAO, TOC, TON, TOH, TOF, TOW
Serbia	**TP – 7152, TP – 7170, TP – 7707, T – 30/A, TP – 7053, TP – 7053, TP – 7807, TP – 7901, TP – 7902, TP – 928, TP – 668, T1 – 50/A, TP – 7013, T1 – 100/A, TP – 5115, TP – 7562, TP – 7920, T5P-79103, TP – 8247, TP – 8248, TP – 8249, TP – 803, TP – 817, T – 160, TP – 7014, TP – 7916, TP – 79115, T1 – 160/A, 250 KVA, TP – 960, TP – 7988, TP5 – 79110, TP – 7048, TP – 908, TP – 804, TP – 914, TP – 749, TP – 7130, TP – 7011, TP – 909, TN - 250-1, T1 – 250/A, T1P – 252, TP – 7560, TP – 8252, TP – 8321, TP – 7617, TP – 8241, TP – 7042, TP – 7557, TP – 7885, T5P – 7987, TP – 7618, TP – 7748, TP – 7031, T5P – 79118, TP – 8251, TP – 8310, TP –68.500/A, TP – 957, TP – 833, TP – 7017, TP – 7030, TP – 810, TP – 826, TP – 807, TP – 830, TP – 751, TP – 752, TP -7250, TP – 7543, TP – 7566, TP – 7447, TP – 7754, TP – 7884, TP – 7818, TP – 7904, TP – 7910, TP – 7921, TP – 7983, TP – 8250, TP – 7032, TP – 7230, TP – 8152, TP – 7441, TP – 934, T1 – 1 000, TP – 932, TP – 809, TP – 7621, TP – 7515, TP – 7525, TP -7704, TP – 7713, TP – 7891, TP – 7984, TP – 7029, TP – 7426, TP – 7336, TP – 7915, TP – 492, TP – 660, TP – 7817, TP – 7985, TP – 7558, T – 1 600, T6 – 1 600, TP – 7559, TP – 7841, TP – 7986, TP – 8612, TP – 7442, TP – 7154, TP – 7609, TP – 7443, TP – 7610, TP – 79124**

2.3.3.1.3. Condensers

Condensers are pieces of electrical equipment consisting primarily of parallel thin metal foil plates made of high quality aluminium. The plates are separated by an insulating fluid, polypropylene or PCB. Only condensers containing PCB are of importance for this inventory compiling. Condensers (of small and large capacity) are used for various purposes, primarily in high and low voltage power lines and high frequency transmission units for power factor increase in industrial electrical units, or in induction-based electrical and thermal units. They are also used for

reactive resistance compensation in power lines, stationary (industrial) and mobile (locomotive) electro motor starting etc. Condensers represent a basic element in many fluorescent light devices, whereby mass of PCB in such devices reaches even 0,1 kg. Depending on the application, condenser can be made as an integral unity (unit/item) or may consist of several units/items, an arrangement referred to as condenser battery.

Figure 2.3.3.1.3.a: Condenser

Figure 2.3.3.1.3.b: Condenser for power factor correction in industrial electrical units

Table 2.3.3.1.3.a: Condensers containing PCB

COUNTRY OF ORIGIN	CONDENSER TYPE
SSSR*	KŠS-6,3-50, KS2-1,05-60-U1, KS2-10,5-75-2 U3,KS2-10,5-50-2U3, KS2-6,3-75-2UZ, KSK-2-10,5-150-2U3, KSK-1-10,5-75-2U3, KS-2-0,38-36-2UZ, KS1-0,66-20-1U1, KS1-0,66-20-1UZ, KS1-0,66-40-1U1, KSA-0,66-20, KS2-1,05-60-2U1, KS2-038-50-U1, KS2-1,05-60-1U1, KS2-0,66-40-2U1, KSK2-10,5-125-1U1, KS2-6,3-75, KSA-0,66-20-U1, KM, KЭ,
German Democratic Republic (East Germany)	BK, KCI, KP,LKC,LKCA, LKCI, LKP, LKPI, LKPF, LKXF, LPXI, LKPH, LKMI, LKMI, LKUI, NKPT, NKNI
West Germany	D, DO, CD, 4RA, 4RL (produced in the period 1950-1975)
Czechoslovakia	DZ
Poland	C
Serbia	PMKS 93/6720, PMKU 0,74-75, PMKU 0,9-125, PMKU 0,74-90, PMKU 0,74-200, PMKS 125/1500, PMKS 66,6/3640, PMKS 83,3/3640, PMKS 75/3640, PMKS 25/5/1.73, TFK 100/6,3, TFK 75/6,3, TFK 66.6/6,3, TFK 125/6,3, PMKS 100/3640, PMKS 50/6000, PMKS 75/1500, PMKS 100/1050, PMKS 125/1050, PMKS 50/1050, PMKS 100/3640, PMKS 125/1500, PMKS 125/1350, PMKS 50/1800, PMKS 16,6/3650, PMKS 66,6/1200, PMKS 125/1800, PMKS 50/1800, PMKS 125/1330, PMKS 100/3640, PMKS 66,6/3000, PMKS 25/1500, PMKS 125/1500, PMKS 50/3000, PMKS 33,3/3640, PMKU 50/3650

** Condensers produced in SSSR contained 10-23 kg of TCB-based (mixture of trichlorobiphenyl isomers) PCB (16,5 kg in average).*

2.3.3.2 Production of equipment containing PCB-based fluids in the Republic of Serbia

Although PCB-based fluids have not been produced in the Republic of Serbia, they have been imported due to requirements imposed by produced electrical equipment and devices intended for different applications. However, equipment containing PCB-based oils and lubricants (hereinafter PCB-containinig equipment) was produced, while certain number of PCB containing transformers and condensers was imported. High demand for specified equipment primarily resulted from intensive industrial development of the Republic of Serbia in the period starting from the middle sixties and lasting until the end of the eighties of the last century.

In the Republic of Serbia transformers and condensers had been produced in two factories:

– production of transformers - "Minel" in Mladenovac (current company name: ABS "Minel-Trafo" jsc),

– production of condenser - "Minel" in Ripanj (current company name: ABS " Minel-Elektrooprema i postrojenja" jsc).

Production lines of the "Minel" in Ripanj, not so far from of Belgrade (a relatively small electrical equipment production workshop had during the years of intensive industrial development evolved into condenser production factory) and "Minel" in Mladenovac (transformer production workshop) had used imported PCB-based fluid for condenser insulation and impregnation.

A total of 565 transformers were produced in the Republic of Serbia, out of which 531 were delivered to Serbian companies, while 34 was exported to Iraq. Total mass of PCB-based fluids contained in produced transformers equalled 438155 kg, out of which 6094 kg was contained in exported equipment.

A total of 2379 condensers had been produced in the Republic of Serbia. Data on the PCB-based fluids contained in produced condensers are not available.

The last transformer containing PCB-based fluid was produced in 1986, while the last condenser was manufactured in 1988.

Records obtained from the manufacturers of PCB containing devices and electrical equipment, including data on the quantities of PCB containing fluids, equipment mass, as well as locations to which produced condenser had been delivered, cannot be considered completely reliable. The records were partially lost during the previous period of reorganisation and ownership transformation (privatisation). Data on produced transformers and locations of their installation are considered reliable.

Based on the data presented in the preliminary PCB inventory, as well as appropriate PCB related Action Plan, it can be stated with high certainty that all equipment produced in the Republic of Serbia, as well as equipment produced in former Yugoslavia or imported during the early eighties, contained PCB-based fluid.

2.3.3.3 Import of PCB-based fluids and PCB-containing equipment in the Republic of Serbia

2.3.3.3.1 Import of PCB-based fluids

Since closed-type equipment (transformers and condensers) containing PCB-based fluids used for transformer/condenser impregnation had been produced in the Republic of Serbia, PCB-based fluids had been imported in the past. In addition, considerable quantities of these fluids had been imported for other purposes (open systems), due to their use in plastic material, polymer, coating and paint production. A particular source category of PCB is a group of imported devices

such as copying machines. Quantities of PCB-based fluids imported due to requirements imposed by equipment manufacturing are unknown. Records on packaging used for fluid delivery are also absent.

2.3.3.3.2 Import of transformers, condensers and other PCB-containing equipment

Intensive industrial development of the Republic of Serbia, occurring around the middle of the last century, required an import of certain electrical equipment. In addition, electrical equipment was partially obtained from former Yugoslavian republics. At that time, such procurement was not an import, but internal trade.

Imported transformers were manufactured by English Electric, General Electric, Allis Chalmers - USA, Schorch, SIEMENS - Germany, Rade Končar - Croatia; ACEC - Belgium, Elin - Austria, Energoinvest - Slovenia, *EMO* – Macedonia etc. A problem during inventory compiling has arisen from the fact that equipment produced in former Yugoslavia could not be identified through customs documentation, since the related trade had been considered to be an internal trade.

Imported condensers were produced by: *ISKRA* - Slovenia, *ASEA* - Sweden, *SIEMENS, ABB* and *VEB* - Germany, *General Electric* - USA, *DUKATI* – Italy and manufacturers from former SSSR. Inventory compiling of condensers produced in former Yugoslavia is related to similar problem as the one mentioned with transformers.

Precise identification of imported equipment based on tariff numbers is not possible, since export-import database of the Serbian Customs dates from 2000. Equipment and devices imported from any former Yugoslav republic (in the period 1946-1990) was not treated as imported equipment. In that respect, data on considered equipment found in the Republic of Serbia were obtained only from the questionnaires distributed to different target groups and existing records of the Public Owned Utility - Power Industry of Serbia ("Elektroprivreda Srbije" - EPS), as well as the records of the Serbian Ministry of Defence.

In addition, almost all records on procured equipment have been lost during the events following the disintegration of Yugoslavia, as well as during the process of privatisation. Even if manufacturers of specific pieces of equipment are in possession of appropriate documentation, at this time it is considered unavailable and non-existent.

Based on data shown in preliminary PCB inventory, as well as appropriate PCB related Action Plan, it can be stated with high certainty that all equipment produced in the Republic of Serbia, as well as equipment produced on the territory of former Yugoslavia or imported during the early eighties, contained PCB-based fluids.

2.3.3.4 Export of PCB-containing equipment

Since PCB-based fluids have not been produced in the Republic of Serbia, these fluids have not been exported. However, PCB-based fluids had been exported, through the exported equipment, with considered fluids previously imported into the Republic of Serbia.

Based on the data shown in PCB preliminary inventory, 34 transformers had been produced in the Republic of Serbia by "Minel" in Mladenovac (current company name ABS "Minel-Trafo" jsc) and exported to Iraq (Table 2.3.3.4.a).

Table 2.3.3.4.a: List of transformers containing PCB-based fluid exported from the Republic of Serbia

Type	Pieces	Capacity (KVA)	Trade number	Manufacturing year	Product mass (kg)	Dimensions (mm)	PCB mass per 1 piece (kg)	Total (kg)
TP-7901	16	50	47921-47936	1979	502	819/550/1241	177	2 832
TP-7902	16	50	47937-47952	1979	502	819/550/1241	177	2 832
TP-7920	2	100	50198-50199	1979	760	1100/683/1401	235	470
Total	**34**	-	-	-	**17584**	-	-	**6094**

2.3.3.5 Preliminary PCB inventory results

PCB preliminary inventory prepared for the territory of the Republic of Serbia during 2006 and 2007, and has been based on data voluntarily submitted by equipment manufacturers and current users. During the period of preparation of preliminary inventory, submission of data on PCB-containing equipment in use was not mandatory by the law.

The Inventory has mainly included closed-type equipment (transformers, condensers, rotor resistors). However, the Inventory can not be considered final and complete.

2.3.3.5.1 Methodology used for preliminary inventory preparation

Preparation of preliminary inventory has been conducted in the following manner:

1. A questionnaire has been developed on equipment containing PCB and waste contaminated with PCB. Based on data obtained from the submitted questionnaires, information on the equipment owner, type, condition, characteristics and its location have been obtained, as well as data on PCB waste and related locations. Form and type of questions given in the questionnaire have been formulated in accordance with UNEP recommendations and requirements of the Serbian Environmental Protection Agency;
2. After the final form of the questionnaire has been adopted, more than 1600 copies of the questionnaire have been distributed to 16 out of 24 districts in the Republic of Serbia (excluding Kosovo and Metohija);
3. After the questionnaires have been filled out, they were collected and submitted data analysed;
4. Equipment manufacturers in the Republic of Serbia, which have been using PCB-based fluid for impregnation, have been contacted and available records on produced equipment obtained;
5. The preliminary inventory of PCB-containing equipment and waste has been prepared based on data provided in the questionnaires. From the aspect of data collection, assembled database may be considered final, but only for the process of preparation of preliminary inventory.

The following parties have been contacted during the preliminary inventory preparation:

– Competent Ministries of the Serbian Government (Ministry of Environment and Spatial Planning, Ministry of Defence, Ministry of Health, Ministry of Science), Ministries' inspection bodies, Government agencies (Serbian Environmental Protection Agency, Recycling Agency);

– Associations (Serbian Chamber of Commerce and Chamber of Commerce of Vojvodina, regional chambers of commerce);

– Economic entities engaged in electricity production and distribution (Public Owned Utility - power industry of Serbia - "Elektroprivreda Srbije" - EPS, Public Owned Utility "Elektromreža Srbije"), public traffic providing companies (public company for mail traffic - "Pošte Srbije",

Public Owned Utility for telecommunications - "Telekom Srbija", Public Owned Utility for railway transport - "Železnice Srbije");

– Manufacturers of equipment and devices containing PCB fluids dating from the middle of the last century, currently integrated within the company ABS "Minel" jsc, with separate production lines for transformer production - ABS "Minel-Trafo" jsc in Mladenovac and condenser production - ABS "Minel - Eletroopreme i postrojenja" jsc in Ripanj;

– General public, through Environmental Protection Committee within the local communities in different districts of the Republic of Serbia;

The results of preliminary inventory of equipment in use have been divided into three groups:

– Data on transformers;
– Data on condensers;
– Data on rotor resistors.

The results of preliminary inventory of waste contaminated with PCB-based fluids have also been divided into three groups:

– Data on transformers;
– Data on condensers;
– Data on other waste, including oils, earth, construction materials, cloths and vessels contaminated with PCB-based fluids.

2.3.3.5.2 Preliminary inventory results

Summary inventory results based on data obtained from the companies, institutions and public owned utilities from different districts of the Republic of Serbia are shown in Tables 2.3.3.5.2.a, 2.3.3.5.2.b and 2.3.3.5.2.c. Results indicate total mass of equipment, expressed as a sum of empty equipment and mass of the fluid. In cases indicated with (*****) data have been approximated. In cases when mass of empty equipment and the fluid have not been indicated in the questionnaire, but the equipment manufacturer, dimensions or capacity were known, total mass of equipment has been estimated. In cases when neither the equipment manufacturer, dimensions nor capacity were known, data on total mass has been omitted. The said was mainly encountered during condenser inventory compiling. The number of condensers or transformers with unknown mass is indicated in the Note column in the tables.

Table 2.3.3.5.2.*a*: Inventory of transformers containing PCB-based fluids

(* - approximated total mass)

District or the owner	Total number of transformers	Fluid mass (kg)	Total mass of the fluid and transformer (kg)	Note
Public Owned Utility "Elektroprivreda Srbije"	23	35856	141642	Data on total quantity and data for quantity of contaminated equipment are not complete and will be subject to complete inventory
Public Owned Utility "PTT Srbije"	1	300	1950	
Public Owned Utility "Železnice Srbije"	491	748000	2244000*	
South Banat District	45	101545	335560	

Mačva District	1	440	1500	
Ministry of Defence	25	21996	101640	There are no data on total mass of 2 transformers
Moravica District	5	4810	19070	
Nišava District	4	1830	5950	
Pčinja District	77	14355	18490 97733*	There are no data on fluid mass in 66 transformers; there are no data on total mass of 60 transformers
Pirot District	19	6420	25520 40404*	There are no data on fluid mass and total mass of 7 transformers
Podunavlje District	38	82655	201515	
Economic Association "Đerdap"	7	6430	25000	
Toplica District	24	13617	63359 69119*	There are no data on fluid mass and total mass of 2 transformers
Zlatibor District	7	2261	14560	
Summary	**767**	**1040515**	**960646**	**3304533***

Table 2.3.3.5.2.b: Inventory of condensers containing PCB-based fluids

(* - approximated total mass)

District or the owner	**Total number of condensers**	**Fluid mass (kg)**	**Total mass of the fluid and condenser (kg)**	**Note**
Bor District	71	609	3155 6395*	There are no data on the mass of 36 condensers
Public Owned Utility "Elektromreža Srbije"**	84	-	2940	
The city of Belgrade	105	-	3960	
Public Owned Utility "Elektroprivreda Srbije"	1084	-	24865 32435*	There are no data on 253 condensers
Public Owned Utility "Železnice Srbije"	110	13000	13000*	
South Bačka District	164		6227,4 7044,4*	There are no data on 19 condensers
South Banat District	167		4555	
Mačva District	180	1800	6300	
Ministry of Defence	184	1005	11017	Fluid and total mass were estimated
Moravica District	320	-	8281	
Nišava District	182	-	2084*	Only fluid mass data are available for 138 condensers. Fluid mass is adopted as a total mass
Pčinja District	108		4110	Fluid and total mass are estimated
Pirot District	195	-	8775 10127*	There are no data on 26 condensers

Podunavlje District	288	5680	14200	
North Banat District	781	-	27771 28807*	Fluid and total mass are estimated - there are no available data on 28 condensers
Middle Banat District	19	-	-	
Šumadija District	231		11670	
Toplica District	121		5698,4	
Summary	**4394**	**22094**	**145608,8**	**172623,8***

**Remark: Public Owned Utility "Elektromreža Srbije" in the meantime exported all identified quantities of condensers

Table 2.3.3.5.2.c: Inventory of rotor resistors

District or the owner	Total number of resistors	Fluid mass (kg)	Note
Jablanica District	7	97,2	Mass has been estimated based on the volume (81 l), there are no data on total mass
Pčinja District	34	3155	There are no data on total mass
Summary	**41**	**3252,2**	

Based on the data collected it is concluded with great certainty that all registered equipment which is still being used and contains PCB-based fluids. Based on data obtained from the questionnaires, it is known that rotor resistors most certainly contain PCB-based fluids.

Total mass (mass of equipment with fluid) of different types of equipment (transformers, condensers and rotor resistors) are shown in Figure 2.3.3.5.2.a.

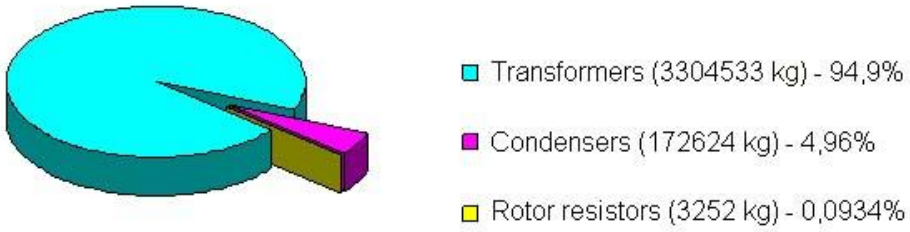


Figure 2.3.3.5.2.a: Total mass of different equipment containing PCB-based fluids in use as determined in the preliminary inventory

During the process of preparation of preliminary inventory, with efforts made to record all equipment containing PCB-based fluids in the most precise and detail manner, it is concluded that the Inventory is incomplete. For example, based on the records provided by the only transformer and condenser manufacturer in Serbia, number of locally manufactured transformers installed in Serbia equals 531, while the preliminary inventory provided information only on 131 transformer in use and 13 out of use. With respect to condensers, information is even less reliable. Based on data obtained from the only condenser manufacturer in Serbia, total number of condensers manufactured and installed in Serbia equals 1537, with 23661 kg of total fluid mass installed. It should be noted that while providing the above data, the manufacturer has stressed that the data were not final. Although the manufacturer has stated the location to which condensers had been delivered (43 locations), it is hard to relate all of the locations to specific entities, public owned utilities or institutions. However, inventory compiling has led to the conclusion that there are 2379 locally manufactured condensers installed in Serbia. Since this is more than specified by the condenser manufacturer, it is concluded that the inventory of produced condensers is not final. It

should also be noted that among the condensers declared as waste, as well as among exported condensers, there is a certain number of locally manufactured condensers which is not possible to determine.

The issue of total number of imported condensers still remains an open question.

2.3.3.6 Existing legal and regulatory framework

Legal framework for implementation of the obligations from the Stockholm Convention with respect to PCB is presented in Chapter 2.2.4. PCB and PCB waste management is adequately addressed in new Law on Waste Management (adopted in May 2009). This law regulates waste types and waste classification, waste management planning, entities involved in waste management, competences and obligations related to waste management, waste management organization, management of special waste flows, conditions and procedure for permit issuing, transboundary waste movement, waste-related reporting and database establishing, waste management financing, supervision, as well as other important waste management issues shall be addressed hereinafter.

The Law on Waste Management stipulates that waste storage, treatment or disposal may be carried out only by the following entities:

1) Organisation, company or other legal entity established for conducting waste storage, treatment or disposal related activities, according to the Law;
2) Legal entity, based on a permit and a contract signed with a local-self government for conducting activities of local importance, according to the Law.

Construction and operation of waste management facility must be in accordance with provisions of the Law on Waste Management, the law regulating construction, as well as other relevant laws (such as the Law on Integrated Pollution Prevention and Control). A waste management facility is not permitted to start operation before obtaining a permit for waste management. Waste can be stored, treated or disposed of in waste management facilities. In case of construction of facility for hazardous waste treatment or disposal, a competent ministry decides on its location in accordance with the Law and after obtaining an opinion of local-self government or autonomous province with respect to facilities to be constructed on the territory under their jurisdiction. When determining the location for waste management facility, the following aspects shall be taken into account:

1) Waste quantities and types;
2) Manner of waste storage, treatment or disposal i.e. types of facilities and plants;
3) Geological, hydrological, hydrogeological, topographic, seismic and pedologic soil properties and microclimate conditions of the area;
4) Proximity of protected natural areas and characteristics of the landscape.

Waste treatment is conducted using the best available techniques and technologies. Waste treatment facilities and equipment can be stationary or mobile. Waste treatment in stationary or mobile facility is conducted in accordance with conditions stated in waste treatment permit. For waste treatment in a mobile facility, it is necessary to obtain a permit for location which is issued by local-self government, as well as other permits, approvals or documentation required by the Law and other regulations.

Issues on special waste flows are regulated in Chapter VII of the Law on Waste Management. This Chapter addresses, among other issues, PCB and PCB waste handling. According to the Law, PCB is defined as PCB, PCTs, monomethyl-tetrachlorodiphenyl methanes, monomethyl-dichloro-diphenyl methanes, monomethyl-dibromo-diphenyl methanes or any other mixture which contains one or more of these substances in concentration higher than 0.005 % by weight. Furthermore, PCB waste is defined as waste, including equipment, facilities, materials or fluids which contain, consist of or are contaminated with PCB. Article 48 of the Law regulates

waste oil management and stipulates that during waste oil collection and storage it is prohibited to mix waste oil with PCB and used PCB or with halogen substances and substances which are not waste oils, or with hazardous waste.

PCB and PCB waste management is regulated by Article 52. According to this Article, PCB waste shall be collected separately. In addition, the following is prohibited:

1) transformer filling with PCB;
2) reuse of PCB waste;
3) PCB recycling from PCB waste;
4) temporary storage of PCB, PCB waste or PCB-containing equipment for a period longer than 24 months prior to their disposal or decontamination;
5) incineration of PCB or PCB waste on ships;
6) use of PCB-containing equipment if they are not in proper operating condition or if they leak.

This Law, for the first time, precisely defines obligations of the PCB owners, PCB waste or PCB-containing equipment:

- the owner of PCB and PCB waste is obliged to organise their disposal i.e. decontamination;
- the owner of PCB-containing equipment in use or a equipment possibly contaminated with PCB, is obliged to examine a PCB content using the services of accredited laboratory authorised to conduct waste analysis;
- the owner of equipment containing more than 5 dm^3 of PCB is obliged to report to the ministry responsible for environmental protection and propose a replacement plan i.e. a plan of their disposal and decontamination, to ensure their disposal and decontamination, as well as to report to the ministry any change of data related to equipment, not later than three months from the date when the change has occurred. Apart from the owner, the equipment may also be reported by a person involved in its maintenance.

All equipment containing PCB and rooms or facilities where such equipment is located, as well as decontaminated equipment must be appropriately labelled.

A person carrying out collection, decontamination or disposal of PCB waste must hold a valid permit, must keep a record on collected, treated or disposed quantities and submit all data to the Serbian Environmental Protection Agency.

The Serbian Environmental Protection Agency keeps a register on PCB-containing equipment in use.

The law specifies that the following is necessary to be prescribed in the Rulebook:

1) content and form of the label and manner of labelling of PCB-containing equipment and room or facility where such equipment is located, as well as of decontaminated devices;
2) manner of PCB or PCB waste disposal, decontamination of PCB-containing equipment and methods for the analysis of PCB content;
3) content of data submission form and register on PCB-containing equipment in use and PCB waste;
4) content of request form for issuing of permit for decontamination of PCB-containing equipment.

Article 100 of the Law on Waste Management sets out transitional provisions for disposal and decontamination of PCB-containing equipment, as well as for disposal of PCB contained in that equipment. According to this article, equipment containing more than 5 dm^3 of PCB will be disposed of or decontaminated until 2015 at latest. The same applies for disposal of PCB contained in that equipment. By the way of derogation, holder of equipment that contain between 0.05%-0.005% by weight of PCB shall ensure its decontamination or disposal when such equipment cease to be used.

2.3.3.7 Environmental monitoring

It is known that natural sources of PCB do not exist. In addition, although PCB are not produced for quite a while, people still may be exposed to their effects in many ways. Two ways of PCB exposure are the most important: through the living environment, resulting from long PCB breakdown periods and through the working environment.

Equipment containing PCB-based fluid has its lifetime, usually from 10 to 30 years. Handling of this type of equipment is regulated by appropriate technical documentation delivered by the equipment manufacturer. When regular control measures are being implemented, operation of such equipment does not impose danger from PCB contamination. However, resulting from improper equipment handling and other similar situations, PCB could be released into the environment.

PCB can enter the environment in different ways:

– Resulting from leakage during equipment operation. In this case, contamination is local and can be quickly stopped and controlled.

– Due to unregulated destruction of equipment containing PCB-based fluids. Similar situation have occurred in the Republic of Serbia during NATO intervention in 1999. PCB-based fluid spilling resulted in contamination of large areas. Rehabilitation from such contamination requires considerable effort, both analytical and financial.

– Resulting from PCB-based fluid leakage during equipment shut down or fluid replacement. Contaminated areas are constrained and can be placed under control and rehabilitation.

– Due to leakage during equipment storage.

Data on PCB concentrations determined in different environmental media are presented in Chapter 2.3.6.

2.3.3.8 Exposure and impact of PCB on human health

Effects of PCB on human health can be presented through impacts of specific large groups of compounds classified as POPs. Toxicity, persistency, bioaccumulative nature and mobility in the environment are the main characteristics of PCB environmental behaviour, imposing risks of their unregulated environmental presence. PCB derivatives, furans and dioxins, produced during incomplete and unregulated combustion of PCB, are extremely dangerous to human health.

Under normal conditions, breakdown periods of PCB in the environment are inversely proportional to a number of chlorine substituents in the biphenyl molecules and directly proportional to molecular resistance to photochemical reactions and biological degradation, as well as their accumulation in adipose tissue of higher organisms.

PCB can enter the human body through inhalation, skin absorption or through the food chain. Irrespective of the way of the introduction, PCB penetrate metabolic processes in the organism through blood. As a result of their lipophilic (fat soluble) characteristics, PCB easily accumulate in liver, adipose tissues and are even found in breast milk.

Effects of exposure to high PCB levels manifest through skin changes (chloracne and nail and skin hyperpigmentation) and neurological effects (muscle weakness and spasms). However, short term exposure to low concentrations is unlikely to cause considerable human health damages. Although some of the chronic impacts are yet to be scientifically confirmed, it is widely accepted that PCB belong to the group of potential cancer-causing substance. Exposure to polybrominated biphenyls, both of humans and animals, result in similar effects as exposure to PCB.

Although, after the chemical accidents that occurred in Kragujevac, Bor, Pančevo and Novi Sad during the war conflicts in 1999 public interest towards environmental pollution has been increased specially directed in possible impacts on the health of workers and local population.

Exposure to POPs and related human health impacts have never been systematically monitored and comprehensively studied in Serbia. In spite of the fact that after 1999 several international and national POPs related projects have been initiated, there are still very little data on the content of relevant contaminants in biological and other samples.

Based on POPs compounds concentrations in food, atmosphere and soil in the town of Novi Sad, it has been calculated that daily PCB intake of an adult weighing 70 kg equals 0.79 μg (1.1% ADI).

Analysis of organochlorine contaminants in breast milk has indicated that concentrations of analysed substances have not exceeded the values recorded in similar investigations conducted in other world countries.

In addition, PCB content in blood samples of potentially exposed workers has also been measured and examined. The results of conducted investigation have not been publicly published. Based on available data it is not possible to conduct detailed exposure analysis and risk assessment.

Apart from the above, in the Republic of Serbia POPs impact on bioindicators or other animal species is not systematically monitored. Sporadic analysis of fish species in the river Danube has shown that although possible POPs impacts on vital functions of considered species have been recognised, effects of other environmental factors can not be neglected.

2.3.3.9 Conclusion

Presence of PCB-containing equipment and wastes is the major POPs management problem in the Republic of Serbia.

According to preliminary inventory of PCB prepared in 2006-2007 the following can be concluded:

- PCB-based fluids have never been produced in the Republic of Serbia;
- Significant quantities of PCB-based fluid have entered the country through devices and equipment imported in the period of intensive industrial development of Serbia (1960-1980);
- Equipment containing PCB-based fluids has been produced in Serbia until 1986 at two site locations (transformers - ABS "Minel-Trafo" jsc in Mladenovac and condensers - ABS "Minel-Elektrooprema i postrojenja" jsc in Ripanj). Both companies are still present on the market producing the non PCB equipment;
- Preliminary inventory of PCB showed the presence of 767 transformers in use (total mass of 3300 t), 4394 condensers in use (total mass 172 t) and 41 rotor resistors (total mass of 3253 kg) but the realistic figures are expected to be much higher since significant discrepancies have been observed between data provided by local equipment manufacturers and data obtained during inventory compiling.

Legal base for appropriate PCB management is given in the Law on Waste Management adopted in May 2009, as well as relevant by-laws which will be developed according to this law.

Within the POPs project, ministry responsible for environmental protection prepared:

- Draft Rulebook on handling of PCB-containing equipment and waste;
- Guideline for identification, recording and environmentally safe handling of PCB-containing equipment and PCB waste, intended for the owners and the entities operating and maintaining PCB equipment;
- Procedure for verification of data obtained from the owners and entities operating or maintaining PCB equipment;

In order to adequately manage PCB, building of further capacity for fulfilling the obligations from Stockholm convention is needed, particularly with regard to:

– Training and education for identification, inventorying and safe use of PCB-containing equipment and PCB waste;

– Development of detailed inventory of PCB-containing equipment and PCB waste in form of an electronic database as well as electronic form for submission of relevant data;

– Establishment of system for data collection regarding use of PCB in the industry of plastics, polymers, varnishes and paints, as well as in construction industry;

– Training and education of entities maintaining PCB-containing equipment in order to reduce the risks of PCB contamination to the surroundings or to the environment;

– Training and education of inspection bodies, and employees in Serbian Environmental Protection Agency in order to proper collect data on PCB waste and equipment for the purpose of inventory assembling;

– Improved performance of laboratory related to conduct analysis of PCB-based fluid, PCB waste and other substrates;

– Establishment of temporary storages for PCB-containing equipment and PCB waste identified in the preliminary inventory especially for PCB-containing equipment and PCB waste where owner is unknown or owner is incapable to adequately dispose of PCB-containing equipment and PCB waste;

– Development of National operational plan for disposal/decontamination of PCB-containing equipment and PCB waste;

– Development of replacement plan i.e. a plan of disposal and decontamination by owners of PCB-containing equipment;

– Establishment of centralised and/or regional storage for hazardous waste with separate areas for PCB wastes;

– Assure financial support to solve the problem with PCB disposal.

2.3.4 Estimated releases of unintentionally produced POPs listed in Annex C (PCDD/PCDF, HCB and PCB)

2.3.4.1 Introduction

The category of unintentionally produced POPs (uPOPs) as specified in the Annex C to the Stockholm Convention includes:

- polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofuran (PCDF), commonly referred to as dioxins and furans;
- hexachlorobenzene (HCB);
- polychlorinated biphenyls (PCB).

Polychlorinated dibenzo-***p***-dioxins and dibenzofuran (PCDD/PCDF), hexachlorobenzene (HCB) and polychlorinated biphenyls (PCB) are unintentionally formed and released from anthropogenic sources.

In accordance with the provisions of the Stockholm Convention, the group of unintentionally released POPs does not include polycyclic aromatic hydrocarbons (PAH). However, being toxic organic micro pollutants regulated by the provisions of the Convention on Long-range Transboundary Air Pollution i.e. Aarhus Protocol on POPs, PAH releases represent an integral element of this document.

*Table 2.3.4.1.a***:** uPOPs and "candidates" for the category of uPOPs considered in 2008 as uPOPs

Category	**uPOPs or unintentionally produced PTS**
Listed under the Convention and POPs Protocol	PCDD, PCDF, PCB, HCB, (PAH)
POPs Reviewing Committee or proposed to be revised	Pentachlorobenzene, PCN, hexachlorobutadiene, (α-HCH, β-HCH)
Should be evaluated in accordance with TEF[28] concept (Van den Berg et al 2006)	PBDD, PBDF, PXDD, PXDF, PBN, PXN, PBB, PXB
Selection of other unintentionally produced toxic substances whose evaluation against the criteria set for uPOPs is justified	Chlorinated PAH, bromated PAH, mixture of halogenated PAH, nitrated PAH etc. Octachlorostyrene, TeCBz, TrCBz, HBBz, PeBBz, TeBBz, TrBBz, PBP, TeBP, TrBP, PCP, TeCP, TriCP, pentachlorobutadiene, tetrachlorobutadiene, hexachloroethane, tetrachloroethane etc.

2.3.4.2 Estimate of uPOPs release sources with special consideration of emissions to air

Potential routes of POPs release into the environment are shown in Figure 2.3.4.2.a.

[28] Project of Re-evaluation of Human and Mammalian Toxic Equivalency Factors (TEF) of Dioxins and Similar Compounds

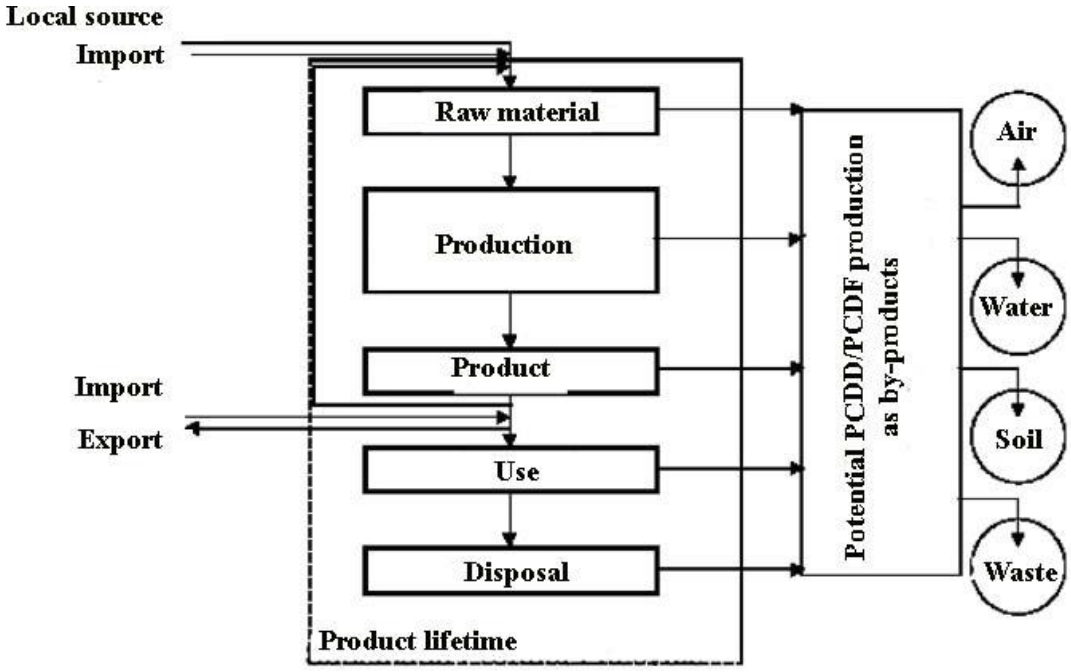


Figure 2.3.4.2.a: Potential routes of PCDD/PCDF release into the environment

Potential industrial sources of unintentional POPs releases into the atmosphere are shown in Figure 2.3.4.2.b.

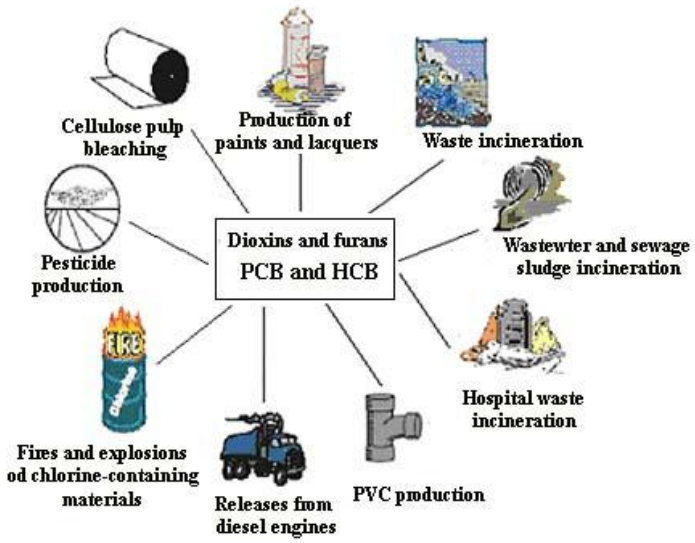


Figure 2.3.4.2.b: Selected potential sources of uPOPs releases into the atmosphere

2.3.4.3 Source categories of unintentional POPs releases

Quantities of unintentionally released POPs resulting from activities carried out in 2006, estimated based on the previously described methodology used for the Inventory compiling, are shown in Table 2.3.4.3.a.

Table 2.3.4.3.a: Estimated quantities/activities and data sources

Categories and sub-categories	Data source
Waste Incineration	
Medical waste incineration	Questionnaires
Waste wood and waste biomass incineration	Questionnaires
Animal carcasses burning	Questionnaires
Ferrous and Non-Ferrous Metal Production	
Iron ore sintering	Questionnaires
Polluted scrap iron, preheated, limited control of reheating/preheating	Questionnaires
Clean scrap/virgin iron, BOF furnaces	Questionnaires
Blast furnaces with preheating	Questionnaires
Cupola or induction furnaces with heated air, bag filter	Questionnaires
Secondary Cu – well controlled process	Questionnaires
Cu/Cu alloy casting and smelting	Questionnaires
Primary Cu, well controlled process with some secondary feed	Questionnaires
Treatment of scrap/secondary Al, minimal treatment before entering the process, simple solid particle separation	Questionnaires
Treatment of scrap/secondary material, well controlled process, preheating	Questionnaires
Treatment of scrap/secondary material, well controlled process, bag filter, lime injection	Questionnaires
Aluminium production from clean primary raw material	Questionnaires
Secondary lead from secondary raw materials free of PVC/Cl_2, partial preheating	Questionnaires
Zinc – only melting	Questionnaires
Brass and bronze production	Questionnaires
Magnesium production	Questionnaires
Thermal of Non-Ferrous metals production (e.g. Ni)	Questionnaires
Production of non-ferrous metals	Statistical data – more sources
Shredders (metal waste shredding)	Questionnaires
Heat and Power Generation	
Fossil fuel/waste boilers – co-combustion	Questionnaires
Thermal power plants – coal boilers	Questionnaires
Heat plants and other industrial coal boilers	Questionnaires
Heavy oil boilers (heat plants and industrial power plants)	Questionnaires
Light oil and natural gas boilers (heat plants and industrial power plants)	Statistical data – more sources
Large capacity biomass boilers (industrial power plants)	Statistical data – more sources
Large capacity wood boilers (industrial power plants)	Statistical data – more sources
Boilers and furnaces in residential sector/households – biomass	Statistical data – more sources
Wood furnaces – households	Statistical data – more sources
Liquid fossil fuel furnaces – households	Statistical data – more sources
Natural gas furnaces – households	Statistical data – more sources
Production of Mineral Products	
Cement production	Questionnaires
Lime production	Questionnaires
Brick production	Questionnaires
Glass production	Questionnaires
Ceramic material production	Questionnaires
Production of asphalt mixtures	Questionnaires
Transport	

Regular fuel	Statistical data – more sources
Unleaded fuel, vehicles without catalysts	Statistical data – more sources
Unleaded fuel, vehicles with catalysts	Statistical data – more sources
Diesel engines	Statistical data – more sources
Uncontrolled Combustion Processes-Fires	
Forest fires	Questionnaire submitted by the Ministry of Internal Affairs
Landfill fires	
Accidental fires in house, factories	Questionnaire submitted by the Ministry of Internal Affairs
Uncontrolled domestic waste burning	Questionnaire submitted by the Ministry of Internal Affairs
Accidental fires in vehicles (per vehicle)	Questionnaire submitted by the Ministry of Internal Affairs
Miscellaneous (including Production of Chemicals and Consumer Goods)	
Paper production	Questionnaires
Production of chorine/chloro-alkaline materials	Statistical data – more sources
PVC production	Statistical data – more sources
Oil refineries – gas flow to the torch	Questionnaires
Textile production	Statistical data – more sources
Leather production	Statistical data – more sources
Crematoria, annual number of cremations	Questionnaires
Meat dryers	Statistical data – more sources
Tobacco – smoking	Statistical data – more sources

2.3.4.4 Releases of unintentionally produced POPs

Preliminary Inventory is compiled in accordance with methodology described in Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases [19]. The specified methodology has also been used for other POPs inventory assembling.

Input data included information on capacities i.e. production rates of various industrial facilities, waste generation factors, emission factors, as well as special data on pollution recorded at specific locations or emissions released from specific sources. Necessary data have been obtained using the following data sources:

– Questionnaires specifically developed for each industrial sector, distributed to industrial and other organisations through the Republic Inspection of the Ministry of Environment and spatial Planning;

– Data received from authorities and related organisations (Ministry of Mining and Energy, Ministry of Internal Affairs – Fire Protection Department, Serbian Chamber of Commerce, Statistic Office of the Republic of Serbia, Serbian Environmental Protection Agency, Public Owned Utility - Electric Power Industry of Serbia ("Elektroprivreda Srbije" - EPS), Public Company "Pogrebne usluge" of the city of Belgrade, providing funeral-related services etc.);

– Other official documents (NPEP, national development strategies developed for different sectors – heat and power generation, waste management, industrial management, EU accession and similar, National Implementation Program for the Energy Sector Development Strategy and other;

– International databases (Eurostat, IEA, EEA, EMEP, EPER, national statistics);

– Extensive technical literature (previously specified UNEP Toolkit, BREF documents, UNEP documents on BAT/BEP related to POPs, EMEP/CORINAIR Atmospheric Emission Inventory, guidebooks developed in Serbia etc.);

– Documents of the international conventions (Stockholm, OSPAR, HELCOM, MEDPOL);

– Papers published in international and national journals;

– Data published by respectable international industrial associations (EUROFER, CEMBUREAU, EUROMETAUX and similar);

– Direct communication with industry, inspection, other bodies, non governmental organisations etc.;

– Extensive data from personal archives of the Inventory compilers.

More than 360 filled-in questionnaires have been collected from the industrial facilities related to the following industrial sectors:

– waste incineration (only medical waste and waste biomass),
– metal industry,
– industrial power and heat generation,
– mineral industry (non-ferrous metals),
– production of chemicals.

In addition, collected questionnaires have provided data on fires in households, forest fires, burned vehicles, fires in buildings and industrial facilities, cremations.

Data on fossil fuel consumption in thermal power plants and households, fuel consumption in transportation sector, quantities of dried meat products, tobacco consumption, waste landfills and treatment of wastewaters generated in different sectors are obtained from relevant institutions, through the use of available databases and extensive literature.

Identification of potential emission sources and source sectors has been carried out based on the source list presented in Parts 2 and 3 of the Annex II to the Stockholm Convention.

2.3.4.4.1 Annual POPs emissions – dioxins/furans, PCB, HCB and PAH in the Republic of Serbia

Data on total POPs emissions from all sources obtained from collected questionnaires as well as from the literature is shown in Table 2.3.4.4.1.a.

Table 2.3.4.4.1.a: Annual emissions of uPOPs in 2006 in the Republic of Serbia

Republic of Serbia, 2006	**Total release into the environment**
PCDD/PCDF – industrial facilities in Serbian districts (based on collected questionnaires)	**115,27 g/a**
PCDD/PCDF – based on literature data related to other industrial and non-industrial activities	**282,72 g/a**
PCDD/PCDF – total	**397,99 g/a**
HCB – total	**137,33 kg/a**
PAH – total	**40616 kg/a**
PCB – total	**199,4 kg/a**

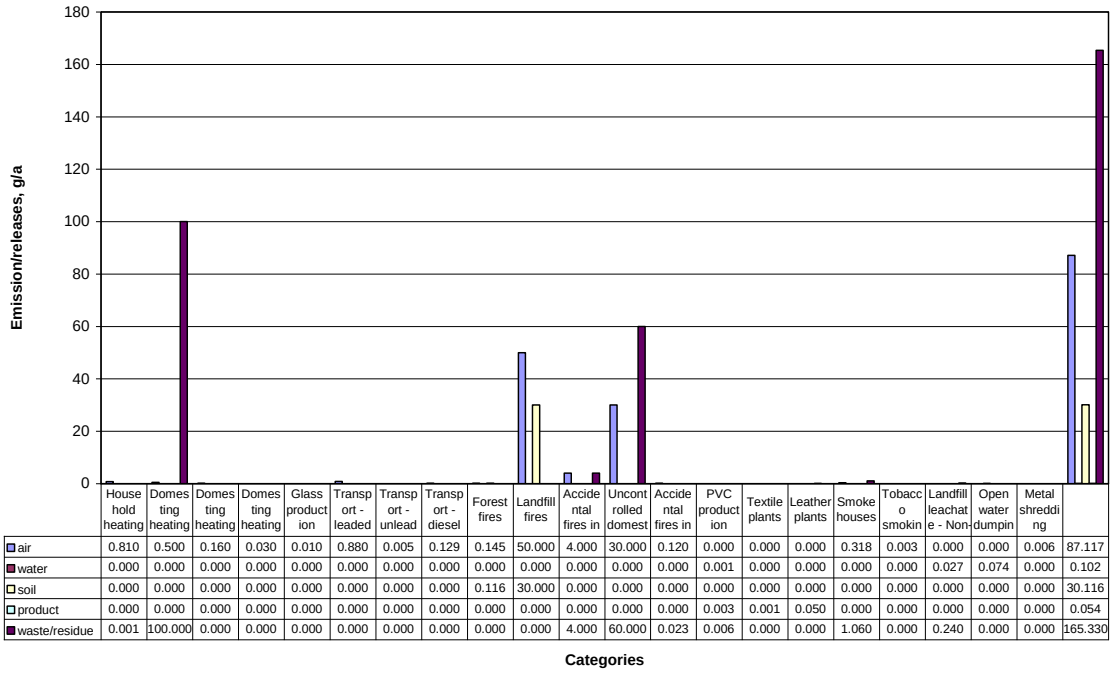
2.3.4.4.2 Annual uPOPs emission originating from different source categories in the Republic of Serbia

Unintentionally produced PCDD/PCDF releases

Annual emission of PCDD/PCDF, originating from different source categories, is shown in Tables 2.3.4.4.2.a and Figures 2.3.4.4.2.a and 2.3.4.4.2.b.

*Table 2.3.4.4.2.a***:** Total PCDD/PCDF releases in 2006 by source category, based on statistical and other literature data on industrial activities

Release category		**Air**	**Water**	**Soil**	**Product**	**Residue/waste**
1	Waste Incineration	9,06	0,00	0,00	0,00	6,44
2	Ferrous and Non-Ferrous Metal Production	19,15	34,56	0,00	0,00	29,35
3	Heat and Power Generation	4,95	0,00	0,00	0,00	104,47
4	Production of Mineral Products	2,32	0,00	0,00	0,00	0,27
5	Transport	1,01	0,00	0,00	0,00	0,00
6	Uncontrolled burning	84,27	0,00	30,12	0,00	64,02
7	Production of Chemicals and Consumer Goods	2,10	0,11	0,00	0,70	3,17
8	Miscellaneous	0,52	0,00	0,00	0,00	1,06
9	Disposal/Landfills	0,00	0,10	0,00	0,00	0,24
1-9	**Total**	**123,38**	**34,77**	**30,12**	**0,70**	**209,02**
	Final summary, g/a	**397,99**				



	House hold heating	Domes ting heating	Domes ting heating	Domes ting heating	Glass product ion	Transp ort - leaded	Transp ort - unlead	Transp ort - diesel	Forest fires	Landfill fires	Accide ntal fires in	Uncont rolled domest	Accide ntal fires in	PVC product ion	Textile plants	Leather plants	Smoke houses	Tobacc o smokin	Landfill leachat e - Non-	Open water dumpin	Metal shreddi ng	
air	0.810	0.500	0.160	0.030	0.010	0.880	0.005	0.129	0.145	50.000	4.000	30.000	0.120	0.000	0.000	0.000	0.318	0.003	0.000	0.000	0.006	87.117
water	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.027	0.074	0.000	0.102
soil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.116	30.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	30.116
product	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.001	0.050	0.000	0.000	0.000	0.000	0.000	0.054
waste/residue	0.001	100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.000	60.000	0.023	0.006	0.000	0.000	1.060	0.000	0.240	0.000	0.000	165.330

Figure 2.3.4.4.2.a: Total PCDD/PCDF releases in the Republic of Serbia in 2006 by source category

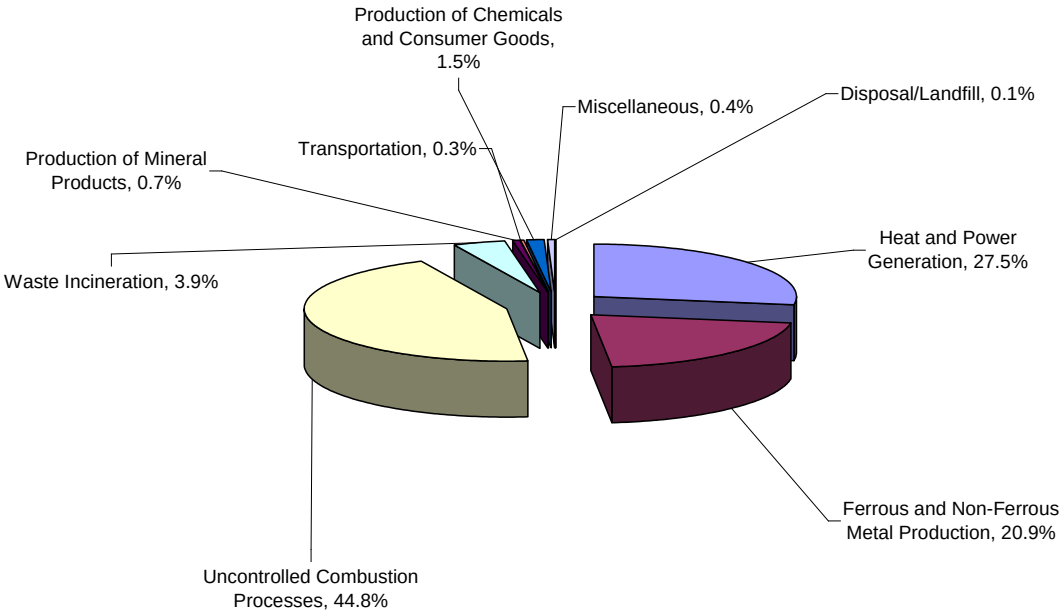


Figure 2.3.4.4.2.b: Distribution of total PCDD/PCDF releases in the Republic of Serbia in 2006 for different source categories

Based on data presented in previous tables and figures it is concluded that the highest PCDD/PCDF emissions to air originate from uncontrolled burning, where landfill fires, industrial fires, accidental fires with respect to unregulated biomass burning (forest fires, agricultural residue burning (in field) and similar) are distinguished as the most significant emission sources. The specified source category of uncontrolled burning is characterised by considerable PCDD/PCDF releases to soil, primarily resulting from residues generated during waste burning or combustion of other materials.

With respect to industrial sources, ferrous and non-ferrous metal production and mineral production represent the most significant emission sources. Cement industry is one of the most distinguishable due to its large production capacities. Heat and power generation i.e. operation of thermal power plants also represents an important emission source. High emissions released from this sector result from intense lignite combustion in thermal power plants. However, the sector of heat and power generation has particularly high release rates to waste i.e. combustion residues, since lignite combustion produces large ash quantities.

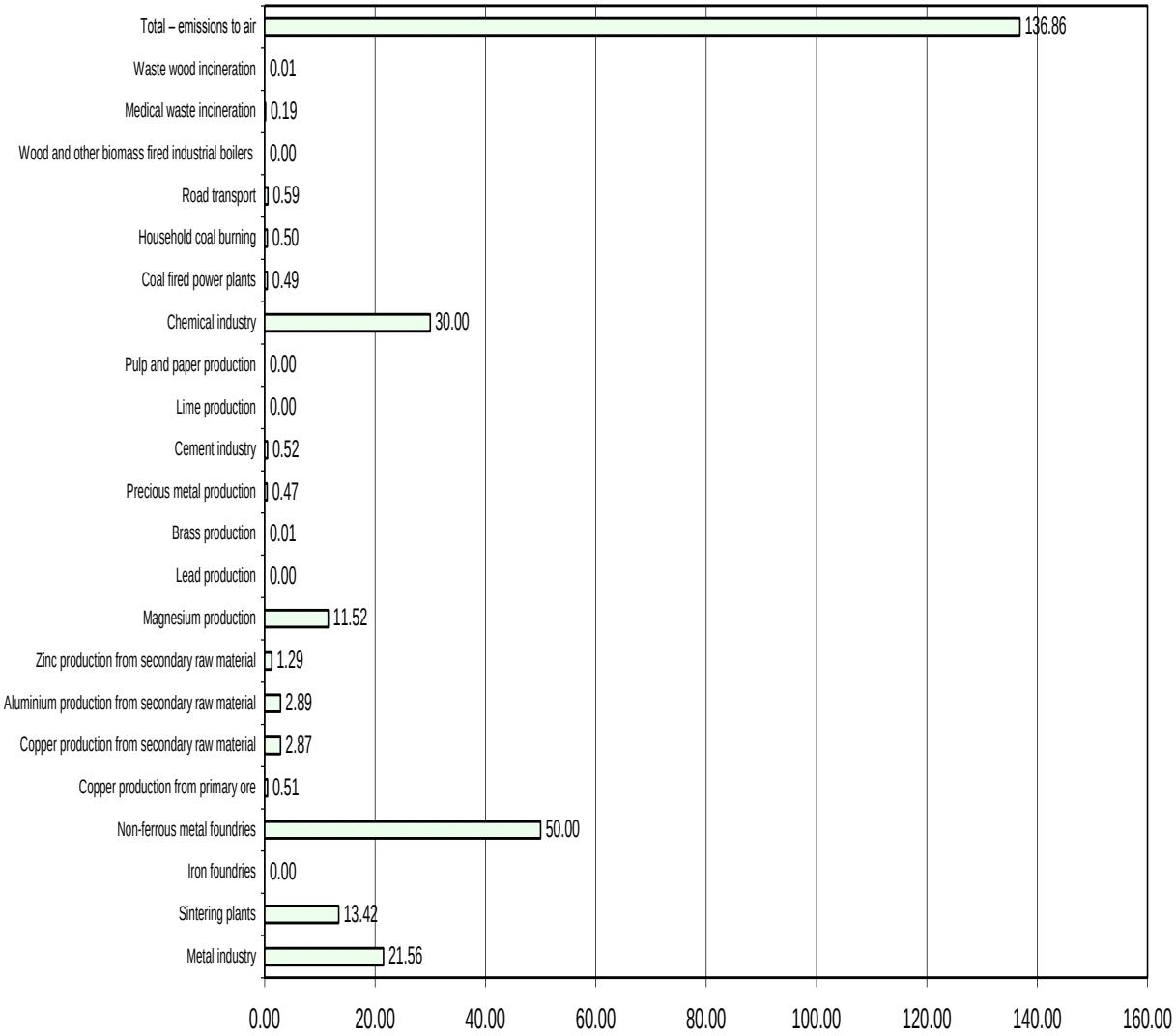
Although there are no facilities for incineration of municipal and hazardous waste in Serbia, emissions to air from these processes are relatively high. The main reason represents a number of outdated facilities for medical waste incineration, as well as incineration of wood and other waste biomass. These facilities are characterised by low quality combustion, as well as the absence of emission reduction devices.

Unintentionally produced HCB releases

An inventory on unintentionally produced HCB has been compiled using a similar methodology to the one employed for PCDD/PCDF release inventory assembling, with emission factors from relevant literature sources. Annual releases from different source are shown in Table 2.3.4.4.2.b and Figures 2.3.4.4.2.c - 2.3.4.4.2.e.

*Table 2.3.4.4.2.b***:** Estimated of unintentionally produced HCB releases by source category, kg/a

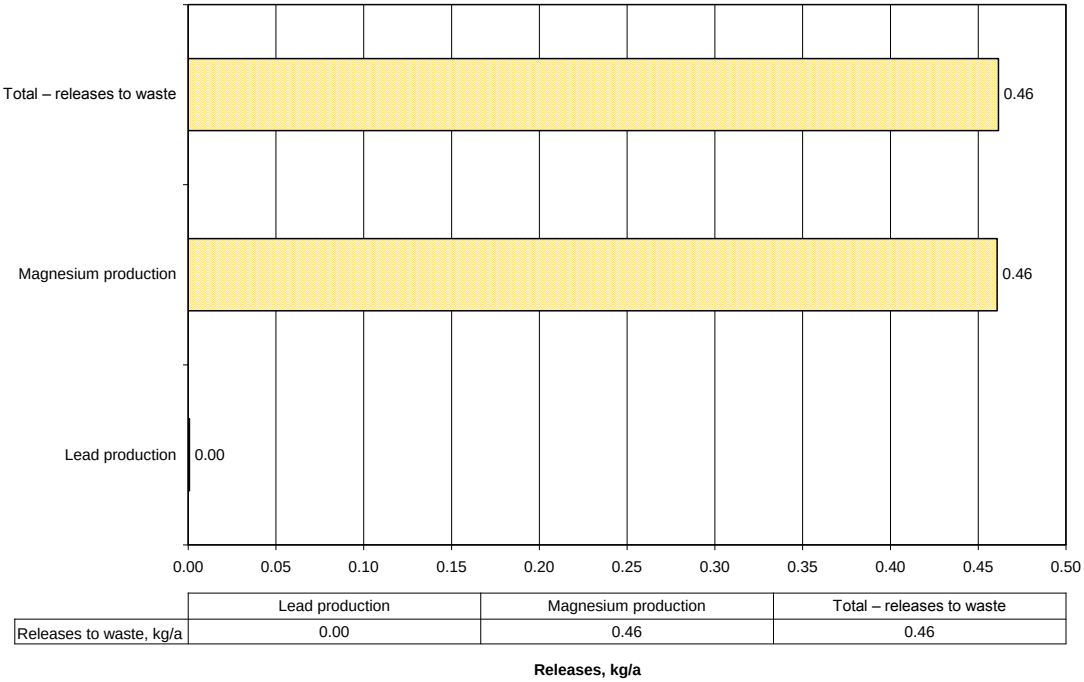
Sector	
Emission to air	**Emission, kg/a**
Metal industry	21,56
Sintering plants	13,42
Iron foundries	0.00
Non-ferrous metal foundries	50,00
Copper production from primary ore	0,51
Copper production from secondary raw material	2,87
Aluminium production from secondary raw material	2,89
Zinc production from secondary raw material	1,29
Magnesium production	11,52
Lead production	0,00
Brass production	0,01
Precious metal production	0,47
Cement industry	0,52
Lime production	0,00
Pulp and paper production	0,00
Chemical industry	30,00
Coal fired power plants	0,49
Household coal burning	0,50
Road transport	0,59
Wood and other biomass fired industrial boilers	0,00
Medical waste incineration	0,19
Waste wood incineration	0,01
Total – emissions to air	**136,86**
Releases to waste	**Release, kg/a**
Lead production	0,00
Magnesium production	0,46
Total – releases to waste	**0,46**
Releases to water	**Release, kg/a**
Magnesium production	0,01
Total – releases to water	**0,01**
Total – from all sources	**137,33**



	Metal industry	Sintering plants	Iron foundries	Non-ferrous metal	Copper produc	Copper produc	Aluminium produc	Zinc production	Magnesium produc	Lead production	Brass production	Precious metal	Cement industr	Lime production	Pulp and paper	Chemical industr	Coal fired power	Household coal	Road transport	Wood and other	Medical waste inciner	Waste wood inciner	Total – emissions to
Emission, kg/a	21.56	13.42	0.00	50.00	0.51	2.87	2.89	1.29	11.52	0.00	0.01	0.47	0.52	0.00	0.00	30.00	0.49	0.50	0.59	0.00	0.19	0.01	136.86

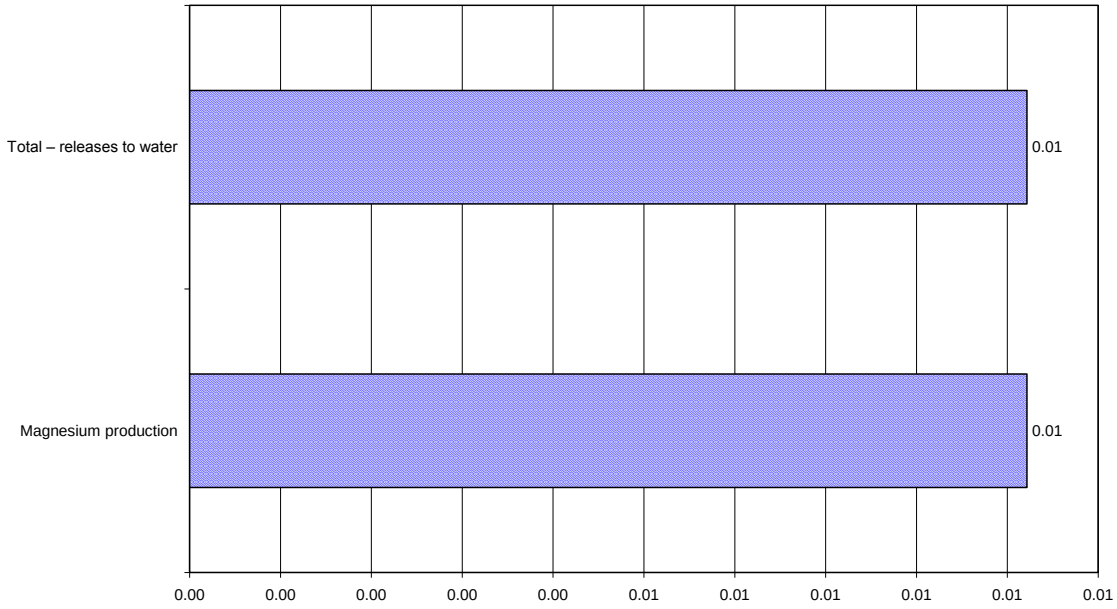
Emission, kg/a

Figure 2.3.4.4.2.c: Estimated unintentional HCB emissions to air by source category



	Lead production	Magnesium production	Total – releases to waste
Releases to waste, kg/a	0.00	0.46	0.46

Figure 2.3.4.4.2.d: Estimated unintentional HCBs releases to waste by source category



	Magnesium production	Total – releases to water
Releases to water, kg/a	0.01	0.01

Figure 2.3.4.4.2.e: Estimated unintentional HCB releases to water by source category

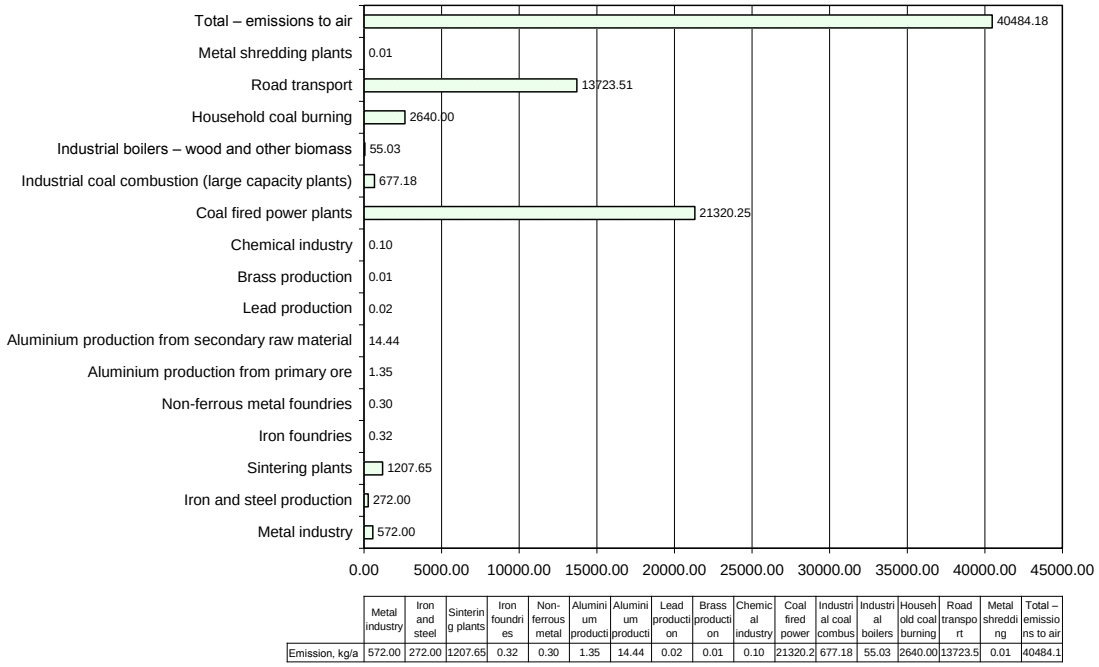
Based on the previously presented results it can be concluded that HCB emissions to air are the most significant. However, it is important to keep in mind that releases to waste and water have been determined based on the emission factors available only for a small number of source categories. The largest sources are determined to be non-ferrous metal foundries and ferrous metal production facilities.

Unintentionally produced PAH releases

A PAH inventory has been compiled using the similar methodology as for previously presented inventories. Inventory results i.e. annual PAH releases from different sources are shown in Table 2.3.4.4.2.c and Figures 2.3.4.4.2.f-2.3.4.4.2.h.

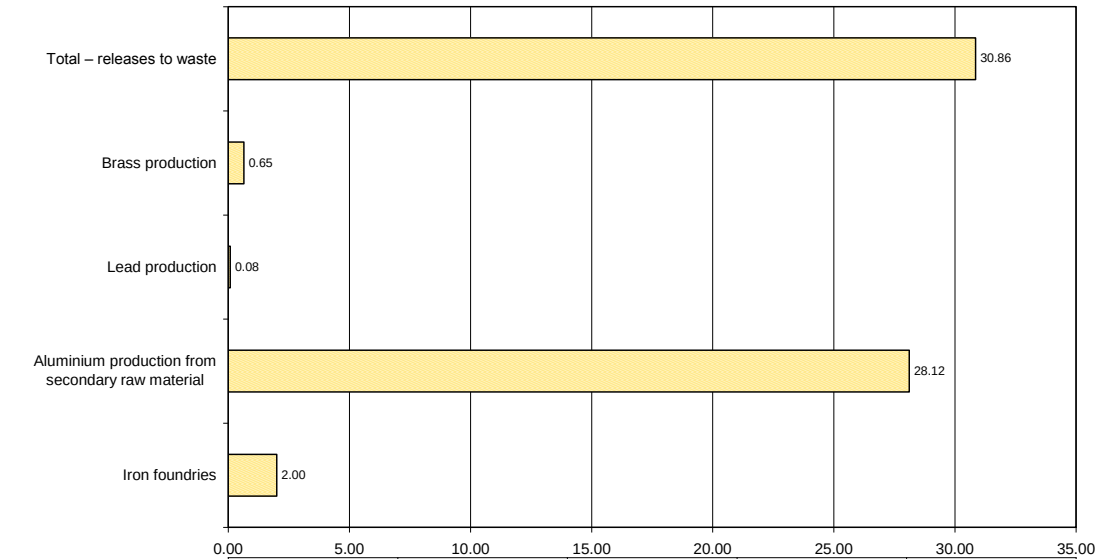
Table 2.3.4.4.2.c: Estimated PAH emissions/releases by source category, kg/a

Sector	**Emission kg/a**
Emission to air	
Metal industry	572,00
Iron and steel production	272,00
Sintering plants	1207,65
Iron foundries	0,32
Non-ferrous metal foundries	0,30
Aluminium production from primary ore	1,35
Aluminium production from secondary raw material	14,44
Lead production	0,02
Brass production	0,01
Chemical industry	0,10
Coal fired power plants	21320,25
Industrial coal combustion (large capacity plants)	677,18
Industrial boilers – wood and other biomass	55,03
Household coal burning	2640,00
Road transport	13723,51
Metal shredding plants	0,01
Total – emissions to air	**40484**
Sector	**Release, kg/a**
Releases to waste	
Iron foundries	2,00
Aluminium production from secondary raw material	28,12
Lead production	0,08
Brass production	0,65
Total – releases to waste	**31**
Sector	**Release, kg/a**
Releases to water	
Non-ferrous metal foundries	100,00
Aluminium production from primary ore	1,50
Total - releases to water	**101**
Total from all sources, kg/a	**40616**



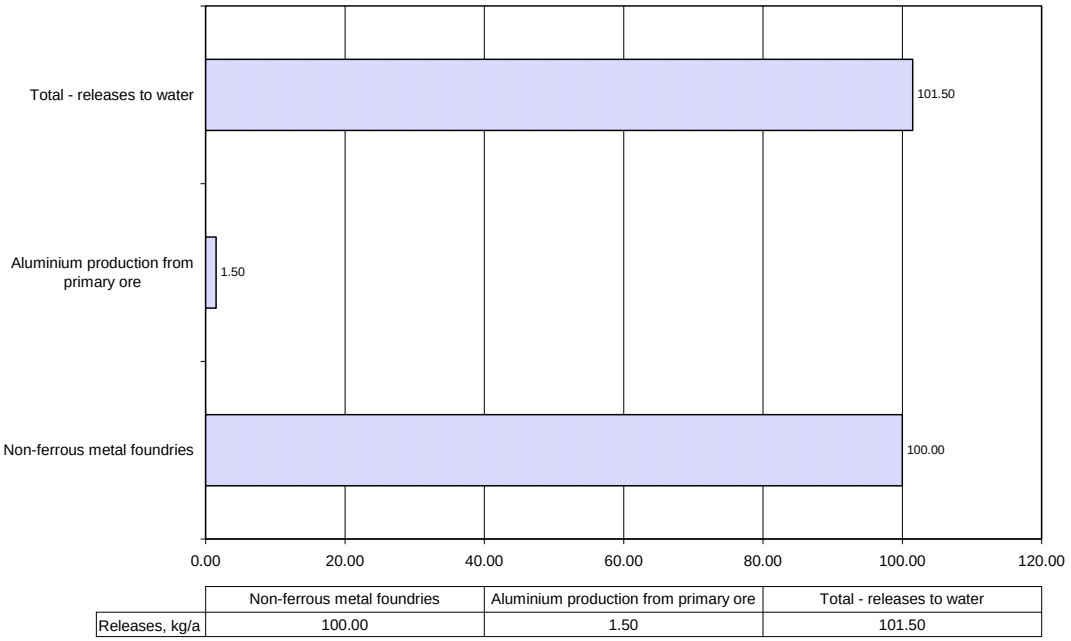
	Metal industry	Iron and steel	Sinterin g plants	Iron foundri es	Non-ferrous metal	Alumini um producti	Alumini um producti	Lead producti on	Brass producti on	Chemic al industry	Coal fired power	Industri al coal combus	Industri al boilers	Househ old coal burning	Road transpo rt	Metal shreddi ng	Total – emissio ns to air
Emission, kg/a	572.00	272.00	1207.65	0.32	0.30	1.35	14.44	0.02	0.01	0.10	21320.2	677.18	55.03	2640.00	13723.5	0.01	40484.1

Figure 2.3.4.4.2.f: Estimated PAH releases to air by source category, kg/a



	Iron foundries	Aluminium production from secondary raw material	Lead production	Brass production	Total – releases to waste
Releases, kg/a	2.00	28.12	0.08	0.65	30.86

Figure 2.3.4.4.2.g: Estimated PAH releases to waste by source category, kg/a



	Non-ferrous metal foundries	Aluminium production from primary ore	Total - releases to water
Releases, kg/a	100.00	1.50	101.50

Figure 2.3.4.4.2.h: Estimated PAH releases to water

Similar to HCB, PAH emissions to air are determined to be the most significant release pathway, but again possibly due to small number of emission factors defined for specific source categories. Traffic sector is the most significant emission source, primarily due to large number of old vehicles and the use of low quality fuel.

Inventory of PAH releases is additionally compiled by calculating emissions of four PAH, identified as indicative by the UNECE Aarhus POPs Protocol: B[a]P, B[b]F, B[k]F, I[123cd]P. Results obtained are shown in Table 2.3.4.4.2.d.

*Table 2.3.4.4.2.d***:** PAH emissions expressed through emissions of four indicative PAH

Category	**B[a]p**	**B[a]p**	**B[b]f**	**B[b]f**	**B[k]f**	**B[k]f**	**I[123cd]p**	**I[123cd]p**	**Emission**
	EF	Emission	EF	Emission	EF	Emission	EF	Emission	
	mg/t	t/a	mg/t	t/a	mg/t	t/a	mg/t	t/a	t/a
Coal fired thermal power plants	0,31	0,01	0,9	0,03	0,7	0,02	0,25	0,01	0,07
Heavy oil fired thermal power plants	4,7	0,00	20,3	0,01	4	0,00	7,6	0,00	0,02
Industrial coal combustion (large capacity plants)	1550	1,50	70	0,07	23	0,02	1192	1,15	2,74
Industrial wood combustion	1300	0,06	1500	0,06	500	0,02	90	0,00	0,14
Household brown coal burning	2600	0,08	100	0,00	40	0,00	2000	0,06	0,14
Household dried coal burning	330	0,10	10	0,00	0	0,00	250	0,08	0,18
Household wood burning	2000	1,08	3000	1,62	1000	0,54	130	0,07	3,31
Sintering plants	17	0,02	20	0,03	10	0,01	10	0,01	0,08
Aluminiumproduction from primary ore	8600	0,00	0	0,00	0	0,00	4400	0,00	0,00
Medical waste incineration	0,7	0,00	3,15	0,00	3,15	0,00	0	0,00	0,00
Crematoria EF mg/cremation	0,01	0,00	0	0,00	0	0,00	0	0,00	0,00
Forest fires	14300	0,41	9300	0,27	4200	0,12	4800	0,14	0,95
Leaded fuel, EF mg/km	0,043	0,22	0,0379	0,19	0,0407	0,20	0,0064	0,03	0,64

Unleaded fuel, EF mg/km	0,0019	0,01	0,0029	0,01	0,002	0,01	0,0005	0,00	0,02
Diesel fuel, EF mg/km	2,2	35,51	1,8	29,05	2,2	35,51	0,3	4,84	104,91
Total emission		38,99		31,34		36,46		6,40	113,20

The results obtained show considerably higher value of total releases when the inventory is compiled based on four indicative PAH, identified as indicative in Aarhus Protocol on POPs, when compared to value obtained based on the analysis of all PAH emission sources.

Unintentionally produced PCB releases

A PCB inventory has been compiled using the similar methodology as for previously presented inventories.

Inventory results are shown in Table 2.3.4.4.2.e and Figures 2.3.4.4.2.i and 2.3.4.4.2.j.

*Table 2.3.4.4.2.e***:** Estimated PCB emissions/releases by source category, kg/a

Sector	**Emission kg/a**
Emissions to air	
Iron and steel production	4,32
Sintering plants	17,44
Iron foundries	0,05
Copper production from primary ore	0,00
Copper production from secondary raw material	0,19
Aluminium production from secondary raw material	7,60
Zinc production from secondary raw material	3,06
Lead production	0,34
Brass production	0,00
Precious metal production	0,37
Cement industry	13,00
Lime production	0,04
Pulp and paper production	0,15
Oil refineries	7,30
Chemical industry	0,00
Coal fired thermal power plants	109,65
Industrial boilers - wood and other biomass	0,03
Liquid fuel burning in households and other boiler of small capacities	0,56
Household coal burning	5,28
Household wood burning	1,89
Road transport	19,61
Waste burning in the open	3,60
Agricultural and forest fires	0,02
Crematoria	0,00
Metal shredding plants	0,16
Liquid fossil fuel combustion	1,86
Coal combustion in industrial and district heating systems	1,21
Industrial wood combustion (small capacity plants)	0,03
Medical waste incineration	0,00
Total – emissions to air	**197,75**
Sector	**Release, kg/a**
Releases to waste	
Lead production	0,02
Brass production	0,01
Household coal burning	0,07
Household wood burning	0,04

Metal shredding plants	1,50
Total - releases to waste	**1,63**
Sector	**Release, kg/a**
Releases to water	
Pulp and paper production	0,00
Total - releases to water	**0,00**
Total from all sources, kg/a	**199,4**

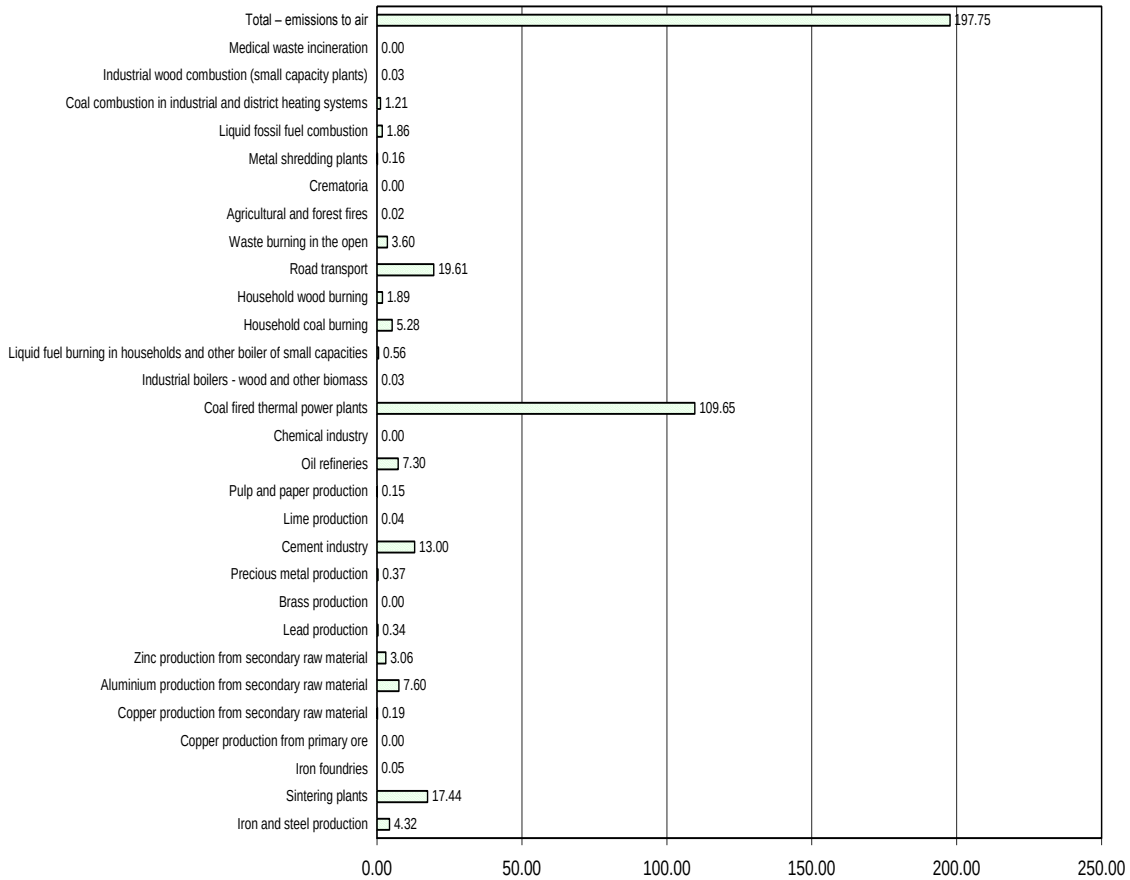
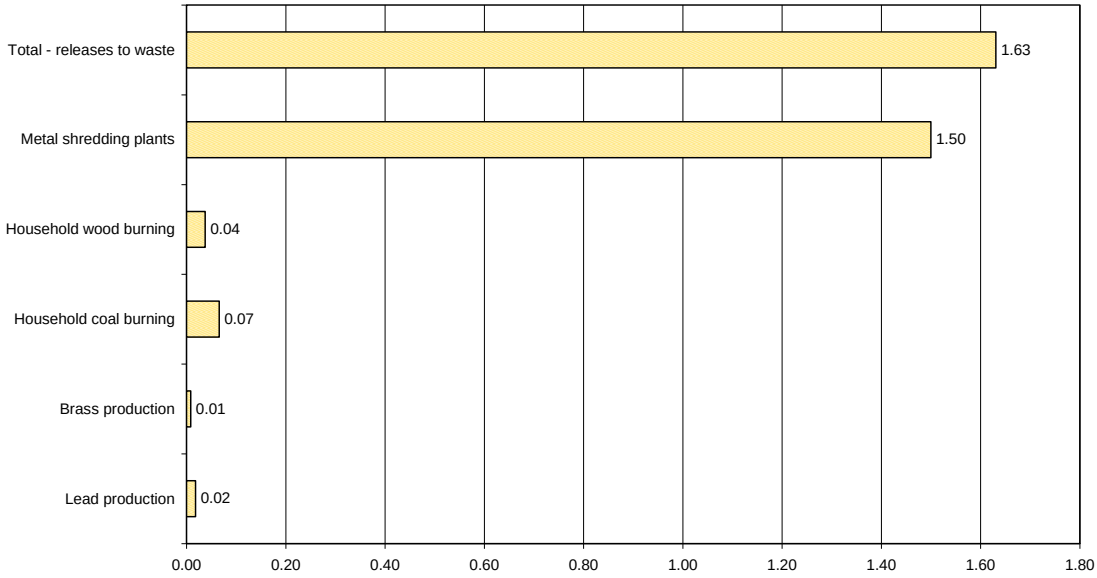


Figure 2.3.4.4.2.i: Estimated PCB emissions to air, kg/a



	Lead production	Brass production	Household coal burning	Household wood burning	Metal shredding plants	Total - releases to waste
Releases, kg/a	0.02	0.01	0.07	0.04	1.50	1.63

Figure 2.3.4.4.2.j: Estimated PCB releases to waste, kg/a

Analysis of the results obtained indicates that emissions to air are significantly higher than releases to all other media. The most important emission sources are lignite burning heat and power generating plants.

2.3.4.4.3 Unintentional produced PCDD/PCDF releases by district/region of the Republic of Serbia

Inventory of unintentional POPs releases by district/region of the Republic of Serbia has been compiled only for PCDD/PCDF (Table 2.3.4.4.3.a and Figures 2.3.4.4.3.a and 2.3.4.4.3.b). Although the same methodology has been used for compiling inventories of other uPOPs (HCB and PCB) and PAH, due to considerably smaller number of activities considered as potential emission/release sources, inventories of the later substances have been compiled for the country as a whole, rather than for each district/region.

It is necessary to mention that in the process of PCDD/PCDF inventorying, estimate of PCDD/PCDF releases per district/regions has been done for six out of nine source categories. In this way, the following source categories have not been included in this inventory:

- source category no 5 – Transport;
- source category no 6 – Uncontrolled Combustion Processes;
- source category no 9 – Disposal/Landfill.

The above specified source categories have been omitted due to the nature of considered sources, which makes contribution from specific locations impossible to be determined.

Table 2.3.4.4.3.a: Estimate of PCDD/PCDF releases by district/region in Serbia, g/a

District/region/town		Total releases to each environmental medium					
		air	water	Soil	product	waste/residue	summary
1	AP Vojvodina	3,046	0,000	0,000	0,000	0,832	3,878
2	Belgrade	2,358	0,081	0,000	0,573	3,387	6,399
3	Mačva	4,487	0,000	0,000	0,000	0,020	4,507
4	Kolubara	0,255	0,000	0,000	0,000	0,326	0,581
5	Šumadija	0,252	0,000	0,000	0,000	0,740	0,991
6	Podunavlje	12,185	0,000	0,000	0,000	0,113	12,298
7	Braničevo	1,957	0,000	0,000	0,000	1,227	3,184
8	Pomoravlje	0,140	0,000	0,000	0,000	0,227	0,367
9	Moravica	0,159	0,019	0,000	0,056	0,269	0,503
10	Bor	0,279	0,000	0,000	0,000	0,019	0,297
11	Zlatibor	2,435	0,000	0,000	0,000	27,300	29,735
12	Raška	0,227	0,000	0,000	0,000	0,891	1,119
13	Rasina	0,054	0,000	0,000	0,000	3,048	3,102
14	Nišava	1,306	34,560	0,000	0,000	0,115	35,982
15	Zaječar	0,003	0,000	0,000	0,000	0,009	0,012
16	Pčinja	0,804	0,007	0,000	0,021	0,080	0,911
17	Toplica	5,220	0,000	0,000	0,000	5,062	10,283
18	Jablanica	0,036	0,000	0,000	0,000	0,007	0,043
19	Pirot	1,062	0,000	0,000	0,000	0,016	1,078

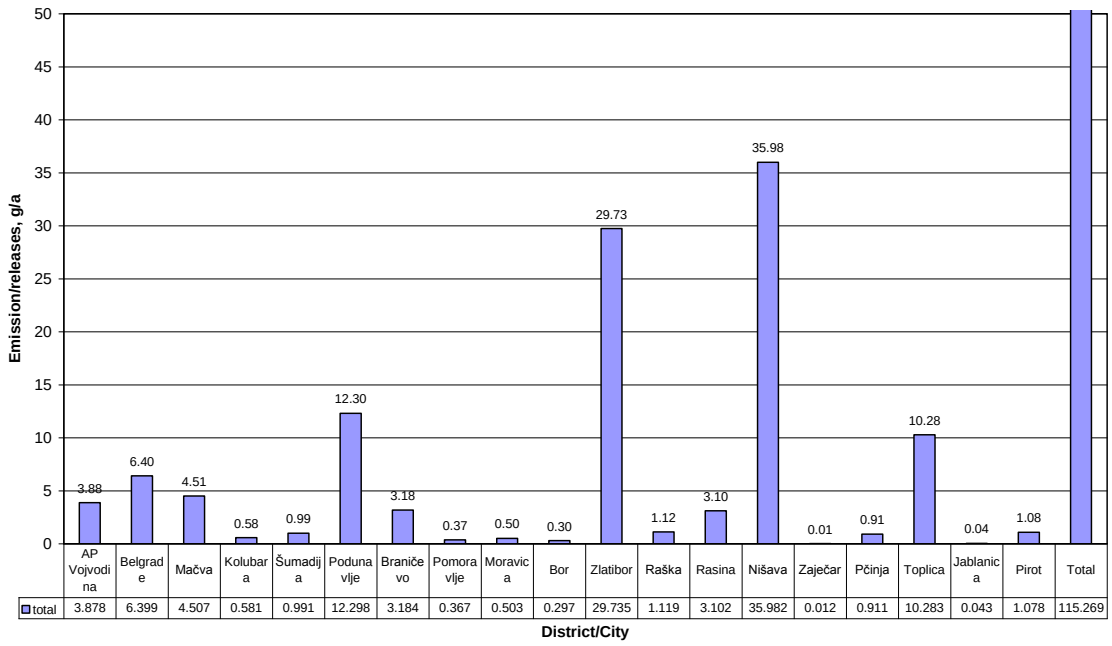
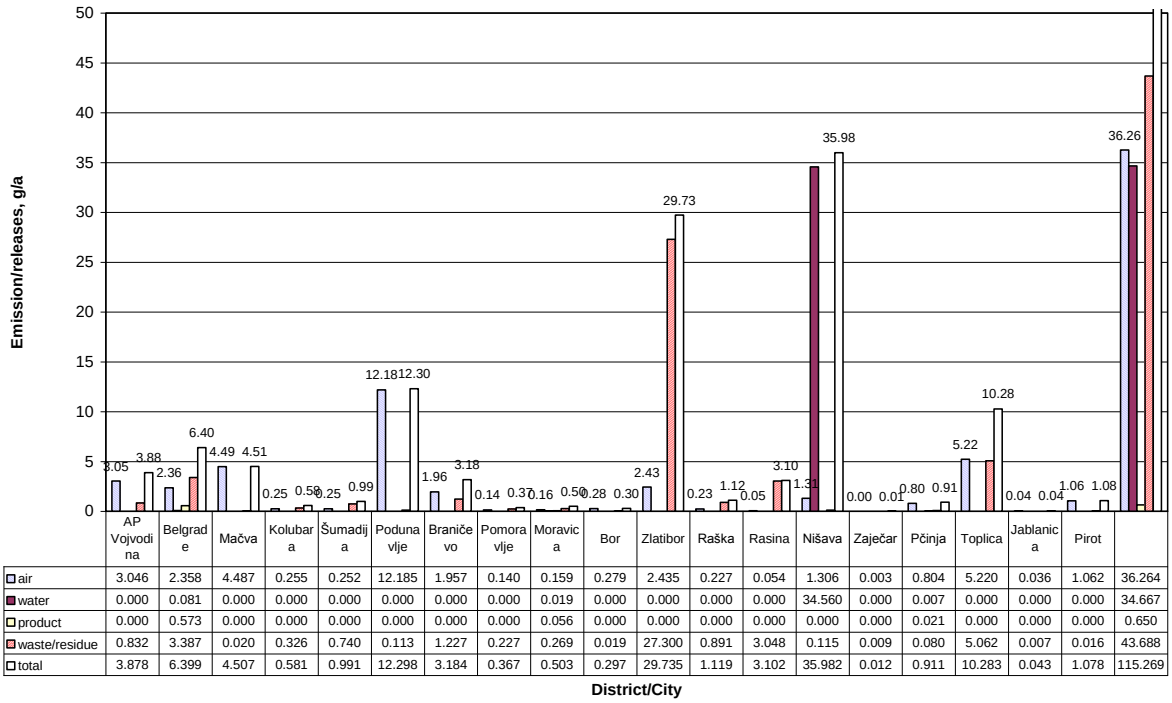


Figure 2.3.4.4.3.a: Total PCDD/PCDF releases in the Republic of Serbia in 2006 by district



	AP Vojvodina	Belgrade	Mačva	Kolubara	Šumadija	Podunavlje	Braničevo	Pomoravlje	Moravica	Bor	Zlatibor	Raška	Rasina	Nišava	Zaječar	Pčinja	Toplica	Jablanica	Pirot	
air	3.046	2.358	4.487	0.255	0.252	12.185	1.957	0.140	0.159	0.279	2.435	0.227	0.054	1.306	0.003	0.804	5.220	0.036	1.062	36.264
water	0.000	0.081	0.000	0.000	0.000	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.000	34.560	0.000	0.007	0.000	0.000	0.000	34.667
product	0.000	0.573	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.000	0.000	0.000	0.650
waste/residue	0.832	3.387	0.020	0.326	0.740	0.113	1.227	0.227	0.269	0.019	27.300	0.891	3.048	0.115	0.009	0.080	5.062	0.007	0.016	43.688
total	3.878	6.399	4.507	0.581	0.991	12.298	3.184	0.367	0.503	0.297	29.735	1.119	3.102	35.982	0.012	0.911	10.283	0.043	1.078	115.269

*Figure 2.3.4.4.3.b***:** Total PCDD/PCDF releases in the Republic of Serbia in 2006 by district and to each environmental medium

With respect to emissions to air, it is concluded that the highest emission has been recorded in Podunavlje district, primarily due to the presence of the largest Serbian plant in the sector of ferrous metallurgy ("US Steel Serbia", located in Smederevo). For that reason, estimated dioxin and furan emissions released from this facility (sintering plant and alike) are the highest. However, apart from the "US Steel Serbia", considerable number of medical waste incineration facilities is also present in Podunavlje district. In addition, the district is also one of the important sources of releases to waste/residue, resulting from large ferrous metallurgy production capacities in the region.

However, the largest source when considering releases to waste/residue are Zlatibor district (non-ferrous metallurgy) and Toplica district (incineration of waste wood and waste biomass), as well as the city of Belgrade. The city of Belgrade is also an important PCDD/PCDF emissions source, primarily due to large power generating capacities of the Public Utility Company - Power Industry of Serbia ("Elektroprivreda Srbije" - EPS). In addition, facilities of the district heating systems also represent important emissions sources.

Since the only two Serbian oil refineries are located in the Autonomous Province of Vojvodina, this province is also considered to be significant PCDD/PCDF emission source.

2.3.4.4.4 Unintentional produced PCDD/PCDF releases to different environmental media

Inventory of uPOPs releases depending on the quantities released to each environmental medium and to product and waste, is compiled only for PCDD/PCDF

(Figures 2.3.4.4.4.a and 2.3.4.4.4.b). Inventories of other uPOPs (HCB and PCB) and PAH have been assembled using the similar methodology as for PCDD/PCDF, with corresponding emission factors for such components.

In addition, it should be mentioned that in the process of PCDD/PCDF inventorying, estimate of PCDD/PCDF releases to each environmental medium has been done for six out of nine source categories, in accordance with explanation provided above (when considering releases by district/region). However, releases into air, water, soil (different environmental media) or releases to product or waste have been calculated and presented for each source category, i.e. for total releases (Figure 2.3.4.4.4.c).

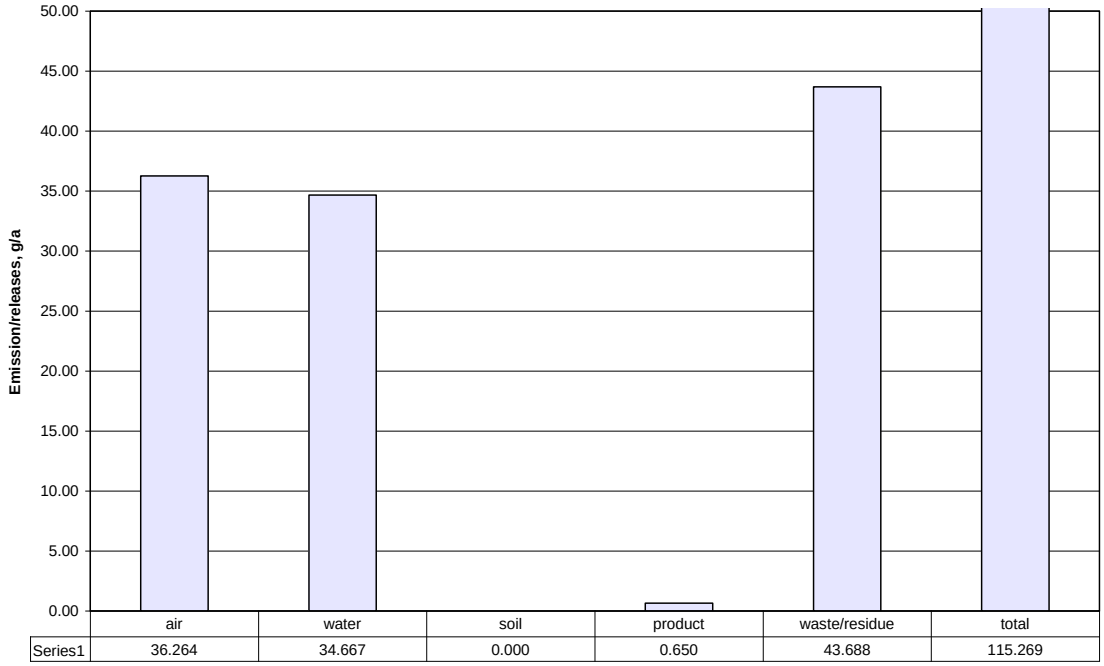
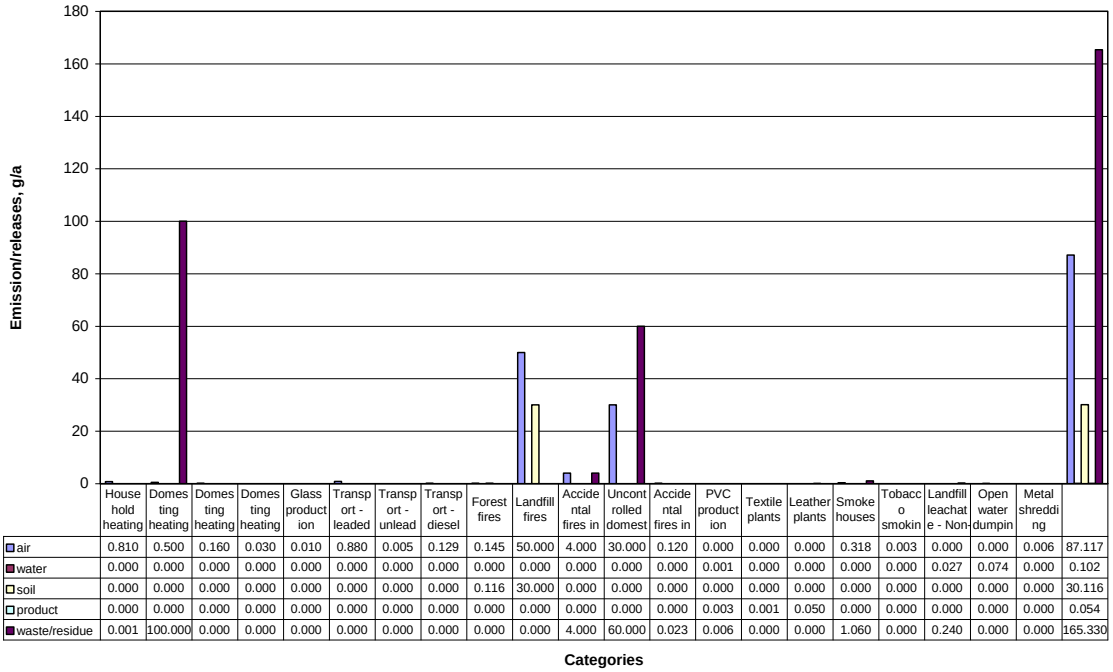
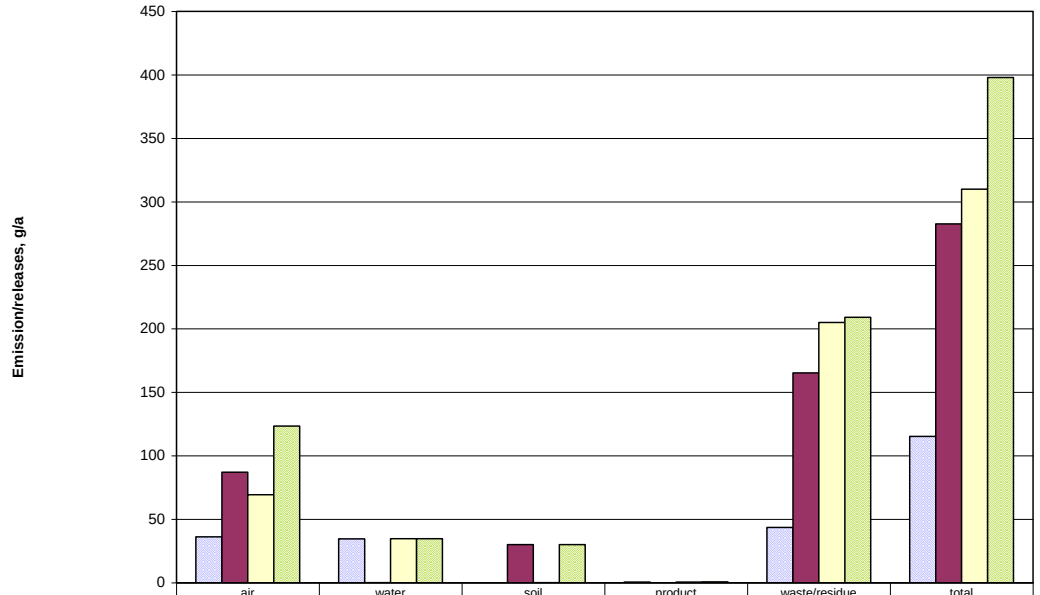


Figure 2.3.4.4.4.a: Total PCDD/PCDF releases in the Republic of Serbia in 2006 to each environmental medium (six out of nine source categories)



	House hold heating	Domes ting heating	Domes ting heating	Domes ting heating	Glass product ion	Transp ort - leaded	Transp ort - unlead	Transp ort - diesel	Forest fires	Landfill fires	Accide ntal fires in	Uncont rolled domest	Accide ntal fires in	PVC product ion	Textile plants	Leather plants	Smoke houses	Tobacc o smokin	Landfill leachat e - Non-	Open water dumpin	Metal shreddi ng	
air	0.810	0.500	0.160	0.030	0.010	0.880	0.005	0.129	0.145	50.000	4.000	30.000	0.120	0.000	0.000	0.000	0.318	0.003	0.000	0.000	0.006	87.117
water	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.027	0.074	0.000	0.102
soil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.116	30.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	30.116
product	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.001	0.050	0.000	0.000	0.000	0.000	0.000	0.054
waste/residue	0.001	100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.000	60.000	0.023	0.006	0.000	0.000	1.060	0.000	0.240	0.000	0.000	165.330

Figure 2.3.4.4.4.b: Total PCDD/PCDF releases in the Republic of Serbia in 2006 to each environmental medium (six out of nine source categories)



	air	water	soil	product	waste/residue	total
Total Serbia by districts	36.264	34.667	0.000	0.650	43.688	115.269
Total-Serbia-statistical data	87.117	0.102	30.116	0.054	165.330	282.719
Укупно-Србија-поуздано	69.381	34.768	0.116	0.653	205.018	309.930
Total - Republic of Serbia	123.381	34.768	30.116	0.704	209.018	397.987

Figure 2.3.4.4.4.c: Total PCDD/PCDF releases in the Republic of Serbia in 2006 (all source categories)

2.3.4.5 Environmental monitoring and population exposure

2.3.4.5.1 Release routes into the environment and environmental behaviour of released POPs

The most dominant emission sources of uPOPs are furnaces in residential sector (households) i.e. small burning facilities, as well as uncontrolled waste burning in the open.

The most common industrial source of PCDD/PCDF emissions are plants in the sector of ferrous metallurgy (iron and steel industry) i.e. iron sintering plants. Another important source is heat and power generating plants, specially those burning biomass.

The most efficient emission reduction measures are particle recirculation and reduction of diffusion emissions from sintering plants (according to BAT/BEP), as well as efficient flue gas treatment in biomass burning facilities.

Waste represents an important source of PCDD/PCDF emissions into the soil. However, if PCDD/PCDF containing waste is being disposed of or stored in appropriate manner, releases to soil are very small.

PCDD/PCDF releases to water are relatively low due to their poor solubility in water.

On the other hand, while unintentional release of PCDD/PCDF occurs only from unintentional production or processes, the main source of unintentional PCB releases are stockpiles, which can be considered as inherited from earlier periods.

The most significant sources of PCB emissions to air are heat and power generation sector, road traffic and iron and steel production. However, data on emissions originating from road traffic may not be considered reliable.

Numerous EU legislations address the problem of PCB waste management and the risk of PCB release to soil. Provisions of EU legislations shall be imported to national legislation, enabling most of the remaining PCB containing stockpiles to be sent to waste management plants.

Release of HCB into the environment originate mostly from stockpiles remained after related production has ceased. As such, they must be considered as inherited from earlier periods.

Emissions of HCB to air mainly result from pesticide use and activities related to metal industry (mainly non-ferrous metals) and to a smaller extent from chemical industry related activities and household fuel burning. Releases to water mainly originate from chemical industry but are considerably lower than emissions to air.

PAH releases have completely different dimension than releases of other uPOPs. Based on available data, around 3000 t of PAH listed in the Aarhus Protocol on POPs (i.e. 4 PAH) is released annually, out of which approximately 2,000 t to air and 900 t to water [20].

Emissions of PAH to air mostly result from households fuel burning (small capacity furnaces), road traffic and wood treatment/protection procedures. All other sources jointly emit 1/3 of total emissions. Apart from oil refineries and production of anodes, other industrial sectors are not considered to be sources of PAH emission/release into the environment.

Releases to water are mostly related to activities carried out in the sector of water management (rivers, harbours, marines and similar).

The main release routes into the environment of uPOPs and their environmental behaviour are shown in Annex 2, Table 2.

2.3.4.5.2 POPs levels in the environment

Preliminary inventory of potential POPs sources indicates that data contained within the existing European databases on POPs releases [20] are still limited, specially concerning PCB, HCB and PAH. For that reason it is very difficult to present a well grounded and scientifically supported overview of all POPs sources. Since obligation defining mandatory measurement of POPs releases

is not imposed, existing database is specially lacking data on releases to water and soil. Although initial indications on uPOPs and their releases in the EU is possible to provide, it is clear that PCB, HCB and PAH release rates to water and soil are underestimated due to absence of available data.

Data on the levels of uPOPs present in the air, water, sediment, soil, food and fauna are presented in Chapter 2.3.6.

2.3.4.6 Conclusions

Based on the results of preliminary inventory on uPOPs (PCDD/PCDF, PCB and HCB), the following can be concluded:

- uPOPs are released into the environment from the sources spread all over the Republic of Serbia;
- The most significant sources are:
  - fires – emissions to air (landfills and other), releases to soil (landfills and other), containers and similar;
  - heat and power generation – emissions to air and releases to waste (specially small furnaces);
  - metal production – emissions to air and releases to waste;
  - medical waste and waste wood incineration – emissions to air and waste generation;
  - production of mineral components – emissions to air;
  - transport – emissions to air;
  - production of chemicals – emissions to air (refineries – also transport), releases to water, waste and products (paper industry);
  - disposal sites/wastewaters – releases to water and waste/residue;
  - miscellaneous – crematoria (emissions to air).
- Extremely high emissions are releases from existing landfills indicate that current waste management system is inappropriate. Results of the preliminary inventory assembled indicate that uncontrolled fires at existing landfills are one of the main sources of uPOPs releases, primarily PCDD/PCDF and PAHs. At the moment there are no sanitary landfills in Serbia that fully fulfil related EU criteria. However, better waste handling and disposal management at the existing landfills can significantly contribute to emission reduction. One of the actions can be establishing a system for sound management of some waste streams (e.g. plastic waste) in order to avoid open burning plastics and uPOPs emission. Also, medical waste management should be improved. There are emissions from old dated facilities used for incineration, which indicates that capacity building activities are necessary to be carried out in order to ensure proper selection of facilities intended for incineration of different waste types. It is necessary to train staff from competent authorities in order to select appropriate type of facility for certain waste type
- High emissions originating from metal processing and other industrial facilities indicate a lack of **knowledge** on BAT/BEP implementation aimed to reduce uPOPs, insufficient knowledge on inventory assembling and integrated permit obtainment;

In order to adequately manage uPOPs, further capacity building is needed, particularly with regard to:

- Improvement of waste management system;
- Development appropriate control and other measures in the filed of open burning categories;
- Improvement supervision in order to reduce the fires associated with waste disposal containers;
- Development Legislative frame and capacity building for BAT/BEP implementation;

- Capacity building/development of employees in the Ministry of Environment and Spatial Planning, aimed to enable proper selection of waste incineration facilities depending on the waste types, including municipal waste;
- Establishment of regulations and standards for measurements, control and supervision of emissions, data storage and reporting of uPOPs together with other relevant emission parameters;
- Implementation of BAT/BEP measures in industry;
- Development and implementation a district heating programme;
- Improvement of energy efficiency in energy producing and industrial facilities;
- Improvement control of service shops carrying out technical control of the vehicles;
- Improvement of sampling and analysis of uPOPs;
- Enforcement of regulations in the field of sampling and analysis of uPOPs;
- Improvement of education and awareness raising;
- Improvement of detailed inventory on uPOPs and reporting;
- Adoption of all necessary EU standards and recommendation with respect to emission factors for uPOPs;
- Involve/perform long term measurement/sampling in industry.

2.3.5 Current state of knowledge on stockpiles and waste quantities, information on contaminated areas and their remediation

2.3.5.1 Stockpiles of POPs pesticides

In the process of data collecting for the purpose of the preparation of preliminary inventory, 6250 kg of POPs (lindane and DDT) at 14 locations (storage facilities) have been detected. Detailed information on POPs pesticide waste could be obtained from Chapter 2.3.

2.3.5.2 Obsolete pesticide waste

During data collecting for the purpose of the preparation of preliminary inventory, 167380 kg of estimated mass of pesticide waste and 42935 kg of estimated mass of unidentified pesticides have been recorded. In addition, 128 pesticide waste storage facilities have been identified, with main features shown in Table 2.3.2.2.3.4.a.

During preliminary inventory, data on pesticide packaging, related storage and handling have also been obtained (Table 2.3.2.2.3.5.a). Mass of pesticide packaging has been calculated to be equal to 112076 kg of estimated mass. Detailed information on pesticide waste could be obtained from Chapter 2.3.

2.3.5.3 PCB waste

As well as data obtained by the preliminary inventory of PCB-containing equipment, results of the preliminary inventory of PCB-waste have been divided into three groups:

- Data on transformers;
- Data on condensers;
- Data on other waste, including oils, soil, construction material, clothes and vessels contaminated with PCB-based fluids.

Preliminary inventory has indicated that, apart from the equipment in use, out of use transformers (Table 2.3.5.3.a) and condensers (Table 2.3.5.3.b) are present in many locations in the Republic of Serbia. From the aspect of their use value, these products are considered as waste. Considerable quantities have already been declared waste and temporary stored as safely as possible. Having in mind that in the Republic of Serbia there is no disposal site intended specifically for hazardous waste disposal, the specified products have mainly been stored in sections of the factories intended to be used for storage, close to the locations of their initial use (improvise storages). In some cases leaking condensers or oils contaminated with PCB-containing fluid have been placed in barrels and tanks, with related mass estimates presented in Table 2.3.5.3.b. However, due to variety of reasons some products have not been declared as waste and have not been temporarily stored.

It is generally stated that there are no storage facilities in Serbia intended for storage of this type of waste. In all locations where out-of-use (waste) equipment contaminated with PCB-containing fluid has been found, appropriate safety measures have been carried out and the facility has been placed under full control. All parties engaged in the facility maintenance have maximally contributed to the process and results obtained.

Temporary storage in the factory ABS "Minel Elektrooprema i postrojenja" jsc in Ripanj is shown in Figure 2.3.5.3.a. The same type of temporary storage has also been set up in the factory ABS "Minel-Trafo" jsc in Mladenovac.

Figure 2.3.5.3.a: Stored equipment contaminated with PCB-based fluid

Table 2.3.5.3.a: Inventory of transformers declared as waste based on data obtained from the authorities and entities from different Serbian districts

No.	District/owner	Total number of transformers	Fluid mass, kg	Total mass, fluid and transformers, kg
1	South Banat district	6	15560	60000
2	Ministry of Defence	9	1200	2100
3	Podunavlje district	2	-	4600
4	Economic Association "Đerdap"	10	6305	23144
TOTAL		**27**	**23065**	**89844**

Table 2.3.5.3.b: Inventory of condensers declared as waste based on data obtained from the public companies and entities from different Serbian districts

No.	District/owner	Total number of condensers	Condenser mass, kg	Note
1	Bor district	3	139	-
2	Public Utility Company "Elektromreža Srbije"	694	26941,5	There are no data on 18 condensers
3	The city of Belgrade	954	30782	-
4	Public Utility Company "Elektroprivreda Srbije"	1228	21322	There are no data on 580 condensers
5	South Bačka district	1	40,6	
6	South Banat district	20	1305	
7	Mačva district	9	315	
8	Moravica district	69	1044	
9	Nišava district	4	8	Fluid mass, not total mass
10	Pčinja district	19	570	"Alfa Plam"- unknown number
11	Pirot district	40	1800	
12	Podunavlje district	490	9800	
13	Šumadija district	74	4435	
14	Zlatibor district	398	22792	
	TOTAL	**4003**	**121294,1**	

Mass ratios of out-of-use transformers and condensers and PCB-containing equipment which is temporarily stored and declared as waste are shown in Figure 2.3.5.3.b. Identified out-of-use transformers and condensers are also considered waste and must be treated accordingly.

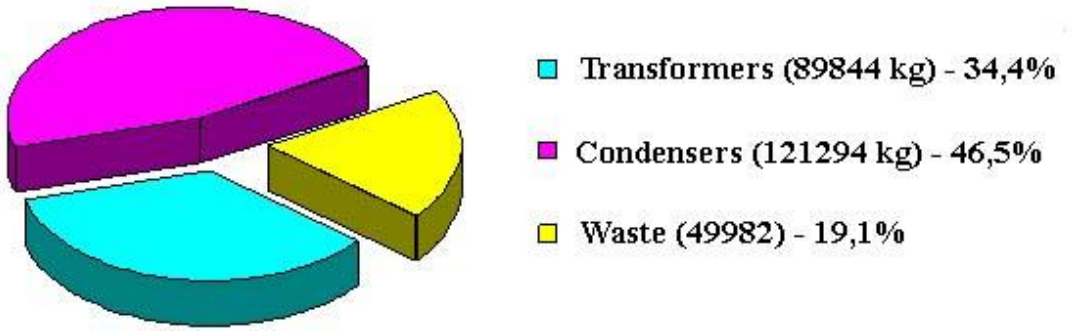


Figure 2.3.5.3.b: Mass ratios of different out-of-use equipment containing PCB fluid

Waste generated during NATO intervention in 1999 and resulting destructions represent a special type of waste. Issues related to this waste and contaminated sites are still unresolved. One of the examples includes large area (approximately 800 m^2) near Majdanpek (Figure 2.3.5.3.c).

Table 2.3.5.3.c.: Waste inventory

District/Waste generator	Waste description	Mass (kg)	Note
Bor district /RTB Bor	100 condensers and 1300 m^3 of construction debris and soil (the remains of bombarded transformer station Bor 3).	Not known and difficult to estimate	In 2002 UNEP conducted a risk assessment related to this disposal site (about 800 m^2). Based on the assessment, a condenser removal program has been developed, but has never been carried out. Disposal site material sampling has been conducted in 2002 by the Health Protection Institute, Belgrade.
The city of Belgrade / ABS "Minel -Elektrooprema i postrojenja" jsc	3 contaminated (empty) tanks	2000	Condenser parts (coils) are placed in barrels.
The city of Belgrade / ABS "Minel-Trafo",jsc in Mladenovac	2 steel tanks	18000	Health Protection Institute, Belgrade conducted analysis (03/07/2006) of transformer oil and confirmed that the oil in question is indeed PCB-based oil and appropriately insured.
	50 barrels and transformer vessel	1300	PCB contaminated packaging has been washed and appropriately stored and insured.
Public Owned Utility "Elektroprivreda Srbije"/ "Trayal" korporation jsc	Waste oil	30	In 2004 "Eko sip", Ruma sanitated leaking from transformers and decontaminated area (TP 7543630).
South Banat district / "HIP-PETROHEMIJA" jsc in Pančevo/division "Elektrosnabdevanje"	Sand in metal barrels and personal protection means	25000	Sand in metal barrels and protection means used for PCB-based fluid handling (approximately 900 m^2 contaminated with PCB).
South Banat district / "HIP-AZOTARA"	Fluid containing barrels	1900	
Moravica district / "ŠPIK IVERICA"	2 barrels and material produced during equipment maintenance	220	
Moravica district / Industrial combine "GUČA"	3 water containing barrels and 1 barrel containing PCB contaminated casting sand	462	Total mass equals 121 kg for all 4 barrels
Podunavlje district	2 fluid containing barrels	220	

(USSS)	Sand and soil in a barrel	200	
	Clothing containing barrels	50	
Economic Association "HIDROELEKTRANE ĐERDAP"	PCB containing fluid, oil absorbing wiping material, old clothing and clothes, 25 m^2 of concrete in PCB-contaminated storage area.	200	
Šumadija district / Topola "LIVAR"	Sand, personal protection means and personal working equipment.	400	Means remained after clean-up (sand, personal protection means and personal working equipment)

Figure 2.3.5.3.c: Contaminated soil and waste in the surroundings of Majdanpek

In accordance with data shown in Table 2.3.5.3.b, in most cases waste classification has not been conducted. However, a reasonable assumption exists that the waste in question is indeed a PCB-contaminated waste.

Based on the result of preliminary inventory, two companies have been identified as being involved in the export of PCB contaminated equipment and waste in that period: "**Miteco**", with offices in Belgrade and "**Eko sip**" based in Ruma.

Data on the exported waste quantities, obtained from the above mentioned companies, are shown in Tables 2.3.5.3.d and 2.3.5.3.e. Data on the "goods" to be exported are not complete since equipment manufacturer, as well as many other important data (serial number, rated power, fluid mass, production year) were not stated in the lists obtained.

Table 2.3.5.3.d: Inventory of exported waste based on data obtained from the company "**Miteco**"

Waste generator	Waste type	Waste mass, kg
Economic Association "Jugoistok", Niš, ED "Elektrotimok", Zaječar	PCB-containing condensers	2880,00
"Centroproizvod" jsc	PCB-containing condensers	500,00
Public Owned Utility "Eletromreže Srbije"	PCB-containing condensers	4393,00
Public Owned Utility "Eletromreže Srbije"	PCB-containing condensers	11436,00
"Cementara Kosjerić" jsc	PCB-containing condensers	1950,00
EPS JP "Elektrosrbija", Kraljevo	PCB oil	3500,00
"Somboled" jsc	PCB-containing condensers	500,00
"Calsberg Serbia" ltd.	PCB-containing condensers	925,00
Cement factory "Lafarge" jsc, Beočin	PCB-containing condensers	9553,50
EPS Public Owned Utility "Eelktrosrbija", Kraljevo	PCB-containing condensers	750,00

Public Owned Utility "Elektromreže Srbije"	PCB-containing condensers	4994,00
"Sartid specijalna proizvodnja i usluge" ltd.	PCB-containing condensers	1030,00
"Elektrodistribucija", Užice	PCB-containing condensers	1300,00
"Elektrodistribucija", Belgrade	PCB-containing condensers	8072,00
"Industrija mleka jsc IMLEK", Belgrade	PCB-containing condensers	2145,00
"Elektrodistribucija", Belgrade	PCB-containing condensers	17813,00
"Titan cementara", Kosjerić	PCB-containing condensers	2783,00
"Titan cementara", Kosjerić	PCB-containing condensers	2505,00
"Služba za zajedničke poslove Sav. min.SCG"	PCB-containing condensers	4500,00
"USS Balkan" Stara Železara ltd., Smederevo	PCB-containing condensers	5810,00
"AD Jagodinska pivara", Jagodina	PCB-containing condensers	1408,00
"Zajednica SCG-VP 9808", Belgrade	PCB-containing transformers	9040,00
"Zajednica SCG-VP 9808", Belgrade	PCB oil	310,00
"Impol-Seval", Sevojno	PCB-containing condensers	3349,00
"Industrija motora Rakovica", Belgrade	PCB-containing condensers	17583,00
"Tetra Pak Production", Gornji Milanovac	PCB-containing condensers	484,00
Cement factory "Novi Popovac" jsc	PCB-containing condensers	11257,00
"RTB", Bor	PCB-containing condensers	6294,00
"Minel EOP", Ripanj	PCB oil	6710,00
Public Utility Company "Beogradske elektrane", Belgrade	PCB-containing condensers	1586,00
Tobacco factory "DIN", Niš	PCB-containing condensers	2608,00
"Cementara",	PCB-containing transformers	-
Srbijateks jsc, Belgrade	PCB-containing transformers	3410,00
Aluminum production plant, Podgorica	PCB-containing transformers, condensers and soil	203000,00
"Bambi", Požarevac	PCB-containing condensers	354,00
"Soko Štark", Belgrade	PCB-containing transformers	6520,00
FSH "Jabuka", Pančevo	PCB-containing condensers	252,00
Total		**361504,00**

Table 2.3.5.3.e: Inventory of exported waste based on data obtained from the company "**Eko sip**"

Waste provider	Waste type	Waste mass, kg
"Kolubara Prerada"	PCB-containing condensers	1500
Hydro Power Plant "Đerdap 1"	PCB waste	200
Oil production company "BANAT"	PCB-containing condensers	1150
"Žito Promet MLIN", Senta	PCB-containing condensers	1120
"Žito Srem", Inđija	PCB-containing condensers	200
Dairy plant "Novosadska Mlekara", Novi Sad	PCB-containing condensers	150
Heat plant "Novosadska Toplana", Novi Sad	PCB-containing condensers	1100
"Sintelon"	PCB-containing condensers	2300
"Sunce", Sombor	PCB-containing condensers	2750
Institute "Sremska Kamenica"	PCB-containing condensers	150
"Neoplanta"	PCB-containing condensers	1000
Construction company "Mostogradnja"	PCB-containing condensers	550
"Belgrade Heat Plants", Belgrade	PCB-containing condensers	150
"Elektrosrbija", Kraljevo	PCB-containing condensers	100
"Elektrodistribucija", Belgrade	PCB-containing condensers and PCB-containing transformer	2850
Power and Heat Plant "Senta", Senta	PCB-containing condensers	450
UNOPS	PCB-containing transformer and PCB oil	10750
"HIP – Petrohemija"	PCB-containing transformers	39000
"Global Business Centar"	PCB-containing condensers	150
"Henkel Merima"	PCB-containing condensers	1150
Institute "Nikola Tesla"	PCB-containing equipment	50
Oil Tratment Industy "Naftna Industrija Srbije", Novi Sad	PCB-containing transformers	31000

TPP Kostolac	PCB waste	150
"Montprojekt"	PCB-containing condensers	1100
Public Company "PTT Srbije"	PCB-containing transformers	6800
"Soko Štark"	PCB-containing transformers	12000
"Zvezda", Kovin	PCB-containing condensers	2350
Sugar production factory "Donji Srem", Pećinci	PCB-containing condensers	700
Total		**120920**

Based on collected data, ratios of total mass of PCB-fluid containing equipment (fluid mass together with mass of empty equipment) of used and out-of-use equipment are shown in Figure 2.3.5.3.d. Data on out-of-use equipment include information on equipment declared as waste.

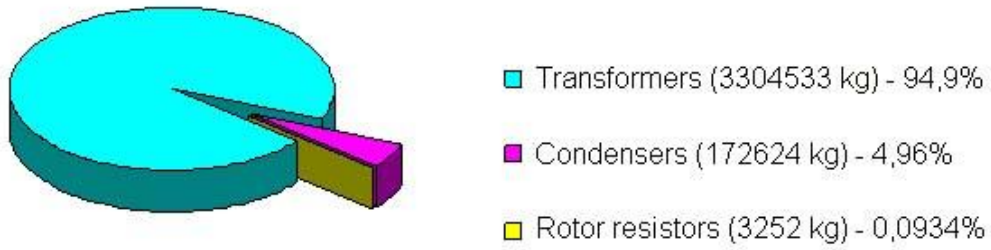


Figure 2.3.5.3.d: Mass ratios of equipment containing PCB-based fluid in use

Figure 2.3.5.3.e shows ratios of total mass of PCB-containing equipment in Serbia, whether in use or out of use, and total mass of exported PCB-containing equipment which became waste, as well as PCB-contaminated waste (summary data on the mass of exported waste, as provided by Serbian waste exporters).

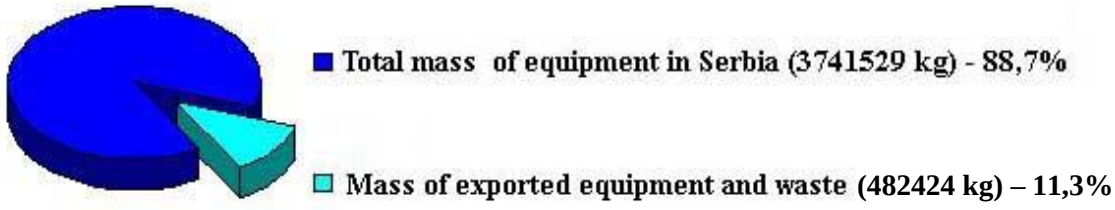


Figure 2.3.5.3.e: Total mass ratios for equipment detected in Serbia and exported equipment which became waste

Analysis of the results obtained by preliminary inventory has indicated that the number of transformers containing PCB fluid is most certainly higher than noted, since the preliminary inventory did not include all transformers produced and installed in Serbia. Based on the records of the only transformer manufacturer in Serbia, there are 531 transformers manufactured and installed in Serbia. The only available data on these transformers refer to total fluid mass installed (429,749 kg of PCBs). However, results of the preliminary inventory show that only 131 locally manufactured transformers have been installed and are currently in operation in Serbia, while 13 locally manufactured transformers are out of use. This means that 387 transformers manufactured in Serbia (locally) have not been identified or noted in the preliminary inventory. In the same time, number of locally manufactured transformers in Serbia is even smaller than the above stated, the difference being the number of exported transformers. However, it is not known if some or any of the exported transformers have been manufactured by the only transformer manufacturer in Serbia.

Based on data obtained from the only condenser manufacturer in Serbia, total number of condensers manufactured and installed in Serbia equals 1537, with 23661 kg of total fluid mass installed. It should be noted that while providing the above data, the manufacturer has stressed that

the data were not final. Although the manufacturer has stated locations where condensers had been delivered (43 locations), it is hard to relate all of the locations to specific entities, public companies or institutions. However, inventory compiling has led to the conclusion that there are 2379 locally manufactured condensers installed in Serbia. Since that is more than specified by the condenser manufacturer, it is concluded that the inventory of produced condensers is not final. It should also be noted that among the condensers declared as waste, as well as among exported condensers, there is a certain number of locally manufactured condensers which is not possible to determine.

The number of condensers manufactured abroad and installed in Serbia remains undetermined. Until a detail "door to door" inventory of PCB-containing condensers is conducted, any data provided with respect to their number would be unreliable.

Preliminary inventory has indicated that some public companies, jsc "Telekom Srbija" and jsc "Pošte Srbije" among others, had replaced their PCB-containing condensers.

Preliminary inventory has also shown that Public Railway Company "Železnice Srbije", providing railway transport services, is in possession of large number of PCB-containing condensers, identified and noted as a summary data, but with unknown locations of their installation and other relevant data. Data provided by the Company are incomplete and thus unusable with respect to the main goals of the inventory compiling.

Based on available data the following can be concluded

1. Identified out-of-use equipment is comprised of 27 transformers (total mass of transformer and PCB-based fluid equals 89844 kg), 4003 condensers (total mass of condenser and PCB-containing fluid equals 121294.1 kg) and 49982 kg of waste, including contaminated construction material, barrels with PCB-contaminated oil and other materials.
2. Number of devices containing PCB-based fluid is considerably higher then noted since comparison of data provided by the Serbian manufacturer on the number of devices manufactured and installed in the Republic of Serbia and data obtained through the inventory assembling has shown significant differences.
3. There are no locations intended for permanent storage and decontamination of PCB-contaminated equipment and waste nor facilities for PCB-based fluid degradation.
4. Exceptionally small number of PCB equipment and waste owners has conducted fluid and waste analysis (about 1%); in many cases, based on data specified on the equipment nameplate (manufacturer, year of equipment manufacturing, serial number, fluid name) it was concluded that equipment contained PCB-based fluid.
5. During preliminary inventory preparation there are two main exporters of PCB-containing equipment and PCB-contaminated waste. In the period from 2003 up to 2007 only 11.3% of total mass of equipment which was declared as waste, including total mass of in-use and out-of-use equipment recorded in the inventory, has been exported. Only one of the exporters (the company "Eko sip") has provided temporary storage for PCB-based waste.
6. Handling PCB-based equipment, irrespective of whether in use or out-of-use, as well as waste handling is carried out in accordance with international rules on handling considered type of equipment (equipment is adequately labelled, surrounding area appropriately protected and marked).

2.3.5.4 Contaminated areas

2.3.5.4.1 Legal framework

Soil protection, as well as soil recovery and remediation are principally regulated by the Law on Environmental Protection, leaving to the special Law on Soil Protection to address the issue in detail.

However, the Law on Amendments on the Law on Environmental Protection consider the issues of soil protection more closely. The specified new Law defines that soil protection and sustainable use of soil are provided through measures of systematic soil quality monitoring,

monitoring of indicators enabling soil degradation risk assessment, as well as remediation programs for elimination of effects resulting from soil contamination and degradation whether occurring naturally are caused by human activity.

The Law authorises adoption of sublegal act which would prescribe criteria for determining the status of the endangered environment and priorities for recovery and remediation. The ministry responsible for environmental protection, according on those criteria, determines status of the endangered environment and priorities for recovery and remediation for areas of importance for Republic of Serbia, and local self government authority for areas of local importance.

Also, the above mention Law specifies that remediation activities and return of degraded areas to the original state are a responsibility of legal and physical entity whose activities have been proven to be the main reason for environmental degradation. This must be done in accordance with project for recovery and remediation. Minister responsible for environmental protection determines methodology for development of these projects.

Apart from regular activities, soil contamination can also be caused by chemical accidents. For that reason, the above specified Law prescribes an obligation imposed upon the operator of a facility carrying out specific activities to develop an Accident Prevention Policy or a Safety Report and Accident Prevention Plan, depending on the quantities of hazardous substances used in the considered activities, as well as to conduct chemical accident prevention measures and measures limiting the effects on human life and health and the environment, as specified in the documents developed.

In the Prevention Plan the operator is obliged, among other, to specify appropriate cleaning, recovery and measures to be carried out following a chemical accident.

In addition, obligations imposed upon the operator in the case of chemical accident include immediate reporting to the ministry responsible for environmental protection and state authorities relevant for responding to emergency situations. The specified report submitted to the ministry responsible for environmental protection and other authorities must define circumstances related to the chemical accident that have occurred, hazardous substances involved, available data on estimated effects on humans and the environment, as well as information on urgent measures which have been carried out.

In case of chemical accident, an endangered status of the environment may be declared and the public informed on all measured that are being conducted.

However, the above specified Law also anticipates recovery plan development in situations when pollution in certain areas exceeds the effects of measures conducted i.e. when capacity of the environment to sustain effects of the pollution is endangered or when there is a risk of permanent environmental quality degradation.

The Government adopts a recovery plan when:

1. Level and scope of environmental degradation exceeds rehabilitation providing capacities of the autonomous province or municipal self government;
2. Entity responsible for increased pollution, producing harmful environmental effects outside the state borders, is not known;
3. Entity responsible for increased pollution, causing harmful environmental effects in the Republic of Serbia, falls outside the jurisdiction of state authorities;
4. Environmental pollution endangers or causes harmful effects in the area declared to be of high importance to the Republic of Serbia;
5. It is necessary to conduct urgent and emergency measures in out-of-the-ordinary situations.

If entity responsible for causing the pollution is later determined, the institution which financed the rehabilitation measures shall request appropriate reimbursement.

In cases of pollution which exceeds the legally defined emission limit values and other activities leading to the environmental degradation, the polluter is obliged to carry out appropriate recovery plan at its own expense.

Action and recovery plans specifically contain information related to the conditions, measures and health effects occurring in case of declared environmental endangerment, as well as the main subjects, manner, dynamics and means of plan implementation.

Action and recovery plans are prepared by the ministry responsible for environmental protection in coordination with the ministry responsible for specific field in question.

Autonomous province and municipal self-government adopt an environmental protection program i.e. local action and remediation plans for the territory under their jurisdiction, in accordance with the National Program and plans defined of the considered Law and their own interests and specific features.

Two or more units of municipal self-government may adopt joint environmental protection program for the purpose of reducing harmful environmental effects or for economical reasons (joint waste management, wastewater management and similar).

From the above mentioned provisions of the Law it can be concluded that obligations stated in Article 6, paragraph 1(e) of the Convention have been recognised in national legislation, although POPs are not specifically mentioned nor obligation of strategy development for identification of polluted locations is defined. However, it should be stressed that the ministry responsible for environmental protection is responsible for determining contaminated locations and defining recovery and, remediation plans development. Implementation of defined plans is an obligation imposed upon the operator i.e. polluter.

The Republic of Serbia does not have a regulation which would more precisely identify and prescribe conditions and procedures for determining liabilities for environmental damages caused by a company in the process of being privatised (or in other ownership-change process). In the processes of a company's privatisation, investigation aimed to identify historical evolution of pollution level at specific location, as well as potential discrepancies between company's activities and legal obligation in the field of environmental protection, are being carried out. However, other than formal allocation of responsibilities in the sale process, where the state assumes responsibility for historically generated pollution and the buyer accepts the obligation to harmonize future operation with legal provisions and obligations, additional legal mechanisms which would impose an obligation for a recovery of historically polluted media using the funds allocated specifically for that purpose and included in the total sale price, have not been developed.

Experience gained in some Eastern European countries has shown that properly treated problem of historical pollution in ownership-change processes had significantly affected market development in the field of polluted soil and ground water remediation, causing improvement of the state of environment in the countries considered.

2.3.5.4.2 Existing data on contaminated areas and their remediation

In accordance with existing data from Serbian Environmental Protection Agency [21], localised soil pollution is present in areas of intensive industrial activity, inadequate waste disposal sites, mines and sites where different accidents have occurred.

Serbian Environmental Protection Agency [21] has identify some 375 where long-term environmental pollution has been confirmed through soil and groundwater analyses conducted on samples taken from the immediate vicinity of localised pollution sources.

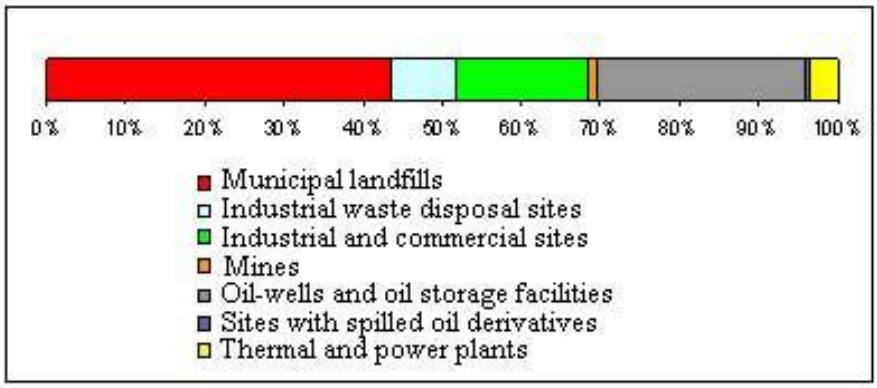


Figure 2.3.5.4.2.a Percentage contributions to soil contamination from localised sources (%)

The highest contribution to the pollution of identified sites comes from the municipal landfills – 43.7%, followed by the oil-wells and oil storage facilities – 26.4% and industrial and commercial sites – 16.3%.

Figure 2.3.5.4.2.b Progress in the management of contaminated sites

The majority of identified sites have been subjected to preliminary investigation, which included identification of contaminated sites and presence of pollutant substances in concentrations higher than the specified maximum permissible levels (MPVs). Only few locations have been subjected to detail investigation. Remediation activities have been conducted at 5.7% of identified sites. Sites where municipal waste is present have not been subjected to investigations with respect to their contribution to soil and groundwater pollution. For that reason these locations have not been addressed when progress in the management of contaminated areas was evaluated.

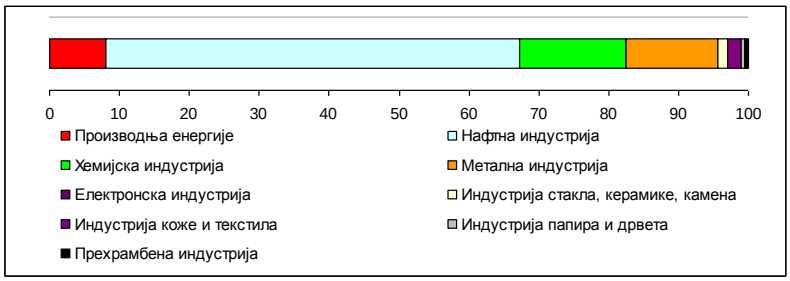


Figure 2.3.5.4.2.c Contribution of different industrial sectors to localised soil pollution (%)

The highest contribution to pollution of identified sites comes from the oil refining industry – 59.2%, followed by chemical industry – 15.2% and metal producing and treatment industry – 13.3%.

In order to identify areas potentially polluted with POPs it is necessary to conduct preliminary identification of contaminated areas which would include sites considered to be at high risk of pollution, including:

– areas characterized by considerable use of POPs pesticides (production and large storage units, distribution centres, areas with significant pesticide use),

– areas characterized by considerable use of PCB-containing equipments, with special consideration of damaged equipment or improperly disposed waste,

– industrial processes generating PCDD/PCDF and PAH releases; it is especially important to check the manner of waste disposal carried out at the considered industrial facilities and identify potentially polluted nearby locations.

When considering the sources of dioxins/uPOPs related soil pollution, the following industrial fields and sources have to be taken into account:

– Chlor-Alkali facilities (2 plants, "HIP Petrohemija", Pančevo and "Župa", Kruševac);

– Earlier production of ethylene dichloride/vinyl chloride monomer used in polyvinyl chloride production ("HIP Petrohemija", Pančevo);

– Chlorinated pesticide production ("Zorka-Zaštita bilja", Šabac - DDT production and other production capacities with pesticides formulated based on imported active substance);

– Accidents/fires (including those warfare-related) specially with respect to PCB containing;

– Use of chlorinated phenols (wood protection, leather production and tanning).

It is important to mention that during the NATO intervention in 1999, 78 industrial complexes have been destroyed or damaged, causing significant environmental pollution, primarily as a result of significant pollutant emissions released to air, water streams and other environmental media and particularly causing considerable soil and groundwater contamination.

Estimates of the relevant international organizations [22] have indicated the presence of high levels of soil pollution, primarily by hydrocarbons, PCB, heavy metals and other dangerous substances, near Pančevo, Kragujevac, Bor, Novi Sad, Barič, Kraljevo, Niš, Belgrade-new town, Obrenovac, Prahovo and Priština, stressing out a necessity for soil remediation activities to be carried out. In 2000, based on the reports mentioned, EU and the UNEP have developed a detailed feasibility study, defining 27 land clean-up and soil remediation projects for sites that had been deemed the most polluted [23]. Funds were provided for 22 projects and the clean-up programme implementation commenced in the end of 2000 and lasted until early 2004.

As stated in the basic premises of the UNEP programme, during the eighties and the nineties of the last century very little have been invested in the field of environmental protection, management and monitoring in Serbia, with no investments in cleaner technologies, absent or poor control over the exploitation of natural resources and little attention paid to potential pollution resulting from industrial and power generation processes.

In the above mentioned feasibility study the following priorities related to soil pollution with PCB have been identified:

Kragujevac: Five projects of soil remediation and remediation of other polluted materials have been carried out (primarily PCB-related contamination) in the industrial complex "Zastava", aimed to reduce health risks facing workers at the location and risks caused by stored hazardous waste, as well as to prevent pollution spreading into the near-by river systems.

Bor: One project aimed to reduce health risks facing workers employed at the location and prevent further PCB contamination caused by un-stored waste present at a location of destroyed transformer station.

Šabac: With respect to current soil quality in the surroundings of the former DDT production facility of the company "Zorka - Zaštita bilja" in Šabac, it was not possible to find any project that had analysed contamination of the area in the surroundings of the facility considered due to the fact that the factory has filed for bankruptcy.

At locations with insufficient data on the soil quality it is necessary to conduct preliminary and/or detail investigation (e.g. Mladenovac and Ripanj: Equipment containing PCB-based fluids has been produced in Serbia until 1986 at two site locations (transformers - ABS “Minel - Trafo” jsc in Mladenovac and condensers - ABS “Minel-Elektrooprema i postrojenja” jsc in Ripanj) for

this two site locations it is necessary to conduct preliminary investigation of possible contaminated location).

In addition, if it is determined that the considered sites are contaminated, appropriate remediation measures aimed to minimize human and environmental exposure need to be defined.

Assessment of potential environmental and human risks associated with contaminated areas should be carried out in accordance with internationally recognised risk assessment methodologies. The specified investigations have been based on specific input information on the vulnerability of the location with respect to geological and groundwater contamination. The risk assessment should also be based on detail investigation and analysis of the underground pollution, toxicological evaluation etc.

While conducting remediation activities, experts with extensive engineering experience in different remediation fields should be consulted. Estimate of available remediation technology must be carried out in order to prevent inadequate technology selection that could cause extremely high costs and late implementation of defined measures. Adequate environmental impact assessment and timely implementation of remediation activities can significantly reduce pollution spreading and consequently reduce the cost of later remediation activities. In parallel, monitoring should be organised at all locations subjected to remediation activities enabling control of the results accomplished.

It is important to mention that many industrialized countries are also encountering challenges with respect to remediation of contaminated areas. Preventive activities, including the use of BAT/BEP and implementation of the Polluter-Pays-Principle are thus recommended to be carried out in all areas where pollution threat is present.

2.3.5.5 Conclusion

2.3.5.5.1 Identified pesticide and PCB waste

The most important environmental problem in the Republic of Serbia is still the absence of adequate waste management, including hazardous waste management. There is only one disposal site in Serbia that partially fulfils sanitary requirements defined in the EU regulations. In addition, there are no hazardous waste treatment facilities in the Republic.

In the process of data collecting for the purpose of the preliminary inventory preparation, the following was identified

I. Pesticide waste
   - 6.25 tonnes POPs pesticides (lindane and DDT) on 14 locations (warehouses);
   - 211 tonnes of waste pesticides located in 128 warehouses;
   - 112 tonnes of pesticides packing

II. PCB waste identified as
   1. Transformers, total mass (PCB fluid with transformer) - 89 tonnes;
   2. Condensers with PCB total mass - 121 tonnes;
   3. About 50 tonnes of contaminated soil, construction material, clothes and vessels contaminated with PCB-based fluid mostly located in improvised storages.

While making the inventory, it was estimated that total mass of PCB-fluid containing equipment (fluid mass with mass of empty equipment) of used and out-of-use PCB contaminated equipment is 3741 tonnes.

A special waste type represents a PCB-contaminated waste generated during NATO intervention in 1999 when 78 industrial complexes have been destroyed or damaged, causing significant environmental pollution, primarily as a result of significant pollutant emissions released

to air, water streams and other environmental media and particularly causing considerable soil and groundwater contamination. The environment has still not recovered from this pollution.

Legal basis which regulates the obligations given in the Stockholm Convention in regard of the PCB is given in the Chapter 2.2.4 in the mentioned document and in the Chapter 2.3.3.6.

Article 100 of the Law on Waste Management sets out transitional provisions for disposal and decontamination of PCB-containing equipment, as well as for disposal of PCB contained in that equipment. According to this article, equipment containing more than 5 dm^3 of PCB will be disposed of or decontaminated until 2015 at latest. The same applies for disposal of PCB contained in that equipment. By the way of derogation, holder of equipment that contain between 0.05%-0.005% by weight of PCB shall ensure its decontamination or disposal when such equipment cease to be used.

Law on Plant Protection Products, adopted in June 2009, defines when a pesticide becomes waste. The Law says that plant protection products, active substance i.e. active substance placed on the market contrary to the provisions of this Law and its implementing regulations, as well as the packaging of the plant protection products shall be deemed as waste.

Pesticides and pesticides package when they become waste shall be treated pursuant to the Law on Waste Management, because they represent hazardous waste.

Management of the previously mentioned POPs waste should be organised in accordance with a Waste Management Strategy of the Republic of Serbia. Serbia The Basel Convention has defined technical recommendation for POPs waste management that needs to be translated and published in Serbian and if needed adjusted for the country-specific conditions in the Republic, in order for the owners of POPs waste to carry out POPs waste management in accordance with environmental and human health protections norms, as well as to provide protection of workers directly handling POPs waste.

2.3.5.5.2 Contaminated areas

There is no available data in the Republic Serbia that identifies the number of sites specifically polluted by POPs chemicals. There are a large number of sites generally contaminated by different types of pollutants. Serbian Environmental Protection Agency has identify some 375 sites [21] where long-term environmental pollution has been confirmed through soil and groundwater analyses but the real figures are probably much higher. The highest contribution to the pollution of identified sites comes from the municipal landfills – 43.7%, followed by the oil-wells and oil storage facilities – 26.4% and industrial and commercial sites – 16.3%.The highest contribution to pollution of identified sites comes from the oil refining industry – 59.2%, followed by chemical industry – 15.2% and metal producing and treatment industry – 13.3%.

One the most significant sublegal act regarding contaminated sites is expected to be adopted in the forthcoming period. The regulation under the preparation will prescribe criteria for determining the status of the endangered environment and determine recovery and remediation priorities. This regulation will also address soil contaminated with POPs.

The Republic of Serbia does not have a regulation which would more precisely identify and prescribe conditions and procedures for determining liabilities for environmental damages caused by a company in the process of being privatised (or in other ownership-change process). It is necessary to develop additional legal mechanisms which would impose an obligation for a recovery of historically polluted media using the funds allocated specifically for that purpose and included in the total sale price.

There is formal allocation of responsibilities in the privatization process, where the state assumes responsibility for *historically generated pollution* and the buyer accepts the obligation to harmonize future operation with legal provisions and obligations regarding environmental protection.

In order to prepare total inventory of POPs contaminated sites, following procedure have to be managed:

1. Preliminary identification of contaminated location which will cover locations with higher risk such as:
    a. Locations of two production sites, where equipment that used PCB were produced (transformers - ABS "Minel - Trafo" jsc in Mladenovac and condensers - ABS "Minel-Elektrooprema i postrojenja" jsc in Ripanj);
    b. Locations where PCB equipment is significantly used, or where some destruction is present or where is inappropriate store;
    c. Locations where POPs pesticides where used (production facilities, storages, distributed centres, agricultural locations where pesticides were used in great quantities;
    d. Industrial processes with PCDD/PCDF and-or PAH emissions; it is particularly important to check a manner of waste disposal practiced at the considered facilities, waste disposal locations, as well as identification of potentially contaminated near-by locations;
    e. Locations which were polluted during NATO intervention in 1999 year.
2. For the location with no data, preliminary and detail geological investigations have to be done;
3. For contaminated areas, population-related and environmental risk assessment needs to be carried out in accordance with internationally recognized risk assessment methodologies;
4. For contaminated locations, appropriate available and efficient remediation activities aimed to minimize human exposure and further environmental pollution should be defined and accompanied by development of related feasibility study
5. Remediation activities have to be followed by appropriate monitoring.

2.3.6 POPs levels in different environmental media (water, air, soil), in food and fauna

2.3.6.1 POPs levels in waters and sediments

Water quality monitoring in the Republic of Serbia is carried out in accordance with Regulations on Systematic Water Quality Control in the Republic of Serbia.

Based on the results of systematic investigations [24] of water quality carried out in 2000, presence of POPs in water streams, still waters and groundwater in concentrations above the maximum permissible levels has not been detected. The same has been concluded as a result of investigations conducted over the following 7 years and in annual reports on the state of the environment [25, 26, 27, 21] developed by the ministry responsible for environmental protection and its executive organs.

Based on data of the Serbian Hydrometeorological Institute, no POPs (PAH and dieldrin) [28] have been detected in water accumulations in the period 2000-2006. In addition, reports of the Serbian Hydrometeorological Institute for 2007 indicated that POPs pollution, as defined in relevant regulations, has not been recorded.

In some Serbian towns water quality is controlled by respective institutes of public health. Based on information provided by the Institute of Public Health in the city of Belgrade, not even traces of organoshlorine insecticides (HCH, DDT, lindane), products of their degradation or PAH [29] have been detected in water samples taken from the municipal fresh waters. As stated in the same report, bank sediments of the Danube and Sava River did not contain organochlorine insecticides or PCB. The same results, with respect to water quality, have been presented in annual reports on the quality of the environment in the city of Belgrade for the period 2004-2007 [31, 32, 33].

However, in 2007 some changes in the Danube's water quality have been recorded at three locations (Brestovik, Vinča, Bela Stena), primarily with respect to higher PAH concentrations. Such situation represents significant deterioration compared to 2006 and the years before. However, detectable concentrations of organochlorine insecticides and PCB have not been recorded in any fish and clam sample, while some PAH have been detected in clams taken at Brestovik location.

In the report Quality of the Environment in the City of Belgrade in 2004 [31] it is stated that PAH have been detected in all bank sediment samples collected from the Danube River but in concentrations considerably lower than concentrations deemed to be "effective". In addition, certain PAH have been detected in bank sediments of the Sava River in more central city areas, whereat PAH concentrations in sediments have been observed to increase upon approaching the Sava/Danube confluence.

Some PAH have been detected in bank sediments of the Danube during investigations conducted in 2005, whereat presence of fluoranthene, benzo[b]fluoranthene, benzo[k]fluoranthene and benzo[a]pyrene is especially concerning. However, PAH, organochlorine insecticides and PCB have not been detected in analysed fish samples.

During 2007, bank sediments of the Sava River have been determined to be free of organochlorine insecticides and PCB, while PAH have been detected in all examined locations i.e. profiles, but in small concentrations [33]. However, detectable PAH concentrations have not been determined in analysed fish samples.

Apart from systematic measurements, specific type of measurements are usually conducted as a part of scientific and research projects or special studies developed in case of an accident or natural disaster.

Lindane, in concentrations higher than the maximum permissible values in Canadian waters has been detected in rivers Dunav, Sava, Tisa, Begej and Tamiš [33, 34]. However, comparing detected lindane concentrations with maximum permissible concentrations defined for waters

classified as I and II category waters[29] it is concluded that waters of the rivers Danube, Sava, Tisa, Begej and Tamiš are not lindane-polluted (Tables 2.3.6.1.a).

Table 2.3.6.1.a: Pesticide concentrations in surface waters in the Republic of Serbia

Water	Lindane	Aldrin	Heptachlor	HCB	Summary of DDT and metabolites
	µg/dm^3				
Danube	**0,45**	0,03	-	-	-
Sava	**0,55**	-	-	-	-
Tisa	**0,199**	0,003	-	-	0,021-0,033
Begej	**0,49-0,552**	-	-	-	0,02-0,047
Danube-Tisa-Danube channel	-	0,008-0,220	0,004	-	-
Jegrička	-	0,002	-	-	-
Stari Begej	0,01	-	-	-	-
Tamiš	**0,49**	-	0,004	-	0,02-0,03
Zlatica	0,004	-		0,003	-

Previous investigations have shown that concentrations of pyrene and benzo[a]anthracene detected in Danube were higher than maximum permissible levels defined for Canadian waters. Concentrations of benzo[a]anthracene and benzo[b]fluoranthene detected in water samples taken from the melioration channels and Danube-Tisa-Danube (DTD) channel were also higher than the values specified in Canadian standard (Table 2.3.6.1.b) [33].

Table 2.3.6.1.b: Mean PAH concentrations detected in the Danube, melioration channels and the DTD channel in the period 2001-2004, ng/dm^3

Substance	Danube-Tisa-Danube channel	Danube	Melioration channels	Maximum permissible concentrations in Canadian waters
	Mean value [ng/dm^3]			
Naphthylene	n/d	14,0	15,0- 20,0	1100
Acenaphthylene	n/d	n/d	10,0	-
Acenaphtene	0,6-0,7	8,0	25,0	5800
Fluoren	0,1-2,0	59,0	17,0-200,0	3000
Phenanthren	0,7-9,0	9,0-122,0	0,9-56,0	-
Anthracene	0,6-0,8	6,0	0,9	12
Fluoranthene	0,4-7,0	14,0	n/d	40
Pyrene	0,7-11,0	29,0	15-25,0	25
Benzo[a]anthracene	0,8-24,0	35,0	1,3-28,0	18
Chrysene	0,6	8,0	0,8-23,0	-
Benzo[b]fluoranthene Benzo[k]fluoranthene	21,0	n/d	n/d	15 15
Benzo[a]pyrene	12,0	n/d	n/d	15
Dibenzo[a,h]anthracene	n/d	n/d	n/d	-
Benzo[g,h,i]perylene	n/d	n/d	n/d	-
Indeno[1,2,3- cd]pyrene	n/d	n/d	n/d	-

Bank sediment of the Danube River collected near the town of Novi Sad and from melioration channel in the Danube's river island "Ratno Ostrvo" has determined to contain DDT in concentrations which are deemed possibly harmful to aqueous systems, based on Canadian criteria defined for river bank sediment. Bank sediment of the Danube River collected from the DTD

[29] Maximum permissible concentrations defined for waters classified as I and II category waters[29] ("Official Gazette of RS" No. 31/82)

channel near Vrbas has been determined to contain lindane, endrin and heptachlor-epoxide in concentrations that are also deemed possibly harmful to aqueous systems (Table 2.3.6.1.c) [33, 35, 36].

*Table 2.3.6.1.c***:** Pesticide concentrations in bank sediments of the Danube and the DTD channel

Bank sediment	**DDT**	**Lindane**	**Aldrin**	**Dieldrin**	**Endrin**	**Heptachlor**	**Heptachlor-epoxide**
	µg/kg						
Danube	**6,31**	-	-	-	-	-	-
Danube	0,03	**0,9-27**	0,3-1,0	-	-	0,2-1,0	0,2-0,5
Melioration channels on the Danube's "Ratno Ostrvo"	**25-100**	0,4-2	-	0,4-1,0	-	0,4-1,7	0,05-0,3
DTD channel near Novi Sad	0,03	0,5-5,0	-	-	-	0,07-1,5	-
Flood deposit	-	-	0,14	-	0,03-0,13	-	**0,07-31,7**
DTD channel near Vrbas	-	**45,23-48,52**	0,61-2,89	-	**53,41-111,94**	-	**3,17-6,42**

Analysis of 58 samples of bank sediments deposited in the municipality of Sečanj (Middle Banat district) after a flood that occurred in 2005 has indicated presence of PCB but detected concentrations were lower than maximum permissible concentrations defined in Canadian standard for a river bank sediment (34.1 µg/kg dry wt.) [37]. However, PCB concentrations detected in bank sediments of the DTD channel near Vrbas and Đerdap Gorge were deemed possibly harmful to aqueous systems (Table 2.3.6.1.d).

Table 2.3.6.1.d PCB content in bank sediment of the Danube and DTD channel

Bank sediment	**PCB (summary of 7 congeners), µg/kg**
Danube	0,41
Danube – Đerdap artificial lake	0,01 – **940**
Melioration channels on the Danube's "Ratno Ostrvo"	10
Flood deposits	2,13-3,27
DTD channel near Vrbas	194 – **972,5**

Analyses has shown that bank sediments in the melioration channels of the Danube and DTD channel contain PAH in concentrations that are deemed possibly harmful to aqueous systems (Table 2.3.6.1.e).

Table 2.3.7.1.d PAH content in bank sediment of Danube melioration channels and DTD channel in the period 2001-2004, μg/kg

Substance	Melioration channels on the Danube's island "Ratno Ostrvo"	DTD channel		Danube
		near Novi Sad	near Vrbas	
	Average range, μg/kg			
Naphthylene	n/d – 2,5	n/d – 0,8	360-520	0,9 – 1,0
Acenaphthylene	1,0 – 90	0,3 - 3,0	50	0,50 – 0,73
Acenaphtene	0,1 – 6	0,35	300-2250	0,5
Fluoren	0,2 – 200	0,2 – 11	2570-3820	0 4 – 5,5
Phenanthren	0,03 – 1500	0,7 – 268	1560-1720	0,7 – 24
Anthracene	0,03 – 410	0,4 - 5,0	270-680	0,4 – 11
Fluoranthene	0,4 – 2400	4,1 – 484	1590-2020	7,1 – 25
Pyrene	1,0 – 9000	7,0 – 462	200-3340	7,5 – 38
Benzo[a]anthracene	0,3 – 1200	0,7 – 110	590-930	1,2 – 27
Chrysene	0,2 – 2270	2,1 – 330	50-290	6,5 – 27
Benzo[b]fluoranthene Benzo[k]fluoranthene	2,1 – 1100	4,8 – 1027	2360-19460 300-4770	8,1 – 13
Benzo[a]pyrene	0,6 – 1100	4,2 – 1350	50-790	5,0 – 20
Dibenzo[a,h]anthracene	0,9 – 750	1,8 – 370	n/d	4,0 – 16
Benzo[g,h,i]perylene	3,1 – 450	0,8 – 1,8	n/d	1,3
Indeno[1,2,3-cd]pyrene	1,7 – 1120	0,45 – 255	n/d	5,0 – 18

In addition, analyses shown that bank sediment of the river Danube near Novi Sad was not PCB contaminated. However, bank sediments of the DTD channel and Đerdap Gorge were determined to contain considered compounds in concentrations deemed potentially harmful to aqueous living systems (Table 2.3.6.1.f) [33, 35, 36, 38].

Table 2.3.7.1.e PCB concentration in bank sediment of the Danube and DTD channel

Sediment	PCB - summary of 7 congeners (μg/kg)
Danube	0,41
Danube	0,01 – 940
Melioration channels on the Danube's island "Ratno Ostrvo"	10
Flood deposits	2,13-3,27
DTD channel near Vrbas	194 – 972,5

Based on the presented data it is concluded that existing water quality monitoring system and related reporting by the Environmental Protection Agency is not adequate. Systematic measurements must be considerably improved, both with respect to the number of samples taken and number of controlled substances.

2.3.6.2 POPs levels in air

The Draft NPEP defines the following problems related to uPOPs:

– air pollution caused by emission of SO_2, NO_x, CO, PAH, particle, soot and other emissions in areas where thermal/power production and industrial facilities are located (Obrenovac, Lazarevac, Belgrade, Kostolac, Pančevo, Bor, Šabac, Novi Sad, Smederevo, Čačak, Lučani etc.);

– air pollution caused by traffic (NO_x, SO_2, ozone, lead, particles, CO, PAH and other) in large urban areas (Belgrade, Novi Sad, Niš);

– high concentrations of air pollutants in urban areas during the heating season, resulting from emissions originating from individual houses and households boilers;

– air pollution caused by uncontrolled burning in landfills, burning of agricultural residues following the harvest etc. (PCDD/PCDF emissions and similar) ;

– cumulative air pollution caused by petrochemical and oil refinery complexes, as well as nitrogen production plant in Pančevo.

In accordance with available data, PCDD and PCDF concentrations in ambient air are not measured in the Republic of Serbia. However, related expert estimates and analyses have been carried out within the scope of many international projects. An example of the results obtained in one of the investigations is shown in Figure 2.3.6.2.a [39].

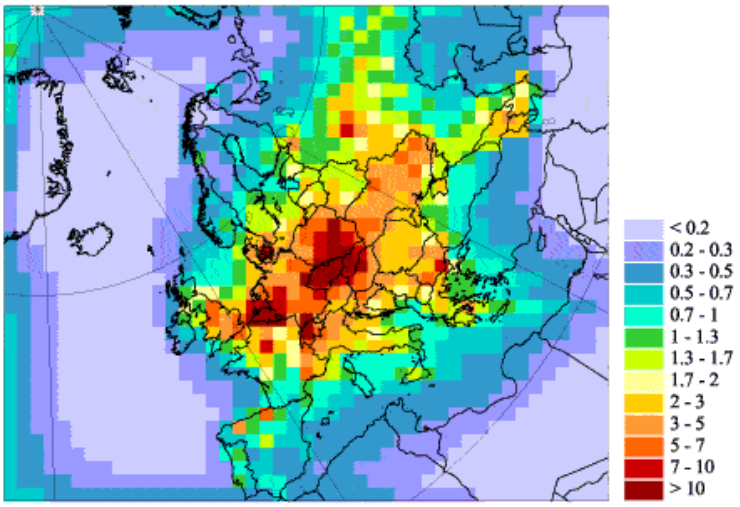


Figure 2.3.6.2.a.: Concentrations of 17 PCDD/PCDF congeners in air in 2001, fg TEQ/m^3

Air Quality Control Programme in the Republic of Serbia is carried out in accordance with the related Act adopted by the Government for a two-year period. The first Program has been issued for the period 1994/95[30].

Implementation of Air Quality Control Programme in the Republic of Serbia is carried with a goal to:

– determine current level of air pollution;

– monitor air pollution trends developed over several years;

– determine air quality based on comparison with the benchmark;

[30] Air Quality Control Programme in the Republic of Serbia or the period 1994/95 ("Official Gazette of RS" No. 70/93)

- determine rehabilitation measures aimed at air quality improvement;
- determine critical and alarming situations for the purpose of public alarming and necessary measure undertaking;
- evaluate the impact of polluted air on human health, climate and forest ecosystems;
- report on the results of conducted measurements, monitoring and investigations.

Systematic air quality measurements ("imissions" i.e. pollutant concentrations in ambient air) are carried out as a part of Air Quality Control Program and using the following air quality monitoring networks installed in the Republic of Serbia:

- basic network of weather stations,
- basic network of weather stations located in urban areas,
- local network of weather stations located in urban areas and intended for measurements of main pollutant imissions in ambient air,
- local network of weather stations located in urban areas and intended for measurements of specific pollutant imissions in ambient air.

Local network weather stations located in urban areas and intended for measurement of specific pollutant concentrations is used for PAH measurements, which are the only uPOPs monitored.

PAH concentrations are measured in Belgrade, Niš, Kruševac, Pančevo, Kraljevo, Kosovska Mitrovica and Novi Sad.

All available data on POPs concentrations in ambient air, as well as data on POPs emissions from industrial facilities are presented hereinafter. In addition, accidents which have caused higher POPs concentrations in ambient air are also listed. Polycyclic aromatic hydrocarbons detected in soot (benzo[a]pyrene, benzo[a]anthracene, pyrene, fluoranthene), generated during fuel combustion in industrial facilities, heat/power production plants and in motor vehicles, as well as soot concentrations in ambient air, are also presented.

PAH concentrations in Belgrade region were measured from June to August 1999. Concentrations obtained as measurement results ranged from 5.33 ng/m^3 to 8.64 ng/m^3, with maximum recorded value of 21.16 ng/m^3.

Based on the Report on the State of the Environment in 2000 and Priority Tasks for 2001 [24] it is determined that the values measured did not exceed the maximum permissible PAH concentrations in ambient air.

Based on the Report on the State of the Environment and Natural Resources in 2002 [25] it is concluded that when compared to 2000, measurement of concentrations of specific pollutants have not been conducted in all the towns initially planned to be included in investigation nor in the initially determined scope of the measurements. It is also determined that all measured PAH concentrations in ambient air did not exceed maximum permissible value.

Based on the Report on the State of the Environment in the Republic of Serbia in 2003 and 2004 [26] it is concluded the scope of the conducted systematic control of air pollution had been limited, covering small number of settlements, small number of measuring points and monitoring limited number of pollutants. Such situation was a result of perennial social and economic regression (UN sanctions, NATO bombarding, decline of industrial potentials).

In 2003 soot concentrations were systematically monitored in 20 settlements and at 93 measuring points, while during 2004 the numbers increased to 26 settlements and 104 measuring points. The number of settlements where soot concentrations were monitored prior to 2003 varied from 15 (2000) to 28 (1996 and number of measuring points 60 (2000) to 104 (2004). In 2004 number of days with soot concentration exceeding the maximum permissible concentrations in ambient air of inhabited areas (50.0 mg/m^3) varied from 0.% in Novi Sad to 18% in Leskovac.

Annual mean soot concentrations in ambient air, measured in different settlements covered by the network of stations installed by the national Health Service of the Republic of Serbia in the period 1995-2004 (µg/m^3) [26], are shown in Figures 2.3.6.2.b and 2.3.6.2.c.

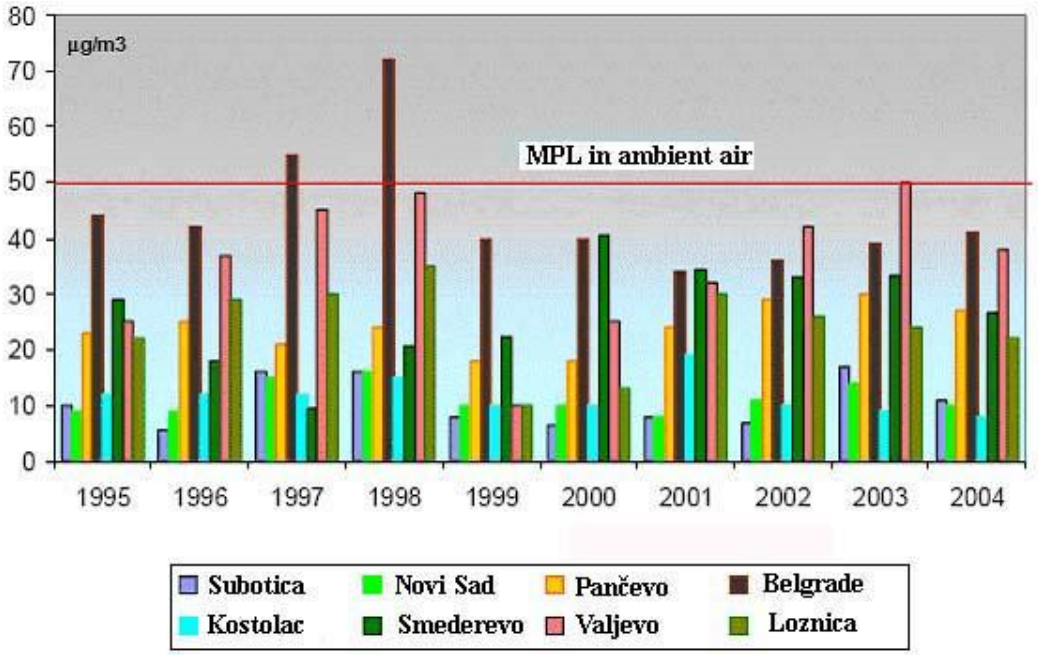


Figure 2.3.6.2.b: Annual mean soot concentrations in ambient air (µg/m^3) in Loznica Subotica, Novi Sad, Pančevo, Belgrade, Kostolac, Smederevo and Valjevo

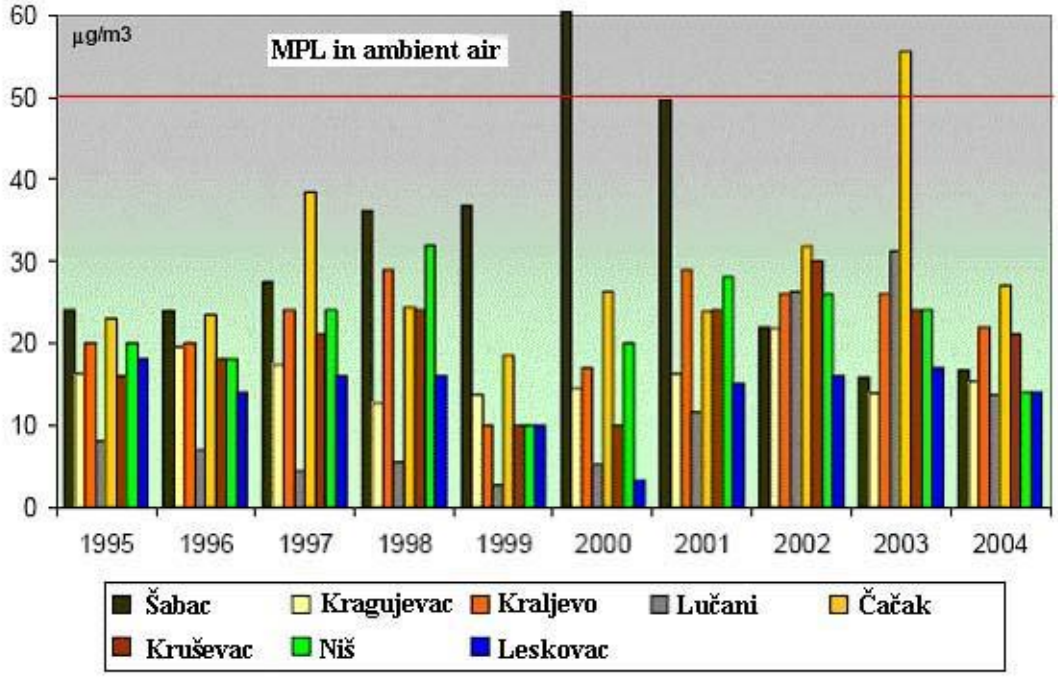


Figure 2.3.6.2.c: Annual mean soot concentrations in ambient air (µg/m^3) in Šabac, Kragujevac, Kraljevo, Lučani, Čačak, Kruševac, Niš and Leskovac

Annual mean concentrations in ambient air of all monitored organic compounds, including benzo[a]pyrene, were below maximum permissible mean annual levels defined for inhabited areas. Data on mean annual concentrations of benzo[a]pyrene released from industrial facilities in the period 1995-2004, based on data obtained from the measuring stations installed by the national Health Service of the Republic of Serbia, are shown in Table 2.3.6.2.a [26].

Table 2.3.6.2.a: Annual mean concentrations of benzo[a]pyrene released from industrial facilities in the period 1995-2004, based on data obtained from the measuring stations installed by the national Health Service of the Republic of Serbia, (µg/m3)

Settlement	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Belgrade		0,2	-	0,7	0,43	0,4	0,1	<0,1	2,78	1,46
Grabovac	-	-	-	-	-	-	<0,1	<0,1	0,22	0,78
Obrenovac	-	-	-	-	-	0,3	0,2	<0,1	1,0	2,10
Lazarevac	-	-	-	-	-	-	-	-	3,57	1,87
Mladenovac	-	-	-	-	-	-	-	-	1,14	-
Novi Sad										5,5
Pančevo										1,89

During 2003 and 2004 concentrations of air pollutants released from motor vehicles had been monitored in Belgrade, Kragujevac, Niš, Novi Sad and Pančevo. However, concentrations of uPOPs were not monitored.

Air Quality Control Program had been carried out in 2005 as well, based on the Act issued by the Government[31]. Unfortunately, during its implementation the Program had to be reduced due to the insufficient funding.

Number of measuring locations of the pollution monitoring network, as defined in the Program, was determined based on the selected and agreed-upon criteria such as number of inhabitants, number of emissions sources, weather parameters (Figure 2.3.6.2.d).

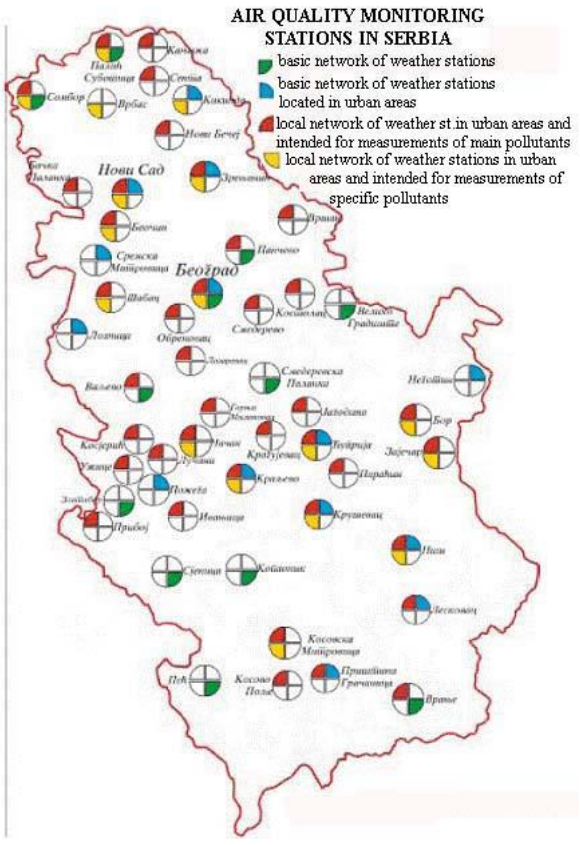


Figure 2.3.6.2.d.: Measuring stations installed for the purpose of Air Quality Control Program implementation in the Republic of Serbia

Based on data presented in the Report on the State of the Environment in 2005 [25] it is concluded that maximum permissible levels of soot concentrations in ambient air were not exceeded.

[31] Air Quality Control Program in Republic of Serbia ("Official Gazette of RS" No. 48/04)

Based on data shown in the report Quality of the Environment in the City of Belgrade in 2005 [31], annual mean concentration of benzo[a]pyrene varied from 0.58 to 2.39 ng/m^3. In 72.22% of the measured concentrations exceeded the maximum permissible level of benzo[a]pyrene in ambient air.

In 2005, one of the several accidents which occurred in industrial facilities was the chemical accident in the polyurethane foam (sponge) manufacturing company "Djukapol" in Belgrade where the storage of final products (sponges) was caught on fire. This accident was identified as a potential source of uPOPs. Timely response to the situation prevented significant health effects to population of densely inhabited surroundings to develop. Danger of possible accident was in relation to 5000 kg of TDI and 400 kg of methylene chloride stored in the nearby raw material storage which, luckily, was not caught on fire.

Figure 2.3.6.2.e.: Fire in the storage of final products of the company "Đukapol", Belgrade

In March 2006, the Government of the Republic of Serbia adopted an Air Quality Control Programme for 2006 and 2007[32].

Results of the soot concentrations measured in 2006 i.e. annual mean concentrations of smoke (soot) and number of days with concentrations above the maximum permissible value are shown in Figure 2.3.6.2.f [21].

[32] Air Quality Control Programme for 2006 and 2007 ("Official Gazette of RS" No. 23/06)

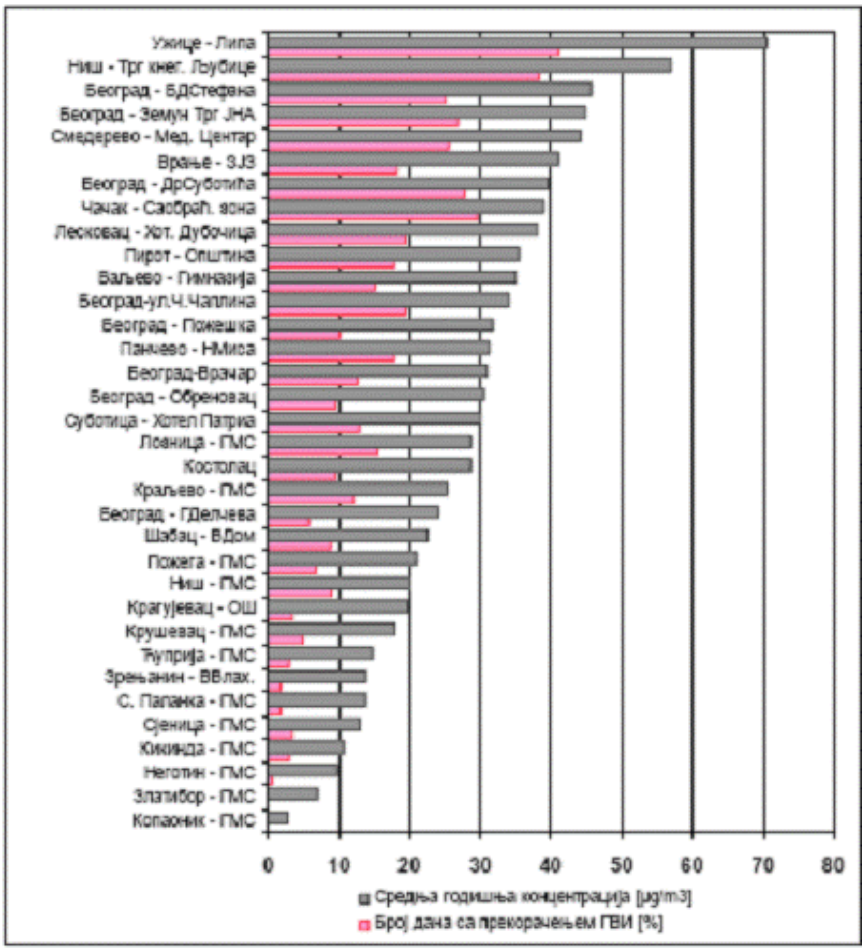


Figure 2.3.6.2.f.: Annual mean smoke concentrations in ambient air (µg/m^3) and number of days with concentrations above the maximum permissible value in 2006

During 2006, an annual mean smoke (soot) concentration above the maximum permissible level (50 µg/m^3) was detected only in Užice (71 µg/m^3) and Niš (57 µg/m^3).

During 2006, concentrations of benzo[a]pyrene in Novi Sad (two measuring locations) varied in the range 0.4-15.1 ng/m^3.

Implementation of a program intended for a long-term monitoring of non-contaminated locations (background sites) and primary, secondary and diffusive sources of POPs, using a technique of passive air sampling (PAS), represents a part of a pilot study developed within the project RECOTOX, carried out in the Czech Republic and west Balkan countries, including the Republic of Serbia. The situation in Serbia, with respect to POPs, became very complicated after 1999 when significant POPs quantities had been released into the environment as a result of NATO bombarding.

A project titled "Assessment of Selected POPs in the Atmosphere and Water Ecosystems from the Waste Materials Generated by Warfare in the Area of Former Yugoslavia (APOPSBAL)", enabled investigation of the impact of destruction and damages of industrial facilities during 1999 bombarding on different ecosystems. Passive ambient air sampling technique, using filter containing polyurethane foam, was used in order to provide truthful measurements results.

Passive ambient air sampling technique is based on specifically designed sampling device.

A list of air sampling locations is shown in Table 2.3.6.2.b.

Table 2.3.6.2.b.: Ambient air sampling locations within the scope of the APOPSBAL/RECOTOX project

Sampling location	**Characteristics of the pollution source**	**CODE**	**North coordinates**	**East coordinates**
Kragujevac, "Zastava - Lakirnica"	Industrial zone, PCB-containing transformers damaged during bombarding, **remediation**	SM_01	46,23333333	26,80000000
Kragujevac, "Zastava - Energetika"	Industrial zone, PCB-containing transformers damaged during bombarding	SM_02	44,00291667	20,91294444
Kragujevac, Faculty of Sciences and Mathematics	Urban zone	SM_03	44,01783333	20,90700000
Novi Sad, Oil Refinery	Industrial zone, Oil industry	SM_04	45,27838889	19,87019444
Fruška gora	Background site	SM_05	45,15916667	19,86280556
Belgrade	Urban zone	SM_06	44,78623056	20,38217500
Grabovac	Industrial zone	SM_07	42,62916667	20,35138889

Within the scope of measurements carried out in the above specified locations, concentrations of PCB (PCB 28, PCB 52, PCB 101, PCB 118, PCB 153, PCB 138, and PCB 180), OCPs (α- HCH, β-HCH, γ-HCH, δ-HCH, *p,p´*-and *o,p´*-DDE, DDD, DDT, HCB, PeCB), and PAH were measured.

In addition, soil samples taken at the above locations were also analysed. Wherever possible, soil samples were taken at the same locations where passive air sampling devices had been installed. Results of soil analysis were used to establish a correlation between different impacts and measured POPs concentration in ambient air.

Measurements were conducted from March to August 2006, during a 28-day period each month.

Results of the measurements are shown in Tables 2.3.6.2.c- 2.3.6.2.g.

Table 2.3.6.2.c.: Statistical evaluation of PCB concentrations determined by passive ambient air sampling

Sampling location / PCB	Minimum (ng filter^{-1})	Maximum (ng filter^{-1})	Mean (ng filter^{-1})
Kragujevac,"Zastava - Lakirnica"	60,5	79,4	73,0
Kragujevac, "Zastava - Energetika"	63,5	107,8	73,5
Kragujevac, Faculty of Sciences and Mathematics	10,7	29,7	19,6
Novi Sad, Oil Refinery	24,9	60,5	41,1
Fruška gora	12,5	22,0	18,4
Belgrade	29,8	40,0	34,6
Grabovac	5,3	13,9	9,6

Table 2.3.6.2.d.: Statistical evaluation of HCH concentrations determined by passive ambient air sampling

Sampling location / HCH	Minimum (ng filter^{-1})	Maximum (ng filter^{-1})	Mean (ng filter^{-1})
Kragujevac, "Zastava - Lakirnica"	6,7	52,9	17,6
Kragujevac, "Zastava – Energetika"	<LOQ	0,3	0,3
Kragujevac, Faculty of Sciences and Mathematics	37,4	77,6	53,4
Novi Sad, Oil Refinery	32,6	443,9	135,1
Fruška gora	21,5	41,1	32,1
Belgrade	98,0	269,3	163,1
Grabovac	141,4	351,9	212,3

Table 2.3.6.2.e.: Statistical evaluation of DDT concentrations determined by passive ambient air sampling

Sampling location / DDTs	Minimum (ng filter^{-1})	Maximum (ng filter^{-1})	Mean (ng filter^{-1})
Kragujevac, "Zastava - Lakirnica"	0,2	0,6	0,3
Kragujevac, "Zastava - Energetika"”	<LOQ	<LOQ	<LOQ
Kragujevac, Faculty of Sciences and Mathematics	2,1	4,6	3,7
Novi Sad, Oil Refinery	16,4	21,7	18,1
Fruška gora	7,5	11,6	9,1
Belgrade	79,8	132,0	98,5
Grabovac	2,9	7,6	5,9

Table 2.3.6.2.f.: Statistical evaluation of HCB concentrations determined by passive ambient air sampling

Sampling location / HCB	Minimum (ng filter^{-1})	Maximum (ng filter^{-1})	Mean (ng filter^{-1})
Kragujevac, "Zastava - Lakirnica"	0,5	1,6	1,0
Kragujevac, "Zastava - Energetika"	<LOQ	<LOQ	<LOQ
Kragujevac, Faculty of Sciences and Mathematics	4,5	5,7	5,0
Novi Sad, Oil Refinery	11,0	20,2	14,0
Fruška gora	7,4	10,3	8,3
Belgrade	4,8	7,1	6,1
Grabovac	5,1	6,6	5,6

Table 2.3.6.2.g.: Statistical evaluation of PAH concentrations determined by passive ambient air sampling

Sampling location / PAH	Minimum (ng filter^{-1})	Maximum (ng filter^{-1})	Mean (ng filter^{-1})
Kragujevac, "Zastava - Lakirnica"	70465	94352	83252
Kragujevac, "Zastava - Energetika"	4108	8547	5271
Kragujevac, Faculty of Sciences and Mathematics	2328	7928	4004
Novi Sad, Oil Refinery	2968	6599	4178
Fruška gora	667	1789	1359
Belgrade	6271	14229	10434
Grabovac	2717	5165	3976

In addition, POPs concentrations had been measured in the same locations from July to December 2004, also during a 28-day period each month.

Based on the data presented above, the following conclusions can be drawn [40]:

– The highest PCB concentration in ambient air was recorded in Kragujevac, in locations where PCB containing transformers were hit during the NATO bombarding, causing release of pyralene to the environment. However, the fact that PCB concentrations measured at sampling locations SM-01 and SM-02 during 2006 were considerably lower (below 100 ng/filter) than the corresponding values from 2004 (above 10 μg/filter) is encouraging. In the Fruška gora zone (background site) the most dominant were volatile congeners (PCB 28), while in contaminated areas PCB 101 and PCB 52 prevailed;

– Higher concentrations of HCH were detected in Belgrade and Grabovac (above 150 ng/filter), as well as in the area of Oil Refinery in Novi Sad (135 ng/filter). At all sampling locations detected γ-HCH concentrations were higher than detected concentrations of α-isomers. Detected HCH concentrations in the soil were below 25 ng/g at all locations except at the Oil Refinery in Novi Sad where the value of 0.5 μg/g was measured;

– Extremely high level of PAH was detected in the factory "Zastava - Lakirnica" in Kragujevac (mean value of 82 μg/filter), which was explained by a vehicle manufacturing technology employed. Concentrations measured at other sampling locations were typical for urban areas and industrial zones (about 10 μg/filter). Concentration measured at the background site (Fruška Gora) was an order of a magnitude lower.

Furthermore, in 2006 more accidents which occurred in industrial facilities have been recorded. Higher concentrations of benzo[a]pyrene have been recorded during an accident which occurred in the surroundings of the factory "US Steel" in Smederevo.

In 2007, annual smoke (soot) concentration above the maximum permissible level of 50 μg/m^3 has been detected in Užice (72 μg/m^{3}at one measuring point, 53 μg/m^{3}at other) and Belgrade - 52 μg/m [3].

Parallel display of annual mean smoke (soot) concentrations in ambient air and number of days with concentrations above the MPL is shown in Figure 2.3.6.2.g.

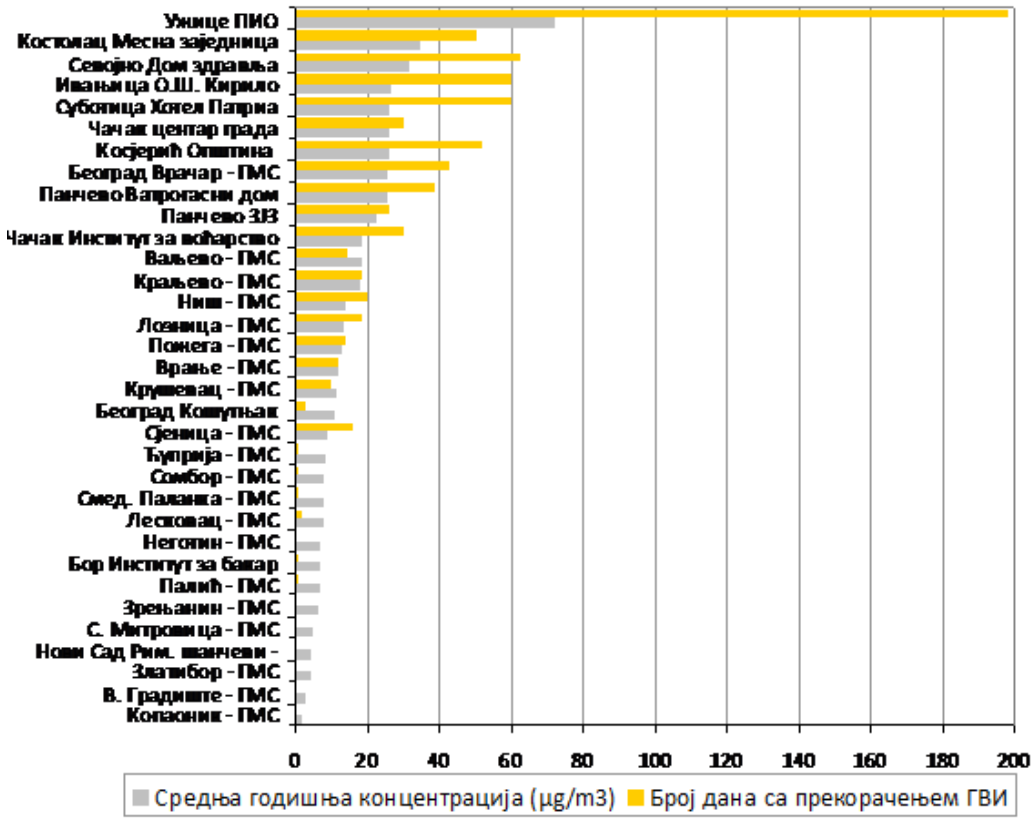


Figure 2.3.6.2.g.: Annual mean smoke concentration (μg/m^3) in 2007 and number of days with concentration above the MPL

Based on data presented in the report titled Quality of the Environment in the City of Belgrade in 2007 [32] presence of benzo[a]pyrene in concentrations above the MPL has been detected in 56.64% of the cases at all six sampling locations.

Based on an instruction issued by the ministry responsible for environmental protection in 2006, the Serbian Environmental Protection Agency has conducted a process of automated air monitoring equipment procurement. The equipment procured were installed in four measuring station, three of which were located in the Smederevo area. Selection of locations and areas where new equipment was to be installed had taken into account the needs of the Municipality of Smederevo. Equipment installation and start of operation were carried out at the end of 2006 and the beginning of 2007.

However, apart from classic, industrial pollution, significant emissions of uPOPs are released during accidents.

Based on data obtained from the Institute of Public Health of the city of Belgrade, 24 chemical accidents have been noted in the area of Belgrade in 2007, while 6 chemical accidents occurred outside the city borders.

Of all recorded accidents, 15 were related to the sector of industry, 7 to transport, while 8 originated from other sectors. Accidents deemed to be potential sources of uPOPs are shown in Table 2.3.6.2.h. However, there are no data on emissions measured.

Table 2.3.6.2.h.: Accidents in the Republic of Serbia deemed to be potential sources of uPOPs

No.	Accident	Date	Location
1.	Air pollution episodes in Pančevo with benzene and other volatile polycyclic aromatic hydrocarbons	01/02/2007-05/02/2007	Settlement of Pančevo Oil Refinery - Petrohemija
2.	Air pollution resulting from the fire spread to 20 ha of forest and low vegetation area in Barajevo	19/07/2007	Parcanski vis – border line of three municipalities: Sopot, Voždovac, Barajevo
3.	Fire in the wood treatment plant "Drvotrejd" in Surčin	23/07/2007	Surčin – Municipality Surčin
4.	Fire occurred in the settlement Staro sajmište, caused by waste and secondary raw material burning	21/08/2007	Settlement of Staro sajmište b.b. – below the "Gazela" bridge Municipality Novi Beograd

Sampling and analysis of PCDD/PCDF concentrations in waste gases emitted from industrial facilities in the Republic of Serbia has been conducted only a few times. One of the first investigations was carried out in the crematorium of the cemetery Lešće, Public Utility Company "Pogrebne usluge Grada Beograda" (providing funeral related services to the inhabitants of Belgrade). The investigation, carried out in summer 2005, was conducted with a goal to examine possible incineration of pathological biohazardous waste, generated by Belgrade medical centres, in cremation furnaces. The investigation was jointly conducted by the Serbian Clinical Centre, Public Utility Company "Pogrebne usluge Grada Beograda", Institute of Environmental and Occupational Health Protection of Belgrade and Department of Process Engineering, Faculty of Mechanical Engineering in Belgrade. Gas sampling, in accordance with requirements defined in the relevant standard, was conducted by the employees of the Institute of Environmental and Occupational Health Protection, while sample analyses were done in the Institute of Public Health of the city of Belgrade. Previously mentioned institutions are authorised to conduct emission measurements i.e. sample analysis. Based on the results obtained it has been concluded that PCDD/PCDF concentrations in flue gases were below detectable level. Since crematoria are well known sources of significant PCDD/PCDF emissions, conducted measurements and related results should be taken with a considerable dose of suspicion.

The first "real" measurements of PCDD/PCDF emissions from industrial facilities were carried out in the cement factory Holcim, Serbia, located in Popovac, analysing emissions from cement furnace of the factory. Measurements were conducted by the Department of Process Engineering, Faculty of Mechanical Engineering in Belgrade and company "Inspekt- kontrola i druge usluge", Zagreb, Croatia. Although more than 50 expert organisations are authorised to carry out emission measurements, none of them fully fulfils requirements which sometimes, in accordance with the best-practice recommendation, may be stricter than legally prescribed. The said is specially true for sampling and analysis of certain organic pollutants, including PCDD/PCDF. For the reasons specified it was necessary to use services of the above named laboratory from Croatia.

Measurements of pollutant emissions from the cement furnace were carried out from 12th to 15th December 2005, during a trial use of tires as an alternative fuel.

Locations of measuring points were selected in accordance with standards and methods recommended for this type of measurements and operating conditions/parameters in the facility i.e. in accordance with ISO 9096:2003.

During analysis of coal and petrol coke mixture (primary fuel) combustion and combustion of fuel mixture formed by partial replacement of primary fuel with waste material (tires), concentration of several compounds were measured, including PCDD/PCDF and PAH.

PCDD/PCDF analysis was conducted in accordance with:

– Sampling: method: EN 1948-1; SiO_2 – filter (with addition of 200 pg of standard solution of $_{13}C^{12}$-PCDD/PCDF-EN 1948-1, Chapter 3.7) + condensate + adsorbent XAD-2. Sampling was carried out using the isokinetic sampling system ZAMBELI 6000 Isoplus No. 0112 and in accordance with national and international standards ISO 9096, EPA, UNICHEM and UNI 10169; flow velocity was determined using the Pitot tube and implementing defined pressure measurement method; temperature was measured with NiCr-Ni thermocouple; glass gas sampling system cooling was provided by a cooler WM 15, Zambelli, serial number 20305, providing system cooling and fuel gas condensing.

– Analysis was made in accordance with a method EN 1948-2 (extraction and treatment) and EN 1948-3 (analysis of HRGC/HRMS) [41].

Mean values obtained as a result of conducted measurements, results of performed calculation as well as pollutant emissions recorded for both operating regimes, burning only primary fuel and burning primary + alternative fuel (tires), are shown in Table 2.3.6.2.i. Comparison of measured values with emission limit value (ELV) is shown in Figure 2.3.6.2.h.

Table 2.3.6.2.i.: PCDD/PCDF concentration and mass flow

Parameter	Unit	Value		ELV
Date of the measurement		12/12/2005	15/12/2005	
Operating condition		combined	combined	
Tiers		-	YES	
Oxygen, % vol.	%	12,2	12,2	
Flue gas flow rate	m_N^3/h	243151	236617	
Flue gas temperature	°C	110	118	
PCDD/PCDF	ng/m_N^3	0,0062	0,0023	0,1
	kg/h	0,000001197	0,000000552	

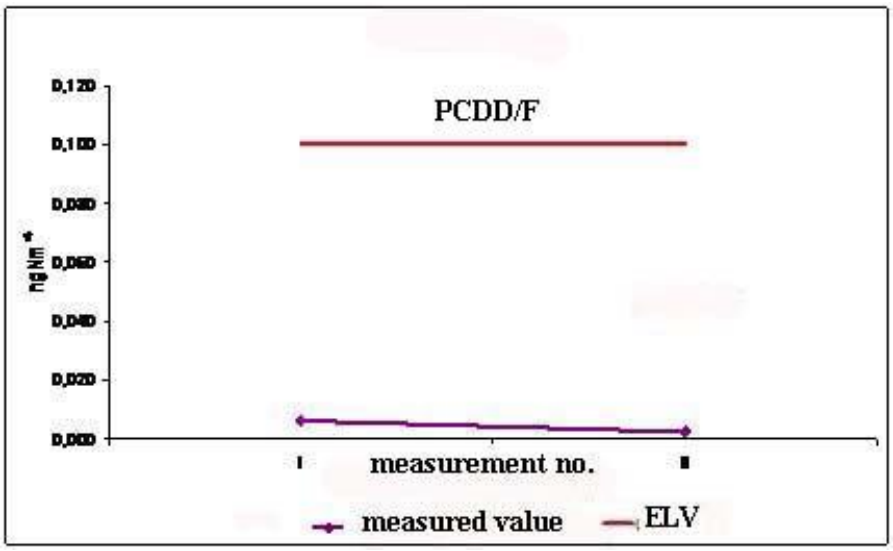


Figure 2.3.6.2.h.: Comparison of measured PCDD/PCDF concentrations and ELV

The same type of the measurements and for the same reasons i.e. permit issuing allowing co-combustion of tiers in the cement furnace, was carried out in May 2007 in cement factory "Lafarge" Serbia, located in Beočin, Serbia. The measurements were conducted by the Department

of Process Engineering, Faculty of Mechanical Engineering in Belgrade and company "Inspekt-kontrola i druge usluge", Zagreb, Croatia. Results obtained and comparisons with ELV are shown in Tables 2.3.6.2.j and 2.3.6.2.k and Figures 2.3.6.2.h and 2.3.6.2.i.

Table 2.3.6.2.j.: Measuring point no. 1 – stack after the bag filter (with respect to flue gas flow direction)

No.	Unit	I	II	III	IV	V	VI	ELV
Date of measurement		10/05/2007	11/05/2007	12/05/2007	14/05/2007	15/05/2007	16/05/2007	
Tiers (share of total heat)		-	3,3%	6%	9,1%	9,9%	15,3%o	
Oxygen, %vol.	%	11,88	12,53	11,60	11,66	11,65	11,92	
Flue gas temperature	°C	157,2	151	147	139	141	143,2	
PCDD/PCDF	ng/m_N^3	<0,0022	<0,0021	<0,0020	<0,0023	<0,034	<0,0098	0,1
Benzene	mg/m_N^3	1,86	4,76	4,33	3,13	4,90	4,87	5
Toluene	mg/m_N^3	7,23	2,65	1,99	0,98	1,95	1,63	100
Xylene	mg/m_N^3	4,40	1,87	1,45	1,40	1,91	1,20	100
Total organic carbon (TOC)	mg/m_N^3	157,7	39,8	21,6	25,8	25,0	17,8	
PAH	$\mu g/m_N^3$	<0,0834	<0,0928	<0,0810	<0,0805	<0,0786	<0,0835	

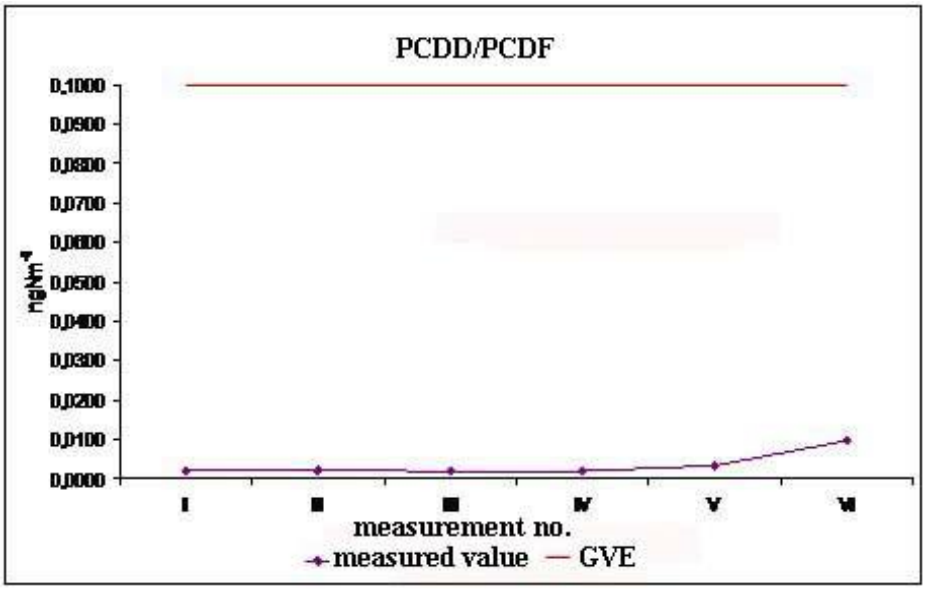


Figure 2.3.6.2.i.: Comparison of measured PCDD/PCDF concentrations with ELV

Table 2.3.6.2.k.: Measuring point no. 2 – stack after electrostatic precipitator of the raw material dryer (with respect to flue gas flow direction)

No.	Unit	I	II	III	IV	V	VI	ELV
Date of measurement		10/05/2007	11/05/2007	12/05/2007	14/05/2007	15/05/2007	16/05/2007	
Tiers (share of total heat)		-	3,3%	6%	9,1%	9,9%	15,3%o	
Oxygen, %vol.	%	12,11	12,30	12,66	12,496	12,81	12,74	
Gas flow rate	m_N^3/h	235016	202880	253222	222343	240784	236352	
Flue gas temperature	°C	89,5	87,9	89,3	89,3	89,7	88,6	
PCDD/PCDF	ng/m_N^3	0,076	<0,0138	<0,0132	<0,0056	<0,0025	<0,0027	0,1
Benzene	mg/m_N^3	3,75	2,72	3,37	4,56	1,92	0,86	5
Toluene	mg/m_N^3	0,9	0,77	1,66	0,75	0,58	3,08	100

Xylene	mg/m_N^3	2,87	1,68	1,04	2,45	1,98	2,32	100
Total metals, including Hg	$\mu g/m_N^3$	<202	<115	<161,1	<237,8	<176,7	<145,0	1000
Total organic carbon (TOC)	mg/m_N^3	139,0	73,7	40,8	43,4	46,1	35,9	
PAH	$\mu g/m_N^3$	<0,0308	<0,0348	<0,0290	<0,0362	<0,0337	<0,0457	

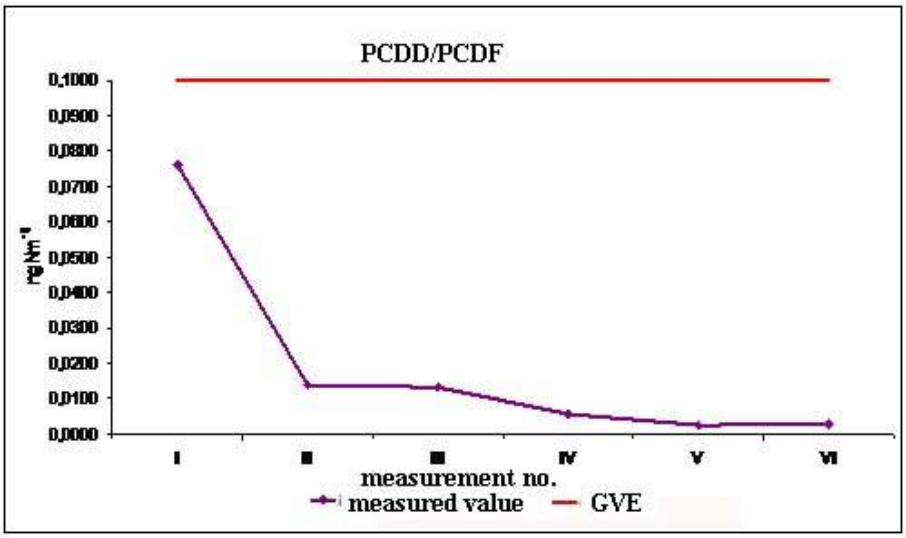


Figure 2.3.6.2.j.: Comparison of measured PCDD/PCDF with ELV

Based on the above presented data the following can be concluded:

– Measurements described previously are the only industrial measurements of PCDD/PCDF carried out in the Republic of Serbia. Emission factors obtained based on described measurements are lower than the values recommended in methodology used for inventory compiling. Emission factors obtained from the measurements have not been used for inventorying, primarily due to the facts that obtained values resulted from small number of measurements conducted. The number of conducted measurements is not enough to provide the use of measurement-based emissions factors instead of the factors defined in inventory methodology, which have been based on extensive measurements carried out worldwide;

– Air quality measurements carried out over the years have, with respect to PAH concentrations in ambient air, not been conducted continuously and at the same locations, thus preventing comparison of the results obtained;

– With respect to PAH measurement it is concluded that the results obtained mostly refer to PAH concentrations in suspended particles and do not include concentrations of volatile PAH in the gas phase. Only a small percentage of the results have been obtained using the standard analysis method (ISO 12884:2000) recommended in the Directive 2004/107/EC;

– Discontinuity in air quality data collecting resulted from insufficient funding provided for the measurements over the last years;

– Ambient air quality measurements conducted in the Republic of Serbia have been carried out using different sampling and analysis methodologies and with no appropriate validation of the method used; for that reason the results obtained should be taken with caution;

– Law on Air Protection was adopted in May 2009 will improve data quality and systematic approach to measurements, as well as, new measuring equipment procured by the Serbian Environmental Protection Agency.

2.3.6.3 POPs levels in soil

In the Republic of Serbia soil quality is not systematically measured [2]. However, extensive soil quality analysis and pollution investigations have been carried out in the previous period.

Different expert estimates and analysis of soil quality and pollution have been conducted within the scope of numerous international projects [39].

In addition, extensive investigation of soil pollution by pesticides has been carried out in the Republic of Serbia during the last twenty years. POPs pesticides were one of the soil pollutants considered in the investigation. Besides this extensive investigation, many other individual analysis have been conducted as well, as a part of scientific and research projects funded by various national and international institutions and organisations.

Results of sample analysis carried out in 1991 on 926 samples taken at different locations in Vojvodina indicated that concentrations of pesticide compounds (except atrazine) in most of the samples were around 5 mg/kg i.e. 0.005 mg/kg for 4.4`-DDT or lower [24]. Higher atrazine concentrations, having in mind usual application doses, are unexpected and are deemed to be concentrated pollution (e.g. pits used for chemical disposal and similar). Results of measurements carried out in other parts of the Republic also indicated low content of all investigated compounds, around 5 mg/kg. However, maximal concentrations of 200 mg/kg were recorded for 4,4`-DDT and atrazine, while maximal concentrations of permethrin and simazin equalled 300-400 mg/kg.

Significant release and consequent spreading of products of incomplete combustion, resulting from combustion of oil and oil derivatives, occurred during NATO bombarding in 1999. In order to investigate a level of soil pollution, two investigations have been carried out: one at an experimental field of the Institute of Field and Vegetable Crops, Novi Sad, formed at Rimski Šančevi, a neighbourhood of the city of Novi Sad, and the other considering all inhabited areas of the Municipality of Novi Sad. Concentrations of 16 PAH have been measured in first 42 horizons of soil profile at experimental field Rimski Šančevi. Mean PAH concentration varied from 0.056 mg/kg to 1.022 mg/kg, with a mean value equal to 0.173 mg/kg. Analysis of soil samples taken from the inhabited areas of the Municipality of Novi Sad indicated total PAH concentration between 2.245 mg/kg and 8.681 mg/kg and was declared as potentially harmful to plant species [24].

An extensive research project titled "Control of Soil Fertility and the Assessment of the Content of Harmful and Hazardous Substances in the Soils of the Republic of Serbia" was initiated in 2001 and funded by the ministry responsible for agriculture. The project examines the soils of the Republic of Serbia, without the Autonomous Provinces. During the first phase of the project, soil properties in central and north-west parts of the country have been analysed. The project analyses presence of pesticide residues in soil, including 18 active substances used in pesticide production (4.4 DDD, 4.4 DDE, 4.4 DDT, aldrin, α HCH, β HCH, γ HCH, lindane, diazinon, dieldrin, endrin, aldehyde, heptachlor-epoxide, alachlor, atrazine, prometrin, simazine, terbutryn). Results obtained after the first three phases of the project (2001-2003) have indicated that soil pollution caused by POPs pesticide residues was not detected in 99% of the samples [25].

Subsequent phases of investigation have confirmed the results obtained initially [26].

Besides the above mentioned project, over the last years the ministry responsible for agriculture has been funding soil quality investigations, carried out by systematic fertility control of agricultural soil (soil classification - class 1 to 5), allocating funds to interested physical entities. In 2003 and 2004 systematic control of soil fertility have been conducted on 65000 soil samples, 35000 samples collected in the area of Autonomous Province of Vojvodina and 30000 samples collected in central Serbia. Analysis of pesticide residues in soil samples collected in central Serbia have shown that the highest concentrations of active substances used in pest production were detected in soil Class 2, 3 and 5 (1000 ha each), followed by Class 4 (5000 ha) and Class 1 (9000 ha). In Class 1 a slightly higher concentrations of organochlorine compounds were detected. The

most widely spread is a Class 6 (1359000 ha), characterised by very low concentrations of pesticide residues. Analysis of relations between active substances detected in soils of different classes has pointed out an interesting, but logical connection between Class 1 and Class 2 soils, with respect to detected DDT metabolites in the surroundings of Belgrade i.e. in the alluviums of the rivers Sava and Velika Morava (resulting from DDT use during the fifties and the sixties). Connection between Class 3, 4 and 5 soils has also been established as a result of triazine-based product use. Based on the results obtained up to date, the prevailing Class 6 soils contain very little pesticide residue, indicating that soil pollution by examined pesticide residue has not been detected in 99% of the samples [26].

Besides the investigations mentioned above, the Institute of Field and Vegetable Crops, Novi Sad has been carrying out a project of "Environmental Quality Monitoring in Autonomous Province of Vojvodina – non-agricultural land" [26].

During the conducted research soil samples have been tested for the presence of 16 characteristic PAH: naphthylene, acenaphthylene, phenanthren, acenaphtene, fluoren, anthracene, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenzo[a,h]anthracene, benzo[g,h,i]perylen and indeno[1,2,3-cd]pyrene. Presence of all listed compounds has been detected in the analysed soil samples (Figure 2.3.6.3.a). Based on the provisions of the Rulebook on the Methods of Organic Farming[33], maximum permissible concentrations in soil intended for organic farming is set to 1 mg/kg. Mean concentration of total PAH equalled 1.49 mg/kg in 2003, ranging from 0.52 mg/kg to 5.68 mg/kg. In 64% of soil samples measured PAH concentrations exceeded maximum permissible level. Mean concentration of total PAH in the soil equalled 0.469 mg/kg in 2004, ranging from 0.163 mg/kg to 2.238 mg/kg. PAH concentrations above the maximum permissible level were detected in 1.5% of analysed samples.

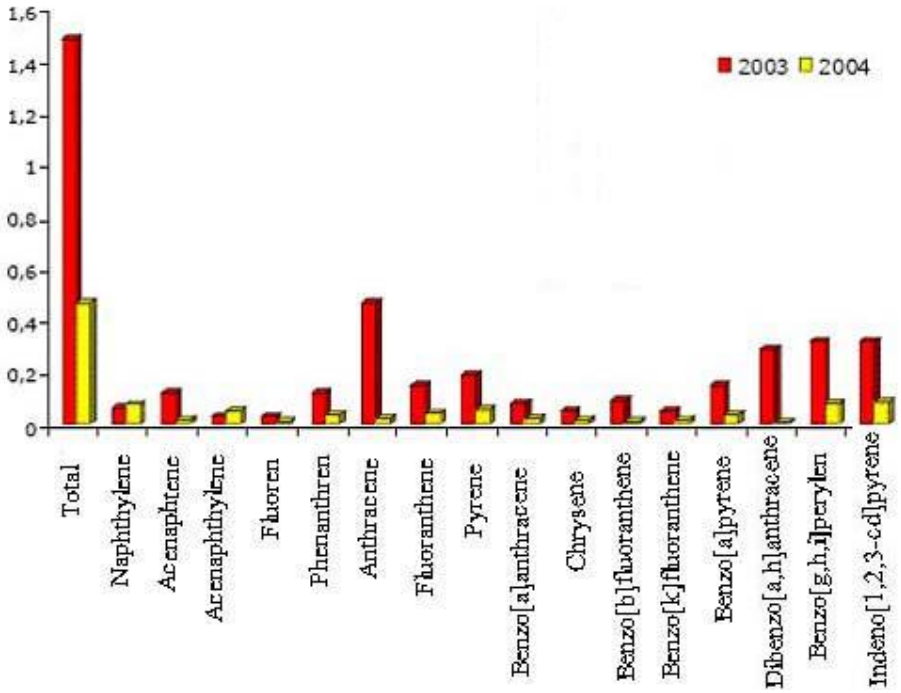


Figure 2.3.6.3.a.: Mean PAH concentrations in non-agricultural soil of Vojvodina, 2003 and 2004 (mg/kg of absolutely dry soil (a.d.s.))

The highest PAH concentration measured in areas outside the zones of industrial activities (soil analysis in the area of Palić lake) equalled 2.238 mg/kg. Detection of PAH at such locations, seemingly completely isolated from the effects of industrial activities and traffic, is not unusual

[33] Rulebook on the Methods of Organic Farming ("Official Gazette of FRY" No. 51/02)

since it is well known that PAH are highly volatile and have lower molecular masses and are therefore transported with dust particles to the most distant parts of the ecosystems.

Total PAH content is higher in soils with higher organic compound content, where PAH are chemically bound and are not easily accessible to plants.

Industrial soils contain PAH with 4-5 aromatic rings, while compounds with 2-6 aromatic rings are present in approximately the same concentrations as in agricultural soils. Comparison of measurement results and literature data on PAH present in industrial soils leads to the conclusion that PAH concentrations detected in the soil are in accordance with literature data.

Presence of all examined compounds has been recorded at measurement locations in the vicinity of factories (industrial zone) (Figure 2.3.6.3.b). In 2003, mean PAH concentration in industrial soils equalled 1.89 mg/kg, ranging from 0.51 mg/kg to 11.91 mg/kg. It can be concluded that total PAH content is higher in industrial than in non-agricultural soil (1.89 mg/kg compared to 1.49 mg/kg). Mean concentration of total PAH in the soil, measured in 2004, equalled 0.363 mg/kg, varying from 0.149 mg/kg to 0.729 mg/kg, with none of the measured concentrations above the MPL.

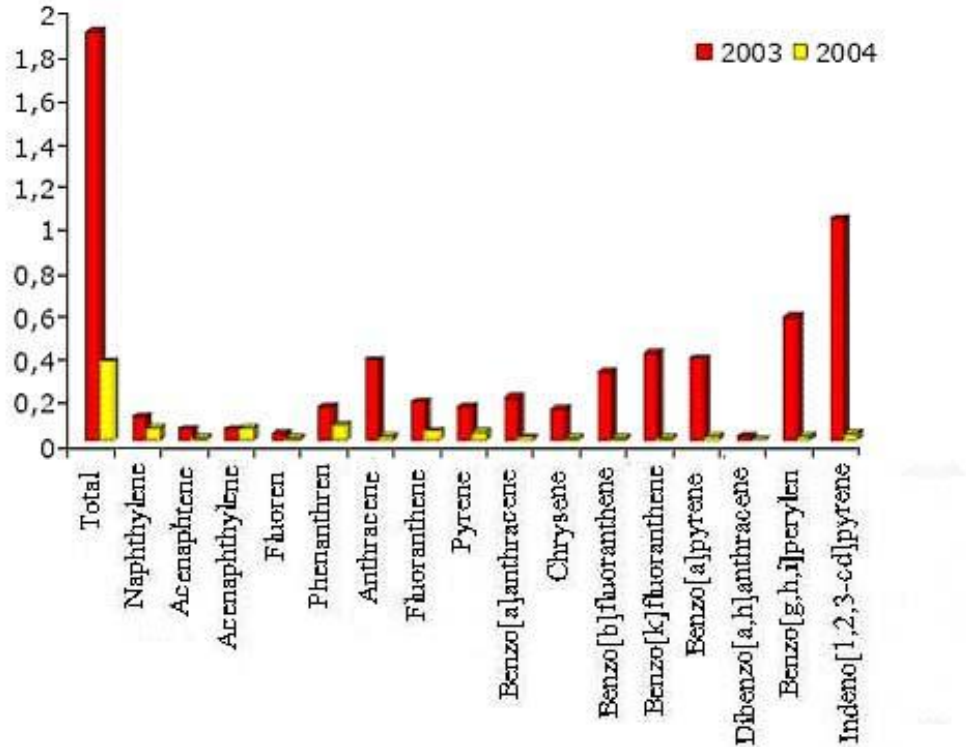


Figure 2.3.6.3.b.: Mean concentration of total PAH in industrial soils of Vojvodina, 2003 and 2004 (mg/kg of a.d.s.)

Analysed samples were not PAH-contaminated and did not contain PAH in concentrations which would cause a concern.

In addition, 25 soil samples have been taken at the immediate vicinity of residential buildings, just next to the outside wall of the structure. Average PAH content has been determined to be 1.510 mg/kg. Maximum permissible PAH content in the soil intended for organic farming was not exceeded in 16% of analysed soil samples. At four examined locations determined PAH content was significantly higher than the average value, due to fossil fuel combustion for heating and resulting increased PAH emissions. Since residential facilities are old dated, heat-providing fossil fuel combustion has been going on for many years, resulting in precipitation of combustion

products in the vicinity of the facilities. All 16 PAH (highly volatile as well as less volatile compounds) have been detected in the yards of residential buildings.

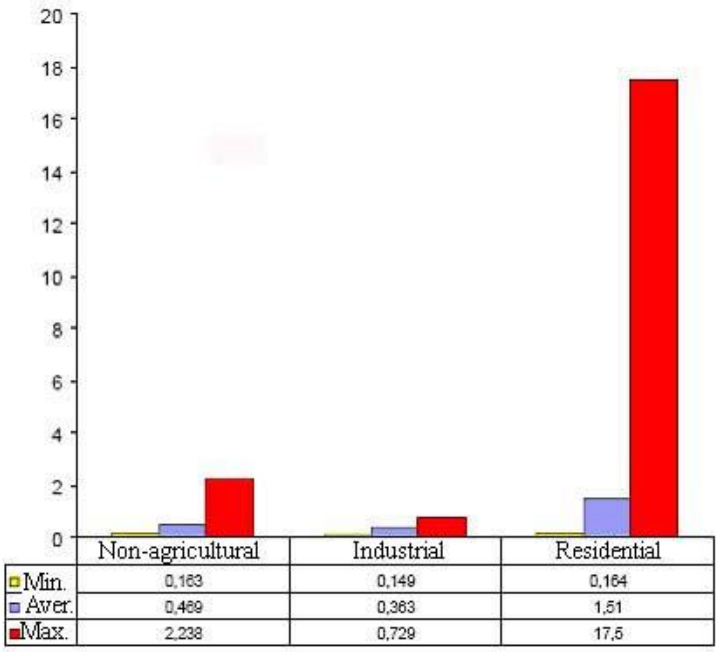


Figure 2.3.6.3.c.: Total PAH in the soils of Vojvodina, 2003 and 2004 (mg/kg of absolutely dry soil- a.d.s.)

Investigation of soil contamination in the area of Belgrade is carried out by the Institute for Health Protection in the city of Belgrade [26].

PAH have been detected in all soil samples taken in all protection zones of the Belgrade Water Supply System and in concentrations varying mostly from 100 to 500 μg/kg. Extremely high PAH concentration (866 μg/kg) has been recorded at Ada Ciganlija (15 m from the right bank of the Sava River, across the Heat Plant "Novi Beograd"). Since the location is very close to the Heat Plant "Novi Beograd", which was targeted during the NATO bombarding in 1999, values obtained may be related to NATO intervention.

With respect to the area along the bank of the effluent Čukarički rukavac, in one of the samples taken at the specified location and at a depth of 10 cm, PCB have been detected in concentration of 108.2 μg/kg.

In the zone of the Clinic for Infectious Diseases, slightly higher PAH concentrations than it would be expected for urban zone where the Clinic is located, have been detected at a depth of 10 cm (1,680 μg/kg). At a location in the city centre (Cvijićeva Street), in the sample taken from the common yard, apart for PAH no other harmful or hazardous substances have been detected.

Presence of PAH, mineral oils and PCB (in 1 sample) in the soils of urban and suburban area of Belgrade, indicate anthropogenic pollution source i.e. soil pollution resulting from industrial, traffic and other activities related to pollutant releases.

During the fifth phase of the project "Control of Soil Fertility and the Assessment of the Content of Harmful and Hazardous Substances in the Soils of the Republic of Serbia", carried out in 2005, 1,007 soil samples have been analysed, representative of an area of 1007000 ha (Figure 2.3.6.3.d) [27].

Figure 2.3.6.3.d.: Sampled area analysed in the fifth phase of the Project, 2005

Samples were taken from the grid-area with a 1000 ha fields. At each selected location a composite sample had been taken, representing an average sample of 25 soil samples taken at depths in a range from 0 to 30 cm.

Soil of different use have been included in the investigations: arables 36%, vineyards 1%, orchards 2.2%, gardens 1.5%, meadows 24%, forests 33%, grasslands 2% and swamp land 0.3%.

Results obtained indicate that mean concentration of examined compounds in the soil is lower than 5 µg/kg. Some pesticides, as well as residues of β-HCH, alachlor, diazinon and chlordane have not been detected. Mean concentrations of α-HCH and heptachlor are low (< 1 µg/kg), while the highest detected mean concentrations are those of DDT and simazine (4.4 µg/kg and 4.6 µg/kg respectively), Figures 2.3.6.3.e and 2.3.6.3.f.

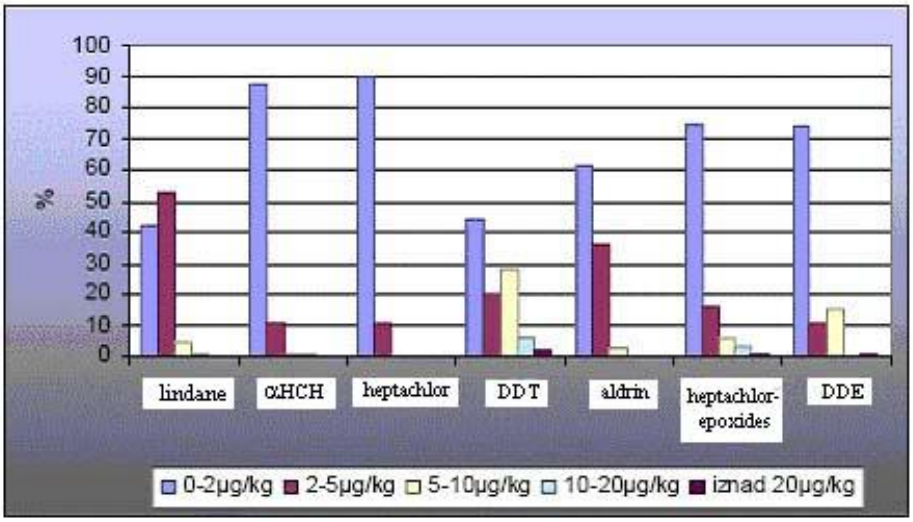


Figure 2.3.6.3.e.: Organochlorine pesticides detected in the soil

Spatial variation of concentration is the most noticeable in the case of organochlorine pesticides DDD, α-HCH, heptachlor-epoxides. In some soil samples taken in forests or the meadows in their immediate vicinity, higher concentrations of DDT, DDD, α-HCH and heptachlor epoxides were detected, probably resulting from their use in forest protection.

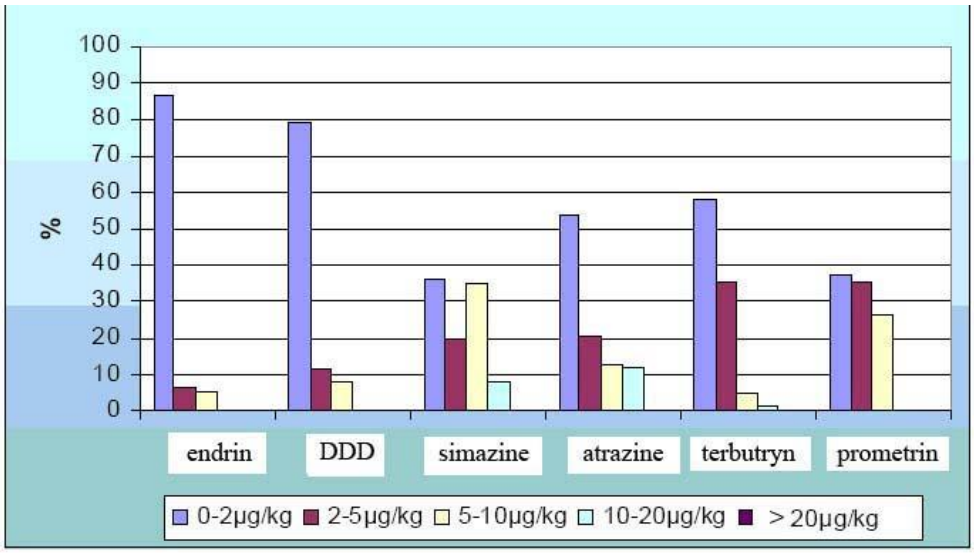


Figure 2.3.6.3.f.: Insecticides and pesticides detected in the soil

The project Environmental Quality Monitoring in Autonomous Province of Vojvodina – non-agricultural land of industrial zones" represents a continuation of the investigations conducted in 2003 and 2004 when soils placed under different types of protection and soils of industrial zones have been analysed. In 2005, quality of non-agricultural soils in Vojvodina has been monitored in larger towns with a well developed industry [27].

Analysis of PCB concentrations in non-agricultural soils – industrial zones have shown that the highest mean PCB concentration of 0.041 mg/kg a.d.s. were detected in Pančevo, with concentrations ranging from 0.0057 mg/kg a.d.s. to 0.071 mg/kg a.d.s.. Mean PCB concentrations in soil in the surroundings of a battery manufacturing factory in Sombor equalled 0.0276 mg/kg a.d.s., varying in a wide range from 0.0008 mg/kg a.d.s. to 0.0595 mg/kg a.d.s. In the surroundings of a foundry located in Kikinda mean PCB concentrations in soil equalled 0.0213 mg/kg a.d.s., while in the surroundings of a cement factory located in Beočin, a mean PCB concentration of 0.0189 mg/kg a.d.s. was measured (Figure 2.3.6.3.g).

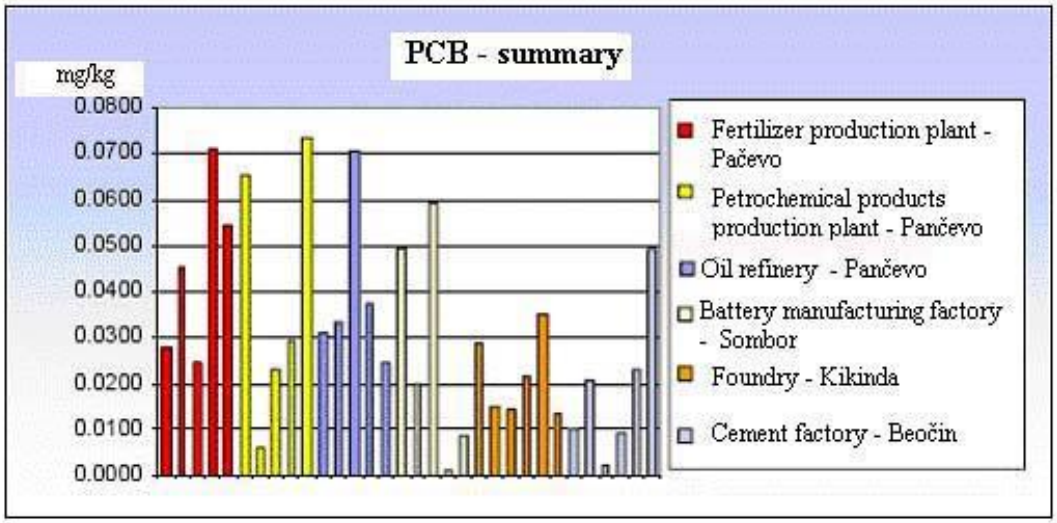


Figure 2.3.6.3.g.: PCB in the soils of industrial zones in Vojvodina

Applying a German standard for MPL of PCB, allowing maximal PCB concentration of 0.05 mg/kg, it is concluded that PCB concentrations detected in 33% of soil samples taken in Pančevo and only 1 sample taken in the surroundings of the battery manufacturing factory in Sombor. Soils in the vicinity of industrial facilities i.e. foundry in Kikinda and cement factory in Beočin do not contain PCB in concentrations that are deemed to cause significant soil contamination (Figure 2.3.6.3.h).

The highest mean PAH concentration in soil of 2.138 mg/kg a.d.s. was detected in Kikinda. Recorded value exceeds the MPL defined for the soil used for organic farming. Average PAH content in the soil samples taken in Sombor and Beočin was also higher than 1 mg/kg and equalled 1.644 mg/kg and 1.473 mg/kg respectively (Figure 2.3.6.3.i). Based on the German standard for MPL of total PAH, allowing maximal concentration of 0.2 mg/kg a.d.s., PAH concentrations above MPL were detected in 76.7% of the soil samples. The said means that the soil in the considered locations potentially represents a source of groundwater contamination by PAH (Figure 2.3.6.3.h) (Figure 2.3.6.3.i).

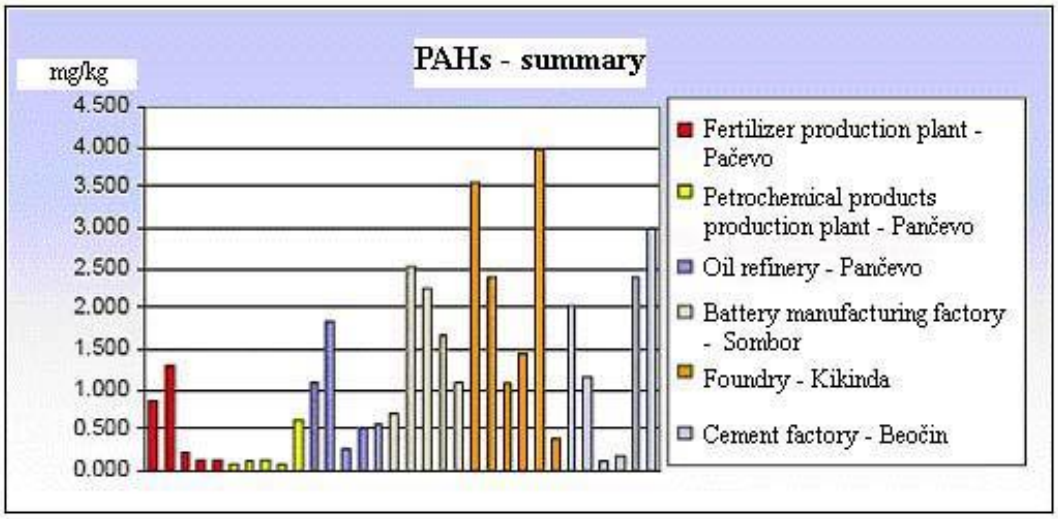


Figure 2.3.6.3.h.: PAH in the soils of industrial zones in Vojvodina

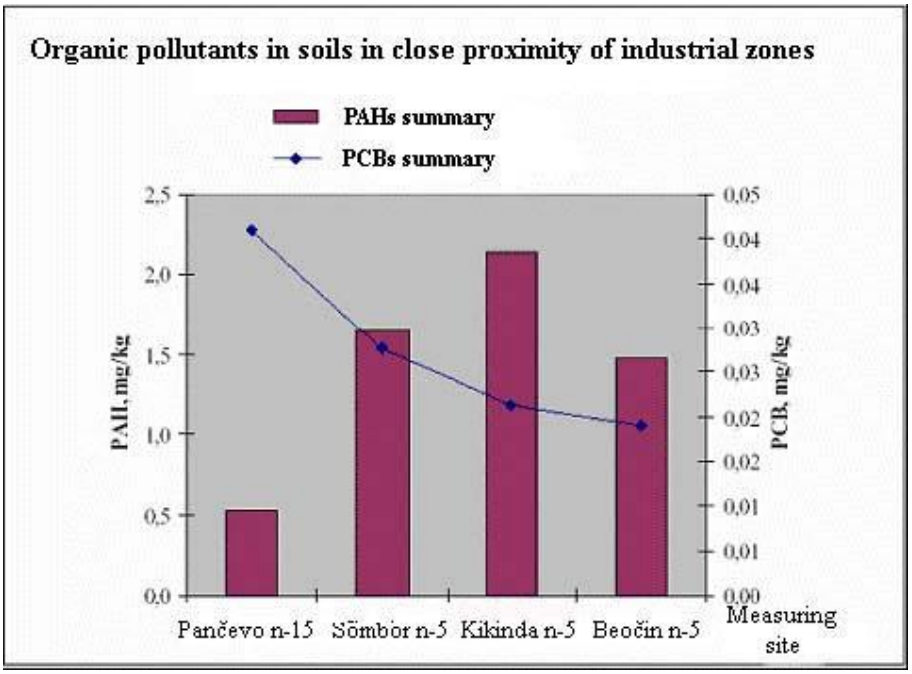


Figure 2.3.6.3.i.: PAH and PCB in the soils of industrial zones in Vojvodina (mg/kg a.d.s.)

During the implementation of the program aimed to investigate soil pollution in the city of Belgrade, carried out in 2005, 64 soil samples taken at 32 locations were analysed [27].

Results obtained indicate that higher concentrations of some of the analysed parameters were detected at certain locations, including:

- locations within water-source-protection zones of the Belgrade Water Supply System;
- location Ada Ciganlija, where PAH concentration above 500 μg/kg (548.2 μg/kg) and PCB concentration of 188.9 μg/kg were detected in one sample each;
- location along the left bank of the Sava River – Ranney wells, PAH concentration of 2,117 μg/kg were measured in one soil sample taken at a depth of 10 cm, which is higher than usual values encountered in urban areas, but still lower than the norms set for contaminated soils requiring remediation;
- soil in urban city zone (presence of DDT was detected in one sample (11.1 μg/kg));
- soil in city parks (out of 4 soil samples taken in Botanical Garden, one contained higher pesticide concentrations: DDT (171.0 μg/kg), hexachlorobenzene (166.1 μg/kg) and simazine (12.9 μg/kg)).

It can be concluded that PCB concentration of 188.9 μg/kg, detected in one sample taken at Ada Ciganlija in 2005 was higher than 50 μg/kg, which is the maximum permissible level for conditionally clean soil as defined in Dutch standard for polluted soils. However, the value detected was still lower than 10000 μg/kg, in the same standard defined as the limit for contaminated soils requiring remediation. At the same location higher PAH concentration was detected as well, confirming the conclusions drawn over the previous years with respect to notion that the surface soil stratum at the location contains considerable concentrations of pollutants released during purpose-specific activities (the marine, rowing clubs, servicing and maintenance of marine vehicles etc.)

Low PAH concentrations detected in larger number of soil samples taken in the area of the town primarily result from precipitation of organic pollutants emitted from heating facilities (household furnaces, boiler houses, heat plants) or traffic (air pollution).

Detection of DDT at three location of common use (Botanical Garden, Zemun Polje, Trošarina) indicated that residues of this, once widely used pesticide from the group of insecticides, were present in the locations analysed.

During 2006, the sixth phase of the project Control of Soil Fertility and the Assessment of the Content of Harmful and Hazardous Substances in the Soils of the Republic of Serbia had been carried out. In this phase of the project 959 soil samples had been analysed, representative of an area of 959,000 ha in the region of south-west and south Serbia [21].

Results obtained indicate that concentrations of 18 examined substances in the soil were mostly low, which is in accordance with the results obtained during the previous years. Five substances (β-HCH, dieldrine, chlordane, alachlor and diazinon) have not been detected in analysed soil samples, while possible presence of the remaining 13 substances had been detected in certain number of samples but in concentrations mainly below the lower limit of quantitative measurement (5 μg/kg for most substances). For that reason it could be stated with certainty that detected concentration of examined substances were low enough not to be considered as pollution but naturally occurring and resulting from other substances present in some soils. Concentrations above the detection limit were recorded for just a few substances and in few samples. These higher levels of atrazin, lindane, DDT/metabolites and partially simazine detected in some samples could be a result of their use in the previous years. Still, this should be confirmed by additional measurements.

During investigation of soil pollution in the city of Belgrade, carried out in 2006, 64 soil samples taken at 33 locations were analysed [21].

Deviations of obtained pollutant concentrations from MPLs are shown in Figure 2.3.6.3.j.

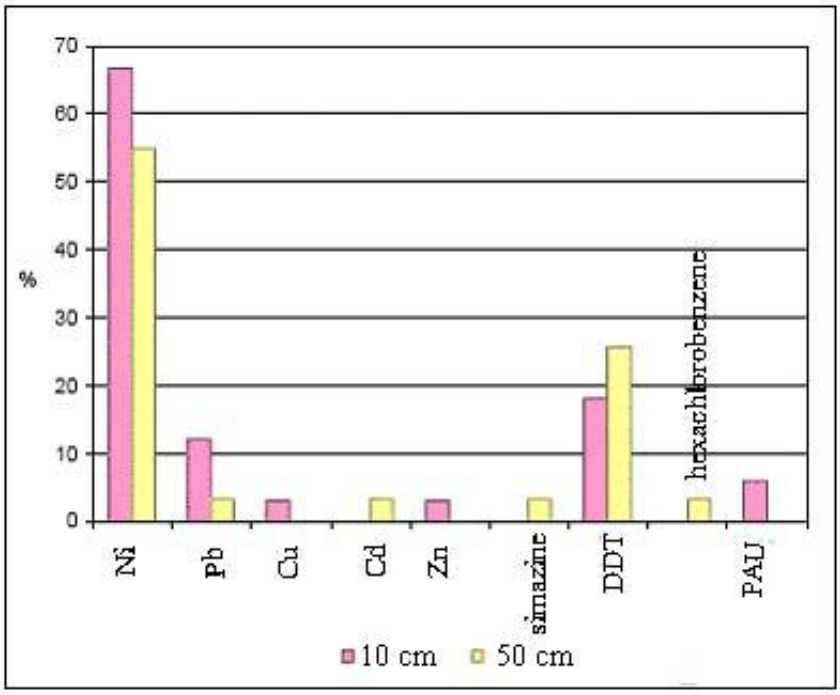


Figure 2.3.6.3.j.: Deviations of obtained pollutant concentrations (at depths of 10 cm and 50 cm) from MPLs

Presence of DDT detected in some soil samples indicated that residues of this pesticide with long half-life are present. DDT has once been used for mosquito control, primarily by ground spraying. PAH concentrations of 1409.9 μg/kg in surface soil layer in the area of Belgrade's harbour indicated presence of organic pollutant which should be further examined.

The seventh phase of the project "Control of Soil Fertility and the Assessment of the Content of Harmful and Hazardous Substances in the Soils of the Republic of Serbia" included

analysis of 700 soil samples, taken in accordance with a grid sample design, representative of an area of about 700000 ha in the region of south-east Serbia [2].

At each location a composite sample was taken, representing an average soil sample at depths from 0 to 30 cm.

A number of industrial facilities, all representing potential soil polluters, were constructed and is still operating in the area investigated. The facilities are primarily from the sector of machine and metal treatment industry (Niš, Kuršumlija, Knjaževac, Aleksinac), production of plastic masses, tiers, asbestos ("Tigar"-Pirot, "FIAZ"-Prokuplje, Niš, Knjaževac), textile industry (Prokuplje, Kuršumlija, Niš, Pirot, Aleksinac, Knjaževac), tobacco industry (Niš), coal mine and construction material manufacturing (Aleksinac). In addition, plantation economies may also be a source of soil pollution due to unregulated use of agrochemical products.

Results obtained indicated that concentrations of 18 examined substances in the soil samples were mostly low, which is in accordance with the results obtained during investigations conducted in the previous years. It could be considered that five substances (β-HCH, chlordane, alachlor and diazinon) were not detected in analysed soil samples, while possible presence of the remaining 13 substances had been detected in certain number of samples but in concentrations mainly below the lower limit of quantitative measurement (5 μg/kg for most substances). It could therefore be stated with great certainty that detected concentrations of the examined substances were low enough not to be considered as a potential risk to the ecosystem.

Higher concentrations of DDT (expressed as a summary of metabolites), atrazin and HCH/lindane (also expressed as a summary value), detected in certain number of samples, could result from their earlier use. Still, this should be confirmed by additional measurements.

The Program of soil quality/pollution analysis in the city of Belgrade was funded by the city of Belgrade itself – Secretariat of Environmental Protection. The program was implemented by the Institute of Public Health in Belgrade [2]. Measurements conducted in 2007 included analysis of 60 soil samples taken at 30 locations.

At all locations examined soil samples were taken at depths of 0.10 and 0.50 m. Low concentrations of DDT residues were detected in 2 samples taken at locations Ada Ciganlija – left bank of the Sava River (60.0 μg/kg) and Makiš Polje (15.0 μg/kg). DDT residues were also detected in one soil sample taken at Čukarica location.

Higher concentrations of organic pollutants (DDT, mineral oils, PAH) were detected in small number of samples. DDT residues detected in some samples indicated that residual quantities of this pesticide could be found in the soil even several decades after it had been used, due to its very long half-life.

A program of Quality Control of Agricultural and Non-Agricultural Soil in the city of Novi Sad [27] has been carried out in 2007. The program was funded by the Municipality of Novi Sad, while the Institute of Field and Vegetable Crops, Novi Sad, helped in its implementation. Investigation of organic soil pollutants indicated that increased content of PAH congeners was present only in the soil sample taken in the Heroja Pinkija Street and was equal to 0.052 mg/kg. In all analysed samples total PAH content was within the acceptable limits. Higher concentration of benzo[a]pyrene was detected in samples taken in Ilije Birčanina Street (0.039 mg/kg) and in the park next to the railway station (0.035 mg/kg). Concentrations of DDT and metabolites above the MPL (0.1 mg/kg) were detected in two samples, one taken in the Heroja Pinkija Street No. 86 (0.537 mg/kg) and the other in the park next to the railway station (0.299 mg/kg). In all other samples concentrations of DDT and metabolites were within the acceptable limits, ranging from 0.008 mg/kg to 0.079 mg/kg. Measured concentrations of metabolites were higher than MPL (0.06 mg/kg) in 54% of examined samples. All samples with higher concentrations of metabolites were samples of agricultural soil. The highest detected concentration of HCH and metabolites equalled 0.193 mg/kg. Probably the reason for that is that HCH was still in use in 2007 in Republic of Serbia.

In addition, it is well known that once in the atmosphere, HCB are transported over long distances and in that way spread into the environment.

Based on the data presented previously, the following can be concluded:

– There is a number of industrial facilities at investigated locations, all deemed to be possible sources of soil pollution;

– Plantation economies are potential sources of soil pollution due to unregulated use of agrochemical products;

– A progress in the number of programs and locations where soil quality is monitored, as well as in data availability, is evident;

– The main reason preventing the comprehensive assessment of soil quality in the Republic of Serbia and comparison of the results obtained over the last years is absence of systematic soil quality monitoring that would provide harmonisation of soil sampling and sample analysis, as well as data presenting.

2.3.6.4 Levels of uPOPs in food

Food safety control in the Republic if Serbia is carried out in accordance with the Rulebook on Permitted Concentrations of Pesticides, Metals, Metalloids and Other Poisonous Substances, Chemotherapeutics, Anabolics and Other Substances in Food[34], which is not harmonized with EU legislation. The Rulebook defines maximum permissible concentrations of POPs pesticides (obsolete pesticide list), PAH and PCB in different food categories. Maximum permissible concentrations of dioxins and furans are not defined. Maximal permissible concentration is given only for benzo(a)pyrene, while norm-setting rate is defined only for total PCB (no congeners).

Rulebook on Maximum Permissible Levels of Harmful Substances and Constituents of Animal Feed[35], does not provide maximum permissible concentrations defined for uPOPs. The Rulebook is not harmonized with EU legislation.

In the Republic of Serbia, 14 laboratories are accredited to conduct analyses of POPs in food. At the moment, 9 laboratories are certified to carry out PCB measurements. One laboratory is accredited for PAH and one for PCDD/PCDF measurements. Some of the laboratories still conduct measurements in accordance with a valid handbook dating from 1989, while some use AOAS methods. Only one laboratory is certified in accordance with the above specified European standards, while one is certified in accordance with SRPS ISO 14181:2005.

Veterinary, phytosanitary and sanitary services carrying out POPs pesticide monitoring are well established in the Republic of Serbia.

Following a war conflict in 1999 and chemical accidents occurred in Kragujevac, Bor, Pančevo and Novi Sad, public interest have been specially directed towards environmental pollution and possible impacts on the health of workers and local population. Such interest initiated several international and national POPs related projects. Still, data on the content of relevant contaminants in biological and other sample are still relatively limited.

In one of the initiated projects POPs intake into human organism and ecotoxicological consequences of exposure to POPs have been analysed. The project included sampling and analysis of breast milk and human tissue, certain plant species, meat, milk and fish, as well as mathematical model development for defining food chain correlations, average daily POPs intake through food and analysis of organochlorine compounds intake depending on the season of the year, age and gender. Based on the concentrations of POPs compounds in food, atmosphere and soil in the town of Novi Sad, it has been calculated that daily PCB intake of an adult weighing 70 kg equals .79 µg (1.1% ADI).

[34] Rulebook on Permitted Concentrations of Pesticides, Metals, Metalloids and Other Poisonous Substances, Chemotherapeutics, Anabolics and Other Substances in Food ("Official Gazette of FRY", No. 5/92)

[35] Rulebook on Maximum Permissible Levels of Harmful Substances and Constituents of Animal Feed ("Official Gazette of FRY", No. 2/90)

Analysis of organochlorine contaminants in breast milk has indicated that concentrations of analysed substances have not exceeded the values recorded in similar investigations conducted in other world countries.

In addition, PCB content in blood samples of potentially exposed workers has also been measured and investigated. The results of conducted investigation have not been published. Based on available data it is not possible to conduct detailed exposure analysis and risk assessment. It is therefore necessary to collect all available data and conduct their re-evaluation based on established technical and scientific criteria.

2.3.6.5 Levels of uPOPs present in fauna

There are no data on analyses and results obtained with respect to levels on uPOPs measured in fauna samples.

2.3.7 Future POPs production, use and release estimates

For POPs pesticides listed in Annex A and Annex B to the Stockholm Convention before May 2009, after expiration date of the permits, new permits were not issued and therefore there was no possibility for them to be found on the market, while mirex has never been placed on the market of the Republic of Serbia since the permit has never been requested i.e. issued.

PCB-based fluids have never been produced in the Republic of Serbia, but have been imported due to requirements imposed by manufactured electrical equipment and devices intended for various applications.

PCB-containinig equipment (transformers and condensers) has been manufactured in the Republic of Serbia, while a portion of the equipment was imported as well. Intensive industrial development of the Republic of Serbia, starting from the second half of the sixties and lasting until the end of the eighties of the last century, resulted in increased production and import of specified equipment.

Due to the amount of PCB-containing equipment and quantities of PCB-containing fluid, the related issue should be carefully considered. Chapter 2.3.3.6 explains the manner of PCB and PCB waste management pursuant to the Law on Waste Management adopted in 2009.

By implementation of the Law on Waste Management, significant reduction of emissions of unintentionally produced POPs chemicals is expected, primarily as a result of proper management of future waste disposal sites, as well as appropriate recovery and remediation of existing disposal sites. Construction of large capacity modern incinerators of municipal and hazardous waste, as defined in the National Waste Management Strategy, may cause increased emissions of uPOPs, which primarily depends on proper incinerator selection.

Pursuant to the Law on Production and Trade of Poisonous Substances which was replaced by the new Law on Chemicals adopted in May 2009, PCB was on the List of Poisonous Substances Whose Production, Placement on the Market and Use are Prohibited which meant that its open use was prohibited as well. On the basis of the Law on Chemicals, new Regulation on Bans and Restrictions shall be enacted which will be fully harmonised with bans and restrictions in the EU.

The Law on Integrated Pollution Prevention and Control defines that the operators are obliged to harmonize operation of their facilities with the best available techniques, as well as to obtain an integrated permit not later than 2015. In that way, emissions of uPOPs originating from industrial facilities and heat/power production plants shall be reduced.

In addition, adoption of new Rulebook on Emission Limit Values, harmonized with corresponding provisions of the EU legislation, would considerably contribute to emission reduction from the existing incinerators of medical waste.

In addition, continuous extension of gas distribution network, connecting more towns and settlements in Serbia to gas distribution system, shall significantly reduce number of individual household with their own furnaces of small capacity, known to be considerable emission sources, in that way contributing to reduction of total emissions.

Decision on proper selection of an incinerator should be preceded by appropriate education on such selection depending on the type of waste planned to be combusted, as well as appropriate waste-type-dependent technologies or technologies used for certain waste types in order to provide environmentally sound waste combustion.

No matter how urgent incinerator procurement may be, since there isn't any currently installed in the Republic of Serbia, before an appropriate decision is made all relevant information on the incineration facility currently in trial (pilot) phase, expected to be on the market in two years, should be obtained.

It has to be mentioned here that, if the issue of PCB disposal is not addressed adequately, the possibility of emission of POPs into the environment shall be increased.

Regarding 9 new POPs there are no adequate data which could provide information on production, use and release of these POPs in Serbia, so there is no possibility for assessment of future production, use and release of this new POPs chemicals.

2.3.8 POPs monitoring programmes in the Republic of Serbia

2.3.8.1 General considerations concerning the Laws regulating monitoring in the Republic of Serbia

Legal framework defining obligations from the Stockholm Convention with respect to monitoring of POPs substances and their presence in environmental media in the Republic of Serbia is provided by the Law on Environmental Protection.

Law on Environmental Protection, adopted in 2004, prescribes that the Republic, autonomous province or municipal self-government, within their jurisdiction, provide continuous environmental monitoring in accordance with the provisions of this Law. The Government of the Republic of Serbia issues a general monitoring programme, while authorities of the autonomous province or municipal self-government issue monitoring programmes for the area under their jurisdiction which must be harmonized with the program issued by the Government. In addition, the Law on Environmental Protection provides basis for determining the content and a manner of carrying out monitoring activities, conditions imposed upon authorised organisations conducting monitoring, as well as conditions imposed upon physical and legal entities owning or using the facilities deemed to be causing environmental pollution (Operator).

The new Law on Amendments on the Law on Environmental Protection more precisely defines obligations of the Operator, stating that an Operator may conduct monitoring by itself and is obliged to develop a monitoring plan, keep the records on monitoring activities and results, as well as to submit related reports to the competent authorities. In addition, an Operator bears a part of the costs of pollutant concentrations measurement in ambient air in the area influenced by his activities.

Special laws regarding air protection, water and soil, shall define specific obligations related to protection of different environmental media, such as emissions and other occurrences that must be monitored, measurement and sampling methodology, record keeping and data submission deadlines.

Besides the above specified monitoring obligations, the Law on Integrated Pollution Prevention and Control (IPPC), adopted in 2004, prescribes an obligation imposed upon an Operator to obtain an integrated permit. This means that the Operator shall plan measures, monitor the environmental emission. Integrated permit specifies methodology, measurement frequency, rules for data interpretation, as well as obligatory data submission to relevant authorities. This Law imposes an obligation upon the permit-issuing authorities (bodies of the state, province, as well as municipal self-government) to supervise implementation and improvement of self-monitoring executed by the Operator.

In order to obtain information on the current state of the environment, as well as to monitor qualitative and quantitative environmental changes and conduct appropriate environmental protection measures, the Law on Environmental Protection prescribes another instrument - Integral Cadastre of Polluters kept by the Serbian Environmental Protection Agency.

Based on the Law on Environmental Protection, a Rulebook on Methodology for Compiling the Integral Cadastre of Polluters has been issued in 2007. The Rulebook defines the content of the Cadastre i.e. types of data, manner of data collecting and data submission deadlines. Integral Cadastre of Polluters (ICP) contains data on POPs chemicals from all facilities listed in IPPC. This Rulebook is harmonized with Pollutant Release and Transfer Register (PRTR Protocol).

The Law on Amendments on the Law on Environmental Protection apart from changing the name of the Cadastre to a Registry of Pollution Sources also defines an obligation of local pollution

source registry keeping (developed on the basis of the same methodology), in addition to the national registry.

Registry of Pollution Sources represents a collection of systematized data and information on types, quantities, manner and locations of introducing, releasing or disposing pollutants in gaseous, liquid and solid state or releasing energy (noise, vibrations, heat, ionizing and non-ionizing radiation), all originating from point, linear or area pollution sources into the environment. The Registry is kept based on data submitted by polluters.

Based on the Registry of Pollution Sources, Serbian Environmental Protection Agency prepares a Report on the State of the Environment.

Serbian Environmental Protection Agency submits an annual Report to the European Environmental Protection Agency. In addition, the Agency should also submit data on POPs to the Secretariat in accordance with the Stockholm Convention.

Data collected on environmental protection measures must be available not only to the authorities but to the public as well. Accordingly, the Law on Environmental Protection defines an obligation imposed upon the regulatory bodies at all levels of government to regularly, timely, completely and objectively inform the public on the state of the environment, emission monitoring and pollutant concentrations in ambient air, as well as pollution-warning measures or pollution spreading which may affect the human health, all in accordance with this Law and other regulations. The public is entitled to access all registries or records containing environmental information or data. Based on this legal provision, the Cadastre of Pollution Sources is made public by providing access to the document from the official web site of the Ministry.

The above mentioned legal provisions are harmonized with the EU legislation as well as obligations defined in the Aarhus Convention on access to information, public participation in decision-making and access to justice in environmental matters (the Law on Ratification of the Aarhus Convention is adopted in May 2009).

From the above presented legal provisions it can be concluded that legislation in force by May 2009 only partially regulated monitoring related issues. However, new laws adopted in 2009, as well as related sub-legal regulations, shall considerably change current situation. In this way, monitoring of hazardous substances, including POPs, shall be regulated in a manner accordant with the provisions of EU legislation.

2.3.8.2 Air monitoring

Until May 2009 the issue of air quality was regulated by:

- Law on Environmental Protection adopted in 1992, since the provisions on air quality remained in force even after the Law on Environmental Protection in 2004 was adopted,
- Law on Environmental Protection adopted in 2004 and,
- Law on Meteorological Affairs Important to the State[36],

On the basis of these laws the whole set of sub-legal acts, as well as technical guidelines related to this fields, not harmonized with EU legislation were adopted.

Besides the above mentioned Law on Environmental Protection, adopted in 1992, which has remained in force with respect to the air quality issues, the Government has authorised development of sub-legal acts, primarily Rulebook on Emission Limit Values, Measurement Methods and Deadlines and Data Collecting[37] and Rulebook on Maximum Permissible Levels in Ambient Air, Measurement Methods, Criteria for Measurement Location Selection and Data Collecting[38]. Emission measurement

[36] Law on Meteorological Affairs Important to the State ("Official Gazette SFRY" No. 18/88 and 63/90)
[37] Rulebook on Emission Limit Values, Measurement Methods and Deadlines and Data Collecting ("Official Gazette RS" No. 30/97 and 35/97)
[38] Rulebook on Maximum Permissible Levels in Ambient Air, Measurement Methods, Criteria for Measurement Location Selection and Data Collecting ("Official Gazette RS" No. 54/92, 30/99, 19/06)

and measurement of pollutant concentrations in ambient air are carried out by authorised institutions, but only if conditions defined in the Rulebook on Conditions Imposed upon Expert Organisations Conducting Emission Measurements and Measurement of Pollutant Concentrations in Ambient Air[39] are met.

The Law on Environmental Protection, adopted in 2004, foresees systematic air quality monitoring, air pollution prevention in accordance with defined maximum permissible pollution levels, technical-technological measures aimed at emissions reduction, as well as monitoring of environmental and health impact of polluted air. Based on this Law, legal Acts defining a two-year Air Quality Monitoring Program are prepared and issued. In addition, organisations accredited to conduct specified measurements must use standardised or validated methods for pollutant measurements, and this amends the obligations previously set out in the regulations for such organisations.

Law on Air Protection was adopted in May 2009.

Law on Air Protection and related sub-legal regulations, which shall completely be harmonised with the following EU legislation: Directive 2008/50/EC, Directive 2004/107/EC, Directive 2001/80/EC, Directive 2001/81/EC Commissions Decisions 2001/839/EC and 2004/224/EC. Law on Air Protection foresees installation of national ambient air monitoring network, in accordance with recommendation presented in Directives 2008/50/EC and 2004/107/EC and introduces a concept of air quality management within different zones and agglomerations. In addition, the Law defines that an Operator is obliged to monitor environmental impact of the owned/used pollution source i.e. to provide emission monitoring either through self-monitoring, if permitted by the Ministry or using the services of accredited and authorised institutions.

Activities on installation of a National System for Automated Air Quality Monitoring in Serbia are currently being conducted. The system shall comprise 30 stationary automated measuring stations (AMS), one mobile station and one calibration laboratory, as well as all other necessary analytical tools providing high-quality air monitoring.

2.3.8.2.1 POPs related ELVs into the air

The Rulebook on Emission Limit Values, Measurement Methods and Deadlines and Data Collecting, adopted in 1997, defines **emission limit values** imposed upon different facilities, industries, as well as different pollutants. The Rulebook addresses the following POPs:

– PAH in flue gas, in a part of cancerogenous substance, as follows: benzo[a]pyrene and dibenzo[a,h]anthracene (0.1 mg/m^3, for a mass flow rate above 500 mg/h); and

– total aromatic hydrocarbons originating from the oil stored in storage facilities, distribution and trade of oil derivatives (storage, installation and petrol stations), 8 mg/m^3; and

– PCDD/PCDF emitted from waste combustion and pyrolysis facilities: 0.1 ng/m^3 (as total PCDD/F) under referent conditions.

This Rulebook does not define any emission limit values for co-incineration processes i.e. joint incineration of standard fuels (coil, heavy oil, natural gas etc.) and waste materials (tiers, waste oils, municipal waste etc.).

Emission limit values defined for PAH are not specified in the EU legislation and it is left to member states and to regulate it by their national legislation.

Directive 2000/76/EC defines emissions limit values for dioxins and furans (PCDD/PCDF), set to 0.1 ng TEQ/m^3 for incineration of more than 3 t/h of solid municipal waste, to 0.5 ng TEQ/m^3 for incineration of more than 1 t/h of medical waste and to 0.2 ng TEQ/m^3 for incineration of more than 1

[39] Rulebook on Conditions Imposed upon Expert Organisations Conducting Emission Measurements and Measurement of Pollutant Concentrations in Ambient Air ("Official Gazette RS" No. 05/02)

t/h of hazardous waste. Directive also defines emissions limit values for dioxins and furans released from waste co-incinerators which are set to 0.1 ng TEQ/Nm^3.

Since currently there are no waste incineration facilities in Serbia, new regulation should prescribe the emission limit values as defined in Directive 2000/76/EC on the incineration of waste. Emission limit values for co-incineration processes should be set in sub-legal regulations issued based on the Law on Air Protection.

Also, when drafting the new regulation on limit values, unit emissions of different congeners should be taken into consideration. In EU legislation emission of different congeners are expressed by toxicity equivalent (TEQ) compared to 2,3,7,8-TCDD, whereby WHO, 2005, TEF (toxic equivalency factor) system is used (WHO, 2005).

The Rulebook on Emission Limit Values, Measurement Methods and Deadlines and Data Collecting, Sampling Methods and emission measurement, does not define well **methods for emission measuring and sampling** but the use of nationally and internationally recognisable standards is allowed. New regulation on sampling and analysis of pollutant concentrations should be harmonised with the EU legislation where sampling and analysis are carried out in accordance with CEN (Comité Européen de Normalization), ISO (International Organization for Standardization) or relevant USA or Canadian standard. PCB and PCDD/PCDF emissions from stationary sources are monitored using CEN standards EN 1948 (1,2,3,4) standards, while ISO standards 11338-1 and 11338-2 are used for PAH monitoring.

Some EU member countries have set emission limit values for emissions released from the sector of metal industry, specifying defined limits in national regulations, which is something that should be considered to be implemented in Serbia.

2.3.8.2.2 Imission limit values in Air quality

Based on the Rulebook on Maximum Permissible Levels in Ambient Air, Measurement Methods, Criteria for Measurement Location Selection and Data Collecting, adopted in 1992, concentrations of cancerogenous substances, including PAH and dioxin (2,3,7,8-tetrachlorodibenzodioxin), are regularly measured in ambient air. **Maximal annual level** in ambient air is defined for dibenzo[a]pyren and is set to 1 ng/m^3. The specified limit value is in accordance with the corresponding value defined in Directive 2004/107/EC, which states that the target value of 1 ng/m^3, set for emissions of dibenzo[a]pyren, is to be reached until December 31, 2012.

The specified Rulebook recommends the use of gas chromatographic method for measurement of PAH concentrations in ambient air. Directive 2004/107/EC defines ISO 12884 as a referent method for measuring PAH concentrations in ambient air. However, the use of national standards is also permitted.

In Serbia, maximal permissible levels of PCB in ambient air are not defined. EU does not prescribe maximal permissible levels of PCB in ambient air, but allows member states to regulate the issue by appropriate provisions defined in their national legislation.

However, improvements are expected in this area, since Law on Air Protection more precisely defines control of the air quality through establishment of the zones and agglomerations, evaluation of the air quality in such zones and agglomerations, pollutants for which the evaluation of the air quality is carried out as well as monitoring of the air quality, and further monitoring of the air quality shall be regulated by the Rulebook which will be harmonised with the EU legislation.

2.3.8.3 Water monitoring

Protection of water resources in the Republic of Serbia is regulated by the Law on Environmental Protection, Law on Waters [40] and Law on Amendments on the Law on Environmental Protection.

The Law on Waters regulates protection of water resources from the effects caused by hazardous substances, including POPs (in surface and groundwater, as well as in waters being treated in order to obtain potable water and in accordance with classification and categorisation of water streams). Rulebook on Hazardous Substances in Waters[41] defines hazardous substances which are prohibited from being directly or indirectly released to waters, as well as maximum permissible levels of hazardous substances in waters (including POPs). Based on this Law, Regulation on the systematic water quality control program in the Republic of Serbia is issued annually which is carried out by the Hydrometeorological Institute of the Republic of Serbia. The Regulation defines locations (profiles) where water quality is to be monitored, as well as type, scope and frequency of the measurement.

In the Law on Environmental Protection adopted in 2004 and Law on Amendments on the Law on Environmental Protection adopted in 2009, basis for water protection are given by setting out the measures for water protection. It is stipulated that wastewaters are allowed to be released only if their appropriate treatment is provided, conducted in an appropriate manner resulting in final water quality which do not impose any danger to natural resources, do not prevent water quality and quantity rehabilitation and do not decrease a possibility of later water use for multiple purposes. Water protection measures should prevent or limit release of hazardous, waste and other harmful substances into water, surface and groundwater quality monitoring and analysis, as well as wastewater quality monitoring and their treatment.

Not all aspects of wastewater release control are regulated by national legislation. Although the Law on Waters defines obligations related to measurements of released wastewater quantities and submission of obtained data to relevant authorities, it does not provide a legal framework for prescribing maximal permissible values of wastewater parameters at points of their release into the receivers. The Law on Environmental Protection foresees water quality standard establishing with respect to emissions limit values and maximum permissible concentrations of pollutant in waters. However, sub-legal act which would regulate specified issues has not been prepared up to date. Still, as mentioned earlier, the new Law on Amendments on the Law on Environmental Protection states that the previously postulated concept specifying that all standard maximum permissible values are to be defined in one sub-legal regulation is being abandoned. Instead of that, it is left for the new Law on Waters to give basis for adoption of the new sub-legal regulation.

Existing legal and sub-legal regulations and planning documentation addressing the issue of water protection in the Republic of Serbia is far behind the corresponding regulations of the EU member countries. In addition, current Serbian legislation does not precisely define specific jurisdictions of state institutions and institutions of municipal self-government with respect to water management.

New Law on Waters and related sub-legal regulations provide harmonization of national legislation with provisions of Directive 2000/60/EC, which regulate the field of water use and management in the EU, and partially with water-related provisions of other Directives (Directive 91/271/EEC, Directive 2007/60/EEC, Directive 98/83/EC, Directive 2006/7/EC), Directive 80/68/EEC (in force until 2013) and Directive 2006/118/EEC.

In accordance with the National Plan for Accession to the EU [14], the above specified Law must be adopted until 2009 at the latest, while complete harmonisation of national legislation with EU legislations shall be provided until 2012, by the means of appropriate sub-legal regulations which shall be adopted.

[40] Law on Waters ("Official Gazette RS" No. 46/91, 53/93, 67/93, 48/94 and 54/96)
[41] Rulebook on Hazardous Substances in Waters ("Official Gazette RS" No. 31/82)

2.3.8.3.1 Maximum permissible levels of POPs in water

Based on the Rulebook on Hazardous Substances in Waters, adopted in 1982, surface waters have been classified in four categories based on the content of hazardous substances. Maximal permissible concentrations of POPs in waters, as defined in the Rulebook, are shown in Table 2.3.8.3.1.a.

Table 2.3.8.3.1.a: Maximum permissible POPs concentrations in surface waters

Hazardous substance	**Class I and II**	**Class III and IV**
	mg/l	
Aldrin	0,017	0,02
Dieldrin	0,017	0,02
DDT	0,04	0,1
Endrin	0,001	0,01
Lindane	0,056	-
Toxaphene	0,005	-
Chlordane	0,003	-
Polychlorinated biphenyls	-	-
Polycyclic aromatic hydrocarbons (PAH): Fluoranthene +3,4-benzofluoranthene +11,12 benzofluoranthene +3, benzopyrene +1 benzoperylene + Indeno[1,2,3- cd]pyrene	0,002	-

On the other hand, Directive 2000/60/EC recommend implementation of the Environmental Quality Standard (EQS) in the EU for high-priority substances and other polluting substances in land waters and other surface waters. Maximal permissible POPs levels with respect to releases to waters are defined in the national legislation of the EU member countries. Directive 86/280/EEC and specific provisions of Directive 88/374/EEC, which addresses the issue of hazardous substance releases, define maximum permissible levels of hazardous substances in wastewaters resulting from production of those or other chemicals.

Limit value of pollutants in waters prescribed in national and EU legislation differ significantly. Referent methods used for pollutant concentration measurement are not properly defined in sub-legal regulations of the Republic of Serbia, although some general analytical techniques are recommended.

As already mentioned the new Law on Waters shall create the basis for this area to be harmonised with the EU legislation.

2.3.8.4 Soil monitoring

Soil monitoring shall be regulated by the new Law on Amendments on the Law on Environmental Protection, as well as new Law on Agricultural Soil[42].

The Law on Amendments on the Law on Environmental Protection provides a basis for soil protection program development and authorises the Government to develop and issue a Systematic Soil Control Programme, monitoring of the indicators for evaluation of the soil degradation risk as well as define methodology for preparation of soil remediation program aimed at soil contamination clean-up and rehabilitation.

On the other hand, Law on Agricultural Soil prescribes that all analyses of agricultural soil and irrigation waters, aimed to determine containing concentrations of dangerous and hazardous substances, are carried out in accordance with a programme issued by the Minister of Agriculture. Based on this Law, appropriate sub-legal regulations, more precisely defining permissible quantities of dangerous and hazardous substances in soil and irrigation waters and methods used for the analysis as well as conditions which and economic operator i.e. enterprise or any other legal entity

[42] Law on Agricultural Soil ("Official Gazette RS" No 62/06)

must fulfil regarding technical and professional capacities for analyses of hazardous substances in agricultural soil and irrigation waters, shall be adopted.

Rulebook on Permissible Quantities of Dangerous and Hazardous Substances in Soil and Irrigation Waters and Methods Used for the Analysis[43], although currently in force in the Republic of Serbia, does not define maximal permissible and/or limit values of POPs pesticides, PCB and PCDD/PCDF. As defined in the Rulebook on the Methods of Organic Plant Production and Collection of Wild Fruits and Medicinal Herbs Representing Organic Agricultural Products[44], maximum permissible level of PAH in agricultural soil equal 1 mg/kg. The main problem in defining maximum permissible levels is that these values are defined based on the characteristics and intended soil use.

During development of new sub-legal regulations for the purpose of defining parameters to be used for soil classification, substances whose presence in the soil may impact human health, food safety, soil fertility and impose environmental risks (biodiversity in soil, groundwater and surface water) should be taken into account, POPs being one of them.

There are no regulations defining maximum permissible POPs concentrations in sediment. These regulations should be developed and adopted.

In 2006 the Republic of Serbia has joined a Joint Research Centre (JRC) of the European Commission, established for the purpose of Multiscale European Soil Information System (MEUSIS) development, resulting in the only harmonized coverage of digital soil information for Europe.

The basis for the implementation of the above Programme in the EU represents the EU Strategy for Soil Protection, as well as Recommendation of the European Commissions from 2006 and a report and a guide prepared by the Workgroup on Soil Database of the European Commission. In addition, framework directive defines an obligation imposed upon all member countries to adopt a methodology to be used for determining concentrations of hazardous substances in soil.

Until the Draft Framework Directive on Soil Protection has been developed there was no special regulation addressing the issue of soil protection in the EU. Germany and Holland have adopted special regulations on soil protection, while in other EU countries the issue of soil protection regulation is integrated in other laws.

There is no uniform stand on the quality of soil protection among the EU countries. For that reason it is necessary to harmonize soil classification system in Serbia with legislation of one of the EU countries.

At the moment there are no standard method for measurement of PAH, PCB and PCDD/PCDF concentrations in the soil, sludge and biological waste in the EU. However, a project titled HORIZONTAL has been initiated, with the aim to develop horizontal and harmonised European standards in the field of sludge, soil and treated biowaste. Only institutions accredited in accordance with DIN ISO 17025/2006 may provide data for this type of monitoring. All accredited laboratories in the Republic of Serbia fulfil the criteria defined.

2.3.8.5. Biota monitoring

New Law on Chemicals defines obligation of **systematic monitoring of placing on the market and use of chemicals** and their metabolites, as well as their pathways in the environment and living organisms, for the purpose of monitoring of the risk which such chemicals represent on human health and environment. Systematic monitoring shall be conducted based on the projects developed by the Chemicals Agency.

[43] Rulebook on Permissible Quantities of Dangerous and Hazardous Substances in Soil and Irrigation Waters and Methods Used for the Analysis ("Official Gazette RS" No. 23/94)

[44] Rulebook on the Methods of Organic Plant Production and Collection of Wild Fruits and Medicinal Herbs Representing Organic Agricultural Products ("Official Gazette SRY" No. 51/02)

Systems for POPs monitoring in biological samples have not been developed in the Republic of Serbia, although there is enough capacities and expert knowledge to provide monitoring of POPs effects on bioindicator species.

Although in the Program of Air Quality Monitoring in the Republic of Serbia, issued every 2 years, it is stated that some of the programme goals include estimation of polluted air impact on human health, climate and forest ecosystems, due to the insufficient funding the program is not carried out in the originally planned manner.

Hence, data on POPs effects on the biota in the Republic of Serbia are sporadic and mainly provided from the literature, since organized systematic monitoring of POPs effects on the biota have not been conducted. Sporadic investigation on fish species in the Danube have indicated possible POPs impacts on vital functions of considered species. However, effects of other environmental factors cannot be neglected.

2.3.8.6 Food monitoring

Until Jun 2009 in Serbia, some sort of systematic food quality control is carried out in accordance with Article 21, paragraph 2 of the Law on Sanitary Control of Food and Articles of Common Use[45]. At least 15 samples of food and articles of common use from their production and trade are taken per each thousands of people for the purpose of their systematic laboratory analysis i.e. systematic safety control.

In Serbia, food safety control is carried out in accordance with the Rulebook on the Quantities of Pesticides, Metals, Metalloids and Other Poisonous Substances, Chemotherapeutics, Anabolics and Other Substances Which Can Be Found in Food[46]. The Rulebook defines maximal permissible concentrations of POPs pesticides (contain a list of pesticides which is not updated), PAH and PCB for different food categories, but does not define maximal levels of dioxins and furans. Maximum permissible concentration is defined only for benzo[a]pyrene. In addition, norms for total PCB are set as well.

Rulebook on Maximum Quantities of Harmful Substances in Animal Feed [47] defines maximum permissible concentrations of aldrin and dieldrin (calculated as total dieldrin), DDT and derivatives (calculated as total DDT), endrin, heptachlor and heptachlor epoxide (calculated as heptachlor epoxide), total HCH, HCH (alpha + beta + delta), lindane (gamma HCH).

It can be concluded that until recently laws on human food safety and safety of animal feed in the Republic of Serbia were out dated and not harmonized with international regulations and standards or EU legislation, and as such they did not provide proper monitoring of POPs.

New Law on Food Safety adopted in Jun 2009 defines measures of systematic control of chemical contaminants in food and animal feed, monitoring conditions and methods, control methods, conditions and ways of food sampling and sample conservation, sample record keeping, as well as methods to be used for laboratory analysis of specific chemical contaminants. Standard sampling and sample handling procedure shall be regulated by new sub-legal regulations related to methods used for analysis of human food and animal feed samples. Law on Food Safety, shall provide prerequisites for strategic management in the field considered, providing better organisation i.e. precise division of jurisdictions and coordinated actions of inspection bodies.

In addition, the Law on Plant Protection Products prescribes mandatory post-registration control of plant protection products. Such control includes analysis of pesticide residues in plants, plant products, certain facilities, food of plant origin, animal feed and environment and especially in surface waters, groundwater, irrigation waters and soil. Post-registration control is conducted based on the yearly program issued by the Minister of Agriculture.

Sub legal acts to this Law shall be harmonised with the following EU legislation:

[45]Law on Sanitary Control of Food and Articles of Common Use ("Official Gazette of FRY" No. 53/91, 24/94, 37/02, "Official Gazette of RS" No. 79/05 and 101/05)

[46] Rulebook on the Quantities of Pesticides, Metals, Metalloids and Other Poisonous Substances, Chemotherapeutics, Anabolics and Other Substances Which Can Be Found in Food ("Official Gazette of FRY", No. 5/92, 11/92 and 32/02)

[47] Rulebook on Maximum Quantities of Harmful Substances in Animal Feed ("Official Gazette of SFRY" No. 2/90)

1. In EU, maximum permissible levels of PCB, PAH and PCDD/PCDF in food are defined in Directive 2002/32/EC and Directive 2006/13/EC and Regulation 199/2006 and Regulation 1881/2006 of the European Commission.
2. Methods to be used for sampling and analysis of benzo[a]pyrene are defined by Commission Regulation (EC) No. 333/2007/EC.
3. Methods to be used for food sampling and analysis of dioxin levels in food are prescribed by Commission Regulation (EC) No. 1883/2006.
4. Maximum permissible residues of prohibited pesticides are defined by Commission Regulations (EC) No. 149/2008 and Regulation (EC) No. 839/2008.
5. Methods to be used for measurement of pesticide residues in food are defined in the EU standards EN 12393-1, EN 12393-2, EN 12393-3, while the corresponding sampling methods are specified in Directive 2002/63/EC.

2.3.8.7 Waste monitoring

Waste classification and categorisation in the Republic of Serbia, before the adoption of the new Law on Waste Management were carried out in accordance with the following:

- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal;
- Law on Waste Material Handling[48];
- Rulebook on Documentation to be Submitted When Applying for a Permit Allowing Waste Import, Export and Transit[49];
- Rulebook on Handling Wastes Having the Properties of Dangerous Substances[50];
- Rulebook on Conditions and Methods for Sorting, Packing and Storing Secondary Raw Materials[51].

According to the previously in force Law on Handling Waste Material, characterization of waste consisting of, containing or contaminated with POPs and waste classification aimed at determining waste character was performed only by authorised and accredited laboratories. Waste classification for the purpose of determining category and use value of waste was performed by the Recycling Agency of the Republic of Serbia.

Based on the provisions stated in the Rulebook on Conditions Imposed upon Organisations Conducting Waste Analysis[52], there are six laboratories in the Republic of Serbia authorised to conduct waste analysis (until April 1, 2009).

Six laboratories in the Republic of Serbia are accredited to carry out analysis of POPs concentrations in waste. This laboratories use EPA methods for analysis pesticides in waste, but also some EPA methods and EN-15308 for PCB and EPA and EN-15527 for PAH. Only one accredited laboratory carries out analysis of PCDD/F content (using the appropriate EPA method).

The following methods are used for POPs-related analyses:

– for pesticides: Method of the American Environmental Protection Agency (US EPA) method Publication SW – 846, Test Methods for Evaluation Solid waste, Physical/Chemical Methods, EPA 8081, 8270;

– for PCB in solid waste: EN-15308: 2008 – Characterization of Waste – Determination of Selected Polychlorinated Biphenyls (PCB) in Solid Waste by Using Capillary Gas Chromatography with Electron Capture or Mass Spectrometric Detection (the method is currently being translated into Serbian and prepared to be adopted by the Institute for Standardization of the Republic of Serbia and declared as Serbian standard, March

[48] Law on Waste Material Handling ("Official Gazette of RS" No. 25/96)
[49] Law on Documentation to be Submitted When Applying for a Permit Allowing Waste Import, Export and Transit ("Official Gazette of FRY" No. 69/99)
[50] Law on Handling Wastes Having the Properties of Dangerous Substances ("Official Gazette of RS" No. 12/95)
[51] Regulation on Conditions and Methods for Sorting, Packing and Storing Secondary Raw Materials ("Official Gazette of RS", No. 55/01)
[52] Rulebook on Conditions Imposed upon Organisations Conducting Waste Analysis ("Official Gazette RS"No. 53/06)

2009), EPA method – Publication SW – 846, Test Methods for Evaluation Solid waste, Physical/Chemical Methods, EPA 8082, 8270;

– for PCB in liquid waste: EN 12766-1:2000, Methods of Test for Petroleum and its Products. Petroleum products and Used Oils. Determination of PCB and Related Products. Separation and Determination of Selected PCB Congeners by Gas Chromatography (GC) Using an Electron Capture Detector (ECD), EN 12766-2:2001, Methods of Test for Petroleum and Its Products. Petroleum Products and Used Oils. Determination of PCB and Related Products. Calculation of Polychlorinated Biphenyl (PCB) Content and EN 61619:1997, Insulation Liquids. Contamination by Polychlorinated Biphenyls (PCB). Method of Determination by Capillary Column Gas Chromatography;

– for PAH in waste: EN-15527: 2008, Characterization of Waste – Determination of Polycyclic Aromatic Hydrocarbons (PAH) in Waste Using Gas Chromatography Mass Spectrometry (GC/MS) (the method is currently being translated into Serbian and prepared to be adopted by the Institute for Standardization of the Republic of Serbia and declared as Serbian standard, March 2009), EPA method – Publication SW – 846, Test Methods for Evaluation Solid waste, Physical/Chemical Methods.

– Out of all accredited laboratories only one is accredited for determining PCDD/PCDF concentration. The laboratory uses the EPA method, Publication SW – 846, Test Methods for Evaluation Solid Waste, Physical/Chemical Methods: Method 8290A Revision 1, December 1998, Polychlorinated Dibenzo–p–Dioxins and Polychlorinated Dibenzofurans by High Resolution Gas Chromatography/Low Resolution Mass Spectrometry, measurement range (1-)5-1000 ng/kg. There are no laboratories in Serbia accredited for determining PCDD/PCDF concentrations by the means of High Resolution Gas Chromatography/ Mass Spectrometry. It is necessary to consider possibilities for equipping at least one laboratory for carrying out this type of analysis. It is also necessary to develop and adopt Serbian standards for specified investigation methods.

– PCB concentration measurements in the EU are carried out in accordance with the methods EN 12766-1 and EN 12766-2 for oil products and EN 61619 for insulation fluids. It is necessary to develop Serbian standards for the above specified and other methods necessary for POPs waste analysis.

New Waste Management Law, adopted in May 2009, regulates special waste flows, specially defining POPs waste as a waste consisting of, containing or contaminated by persistent organic pollutants (POPs). The owner of POPs waste is obliged to report to the ministry and submit data on the type, quantity and character of POPs waste. The Law authorises development of sub-legal regulation which would define a list of POPs chemicals, manner of conducting POPs waste management and maximum permissible POPs concentrations related to disposal of waste containing or contaminated with POPs. The Law also specifies that the owner of POPs waste i.e. an operator is obliged to properly classify waste including POPs waste in accordance with the regulation on waste classification, as well as for the purpose of establishing of the properties and dangerous properties of waste, to carry out analysis of potentially harmful waste or waste known to cause harmful effects. Such analysis must be performed by professional institution i.e. laboratory accredited and authorised by the ministry responsible for environmental protection.

Owner of the POPs waste is obliged to declare to the Ministry type and quantity of POPs waste.

Based on the Law on Waste Management, an person carrying out collection, treatment, decontamination or disposal of PCB-containing waste is obliged to keep a record on the collected, treated or disposed waste quantities, as well as to submit all the data to the Serbian Environmental Protection Agency which keeps a registry of PCB-containing products in use and PCB waste.

According to this Law the owner of PCB-containing equipment in use or equipment possibly contaminated with PCB, is obliged to examine a PCB content using the services of accredited laboratory authorised to conduct waste analysis. However, until now there were no legal

obligations so only few owners of PCB-containing equipment and PCB waste conducted analyse of fluids and waste.

In addition, this Law gives authorisation for adoption of Rulebook which would introduce limits on maximum permissible POPs concentrations defined in related EU regulations: EU Directive 850/2004/EC, amended by Directive 1195/2006/EC, as well as Directive 172/2007/EC provides maximum permissible POPs concentrations in waste, as well as maximum permissible POPs concentrations allowing permanent storage of POPs waste.

This Law shall regulate the movement of hazardous waste in such manner that such waste must be accompanied by the Document on Waste Movement.

If transboundary movement of waste consisting of, containing or contaminated with POPs occurs, provisions of Basel Conventions shall apply. Information on transboundary movement of specified POPs waste and exported waste quantities must be provided in the annual report on transboundary movement of waste, regularly submitted to the Basel Convention Secretariat. The report must be submitted by ministry responsible for environmental protection - Focal Point of the Basel Convention - in cooperation and data occurred from authorities responsible for implementation of the Basel Convention on the basis of data obtained from competent authorities and organizations.

2.3.8.8 Human exposure and related health effects

2.3.8.8.1 Human exposure

General population is exposed to POPs mainly through food, specially fish, poultry, meat and dairy consummation. The said exposure results from POPs ability to bioaccumulate and biomagnify in aquatic and land food chains. In case of some POPs professional exposure is also of importance, with recorded cases of accidental poisoning resulting from exposure to relatively high POPs levels. Luckily, use of majority POPs compounds has been prohibited or limited for decades, enabling continuous reduction of POPs concentrations in the environment. However, in many countries, including the Republic of Serbia, possible exposure of workers involved in waste management is currently considered to be a significant professional risk.

2.3.8.8.2 POPs levels in human tissues – breast milk

During 2003 analysis of breast milk samples provide by 18 breast-feeding women from the area of Novi Sad, Autonomous Province of Vojvodina, was conducted. Analysis was performed for seven EPA PCB congeners (28, 52, 101, 118, 138, 153, and 180). Total determined content of PCB congeners equalled 0.4-14.31 ng/g, with an average value of 3.26 ng/g.

Concentrations determined for individual congeners were as follows:

PCB 28: 0.04–0.37; PCB 52: 0.04–0.44; PCB 101: 0.04–1.21; PCB 118: 0.05–0.62; PCB 138: 0.13–4.61; PCB 153: 0.13–4.81; PCB 180: 0.10–3.07 ng/g of the moist sample.

Correlation between the age of the mothers and recorded PCB concentration was not determined. In addition, comparison of the above results with the results obtained during investigation conducted in 1993 had indicated that PCB concentrations in breast milk had not increased.

Effects on human health

Investigations of POPs levels in human tissues and POPs-related effects on human health have not been carried out in the Republic of Serbia. Effects and risks induced by certain uPOPs are shown in the Annex 3, Table 3.

Tolerable daily intake is defined in recommendations issued by different international institutions, as described below.

– **Recommendation of the World Health Organisation – WHO.** Using the reliability factor of 10 for the range of lowest observable adverse effects levels (LOAEL) from 14 to 37 pg TCDD kg^{-1} tm day^{-1}, a tolerable daily intake (TDI) of 1-4 pg WHO-TEQ kg^{-1} tm is defined. This value is used for dioxins and furans. It is stated that upper limit (4 pg WHO-TEQ kg^{-1} tm) should represent a maximal acceptable daily intake and that the final goal should be to reduced tolerable daily intake below 1 pg WHO-TEQ kg^{-1} tm day^{-1}.

– **Recommendation of the Scientific Committee for Food (SCF).** Recommendation issued in 2000, states that lower limit i.e. 1 pg WHO-TEQ kg^{-1} tm should only be accepted as a temporary limit value. Temporary tolerable weekly (t-TWI) intake of 7 pg WHO-TEQ kg^{-1} tm has also been defined. Calculation was based on weekly, instead of daily intake, since it was estimated that such approach was more adequate to be used for chemicals with relatively long half-life in human organism. Only one year later, the Committee has revised the above specified limit values and new tolerable weekly intake of 14 pg WHO-TEQ kg^{-1} tm has been defined.

– **Recommendation of the Joint FAO/WHO Expert Committee on Food Additives (JACFA).** Temporarily tolerable monthly intake of 70 pg kg^{-1} has been recommended. The Committee has also concluded that specified limit should be applied for PCDD, PCDF and coplanar PCB expressed through appropriate TEFs (Toxic Equivalent Factors).

– **Recommendation of the Committee on Toxicity of the UK (COT).** The Committee has recommended TDI of 2 pg kg^{-1} tm day^{-1}. Recommendation has been based on assumed TCDD bioavailability of 0.5 and half-life of 7.5 years.

– **Recommendation of the American Environmental Protection Agency (EPA).** Based on the studies of cancer causing effects, it was estimated that the maximal permissible intake with respect to cancer-related risk should be set to 1 x 10^{-3}/ pg TCDD kg^{-1} tm day^{-1}.

– **Recommendation of the Agency for Toxic Substances and Disease Registry (ATSDR).** The Agency has recommended minimal risk level (MRL) related to chronic peroral exposure of 1 pg kg^{-1} tm day^{-1} (for TCDD or total TEQ). This value has been established based on a 16-month long study in *Rhesus* monkeys and their offspring exposed to TCDD through food. Effects of such TCDD exposure on behaviour and cognitive functions have been monitored and recorded.

2.3.8.9 Integral Cadastre of Polluters (Registry of Pollution Sources)

Integral Cadastre of Polluters represents a registry of human activities deemed to have negative impact on the environment of certain area. The Cadastre represents an integral part of Environmental Information System of the Republic of Serbia managed by the Environmental Protection Agency.

The Cadastre contains data on sources, types, quantities, ways and locations of pollutant releases to air and water, as well as quantities, types, composition and manner of waste treatment and disposal.

Integral Cadastre of Polluters is, in accordance with the provisions of the Rulebook on Methodology for Compiling the Integral Cadastre of Polluters with all annexes, codes and forms The Rulebook is harmonized with the Pollutant Release and Transfer Register (PRTR Protocol) to the Aarhus Convention.

This Cadastre presents good basis for further development of the Register of Environmental Pollution Sources.

2.3.8.9.1 Information System of the Integral Cadastre of Polluters

Following the adoption of the Rulebook on Methodology for Compiling the Integral Cadastre of Polluters, the Serbian Environmental Protection Agency has started working on development of appropriate information system. Basic principles of data base formation have been defined, taking into account the type of data to be collected. Based on the relevant technical and organisational characteristics, the main goals of the considered information system are defined as follows:

- integral access to pollutant emission data through a centralised open access database;
- automated exchange of electronic data and information;
- access to data, information and reports using the Internet technologies;
- data protection from unauthorised access;
- basis for estimation of environmental pollution caused by industrial facilities;
- data base as a support for decision making.

The Law on Environmental Protection provided basis for development of Integral Cadastre of Polluters. However, significant gaps exist which may slow down the process of registry compiling and keeping. The most important include:

– Insufficient capacities in the Serbian Environmental Protection Agency: a group for Integral Cadastre of Polluters compiling has only 3 employees; Lack of experts is more than evident, specially comparing to other countries where the number of employees engaged in the considered activities ranges from 15 to 20;

– Absence of all necessary sub-legal regulations;

– Lack of standard methods for analytical analysis of waste gases, wastewaters and solid waste;

– Slow process of laboratory accreditation in accordance with ISO 17025;

– Insufficient capacities in companies engaged in result reporting.

2.3.8.9.2 Future activities related to development of information system of the Integral Cadastre of Polluters

A series of activities have been planned to be carried out in the upcoming period, aimed at compilation of Integral Cadastre of Polluters (ICP), as shown in Figure 2.3.8.9.2.a.

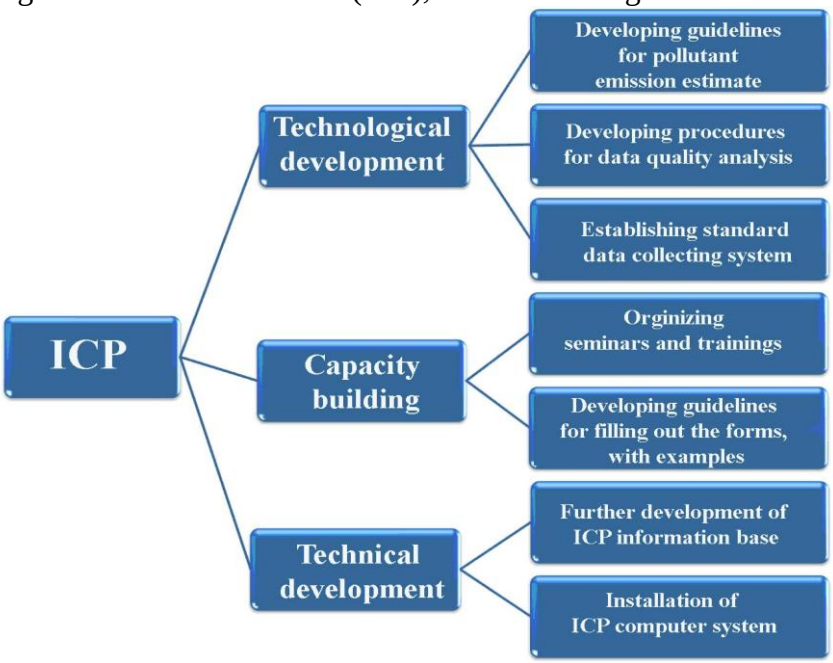


Figure 2.3.8.9.2.a.: Future activities planned

Besides the basic current activity – data collecting, the most intense activities shall be related to development of computer basis of the Cadastre, data quality estimate and capacity building among Operators and the public.

Besides conceptually, the Republic of Serbia has time-coordinated these activities with other European countries, since starting from 2007 reporting to E-PRTR shall replace reporting to European Pollutant Emission Register (EPER).

2.3.8.10 Global monitoring plan – recommendations

Article 16 of the Stockholm Convention states that the Conference of the Parties shall, at its first meeting, initiate the establishment of arrangements to provide itself with comparable monitoring data on the presence of the chemicals listed in Annexes A, B and C, as well as their regional and global environmental transport. In order for submitted analytical data on POPs detected in environmental media to be comparable, UNEP has developed a Global Monitoring Plan of Persistent Organic Pollutants. The Plan is a collection of instructions and recommendations for analytical procedures and data processing. The main goal of the Plan is to provide harmonized and organised framework for collection of comparable data on POPs monitoring, identification of POPs related trends, as well as to provide information on regional and global environmental transport, which is one of the Convention's goals. Another goal is to conduct monitoring in a manner which would provide the most efficient use of funds while obtaining maximal results.

It is also recommended to implement principles such as selection of specific geographic and topological positions to carry out the measurements, conducting at least a minimum number of measurements and repeating the measurements in order to identify the trends, all using the standard sampling procedures and appropriate analytical tool. Having in mind the related scope and the costs, it is necessary to make good and cost effective monitoring plan. POPs monitoring plan, based on the Report on the State of the Environment, include expert teams assembling, directly responsible for monitoring plan development. Organisation and implementation of the plan would be carried out in coordination with, apart from the immediate plan executors, supervisory team, consisting from experts and member of the responsible ministry and/or members of municipal self-government. Laboratories and institutions selected to conduct analysis should not be changed during implementation of the monitoring program. Evaluation and interpretation of measurement results are recommended to be carried out using the geographic information system and later modelled and statistically processes in order to determine trends in the change of POPs content in environmental matrices and estimate human and environmental exposure accordingly. It is recommended to conduct sample analysis once per season each year, except for human samples, to process enough samples taken at the same measurement point (not wide area with small number of measurement points) and to provide their proper conservation.

Conference of the Parties to the Stockholm Convention has, at its second meeting, decided that the level of POPs for the first evaluation should be determined in the following matrices: ambient air, breast milk and human blood.

As a part of the RECETOX project, the Republic of Serbia has participated in two projects of auto-sampler (automatic samplers) installation used for soil and air monitoring.

Air monitoring conducted in 2006 by the means of passive air samplers (PAS), had been organised within the monitoring programs in Central and East Europe carried out by the Regional POPs Centre of Czech Republic and Research Centre for Environmental Chemistry and Ecotoxicology RECETOX, Masaryk University, Brno, Czech Republic. Results obtained in cooperation with local institutions confirmed the findings of earlier studies on POPs concentrations in ambient air.

2.3.8.11 Conclusion

Present data collecting and monitoring system is not appropriate and does not provide for decision makers, the public and international communities to be timely informed on POPs presence in the environment and biological samples.

Adopted laws do not adequately or sufficiently define monitoring-related issues. Newly adopted regulations provide good basis needed to address this issue, i.e. to regulate POPs concentration measurement in different environmental media, food or biological matrices. However, it is necessary to adopt new bylaws on the basis of the aforementioned regulations in order to provide fully developed system.

In addition, it is necessary to further develop the ICP, paying special attention to POP-related data finding and collecting. In the same time, capacity building activities should be carried out within the Environmental Protection Agency, specially having in mind extensive work on the Cadastre compiling that have been commenced. It is also necessary to organise training of personnel employed in inspection bodies conducting review of collected data.

It is necessary to improve analysis of environmental and biological samples (samples of animal and human origin), primarily by improving the knowledge and techniques used by the experts carrying out laboratory analysis and procuring appropriate equipment, especially with respect to measurements of uPOPs. It is also necessary to determine an annual scope of measurement of uPOPs and improve laboratory work accordingly. In order to check emission factors of uPOPs emitted from specific facilities it is necessary to envisage a procurement of equipment to be used for long-term sampling. In order to obtain uniform data it is very important to establish a mandatory procedure for comparison of laboratory data with data provided by regionally and internationally recognized laboratories. The said may also be accomplished through the process of standardisation and accreditation.

2.3.9 Information and education levels of each target group, systems for target group informing, mechanisms for information exchange with other members of the Convention

2.3.9.1 Capacities of the state bodies

Ministry in charge of environmental protection is divided into special organisational units i.e. departments based on the scope of authority, i.e. department for chemical management, natural resources protection (water, air, and soil), waste management and IPPC, etc.

It is necessary to note that there is legal basis for establishment of the Chemicals Agency, which will take over professional, regulatory and development activities related to chemicals management from the Ministry.

Civil servants employed in this Ministry, as well as those who will move to the Chemicals Agency are experts in different areas of expertise, such as chemistry, medicine, pharmacy, biology, law, mechanical engineering, physics, agriculture, geology and environment.

In addition, civil servants employed in the institution have completed a range of trainings, national as well as international, related to implementation of national laws and EU regulations, as well as preparation for their implementation after harmonisation of national with the legislation of the EU.

However, civil servants still do not have enough professional knowledge in certain fields, particularly having in mind that in 2001 number of employees has dramatically increased, as well as that many regulations require harmonisation with EU legislation. That is why continuous work on capacity building in state organisations is required, especially future employees of the Chemicals Agency. The Agency's staff should be particularly trained in the fields of environmental and health risk assessment related to the impacts of different chemicals, as well as their classification and labelling, regulatory toxicology and socio-economic analysis that enable decision making process, while other civil servants should be trained in the areas of air and water protection, waste management, specially PCB and obsolete pesticides. Such improved expert knowledge would provide active participation of state employees in future activities of European Commission and other EU bodies, i.e. decision makers of the future policies on chemical management, waste management, air and water protection etc. In addition, the number of employees should be increased in accordance with the National Plan for Accession to the EU so as to provide quality in implementation of new regulations.

Constantly organised trainings of environmental inspectors are necessary in order to provide expert and efficient supervision over implementation of new laws, as well as to help economic operators to fulfil their legal obligation in the filed of environmental protection.

Education of the civil servants in the ministry in charge of environmental protection, but also in other ministries which are competent for certain activities related to chemicals management, as well as of the Chemicals Agency staff would be organised in the same way as in other transition countries i.e. mainly though the EU funded projects. It is essential that education *on* POPs management is introduced in the projects related to capacity building of entire workforce about the environmental protection and environmental impacts of POPs.

National Programme for the Accession to the European Union [14] represents an important document contributing to determination of jurisdiction of certain organisational units within the ministries, ministries and agencies, as well as between different. The document also determines directions of institutional development with respect to obligations resulting from harmonisation of national legislation with EU legislation in the field of environmental protection.

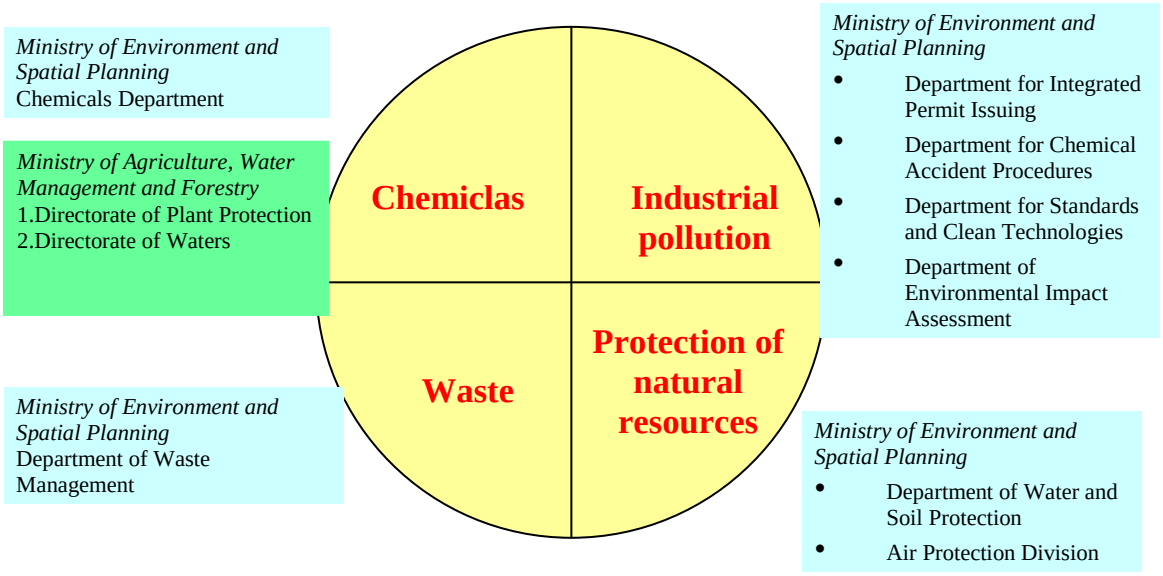


Figure 2.3.9.1.a.: Institutional framework for development and implementation of NIP

2.3.9.2 Consideration of environmental issues at different education levels

2.3.9.2.1 Primary education

Syllabis and textbooks for the courses taught from the first to the sixth grade in reformed elementary education contain some basic educational goals and principles of environmental protection and sustainable development. Goals and scope of education in the field of environmental protection and sustainable development are incorporated in the programmes of the following subjects: The World Around Us (1st and 2nd grade) and Nature and Society (3rd and 4th grade), as well as Civil Society (1st - 6th grade) and Health Education (1st and 2nd grade). In addition, the above specified topics are also present in the curriculum and learning programme of the subject Biology (5th - 8th grade). Elements of sustainable development are addressed in the 4th grade, in the subject Nature and Society.

Starting from the 5th grade of elementary school environmental issues are considered within the subject Technology and Computer Science, as well as in the Civil Education. However, subjects such as Mother Tongue, Mathematics and History do not addresses issues related to environmental protection and sustainable development.

Starting from the academic 2003/04, a new optional subject has been added to the program of primary education. The subject is titled Guardians of Nature and is intended for children in 1st through 6th grade. It is planned for this subject to be introduced into the programme of the 7th grade.

2.3.9.2.2 Secondary education

Environmental protection and sustainable development related education is not adequately implemented in the Secondary Education Curriculum i.e. programmes studied in vocational high schools and gymnasiums. Environmental protection is addressed in some of the courses lectured in Gymnasiums and vocational high schools: Biology, Chemistry, Ecology and Environmental Protection, Disinfection and Deratisation etc.

In Gymnasiums, environmental protection is partly implemented in the scopes of the following courses: Biology, Chemistry, Geography, Physics (all four years), as well as Philosophy, Sociology, Constitution and Civil Education.

Analysis show that most of the programmes offered in vocational high schools include topics "ecology and environmental protection" at the 3rd year level. Some vocational high schools address environmental issues in more complex manner.

Some vocational high schools have formed experimental classes which are being educated in accordance with innovative programme, paying more attention to environmental issues.

2.3.9.2.3 University

From 24 Faculties of four Universities in Serbia (Belgrade, Niš, Novi Sad and Kragujevac), ten [10] have incorporated a special course dedicated to environmental education. In total, there are 17 courses which offer some elements of environmental protection related education (12 mandatory and 5 elective). A special environmental chairs, departments or study groups have been formed both within graduate and post-graduate programmes. The following faculties offer university education in the field of environmental protection: University of Belgrade: Faculty of Technology and Metallurgy, Faculty of Mechanical Engineering, Faculty of Chemistry, Faculty of Pharmacy, Faculty of Biology, Faculty of Civil Defence, Faculty of Physical Chemistry, Faculty of Geography, Faculty of Agriculture, Faculty of Mining and Geology, Faculty of Forestry, Centre for Multidisciplinary Studies; in Bor – Faculty of Technical Science; in Novi Sad – Faculty of Agriculture, Faculty of Technical Science, Faculty of Science and Mathematics; in Zrenjanin – Faculty of Technical Science; in Niš – Faculty of Science and Mathematics, Faculty of Occupational and Environmental Protection; in Kragujevac – Faculty of Science and Mathematics, Faculty of Mechanical Engineering; in Čačak – Faculty of Agronomy; in Kraljevo – Faculty of Mechanical Engineering.

In addition, environmental courses are also offered by the Faculty of Law, Faculty of Political Sciences, Faculty of Geography, Faculty of Science and Mathematics, Faculty of Pedagogy in Belgrade, Sombor, Užice etc.

On the other hand, environmental issues are barely considered in the courses offered by the Faculties of Philosophy, Philology and Economy. However, number of courses addressing environmental issues is gradually increasing.

Faculties of Pedagogy, providing teacher education, offer one-year course titled Nature and Society, broadening the student knowledge in the fields of Biology, Chemistry and Physics. Environmental Protection is not addressed in the previously specified course or in specific course.

2.3.9.2.4 Teachers education

Faculties of Pedagogy do not sufficiently address the issues of environmental protection and sustainable development.

Educators are required to participate in trainings and expert courses in different fields. Educators training may be organised only through programs accredited by the Ministry of Education (process has started in 2003). These training programmes include programs from the field of environmental protection and sustainable development. However, number of accredited educators training programs addressing the specified issues is insufficient. Out of 190 programmes accredited in 2006/07, 21 was related to ecology and environmental protection, while 19 provided training in biology.

2.3.9.2.5 Didactic material

There are not enough textbooks and educational means designed for teachers and professors which are specifically related to environmental protection and sustainable development.

At the moment, multimedia education material intended for elementary school teachers has being prepared. The material is titled Green package and is prepared by the Regional Environmental Centre (REC) for Central and South-East Europe. Both ministries (Ministry of Education and the Ministry of Environmental Protection) support realisation of the project in Republic of Serbia. The material is intended for teachers/professors and school children in primary and secondary schools as an additional educational tool in the field of environmental protection and sustainable development. The initial training of professors, is the objective of this project, for the purpose of providing the material for future teaching/lecturing.

Within a project Environmental Capacity Building Programme 2003 (ECBP 2003), the Ministry of Environmental Protection has developed guidelines related to the issues of environmental protection and sustainable development and intended for teachers who wish to incorporate specified issues into their courses. The material is waiting to be finally designed and published.

2.3.9.3 Estimates of public awareness related to environmental protection

Formal education in the field of environmental protection in the Republic of Serbia is underdeveloped, generally resulting in low level of public environmental awareness.

Public informing, as an important aspect of non-formal population education about the current problems is partial and unplanned. There are no continuous campaigns for awareness building and development. Trainings or courses organised for journalists reporting on the environmental issues are very important since they are often not familiarized with environmental terms, legislation etc. and for that reason are encountering problems when trying to explain certain ecological problems to their readers, viewer, listeners etc.

Public Opinion Poll on the topic of the environmental was conduced by the *Strategic marketing* in the period September 22-30, 2007. The results have shown that population is poorly informed about the aspects of environmental pollution (very good – 4%, quite good – 28%, yes and no – 34%, poor – 25%, very poor – 8%)

Survey on the subject of POPs was conducted within the Strategy of Public Informing, Awareness Raising, Education and Action Plan for Strategy Implementation Development. The Survey was conducted on 400 participants in the period November 8-23, 2007.

Results obtained indicate that level of public awareness on ecological issues is low, confirmed by the fact that only 20% of participants have filled out the questionnaire. Insufficient level of awareness and information about POPs and the importance of one's own role in the problem solving represent the main reasons for the situation detected. Another reason is the lack of appropriate education, training and lectures on environmental topics, as well as the absence of problem solving options.

It is very important to mention that the above POPs research was the first POPs related investigation conducted in Serbia, which was maybe the reason of relatively bad participation in the survey and the fact that more than 80% of the targeted population was a population professionally familiar with the issues of POPs (non-government institutions dealing with environmental issues and government employees), while only a small part of participants came from the sectors of education and industry.

The results obtained indicated the following:

- Half of the participants knew what POPs were and what substances are considered to be

POPs, 20% had never heard of them, while 30% had heard of POPs but was not informed on related issues;

– Since 72% of participants were members of non-governmental institutions it was not surprising that the main source of information stated in the questionnaires had been a technical literature, while mass media (TV, radio and newspapers) were a main information source for 25% of participants;

– More than 40% (41.5%) of participants stated that seminars were the best way of informing about POPs issues, while 39% identified mass media;

– At the time when the survey was conducted, 28% of participants were very well informed about the goals of the Stockholm Convention, while 72% stated that they had never heard of Stockholm Convention or were not fully informed;

– About 80% of participants thought that the main obstacle in project implementation was poor implementation of the provisions stated in the Law and absence of national environmental protection strategy; 10% stated that the main reasons were irresponsible behaviour of citizens and individuals, while only 2% thought that the main problem was a lack of funding.

Potentially the most efficient way for the public to be informed about the state of the environment is through the national TV stations, as well as all means for delivering information to the public used by municipal self-governments and local non-governmental institutions (local radio and TV stations, posters, leaflets, organised public actions such as public forums and displays). The most important fact is that, in coordination with the Ministry of Education, a series of alternative programs have been identified which shall, primarily through optional courses and some of the mandatory courses, provide a long-term increase of the environmental education level of population under 18 years of age.

2.3.9.4 Workshops, seminars, trainings and other activities intended for the education of the state administration employees, and workforce in the industry, as well as education and information dissemination to a general public, on the POPs related issues

Activities carried out for the purpose of the state and industry employees training, as well as providing POPs-related education and information to the public are the following:

– "Consultations on introduction of BAT/BEP in South-East Europe", organised by United Nations Environment Programme (UNEP), February 2005, Vienna, Austria.

– Regional Workshop "Preparation of a Regional Approach for the Environmentally Sound Management of POPs as Wastes in Selected Central and Eastern European Countries", May 2005, Bratislava, Slovakia.

– Regional Workshop of the UNEP/GEF project "Assessment of Existing Capacity and Capacity Building Needs to Analyze POPs in Developing Countries", December 2005, Beijing, China.

– Regional Workshop organised by UNEP/GEF on the topic of "Lessons Learned and Good Practice in Preparation of the National Implementation Plans (NIP)" for the regions of Central and East Europe and Central Asia, February 2006, Sofia, Bulgaria.

– "First – introductory workshop of POPs project", March 2006, Budva, Montenegro.

– Workshop on "POPs destruction technologies and decision-support tools", August 2006, Mahmudia, Romania.

– Meeting on "Presentation of recommendations for National Chemical Management Profile of the Republic of Serbia", September 2006, Belgrade, Republic of Serbia.

– Meeting on the topic "Inventory of POPs pesticides", October 2006, Belgrade, Republic of Serbia.

– Meeting on the topic "Inventory of PCB", November 2006, Belgrade, Republic of Serbia.

– Workshop on "PCB waste management" November 2006, Skopje, Republic of Macedonia.

– Meeting on the topic "Inventory of PCB in Vojvodina", November 2006, Novi Sad, Republic of Serbia.

– Meeting of POPs project consultants with representatives of the industry and environmental association sector held in Serbian Chamber of Commerce, February 2007, Belgrade, Republic of Serbia.

– Meeting on the topic "Inventory of pesticide waste and unintentionally released POPs", April 2007, Belgrade, Republic of Serbia.

– Introducing Stockholm Convention on Persistent Organic Pollutants, presentation organised by the Regional Chamber of Commerce Pančevo, June 2007, Pančevo, Republic of Serbia.

– Training on Methodology of POPs Project Related Action Plan Development, February 2008, Palić, Republic of Serbia.

– Opening Seminar on Development of Action Plans of the NIP, March 2008, Novi Sad, Republic of Serbia.

– Project Presentation within the ECO-EDU workshop for teachers "School as a Partner in Environmental Protection" organised by Institute of Nature Protection, April 2008, Belgrade, Republic of Serbia.

– Pilot action within PR activities on the project "Containers are Also Lungs of the City", May 2008, Belgrade, Republic of Serbia.

– "Regional Workshop on Environmentally Sound Management of Pesticides and Waste Containing POPs and PCB", May 2008, Bratislava, Slovakia.

– Art display within PR activities on the project "Containers are Also Lungs of the City", June 2008, Belgrade, Republic of Serbia.

– Seminar "Management of PCB and Obsolete Pesticides and Unintentionally Released POPs", TAIEX, September 2008, Belgrade, Republic of Serbia.

– Seminar "Establishing a Management System for PCB-contaminated Electrical Equipment", October 2008, Skopje, Republic of Macedonia.

- Workshop "CEE regional workshop for effective participation in the work of the POPRC", 25-27 March 2009, Brno, Czech Republic.

2.3.9.5 Relevant activities of civil sector

During the development of this document, data about environmental associations were collected from certain databases. For example, data basis of the Regional Environmental Centre for Central and Eastern Europe provides information on 160 environmental non-governmental organisations (www.rec.org/REC/Databases/NGODirectory/NGOFind.html) and 35 environmental information centres and service providers (www.rec.org/REC/Databases/EnvInfDirectory/search.html). Data basis of the Centre for Development of Non-Profitable Sector specifies that there are more than 200 environmental associations in Serbia (http://directory.crnps.org.yu). The Law on Associations[53] prescribes that Associations Register is maintained by the Serbian Business Registers Agency (SBRA) which will facilitate provision of information about these associations.

[53] Law on Associations (Official Gazette of RS, no. 51/09)

In addition, EcoForum, apart from keeping a date base of environmental experts, also collects and regularly updates information on environmental associations in Serbia.

The majority of identified associations have been established during the last years, although there are those with long tradition (climbing and scout associations, Young explorers of Serbia etc.) Most of environmental associations act on the local level, although there are organisations that are active on the national level. During the last years numerous networks of environmental organisations have been developed. Young explorers of Serbia are a network which has been active for more than 30 years and consists of 27 local organisations. The Ecological Movement of the City of Novi Sad was established in 1990 as an association of citizens gathered around a program of environmental protection and improvement and the protection and affirmation of the cultural heritage. The organisation gathers over 15000 individual members and over 150 collective members.

In the beginning of 2005 an Association of NGOs named VOLVOX was established, gathering more than 100 NGOs. There are also Green Field of Vojvodina and Federation of NGOs of Serbia, a network comprising the largest number of Serbian NGOs, as well as an open electronic network GREEN PRESS.

Serbian ecological associations are member of many international NGO networks. For example, Danube Environmental Forum Serbia is a member of the Danube Environmental Forum (DEF), Young Explorers of Serbia are a member of SEEENN – South Eastern European Environmental NGO's Network, MED Forum – Mediterranean NGO Network for Ecology and Sustainable Development and CEEB – The Central and Eastern Eurobarometer, a workgroup acting on an increase of biodiversity of Central and Eastern Europe. Five ecological NGOs in Serbia are members of CERI – Carpathian Ecoregion Initiative. The Ecological Movement of the City of Novi Sad is a member of European Ecological Bureau since 2003. NGO "Local Agenda 21 for the Municipality of Kostolac" is a member of many international networks, including GEF, UN-NGO, European ECO-Forum, which comprises large number of countries of northern hemisphere, as well as many regional associations, including DEF.

However, in some parts of Serbia there are not enough environmental associations or the one that do exist are not sufficiently involved in the activities of the NGO networks. On the other hand, associations in Vojvodina, West Serbia and Belgrade are active both on the local and national level.

Information on environmental associations involved in chemicals-related issues i.e. POPs may be obtained from the Directory of associations for 2006 available from the official REC web site.

Detail information on this association may be obtained from the Internet.

Environmental organisations and consumer associations may influence the level of public environmental awareness through the following activities:

- conducting environmental pollution monitoring and reporting to the authorities on irregularities detected,
- participating in development of plans, strategies and other relevant documents,
- conducting educational activities (public forums, lectures, round tables, summer camps for school and preschool children),
- cultural activities (recognizing environmentally important dates by organising concerts, displays, subject specific lectures, public gatherings...),
- organising environmental campaigns,
- scientific conferences, symposiums and similar,
- aiding citizens to protect their rights to live in healthy environment by collecting their reports on environmentally endangering situations and organising court trials; in theses situations internet may be used as a simple and the least costly way of communication between the

environmental NGOs and the citizens (e.g. on its official web site, EcoForum often publishes information provided by the citizens, complaining about different environmental problems),

– participating in municipal self-government through elected representatives in municipal bodies, electing individuals which are members of environmental organizations and consumer associations and which are urging for municipal utility and environmental problems to be solved.

Environmental associations conduct the above specified activities periodically and as individual actions, primarily due to their irregular funding. It is therefore necessary to straighten the capacitates of non-governmental organisations, specially those acting in the field of consumer protection, in order to enable them to timely provide public information on the environmental and health risks caused by different chemicals.

Since the internet and its services nowadays represent an efficient and inexpensive mean to distribute information to the public and enable a two-way communication, members of associations should be trained to use the appropriate Internet tools. In addition, it is important for the members of environmental association to be trained to achieve efficient communication with journalist working in all types of media.

2.3.9.6 Publicly available information on POPs

All information on activities carried out with respect to POPs project, as well as a set of relevant POP-related information, are available from the official web-site of the Ministry of Environmental Protection and Physical Planning of the Republic of Serbia http://www.ekoplan.gov.rs/php/projekti/pops.

Other relevant e-links to international organisations are the following:

- Official website of the Stockholm Convention http://www.pops.int;
- Official website of the Rotherham Convention http://www.pic.int;
- Official website of the Basel Convention http://www.basel.int;
- Official website of the UNEP- Chemicals http://www.chem.unep.ch;
- Official website of the World Health Organisation (WHO) http://www.who.ch;
- Official website of the World Food and Agriculture Organisation http://www.fao.org;
- Official website of the United Nations Industrial Development Organization *(*UNIDO) http://www.unido.org;
- Official website of the OECD http://www.oecd.org;
- Official website of the UNITAR http://www.unitar.org;
- Official website of the IFCS http://www.ifcs.int/fcs;
- Official website of the GEF http://www.gefweb.org

In addition, the public may obtain more detail information related to POPs from the following publications and booklets:

– Technical Guideline for Handling the Substances Contaminated With Polychlorinated biphenyls (PCB), Authors : Hristina Stevanović Čarapina, Aleksandar Jovović, Milica Sovrlić, Dušan Antonović, Vladimir Pavićević, Snežana Lekić, Vladica Čudić, Ljiljana Ađanski Spasić, Miloš Kuburović, Marina Ilić, Miroslav Stanojević, Dejan Radić;

– Booklet: Raising Awareness in Elementary School Children about the Effects of uncontrolled burning of Containers;

- Booklet: Raising Teachers' Awareness of POPs related issues;
- Booklet for industry training on compilation of POPs pesticide inventory;
- Booklet for industry training on compilation of furans and dioxins inventory.

2.3.9.7 Mechanisms for information exchange with other Parties of the Convention

Having in mind that in 2003 implementation of international conventions has been placed under the jurisdiction of each member state of the former state union of Serbia and Montenegro, implementation of the Stockholm Convention in Serbia had been placed under the jurisdiction of the Ministry of Environmental Protection. In that way, the Ministry of Environmental Protection became a focal point i.e. an institution co-ordinating a flow of information to and from the Secretariat of the Stockholm Convention, international organisations and other signatory countries.

2.3.9.8 Conclusions

1. State employees within the Ministry of Environment and Spatial Planning are appropriately qualified to perform the work within their job description, and the considerable number of them has undergone through professional trainings on international and national level. However, for the purpose of further build up of the professional capacities trainings are still needed. The training programs should in particular include newly - employed.

2. In addition to the fact that in primary and secondary education, and even more so at the Universities new programs regarding environment protection have been introduced it is important that the influence on the curricula would be obtained, and furthermore, the awareness rising among the educators, about the environmental concerns should be resumed.

3. Degree of awareness of general public about the environmental issues is still very low, which in general leads to a lack of environmental responsibility within the entire population, and constitutes the need to enhance the public awareness about the importance of taking action in order to get solutions for the environmental problems. This mainly refers to awareness about the POPs, and about the role of each individual in solving the problems related to POPs. It is also essential to permanently, (or occasionally) perform opinion polls and based on their results, add efforts on development of various types of formal education and further awareness rising.

2.3.10 An overview of technical infrastructure for POPs-related estimation, research, measurements and development

2.3.10.1 Capacities of expert organisations carrying out POPs analysis

In the Republic of Serbia, POPs analysis is conducted by accredited and authorised organisations. Systematic control of defined matrices is authorised by responsible ministries, while accreditation of organisations carries out the Accreditation Board of Serbia, in accordance with SRPS ISO/ IEC 17025:2006. Many accredited laboratories are currently in the process of accreditation or re-accreditation. Information on the laboratories and their accreditation status are available from the official website of the Accreditation Board of Serbia.

Table 2.3.10.1.a.: Number of organisations accredited for POPs analysis in Serbia

POPs	POPs matrices					
	Air	Water	Soil	Human food	Animal feed	Waste
Organochlorine pesticides / insecticides	3	13	2	13	3	4
Polychlorinated biphenyls (PCB)	4	10	5	7	2	7
Polycyclic aromatic hydrocarbons (PAH)	5	8	4	1	/	4
Dioxins and furans	/	1	1	1	/	1

Valid authorisation for emission measurement is currently issued to 16 expert organisations, while 26 expert organisations are authorised to conduct measurement of pollutant concentrations in ambient air. Authorization for carrying out food and animal feed analysis is under the jurisdiction of the responsible ministries i.e. ministry responsible for agriculture and ministry responsible for health. The following institutions are authorised to conduct analysis of food and animal feed: Institutes of Health, Hygiene and Occupational Medicine [6], Institutes of Public Health (20), Veterinary Institutes (12), Institutes of Plant Protection [4] and Faculties [3]. Authorisation is granted to 6 professional organizations for examination of waste. Large number of authorised organisation is accredited for POPs analysis in defined matrices.

Based on data provided by the Accreditation Board of Serbia, a list of accredited laboratories for POPs analysis in defined monitored matrices is shown in Tables 2.3.10.1.b, 2.3.10.1.c, 2.3.10.1.d, 2.3.10.1.e, 2.3.10.1.f and 2.3.10.1.g.

Table 2.3.10.1.b: List of organisations accredited for sampling and analysis of POPs concentrations in air

Accredited organisation	Types of analysis	Method
SP Laboratory AD, Bečej	Determining concentrations of polychlorinated biphenyls	VM/MET 381
	Determining concentrations of polycyclic aromatic hydrocarbons	VM/MET 388
"Bio-ekološki centar" ltd. laboratory in Zrenjanin	Determining concentrations of polycyclic aromatic hydrocarbons in ambient air	Q 5.21.035
	Air sampling (stationary source emission) – Determining mass concentration of polychlorinated[p]dibenzodioxins and polychlorinated dibenzofurans (PCDD/PCDF) and dioxin-like polychlorinated biphenyls (PCB)	EN 1948-1:2006
	Stationary source emission – Determining mass concentration of polychlorinated[p]dibenzodioxins and polychlorinated dibenzofurans	EN 1948-2:2006

	(PCDD/PCDF) and dioxin-like polychlorinated biphenyls (PCB)	
	Air sampling (stationary source emission) for determining polycyclic aromatic hydrocarbons (PAH) in solid and gas phases	ISO 11338-1:2003
	Stationary source emission – Determining mass concentration of polycyclic aromatic hydrocarbons (PAH) in solid and gas phases	ISO 11338-2:2003
	Determining concentrations of PCB / OCP – emissions and concentrations in ambient air	Q 5.21.038
Institute of Public Health Belgrade	Determining concentrations of polycyclic aromatic hydrocarbons (PAH) in the measurement range 0.02-20 ng/m^3	DM 0102
	Determining concentrations of polychlorinated biphenyls (PCB) and organochlorine pesticides in the measurement range 0.10-10.0ng/m^3	DM 0104
Institute of Public Health "Pomoravlje", Ćuprija	Determining concentrations of polycyclic aromatic hydrocarbons (PAH) in the measurement range 0.01-1µg/µl	H-DM 211
"Mol AD", company for chemistry, biotechnology and consulting, Zemun	Determining concentrations of polychlorinated biphenyls (PCB) using the GC/ECD method	NIOSH 5503:1994
	Determining concentrations of polycyclic aromatic hydrocarbons (PAH) using the HPLC method	NIOSH 5506:1998
	Determining concentrations of polychlorinated biphenyls (PCB) using the GC/ECD method	EPA M 8082 A: 1996
	Determining concentrations of organochlorine pesticides using the GC/ECD method	EPA M 8081 B: 1998
Occupational Health and Safety Institute, Novi Sad	Determining total polycyclic aromatic hydrocarbons, emissions and in ambient air	Q5-02-14
	Determining semi-volatile organic compounds (GC/MS) (Aldrin, Lindane, Chlordane, Heptachlor-epoxy, Heptachlor, Methoxychlor, Dieldrin, Endosulfan, 1,3- Dichlorobenzene, DDT)	EPA 8270C/1996
	Determining PCB emission	Q5-02-70
	Determining PAH mass concentration - GCMS	Q5-02-71 ISO 12884/04
	Determining mass concentration of dioxins and furans	EPA TO9A/1999 EPA 8290/94
	Sampling of total polycyclic aromatic hydrocarbons – emissions	EPA TO-13A:1999
	Sampling of total polycyclic aromatic hydrocarbons – emissions	ISO 11338-1:2003
	Sampling of polychlorinated[p]dibenzodioxins and polychlorinated[p]dibenzofurans and dioxin-like polychlorinated biphenyls (PCB) – emission	EN 1948-1:2006
	Sampling of polychlorinated[p]dibenzodioxins and polychlorinated[p]dibenzofurans – emission	EPA 0023:1996
	Sampling of total polychlorinated[p]dibenzodioxins and polychlorinated[p]dibenzofurans – emission and concentrations in ambient air	EPA TO 9A:1999

Table 2.3.10.1.c: List of accredited organisations for analysis of POPs concentrations in waters

Accredited organisation	Types of analysis	Method
SP Laboratory AD, Bečej	Determining concentrations of organochlorine pesticides: Aldrin; Chlordane; Endrin; Dieldrin; Heptachlor; 1,4,4- DDE; 4,4-DDD; 2,4,4 DDT	VM/ MET 378
"Bio-ekološki centar" ltd. laboratory in Zrenjanin	Determining concentrations of organochlorine pesticides in potable water, surface water, groundwater and waste water	Q5.22.019 EPA 8081
	Determining concentrations of polycyclic aromatic hydrocarbons PAH	Q5.22.001 EPA 610
	Determining concentrations of polychlorinated biphenyls in water	Q5.22.003 EPA 608
Institute of Public Health Vranje	Determining concentrations of polychlorinated biphenyls (PCB) using the GC/ECD method	ZZ 215
Institute of Public Health Belgrade	Determining concentrations of semi-volatile organic compounds: PAH, PCB and organochlorine pesticides	DM 0005
	Determining concentrations of dibenzodioxins and dibenzofurans	DM 0011
Institute of Public Health Subotica	Determining residues of organochlorine pesticides: Lindane, α- HCH, β- HCH, δ- HCH, p,p- DDE, p,p- DDT, measurement range 0.00002-0.2 mg/kg	DM 25
Petroleum Industry of Serbia "NIS Naftagas" – Central laboratory, Novi Sad	Determining concentrations of PCB in water	ISO 6468: 1996
	Determining concentrations of PAH in water	DMN.38.136
	Determining concentrations of organochlorine pesticides in waters	DMN.38.138
Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Department of Chemistry, Laboratory of the Department of Chemistry, Belgrade	Determining concentrations of polychlorinated biphenyls (PCB)	UP/CIA/M /11 International standard IEC 61619
Institute of Public Health Čačak Centre for Hygiene and Human Ecology	Determining concentrations of organochlorine pesticides: Aldrin, Dieldrin, Lindane, Heptachlor, Heptachlor-epoxy, DDT	VMK 009 EPA 508.1
Institute of Public Health of Serbia "dr Milan Jovanović-Batut" Belgrade	Determining concentrations of organochlorine insecticides, polychlorinated biphenyls and polycyclic aromatic hydrocarbons	UP-801
Institute of Public Health "Pomoravlje" Ćuprija	Determining concentrations of polycyclic aromatic hydrocarbons (PAH) measurement range: 0.01-1µg/µl	H-DM 213
	Determining concentrations of organochlorine pesticides	H-SM 080
Institute of Public Health Niš Centre for Hygiene and Human Ecology	Analysis of polychlorinated biphenyls in water	EPA 505
Hydrometeorology Institute of Serbia, Department of Environmental Protection, Environmental Laboratory	Determining concentrations of polycyclic aromatic hydrocarbons	EPA 8100
	Determining concentrations of organochlorine pesticides, polychlorinated biphenyls and triazine-based herbicides	EPA 8080 A
"Mol AD", company for chemistry, biotechnology and consulting, Zemun	Determining concentrations of polycyclic aromatic hydrocarbons using the HPLC method	EPA 550.1: 1990
	Determining concentrations of polychlorinated biphenyls (PCB) using the GC/ECD method	EPA M 8082 A: 1996

	Determining concentrations of organochlorine pesticides using the GC/ECD method	EPA M 8081 B: 1998
Holding Company: Institute of General and Physical Chemistry jsc Analysis, Research and Development Laboratory	Determining concentrations of PCB, PAH and pesticides	EPA 8270 C: 1996

Table 2.3.10.1.d.: List of accredited organisations for analysis of POPs concentrations in soil

Accredited organisation	Types of analysis	Method
SP Laboratory AD, Bečej	Determining concentrations of organochlorine pesticides: Aldrin; Chlordane; Endrin; Dieldrin; Heptachlor; 1,4,4- DDE; 4,4-DDD; 2,4,4 DDT	VM/ MET 374
Institute of Field and Vegetable Crops, Soil and Agroecology Laboratory, Novi Sad	Determining concentrations of polycyclic aromatic hydrocarbons (PAH)	US EPA 3540C, 360C,8310
	Determining concentrations of polychlorinated biphenyls (PCB)	US EPA 3540C, 3630C, 8082
Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Department of Chemistry, Laboratory of the Department of Chemistry, Belgrade	Determining concentrations of polychlorinated biphenyls (PCB)	UP/CIA/M /11 International standard IEC 61619
"Mol AD", company for chemistry, biotechnology and consulting, Zemun	Determining concentrations of polychlorinated biphenyls (PCB) GC/ECD	EPA M 8082 A: 1996
"Bio-ekološki centar" ltd. laboratory in Zrenjanin	Determining concentrations of polycyclic aromatic hydrocarbons (PAH)	Q 5.23.038 EPA 8082, 8100, 3540 C
Institute of Public Health, Belgrade	Determining concentrations of polycyclic aromatic hydrocarbons (PAH), measurement range: 5.0-250 µg/kg	DM 0085
	Determining concentrations of polychlorinated biphenyls (PCB), measurement range: 10-1000µg/kg	DM 0085
	Determining concentrations of polychlorinated dibenzo dioxins and furans 5 – 1000 ng/kg	DM 0086
Holding company: Institute of General and Physical Chemistry jsc Analysis, Research and Development Laboratory	Determining concentrations of PCB , PAH and pesticides	EPA 8270 C : 1996

Table 2.3.10.1.e.: List of accredited organisations for analysis of POPs in food

Accredited organisation	Types of analysis	Method
Centre for Food Analysis, Belgrade	Determining concentrations of organochlorine compounds (pesticides and OCBs) using the gas chromatography	IHM-03-002
SP Laboratory AD, Bečej	Determining concentrations of organochlorine pesticides: Aldrin; Chlordane; Endrin; Dieldrin; Heptachlor; 1,4,4- DDE; 4,4-DDD; 2,4,4 DDT using the GC/MS method	VM/ MET 354
	Determining concentrations of organochlorine pesticides: Aldrin; Chlordane; Endrin; Dieldrin; Heptachlor;	VM/ MET 375; 364

	1,4,4- DDE; 4,4-DDD; 2,4,4 DDT using the GC/ECD method	
Institute of Public Health Belgrade	Determining concentrations of polychlorinated biphenyls (PCB)	DM 0020
	Determining concentrations of polychlorinated dibenzo dioxins and furans	DM 0086
	Determining concentrations of polycyclic aromatic hydrocarbons (PAH)	DM 0021
Jugoinspekt Beograd AD, Topčider Institute, Laboratory for Food Quality and Safety Analysis	Determining concentrations of organochlorine pesticides and PCB using the GC/ECD method (HCHs, HCE, aldrin, DDT and derivatives)	Documented method 29 JUP 010102-34
Institute of Meat Hygiene and Technology, Laboratory sector	Determining concentrations of organochlorine pesticides and PCB	02R.01.001
Institute of Public Health Subotica	Determining residues of organochlorine insecticides: Lindane, α- HCHs, β- HCHs, δ- HCHs, p,p- DDE, p,p- DDT 0.0002-0.2 2 mg/kg	MZS 14475/2-87 DM 11
Company "Knjaz Miloš" jsc Laboratory "Knjaz Miloš", Aranđelovac	Determining semi-volatile organic compounds (pesticides and polychlorinated biphenyls)	DM 0400
Institute of Public Health Čačak Centre for Hygiene and Human Ecology	Determining concentrations of organochlorine pesticides (measurement range: 0.001 – 0.1 mg/kg) Aldrin, Dieldrin, Lindane, Heptachlor, Heptachlor-epoxy, DDT, DDD, DDE, Endosulfan, α HCH, β HCH, γ HCH	VMK 008
Institute of Public Health of Serbia “dr Milan Jovanović-Batut”, Belgrade	Determining concentrations of organochlorine insecticides and polychlorinated biphenyls	UP-806
Institute of Public Health "Pomoravlje" Ćuprija	Determining concentrations of organochlorine pesticides: Aldrin, Dieldrin, 4,4-DDT, Endrin, α-BHC, β-BHC, γ-BHC(Lindane), Heptachlor, Heptachlor-epoxy -isomer, Heptachlor-epoxy-isomer B, Hexachlorbenzene, α-Endosulfan, β-Endosulfan	H-DM 081
Institute of Public Health Niš Centre for Hygiene and Human Ecology	Determining residues of organochlorine pesticides (using gas chromatography)	Reference manual 12) Chapter III. 1
	Determining residues of polychlorinated biphenyls (using gas chromatography)	Reference manual 12) Chapter III. 5
ltd. "Alfa lab", company providing laboratory services	Determining concentrations of organochlorine pesticides: (α-BHC, β-BHC, γ-BHC, δ-BHC, Heptachlor, Aldrin, Heptachlor-epoxy, γ-Chlordane, α-Chlordane, Endosulfan, 1,4,4′-DDE, Dieldrin, Endrin, 4,4′-DDD, Endosulfan, 2,4,4′DDT, Endrin ketone, Methoxychlor), GC MS method	AL-DM-31
"A BIO TECH LAB" ltd. Sremska Kamenica	Determining concentrations of organochlorine pesticides in samples with more than 5% of fat (GC/MS) measurement range: 0.001-50 mg/kg	U 12 02
Veterinary Institute of Serbia	Determining residues of organochlorine pesticides	DMH007

Table 2.3.10.1.f.: List of accredited organisations for analysis of POPs in animal feed

Accredited organisation	Types of analysis	Method
SP Laboratory AD, Bečej	Determining residues of organochlorine pesticides: Aldrin; Chlordane; Endrin; Dieldrin; Heptachlor; 1,4,4- DDE; 4,4-DDD; 2,4,4 DDT, using the GC/MS method	VM/ MET 354
	Determining concentrations of organochlorine pesticides: Aldrin; Chlordane; Endrin; Dieldrin; Heptachlor; 1,4,4- DDE; 4,4-DDD; 2,4,4 DDT using the GC/ECD method	VM/ MET 359
Institute of Meat Hygiene and Technology, Laboratory Sector	Determining concentrations of organochlorine pesticides and PCB	02R.01.001
Jugoinspekt Beograd AD, Topčider Institute, Laboratory for Food Quality and Safety Analysis	Determining concentrations of organochlorine pesticides and PCB using the GC/ECD method (HCH, HCE, Aldrin, DDT and derivatives)	Documented method 29 JUP 010102-34

Table 2.3.10.1.g.: List of accredited organisations for analysis of POPs in waste

Accredited organisation	Types of analysis	Method
Institute of Public Health, Belgrade	Determining concentrations of polychlorinated biphenyls (PCB)	EN 15308:2008, DM 0107
	Determining concentrations of polychlorinated dibenzo dioxins and furans	DM0086
	Determining concentrations of polycyclic aromatic hydrocarbons (PAH)	EN 15527:2008, DM 0107
	Determining concentrations of organochlorine pesticides	DM 0107
"Bio-ekološki centar" ltd. laboratory in Zrenjanin	Determining concentrations of semi-volatile organic compounds (benzo[a]pyrene, pyrene) in waste sludge and ash, measurement range 40-2500 µg/kg	Q5.23.038 EPA 8082 SW 846
Occupational Health and Safety Institute, Health and Safety Analysis Laboratory, Novi Sad	Determining concentrations of polychlorinated biphenyls, measurement range 200-500 µg/kg	EN 15308: 2006
	Determining concentrations of polycyclic aromatic hydrocarbons, measurement range 10-300 µg/kg	EN 15527:2007
"Mol AD", company for chemistry, biotechnology and consulting, Zemun	Determining concentrations of polychlorinated biphenyls (PCB) using the GC/ECD method	EPA M 8082 A: 1996
	Determining concentrations of organochlorine pesticides	EPA M 8081 B: 1998
Holding Company: Institute of General and Physical Chemistry jsc Analysis, Research and Development Laboratory, Belgrade	Determining concentrations of PCB, PAH and pesticides in waste (GC/MS method)	EPA 8270 C: 1996
Anahem ltd. Laboratory , Belgrade	Waste characterization - determining concentrations of semi-volatile organic compounds *(*PAH, pesticides and PCB), measurement range > 1 µg/kg	EPA 3540/8270: 1998

2.3.10.2 Scientific institutions conducting POPs research

Research-development programmes in the filed of POPs are sporadic, leading to the conclusion that Serbia is not integrally solving the problem of persistent organic pollutants. There are research teams of scientists and experts in Serbia that partially address the considered problem within their research activities, but there are no projects and research teams which are specialised to address problems of POPs. It is therefore necessary to provide support for present research teams which have provided results and established proven scientific profile for dealing with POPs-related issues, as well as to initiate new research activities in this field. In Serbia, research and development are mainly funded by the ministry responsible for science, but not based on the specialised area of research, but rather on the scientific grounds of the project proposal and competency of the proposed project team. Specialised research is considered by other ministries which may provide funding for specialised programmes and projects within the scope of their work, finances and the needs, as defined by each ministry for itself.

POPs related research in Serbia are carried out in many scientific and research institutions, but the results obtained in different regions of the country are not collected nor are obtained within the projects considering exclusively POPs. Certain research activities have been intensified after 1999 (high contamination by PCB) in the field of chemical degradation of PCB – "A procedure for PCB-based transformer oil degradation with oleum treatment" patent right no. 484/03 and "A procedure for alkaline PCB-based transformer oil degradation" patent right no. 196/04.

Results of the POPs research have been published in many international journals. Selection of published papers from the considered field is shown in Tables 2.3.10.2.a and 2.3.10.2.b. Most of these papers are available from the Internet (www.scopus.com, www.sciencedirect.com etc.).

Table 2.3.10.2.a.: Scientific and research institutions conducting POPs research in Serbia

Faculty of Agriculture – Institute of Plant and Food Protection, Zemun
Faculty of Agriculture – Department of Plant and Environmental Protection "Dr.Pavle Vukasović", Novi Sad
Faculty of Veterinary Medicine, University of Belgrade, Belgrade
Faculty of Mathematics and Science, University of Novi Sad, Novi Sad
Faculty of Chemistry, University of Belgrade, Belgrade
Faculty of Pharmacy, University of Belgrade, Belgrade
Faculty of Technical Sciences, University of Novi Sad, Novi Sad
Faculty of Technology, University of Novi Sad, Novi Sad
Faculty of Forestry, University of Belgrade, Belgrade
Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Department of Chemistry**,** Laboratory of the Department of Chemistry, Belgrade
Veterinary Institute of Serbia, Belgrade
Veterinary Institute Novi Sad, Novi Sad
Faculty of Mechanical Engineering, University of Belgrade, Belgrade

Faculty of Mining and Geology, University of Belgrade, Belgrade
Faculty of Technology and Metallurgy, University of Belgrade, Belgrade
Institute of Nuclear Sciences "Vinča", Belgrade
Institute for Pesticides and Environmental Protection, Belgrade

Table 2.3.10.2.b.: Selection of papers covering various aspects of POPs published in international journals

Author	**Title of the paper**	**Journal**
Vukmirović, B.Z. et al.	Regional air pollution caused by a simultaneous destruction of major industrial sources in a war zone. The case of April Serbia in 1999	Atmospheric Environment, 2001, Vol. 35(15), pp. 2773-2782.
Turk, M. et al.	Post-war levels of persistent organic pollutants (POPs) in air from Serbia determined by active and passive sampling methods	Environmental Chemistry Letters, 2007, Vol. 5(3), pp. 109-113.
Škrbić, B. et al.	Non-dioxin-like PCB in crops and related products: Levels and intakes in Serbia	Food Additives & Contaminants: Part A, 2007 , Vol. 24(6), pp. 652 – 662.
Kovačević, R. et al.	Effect of PCB on androgen production by suspension of adult rat Leydig cells *in vitro*	The Journal of Steroid Biochemistry and Molecular Biology 1995, Vol. 52 (6), pp. 595-597.
Vojinović-Miloradov, M. et al	Determination of polychlorinated biphenyls and polyaromatic hydrocarbons in frog liver	Water Science and Technology, 1996, Vol. 34(7-8), pp. 153-156.
Vukavić, T. et al.	PCB pollution of early milk in the Province of Vojvodina	Environmental Toxicology and Pharmacology 2008, Vol. 25(2), pp. 176-178.
Kaisarevic, S. et al.	Detection of dioxin-like contaminants in soil from the area of oil refineries in Vojvodina region of Serbia.	Bulletin of Environmental Contamination and Toxicology (2007) Vol. 79 (4), pp. 422-426.
Manojlović, D. et al.	Degradation of transformer oil on the basis of PCB without disturbing the existing quality of the environment	Electric Power Industry 2003, Vol. 56 (2), pp. 35-40.
Andrić, L.N. et al.	Effect of a PCB-based transformer oil on testicular steroidogenesis and xenobiotic-metabolizing enzymes	Reproductive Toxicology 2006, Vol. 22(1), pp. 102-110.
Škrbić, B. et al.	Polycyclic Aromatic Hydrocarbons in Surface Soils of Novi Sad and Bank Sediment of the Danube River	Journal of Environmental Science and Health, Part A, 2005 ,Vol. 40 (1), pp. 29 – 42.
Antonijević, B. et al.	Simulated impact of a fish based shift in the population *n*−3 fatty acids intake on exposure to dioxins and dioxin-like compounds	Food and Chemical Toxicology Journal 2007, Vol. 45(11), pp. 2279-2286.
Golobočanin, D.D. et al.	Principal component analysis for soil contamination with PAH	Chemometrics and Intelligent Laboratory Systems 2004, Vol. 72 (2), pp. 219-223.

Lončar, S. E. et al.	Qualitative TLC determination of some polycyclic aromatic hydrocarbons in sugar-beet	Journal of the Serbian Chemical Society 2005, Vol. 70(10), pp. 1237-1242.
Škrbić, B. et al	Organochlorine and organophosphate pesticide residues in wheat varieties from Serbia	Food Additives & Contaminants: Part A, 2007, Vol. 24 (7), pp. 695 – 703.
Lemić, J. et al.	Removal of atrazine, lindane and diazinone from water by organo-zeolites	Water Research 2006, Vol. 40 (5), pp. 1079-1085.
Škrbić, B. et al.	Principal component analysis for soil contamination with organochlorine compounds	Chemosphere 2007, Vol. 68(11) pp. 2144-2152.
Popovic, M. et al.	Effects of Laurel (Laurus nobilis L.) leaves and berries ether oil, PCB and CCl_4 on production of oxygen radicals	Toxicology Letters, 2003, Vol. 144(1), pp. 67.
Andric, N. L. et al.	Effect of a PCB-based transformer oil on testicular steroidogenesis and xenobiotic-metabolizing enzymes	Reproductive toxicology 2006, Vol. 22(1), pp. 102-110.
Andric, N. et al.	In vivo and in vitro effects of PCB126 and PCB153 on rat testicular androgenesis	Environmental Toxicology and Pharmacology (2008)25, 222-226.
Andrić, S. et al.	Effects of polychlorinated biphenyl-containing and –free transformer fluids on testicular enzyme activities	Fresenius Environmental Bulletin FEB, (2003):Vol. 12, pp. 245-249.
Andrić, S.A. et al.	Acute effects of polychlorinated biphenyl - containing and –free transformer fluids on rat testicular steroidogenesis	Env Health Perspective 2000, Vol. 108 (10) pp. 955-959.
Andrić, S.A. et al.	Inhibition of rat testicular androgenesis by a polychlorinated biphenyl mixture Aroclor 1248	Biology of Reproduction 2000 Vol. 62(6), pp. 1882-1888.

Table 2.3.10.2.c: Selection of papers covering various aspects of POPs presented at international conferences

Author	**Title of the paper**	**Conference and publication**
Andrić N., et al.	Effects of commercial PCB mixture on rat testicular enzyme activities	6th International Symposium Interdisciplinary Regional Research (Hungary, Romania, Yugoslavia). (2002): University of Novi Sad, Yugoslavia. CD Proceedings 0103.
Kovacević R., et al.	Application of combined bioanalysis and gas chromatography methods in detection of PCB and dioxin-like compounds in sediment samples.	35th IAD Conference, Novi Sad, Serbia and Montenegro (2004), Limnological reports 35, Proceedings, pp. 181-186.
Zoric S., et al.	Danube-Subic sediments: PCB congener profile and dioxin-like toxic potency.	International Symposium on Danube Basin and Sustainable Development, Novi Sad, Serbia and Montenegro (2005), CD Proceedings.
Vojinović-Miloradov, M. et al.	The Residues of PCB and organochlorine hydrocarbons in the frog liver from the Kragujevac Hot Spot	23rd International Symposium on Halogenated Environmental Organic Pollutants and POPs, DIOXIN 2003, Boston, USA (2003), Proceedings pp. 45-48
Andrić, S.A. et al.	Acute effects of PCB- and mineral oil based dielectric fluids on antioxidant enzyme activities in adult rat testis.	3rd International Symposium Interdisciplinary Regional Research, part II, University of Novi Sad, Novi Sad, Yugoslavia(1998), Proceedings pp. 915-918.
Adamov, J. et al.	Content of PCB in food in animal and plant origin in Vojvodina (Serbia) after industrial disasters in 1999	6th International Symposium and Exhibition on Environmental Contamination in Central and Eastern Europe, Prague (2003), Proceedings on

		CD.
Vojinovic-Miloradov, M. et al.	The residual levels of PCB determined by gc/ecd and bioassay in soil samples from Kragujevac after the warfare in former Yugoslavia	PSU-UNS International Conference 2003: Energy and the Environment, Thailand(2003), Proceedings 205.
Adamov, J. et al.	Contents of polychlorinated biphenils in adipose tissue of the human population of Vojvodina (Serbia),	ICOSECS - 4thInternational Conference of the Chemical Societes of the South-East European Countries on Chemical Sciences in Changing Times: Visions, Challenges and Solutions, Belgrade, Serbia and Montenegro (2004), Proceedings 161.
Ljubojevic, S. et al.	Is DDT still a threat? Exposure of human population to DDT and its metabolites via food	6th International Symposium and Exhibition on Environmental Contamination in Central and Eastern Europe- Prague, Czech Republic, 2003, Book of Abstracts, 90.
Matic, I M. et al.	Conceptual hydrogeological and mathematical model of behavior and fate of PCB in soils of the locality of Kragujevac- Serbia and Montenegro	First Conference on Applied Environmental Geology (AEG`03) in Central and Eastern Europe, Vienna, Austria, 2003, Book of Abstracts, 160.
Antonijevic, B.	Food Chemical Contaminants in Serbia	FOODSAFENET Workshop, International Life Science Institute, 12-13 January 2007, Brussel, Belgium, 2007.
Antonijevic, B.	Exposure of General Population to Dioxines and Dioxin-like Compounds	4th Congress of Serbian Pharmacy with international November 28- December 2, Belgrade 2006, Arh Farm 2006; 4: 593-594.
Petrovic, V. et al.	Average intake of dioxins and polychlorinated biphenyls among adult population in Serbia	7th Xenobiotic Metabolism and Toxicity Workshop of Balkan Countries, Novi Sad, Serbia, 2008 June 3-6, Eur J Drug Metabol Pharmacokinet 2008; 33: 14.
Vukomanović, P. et al.	Organochlorine and organophosphorus pesticides in various herbal teas grown in our rural environment	Second International Conference on Rural Health & First International Conference on Occupational and Environmental Health in Mediterranean, South East, and Central European Countries 2004, May 26-29 2004, Belgrade, Serbia and Montenegro, Book of abstracts: 116.
Jankovic, S. et al.	Levels of non-dioxin-like PCB in freshwater fish from the Danube	45th Congress of the European Societies of Toxicology – EUROTOX 2008, Rhodes, Greece, 2008 October 5-8, Toxicol Lett 2008; 180: S181.

2.3.10.3 Conclusion

It is necessary to determine strategic directions that will guide the required improvement of laboratory work, since although there are laboratories accredited to carry out POPs analysis, their number is not sufficient to cover all the measurements needed or the ones established are not accredited to conduct specific test methods.

It is especially important to conduct procurement of laboratory equipment in an organised manner in order to avoid unnecessary duplication of capacities intended for one type of analysis and lack of equipment necessary for the others. In addition, it is very important to establish a system of continuing education for laboratory employees.

On the other hand, it is necessary to establish better collaboration between scientific organisations, as well as improve participation of local experts in international projects related to investigation of persistent organic pollutants.

CHAPTER 3. STRATEGY AND ACTION PLAN ELEMENTS

3.1 Introduction

3.1.1 Adoption of the NIP

Implementation of the Stockholm Convention is placed under the jurisdiction of the Ministry of Environment and Spatial Planning, since the provisions of the Law on the Ministries specify that the Ministry of Environment and Spatial Planning is the authority responsible for the issues of environmental protection and chemical and waste management. For that reasons, Ministry of Environment and Spatial Planning will adopt the NIP, but taking into account the remarks and opinions of other relevant authorities and send NIP to the Government of Republic of Serbia on adoption.

A process of Draft NIP adoption has been carried out in five phases:

- Phase I: Public hearing on Draft NIP;
- Phase II: Obtaining of approval of Coordinating Committee for Project Implementation and its submission to the Ministry of Environment and Spatial Planning;
- Phase III: Obtaining of approvals of state authorities responsible for certain activities specified in the NIP, as well as opinions of other parties involved (industry, scientific and research institutions and non-governmental organizations);
- Phase IV: Adoption of final version of the NIP by the Government of Republic of Serbia;
- Phase V: Submission of adopted NIP to the UNEP and to the Secretariat of the Stockholm Convention..

Based on the preliminary inventory (on PCB, POPs pesticides together with obsolete pesticides and uPOPs), as well as consideration of obligations defined in the Stockholm Convention which were implemented into the national Laws and strategic documents, specific problems related to Convention implementation have been identified and implementation action plans developed.

Having in mind that obligations imposed by the Stockholm Convention require implementation of complex activities, not only by the relevant state authorities but the industry as well, which need to be carried out over the long period of time and backed up by significant financial means, action plans developed within the NIP must be correlated with other activities in the country conducted with the aim of environmental improvement and sustainable development.

Due to the above stated reasons, action plans have been developed specially taking into account provisions of several strategic documents defining strategic directions for civil society development, as well as development of the field of environmental protection.

Institutional and regulatory activities and measures defined in the NIP have been defined based on the National Programme for Accession to the European Union. The Program specifies that all institutional and regulatory requirements defined as a prerequisite for accession to the EU must be fulfilled until 2012. This means that until 2012, all national regulations need to be harmonized with the EU legislation, in such way so it could provide the same legal framework for fulfilling the Convention's obligations as the one in force in the EU. For that reason 2012 has been specified in the NIP as the target year.

While planning the PCB related activates, special attention has been paid to the provisions of the National Waste Management Strategy adopted in 2003. Among other issues, the Strategy defines that PCB/PCT containing equipment must be replaced until 2015. The specified obligation has been directly imported in the Law on Waste Management. It is also defined that equipment containing more than 5 dm^3 of PCB will be disposed of or decontaminated until 2015 at latest. The same applies for disposal of PCB contained in the equipment. By the way of derogation, holder of

equipment that contain between 0.05%-0.005% by weight of PCB shall ensure its decontamination or disposal when such equipment cease to be used.

Since the National Waste Management Strategy was developed six years ago, an updated Waste Management Strategy is currently being prepared, aimed to address all problems and priorities defined in the NIP with respect to waste management.

In addition, prior to the final NIP issuing, due consideration had been paid to the provisions of the Draft National Programme of Environmental Protection (2009-2018). This document has defined strategic goals of the environmental protection policy. One of the important strategic goals defined refers to the obligatory reduction or elimination of pollutant releases to all environmental media. Such reduction has been planned to be achieved by implementation of the provisions of the Law on Integrated Pollution Prevention and Control, which represents a basis for integrated permit (IPPC permit) issuing. Therefore, the Law on Integrated Pollution Prevention and Control defines that operators are obliged to obtain IPPC permits for all pollution sources of specified capacities. It is also defined that the IPPC permits must be obtained by 2015 at the latest. In that way, 2015 has been set as the final year for BAT/BEP introduction into the specified processes and related facilities of defined capacities whose operation results in POPs releases into the environment.

Goals and priorities for fulfilment of the obligations prescribed by the Stockholm Convention are defined in the following Action Plans (given in Chapter 3.3.):

1. Action Plan for Obsolete Pesticides (pesticide waste);
2. Action Plan for PCB;
3. Action Plan for uPOPs (PCDD/PCDF, PCB and HCB);
4. Action Plan for Institutional and Regulatory Measures Aimed at Stockholm Convention Implementation and reporting;
5. Action Plan for Monitoring,
6. Action Plan for Contaminated Areas;
7. Public Informing, Awareness-Raising and Education Strategy and Action Plan for the Strategy Implementation.

3.2 Implementation strategy

As mentioned earlier, the Ministry of Environment and Spatial Planning is in charge for implementation of the Stockholm Convention. However, since certain obligations resulting from the Convention provisions fall under the jurisdiction of other state authorities all competent authorities as well as the key-players responsible for carrying out specific activities have been identified in the Action Plans developed. Coordination of activities conducted by the specified authorities, industry and other stakeholders is to be carried out by the Ministry of Environment and Spatial Planning, providing timely and adequate fulfilment of obligations determined by the NIP.

Periodic update and evaluation of NIP implementation is to be carried out by the Ministry of Environment and Spatial Planning. The ministry shall inform other relevant ministries on the results of conducted evaluation. If it is determined that some of the relevant ministries have not fulfilled obligations imposed upon them, the Ministry of Environment and Spatial Planning shall provide all the support necessary to enable satisfactorily fulfilment of all requirements.

Methods to be used for NIP implementation monitoring shall be harmonized with decisions made by the Conference of the Parties to the Convention, as well as other EU legislation.

Results of conducted monitoring, as well as data defined in the Article 15 of the Convention, shall be submitted to the Conference of the Parties to the Convention by the Ministry of Environment and Spatial Planning in the format adopted in the first Conference meeting.

NIP implementation progress estimate shall be conducted every four years, starting from the year of initial report submission to the Conference of the Parties to the Convention.

3.2.1 Identified priorities during NIP preparation

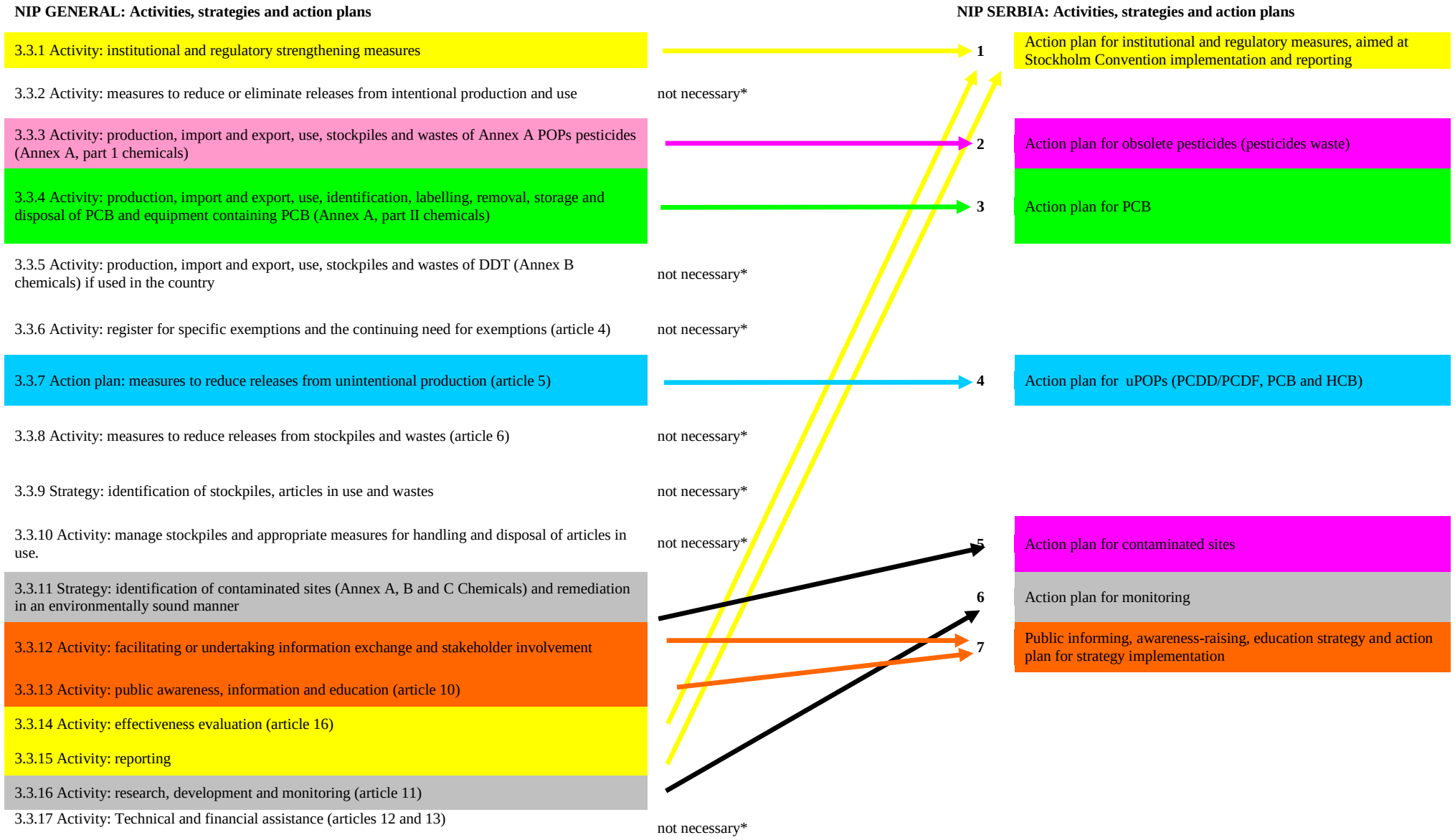
During NIP preparation several priorities were identified such as:

- Complete establishment of relevant legislation and strengthening of stakeholders capacities for rising of public awareness regarding all POPs;
- Preparation of overview of import, production and use of new POPs;
- PCB management and phase out management of PCB equipment until 2015 for the equipment above 5 dm^3;
- Sound waste management for proper handling of POPs waste and in order to avoid uPOPs;
- Implementation of BAT/ BEP for avoidance of emission of uPOPs in relevant industrial and other sectors;
- Identification and remediation of POPs contaminated sites on the environmentally sound manner;
- Addressing the obsolete pesticide issue and prevention of generation of new waste.

Identified priorities will lead to protect human health and environment against POPs as targeted by Stockholm convention.

3.3 Strategies and action plans

Picture 3.3.a.: Comparative review of recommended adopted activities, strategies and action plans



* NOTES:

Activity 3.3.2: measures to reduce or eliminate releases from intentional production and use - is not elaborated as separate action plan because this activity was taken into consideration during preparation of Action plan for PCB. This activity was not taken in consideration during preparation of Action plan for obsolete pesticides (pesticides waste) since production and use of POPs chemicals are forbidden.

Activity 3.3.5: production, import and export, use, stockpiles and wastes of DDT (Annex B chemicals) if used in the country - is not elaborated as separate action plan because production, import, export and use of DDT is banned in Serbia and stockpiles of DDT waste taken into consideration during preparation of Action plan for obsolete pesticides.

Activity 3.3.6: register for specific exemptions and the continuing need for exemptions - is not elaborated as separate action plan because in Serbia there was no need for use of Annex A and Annex B chemicals as defined in the convention. However, exemption for new POPs was not considered during NIP preparation.

Activity 3.3.8: measures to reduce releases from stockpiles and wastes (article 6) - is not elaborated as separate action plan because this activity was taken in consideration during preparation of Action plan for PCB.

Strategy 3.3.9: Identification of stockpiles, articles in use and wastes - is not elaborated as separate action plan because it was taken in consideration during preparation of Action Plans for PCB, Action plan for obsolete pesticides (pesticide waste) and Action plan for uPOPs (PCDD/PCDF, PCB, and HCB).

Activity 3.3.10: manage stockpiles and appropriate measures for handling and disposal of articles in use – is not elaborated separately because it was taken in consideration during preparation of Action Plans for obsolete pesticides and PCB.

Activity 3.3.17: technical and financial assistance (articles 12 and 13) - is not elaborated separately. The Republic of Serbia is country with economy in transition and for successful implementation of the Convention it is heavily dependent on the financial assistance from developed countries. Technical and financial assistance is given in Chapter 3.4. as separate subtitle.

3.3.1 Action plan for obsolete pesticides (pesticide waste)

Main goal is: Removal of POPs pesticides and pesticide waste, prevention of their future releases into the environment and inadequate management.

Specific goals of Action plan for obsolete pesticides are:

- System for identification and sound pesticides packaging waste and pesticides waste management for existing pesticides waste quantities and empty pesticides containers established,
- System for identification and sound pesticides packaging waste and pesticides waste management for future pesticides waste quantities and new empty pesticides containers established.

ACTION PLAN DEVELOPED FOR OBSOLETE PESTICIDES (PESTICIDE WASTE)

MAIN GOAL

Removal of POPs pesticides and pesticide waste, prevention of their future releases into the environment and inadequate management

Specific goal no. 1: System for identification and sound pesticides packaging waste and pesticides waste management for existing pesticides waste quantities and empty pesticides containers established					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 1.1: Establishment and management of Pesticides Coordination Committee.	Committee has following tasks for all pesticides related issues such as: - Cooperation between stakeholders; - Fast communication and solutions of administrative and technical problems; - Back-up and guidance of inventory project and demonstration project for Management POPs pesticides waste and stocks at previous POPs Production Facility; - To secure process of permit issuance, allowing collection, transport and storage of detected and future quantities of pesticides waste during all phases of the project (see Action 1.4.); - Tackles other bottle necks. In order to provide the best manner of waste pesticide and packaging inventorying and collecting, it is necessary for all relevant ministries and bodies of municipal self-government to reach a consensus and confirm it by signing a Memorandum of Cooperation. This specially refers to the ministry responsible for agriculture (dealing with the issues of pesticide management and water management permit issuing), ministry responsible for environmental protection (waste management, environmental protection assessment, permit for planning, permit for construction work and use-permit issuance and chemical management) and municipal self-government (with respect to the location of planned adaptation or container installation).	Ministry of Environment and Spatial Planning (Department of Waste Management, Department of Integrated Permits, Department for Harmonization of Environmental Protection Regulations, Sector for construction, investment and land), Ministry of Agriculture, Forestry and Water Management (Directorate of Plant Protection, Department of Pesticides and Fertilizers), municipal self-government, local self-government (Environmental department, Department for construction and urban planning).	Adopt the Law on Waste Management, Law on Plan Protection Products. Provide funding.	Regular activities carried out in the Ministry of Environment and Spatial Planning and Ministry of Agriculture, Forestry and Water Management and in local self government.	10000 EUR
Action 1.2: Define a manner for conducting Obsolete Pesticides and POPs waste management and conditions and procedures for obtaining permits	Law on Waste Management defines hazardous waste and among them POPs waste management and authorizes development of sub-legal regulations which would import the provisions of Regulation (EC) 850/2004 into national legislation.	Ministry of Environment and Spatial Planning (Department of Waste	Adopt the Law on Waste Management. Provide funding.	Regular activities carried out in the Ministry of Environment and Spatial Planning and Ministry of	4000 EUR

allowing temporary hazardous waste storage, disposal and treatment.	The sublaw on POPs waste management shall define proper POPs pesticide handling. In order to fully regulate the issue of hazardous waste management, including POPs waste management, it is necessary to develop a set of sub-legal regulations related to procedures for obtaining permits allowing storage, disposal and treatment of hazardous waste, hazardous waste catalogue etc. Among the legislation development dealing with hazardous waste it is necessary to develop related gap analyses of existing system for obsolete waste management as well as plan for future activities.	Management, Department for Harmonization of Environmental Protection Regulations, Sector for construction, investment and land).		Agriculture, Forestry and Water Management. Mobilization of national and international experts.	
Action 1.3: Capacity building for authorities, inspection, industry and other stakeholders for sound pesticides waste management.	Capacity building have to be established through training of trainers for following issues: 1. Inventory for pesticides waste (securing that all trainers for each district have been trained and can execute own training in their district). This training should include training for data collecting, based on experiences in preliminary inventory and FAO Standard Approach for inventory using FAO PSMS (Pesticides Stockpile Management System) with Server based data management system; 2. Risk assessment system and prioritization and selection of temporary storage and collection centers for pesticides waste (using FAO PSMS); 3. Professionals for repacking of obsolete pesticides, possible destruction technologies for pesticides and packaging waste; 4. Necessary requirements for permits issuing for temporary storage and necessary management system for assuring appropriate storage of pesticides waste. It is planned to organize at least 1 training per year (1 in 2010 and 1 in 2011) for 30 trainers, 5 days long in order to cover all relevant requirements addressing the sound practice. It is also possible to organize 5 independent trainings with specific themes and different stakeholders	Ministry of Environment and Spatial Planning (Environmental Protection Inspection, Department for EIA, Sector for construction, investment and land), Ministry of Agriculture, Forestry and Water Management (Phytosanitary Inspection, Veterinary Inspection), Serbian Environmental Protection Agency.	Adopt the Law on Waste Management, Law on Plan Protection Products. Provide funding.	Regular activities carried out in the Ministry of Environment and Spatial Planning and Ministry of Agriculture, Forestry and Water Management. Mobilization of national and international experts.	28000 EUR
Action 1.4: Pilot demonstration inventory project for one selected district, for POPs and other waste pesticides and propose a solution for their ultimate disposal.	Since the preliminary POPs pesticides and pesticides waste have been detected at location of different generators (farms, individuals, institutes, industry etc.), it is necessary to assemble an detailed inventory of waste pesticides for one, selected district, which would serve as a general example for proper waste pesticides inventory assembling, but also for demonstrating and optimizing awareness process. This detailed inventory is necessary to be prepared according to the preliminary inventory experience and using FAO PSMS	Ministry of Environment and Spatial Planning (Environmental Protection Inspection) Ministry of Agriculture, Forestry and Water	Provide funding.	Regular activities carried out in the Serbian Environmental Protection Agency and inspectors of different state regulatory bodies. Mobilization of national and international experts.	61000 EUR

	(Pesticides Stockpile Management System) with Server based data management system. FAO PSMS include: Risk assessment system and prioritization and selection of temporary storage and collection centers; Determination of quantities of POPs pesticides, obsolete pesticides, contaminated empty containers and other related materials like contaminated building materials, contaminated spraying equipment, contaminated soil and standard reporting based on lists generated by the PSMS. Activities during the demonstration inventory preparation will be following: -Central Training of the Trainers (ToT) for inventory, securing that all trainers for each district have been trained and can execute own training in their district; -Development of procedures for waste pesticide data collecting; -Data collection according to adopted procedures; -Evaluation of demo-inventory for sharing experience to other district; -Development of methodology for solving existing problems within particular district. During methodology development, a process of permit issuance, allowing collection, transport and storage of detected and future quantities of waste pesticides, should be analysed. After evaluation of Pilot Project, new Training for trainers for inventory in other districts has to be organised with presentation of results of best practice obtained from pilot project.	Management (Phytosanitary Inspection, Veterinary Inspection), Secretariat for Environmental Protection of the Autonomous Province of Vojvodina, Serbian Environmental Protection Agency.			
Action 1.5: Demonstration Project: Management POPs pesticides waste and stocks at previous POPs Production Facility.	Demonstration project will have a learning effect for Serbia on how to deal with a POPs pesticides production from the first step till final clean-up. The project will serve as learning case where authorities can learn how to deal with investigation methods, risk assessment, remediation/treatment techniques, remediation plans, tender documents for clean-up, calls for tender. Also the project will serve as a learning case for the Serbian pesticides producing industry in how to deal with their production sites in the future. Committee (Action 1.1.) and technical working group(s) will have task to write a Lessons Learned Book, that collects all experiences gathered on the project and that will be disseminated accordingly. Proposed activities are as follows: 1. Establishment bring into function of Technical working group for Demonstration POPs pesticides Production site; 2. Select the most appropriate site that will serve as demonstration site; 3. Historical investigation of the production site and	Ministry of Environment and Spatial Planning (Environmental Protection Inspection) Ministry of Agriculture, Forestry and Water Management, Secretariat for Environmental Protection of the Autonomous Province of Vojvodina, Serbian Environmental Protection Agency, Local self-government addressing to historical	Provide funding.	Regular activities carried out in the inspections of different state regulatory bodies. Mobilization of environmental inspection. Mobilization of Production facility management as well workers. Mobilization of national and international experts.	500000 EUR

	surrounding landfills and suspected sites. Based on the results of the preliminary investigation execute a detailed field investigation, the extent and volumes of POPs pesticides waste and deposited at landfills will be determined. If results determine that it is necessary to deal with site contamination, that further activities should be taken: 4. Field investigation and lab analysis to determine the extent of related soil and groundwater contamination. Selection and Establishment Risk assessment system, based on systems used in other EU Member States in order to determine the urgency of steps to be taken in order to eliminate present and future expected dangers to environment and population; 5. Compare various technical alternative solutions, technical feasibility and costing and choice of «best technical and financial option»; 6. Plans of action for selected method for clean-up of POPs pesticides waste, soil and water and final budgeting; 7. Preparation of tender documents for clean-up, call for tender, evaluation of bids and final selection and contracting; 8. Preparation of tender for supervision works including analytical monitoring of remediation results; 9. Preparation of reporting system for contracting parties and supervisors; 10. Clean-up and supervision of production site; 11. Monitoring of clean-up works and monitoring (emissions during excavation, waste destruction and soil clean-up and groundwater cleaning etc) strategy after clean-up, like long term groundwater remediation; 12. Documentation movie with PR materials for teaching and learning and awareness. Note: Investigation (phases 1-5 of the demonstration project) should be taken together with Action 1.4 and/or 1.6.	investigation			
Action 1.6: Assemble national-wide inventory of waste pesticides, POPs pesticides and pesticide packaging detected in Serbia.	Based on the good practice obtained through implementation of a pilot project, assemble inventories for other districts and estimate a possibility for temporary storage establishing, analyzing characteristics of the existing storage facilities in those districts, as well as detected quantities of pesticide waste. Accordingly, for specified short-term needs and find quantities of obsolete pesticides it would be useful to select one or several of the existing pesticide storage facilities to be adapted in	Ministry of Environment and Spatial Planning (Environmental Protection Inspection), Ministry of Agriculture, Forestry	Develop a methodology for inventory assembling for the district defined in Action 1.4.	Regular activities carried out in the Environmental Protection Inspection, Phytosanitary inspections and inspectors of different state regulatory bodies. Mobilization of national	504000 EUR

	accordance with environmental protection requirements and other pesticides. Compiled inventory of detected POPs and POPs waste shall be submitted to the Serbian Environmental Protection Agency, as well as to the state institution responsible for POPs reporting (Focal Point).	and Water Management (Phytosanitary Inspection, Veterinary Inspection), Secretariat for Environmental Protection of the Autonomous Province of Vojvodina, Serbian Environmental Protection Agency.		experts. Cost of inventory	
Action 1.7: Demonstration how to solve problem of pesticides waste from private households.	Obsolete POPs pesticides waste and other pesticides waste for private households should be dealt with in a different way from the stores and similar to the as practice in EU member states for the collection of empty containers. In the awareness campaigns, information can be spread by advertisements, leaflets and TV spots and other media, and installation of a hot line, if needed, so families can be called up to bring at certain days the materials to chemical collection busses or temporary collection spots gathered. Collected waste can be temporary stored with other hazardous waste. This demonstration test can also give information on expected quantities being forwarded by the private households. Note: Demonstration project should be taken together with Action 1.4 and/or 1.6	Ministry of Environment and Spatial Planning (Environmental Protection Inspection, Department for Waste Management), Ministry of Agriculture, Forestry and Water Management (Phytosanitary inspection, Veterinary inspection), Serbian Environmental Protection Agency. Local self-government	Established household hazardous collecting system.	International expert for experience exchange/study related to solution for household pesticide waste. Local consultant 30 trainings for 30 people. Leaflets, brochures. 2000 Euros per training. 2 days National Workshop (including travel etc. for 3 countries representatives). Study tour to selected country – on site visits and discussions with implementing agencies and contractors for 5 persons (1 week).	88000 EUR

Action 1.8: Demonstration: repackaging and storage of pesticides waste in one district and destruction tests in Serbia.	Demonstration should be organised at one district. - Collected obsolete pesticides have to be repacked and stored at temporary storage; - Preparation of Demonstration Plan for final elimination by destruction in Serbia (look into local destruction possibilities in cement kilns); - Public awareness campaign about understanding of technologies for waste treatment and disposal (see therefore under Public Informing, Awareness-raising, education Strategy and Action Plan for strategy implementation); - Transfer of available destruction technologies and experiences to Serbia Transport of repacked obsolete pesticides to "demo-cement plant" if is concluded in demonstration plan as appropriate technology; - Arrange 2 different trial burns for destruction of: • empty packaging at cement kilns, • obsolete pesticides in cement kilns. Project includes public participation and strategy to gain trust, make technologies and monitoring results more understandable to public (see therefore under Public Informing, Awareness-raising, education Strategy and Action Plan for strategy implementation).	Ministry of Environment and Spatial Planning (Department of Waste Management, Department for Strategic Impact Assessment, Department on EIA and IPPC)	Agreement between cement industry and relevant ministries. Provide funding	Estimation 100 tons OPs (Including repack etc.). Estimation 50 tons empty packaging. Public participation etc. Monitoring programme (Dioxin measurement etc, international independent experts).	500000 EUR
Action 1.9: Development of Operational Plan (OP) for pesticide waste, POPs pesticides and pesticide packaging collection for substances recorded during the Actions 1.4 and 1.6, for each district nationwide defining the conditions required for carrying out related transport to destruction plant or export.	The plan is developed based on the data provided in the inventory assembled within the Actions 1.4 and 1.6. The plan addresses collection, packaging and transport of detected pesticide waste for the purpose of waste destruction in Serbia (depending on the results of Action 1.8) or export for final destruction to a waste treatment facility in the EU. OP should consider if waste should be collected into one storage facility or its collection should be organised via temporary storage. This issue will be dealt with in the demonstration repackaging under action 1.8. and the results from the inventories will have a major impact on the strategy and the number of temporary storage to be designated.	Ministry of Environment and Spatial Planning (Department of Waste Management, Department for Strategic Impact Assessment, Department on EIA, IPPC, Sector for construction, investment and land), Ministry of Agriculture, Forestry and Water Management (Directorate of Plant Protection), Secretariat for Environmental Protection of the Autonomous Province of Vojvodina.	Complete Actions 1.5 and 1.6.	Regular activities carried out in the Ministry of Environment and Spatial Planning, Ministry of Agriculture, Forestry and Water Management and the Secretariat for Environmental Protection of the Autonomous Province of Vojvodina. Mobilization of national (90 days) and international experts (5 days)	11000 EUR

Action 1.10: Adaptation of temporary storage, facilities or facilities for storing pesticide waste, POPs pesticide and packaging whose owner is not known (not determined) and which have been detected during inspection.	In the Republic of Serbia there are currently no storage facilities where waste pesticides could be stored. Since potential storage facilities, that could be used for pesticide waste storage, have been considered during activities carried out within the scope of the Action 1.4 and 1.6., one or more storage locations should be selected to be used for storing hazardous waste whose owner is not known. Beside technical characteristics of the storage facility, possibilities for change of its functionality i.e. intended use should also be considered. All necessary administrative procedures should be conducted (obtain required permits and similar), aimed to provide the use of considered facility/facilities for pesticide waste storage. After procedures are finalised, adaptation of the facility may begin. Here considered pesticide waste storage facilities may also be used for storing other hazardous waste whose owner is not known. Note: It is assumed that nearly each district will have a store and at the same time, a plan will be made the stores after their use will get a function in each region for the management and/storage of present pesticides. *Further the definitive number of stores will depend on the volumes of waste pesticides found in the inventory.	Ministry of Environment and Spatial Planning (Environmental Protection Inspection, Department for Waste Management, Department for EIA, Sector for construction, investment and land), Environmental Protection Fund.	Provide funding. Number of storages based on the results in 1.6	Regular activities carried out in the Ministry of Environment and Spatial Planning (Department for Waste Management). 50.000 per storage – 10 storages.	500000 EUR
Action 1.11: Destruction in Serbia or export of detected quantities of POPs, other pesticide waste and POPs and pesticide packaging for the purpose of their ultimate disposal in approved/authorised facilities, in accordance with the provisions of the Basel Convention in case of export.	All pesticide waste quantities found in the inventories, as specified under Actions 1.4.and 1.6., are declared to be hazardous waste, all quantities should be collected and destroyed in Serbia or when destruction in Serbia is not possible, be exported for the purpose of their ultimate disposal at approved/authorised facility in accordance with the provision of the Basel Convention. A registered company, planned to carry out the export of pesticide waste, should be selected by a competitive public bidding procedure. According to experience from other countries and experts judgment it is estimated that the 220 tons represents about 20% of the total amount of obsolete pesticides in Serbia.	Ministry of Environment and Spatial Planning (Department of Waste Management) and the Secretariat for Environmental Protection of the Autonomous Province of Vojvodina.	Provide funding. Complete Actions 1.5, 1.6, and 1.7. Register a company for hazardous waste transport.	Funds provided for waste collection and transport and export for final destruction. Depending on results from inventory. According to the preliminary inventory results it is estimated about 220 tonnes of obsolete pesticides.	3500000 EUR + 700000 EUR

Specific goal no. 2: System for identification and sound pesticides packaging waste and pesticides waste management for future pesticides waste quantities and new empty pesticides containers established					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 2.1: Develop a system, organize capacity	System for sound pesticides packaging waste should be based on	Ministry of	Adopt the Law on	Regular activities carried	38000

building, and develop regulatory and financial measures for pesticides packaging waste.	recent experiences and best practice in neighbouring countries like Hungary, Poland and other EU Members States and on the ECPA Guidelines for empty containers and adapted to Serbian conditions. An exchange programme including review study will be implemented to optimize this process. It is necessary to bring together all stakeholders that deal with empty containers and work towards by establishing a national organisation for the handling of empty pesticides containers and other packaging management. Goal is that pesticides branch takes responsibility for packaging from the "cradle to grave". Also it is necessary to ensure participation of all stakeholders and sufficient financial support from all stakeholders to set up system. Important condition for success is that in Serbia, a technical solution is created at the earliest possible stage, for the recycling/destruction of the packaging materials (it is proposed in Action 1.8 to make tests for destruction of rinsed empty containers could be made at cement kilns.). Also the following laws which would define a requirement for rational packaging handling: Law on Packaging and Packaging Waste, Law on Waste Management, Law on Plant Protection Products. Subsequently, appropriate sub-legal regulations should be developed which would more precisely regulate the issue considered. These acts should be developed taking into account the practical experiences in the countries listed before and being validated accordingly. Within the development of system it is necessary to create financial mechanism for empty pesticides container management. Awareness campaign for the agricultural sector should be consider, plan and performed as necessary step within the development of appropriate system (see under Public Informing, Awareness-raising, education Strategy and Action Plan for strategy implementation.).	Environment and Spatial Planning (Department of Waste Management, Department of Integrated Permits, Department for Harmonization of Environmental Protection Regulations), Ministry of Agriculture, Forestry and Water Management (Directorate of Plant Protection, Department of Pesticides and Fertilizers). Pesticides producers, distributors, agro associations and representatives of formers agro collectives and new private representatives, Secretariat for Environmental Protection of the Autonomous Province of Vojvodina.	Waste Management, Law on Packaging and Packaging Waste, Law on Plan protection. Provide funding. Provide institutional stability	out in the Ministry of Environment and Spatial Planning and Ministry of Agriculture, Forestry and Water Management. Mobilization of national and international experts. Development the system 1 international expert/month 2 national experts 3 national experts 5 workshops	EUR
Action 2.2: Develop a system, organize capacity building, and develop regulatory and financial measures to avoid and recurrence of obsolete pesticides.	FAO PSMS (Pesticides Stockpile Management System) with Server based data management system should be introduced in Serbia with appropriate regulatory, administrative and financial measures. The system can be based on bar coding for new containers from Serbian producers and for those entering the country at customs. Following aspects will be included: – Inventory (stores and containers in use): – Registration of pesticide uses: – Movement instruction and tracking: – Usage planning and monitoring, returns: – Loss/damage reporting: – Stock checking: – Reporting. Parallel with this activities it is necessary to perform Programme	Ministry of Agriculture, Forestry and Water Management (Directorate of Plant Protection, Department of Pesticides and Fertilizers). Pesticides producers, distributors, agro associations and representatives of formers agro	Adopt the Law on Waste Management, Law on Plant Protection. Provide funding. Provide institutional stability	Regular activities carried out in the Ministry of Environmental Protection and Spatial Planning and Ministry of Agriculture, Forestry and Water Management. Mobilization of national and international experts. Training and management of data base PSMS. Development the system.	43000 EUR

	for improvement of farmer management by education on: – Waste, soil and water management: – Store management: – Integrated Pest Management: – Certification of farmers practise (for example periodical sprayer controls and certification): – Good Agricultural Practise (GAP): – Reference manuals are dealt with under Action 2.3.	collectives and new private representatives Ministry of Environment and Spatial Planning (Department of Waste Management Department for Chemicals).		Mobilization of 1 international expert/month and 2 national experts. Mobilization of 3 national experts. Organization of 5 workshops.	
Action 2.3: Develop reference manuals for pesticide waste and waste pesticide packaging management.	In accordance with a complex issues related to POPs, pesticide waste and waste pesticide packaging management, it is necessary to organise waste handling training programmes and develop reference manuals intended for waste generators, but also collectors, carriers and operators. Specified training programmes should be correlated to training programmes considering proper management of plant protection products. It is necessary to develop: – brochures explaining the rules for proper pesticide handling and storage, – guidelines for the use of plant protection products, – handling empty packaging and pesticide waste, – guidelines for waste minimisation, intended for farmers. The following internet sites provide more information: www.defra.gov.uk/ENVIRONMENT/WASTE/topics/agwaste www.voluntaryinitiative.org.uk www.corpprotection.org.uk	Plant protection Products producers, distributors, agro associations and representatives of formers agro collectives and new private representatives Ministry of Agriculture, Forestry and Water Management (Department of Pesticides and Fertilizers), Ministry of Environment and Spatial Planning (Department of Waste Management, Department for Chemicals).	Provide funding.	Regular activities carried out in the Ministry of Environment and Spatial Planning and the Ministry of Agriculture, Forestry and Water Management. Mobilization of national (3 month) and international (0,5 months) experts.	10000 EUR
Action 2.4: Assemble the inventory of POPs and other pesticides.	Based on the PSMS data type and way of data collecting, defined maintain an inventory of POPs and other pesticides. In cooperation with the Serbian Environmental Protection Agency it is necessary to define the type of data, sources and manner of data collecting for the purpose of waste pesticide data base developing.	Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning, Ministry of Agriculture, Forestry and Water Management.	Increase number of employees in the Serbian Environmental Protection Agency working on the data base assembling.	Regular activities carried out in the Serbian Environmental Protection Agency and Ministry of Environment and Spatial Planning.	20000 EUR
Action 2.5: Develop reports on pesticide waste and POPs pesticides, to be submitted to the European Environmental Protection Agency and the Secretariat of Stockholm Convention.	In accordance with the Stockholm Convention, as well as for the purpose of reporting to the European Environmental Protection Agency, it is necessary to prepare a report on the current situation with respect to waste and POPs pesticides. The report should provide data drawn from PSMS on quantities	Serbian Environmental Protection Agency.	Increase number of employees in the Serbian Environmental Protection Agency	Regular activities carried out in the Serbian Environmental Protection Agency and Ministry of Environment	12000 EUR

	of pesticide waste and POPs pesticides, as well as data on the quantities of waste pesticide and POPs pesticide packaging.		working on the data base assembling.	and Spatial Planning.	

3.3.2 Action plan for PCB

Main goal is: Disposal or decontamination of PCB-containing equipment and disposal of PCB waste and prevention of PCB releases from PCB equipment and PCB waste into the environment.

Specific goals of Action plan for PCB are:

- Improved control over the PCB equipment phase-out and over the PCB waste,
- Disposal or decontamination of PCB-containing equipment and disposal of PCB waste.

ACTION PLAN DEVELOPED FOR PCB

MAIN GOAL

Disposal or decontamination of PCB-containing equipment and disposal of PCB waste and prevention of PCB releases from PCB-containing equipment and PCB waste into the environment

Specific goal no. 1: Improved control over the PCB equipment, phase-out and over the PCB waste					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 1.1: Establishment of Coordination Committee for PCB management.	Members of Coordination Committee should be representatives of following stakeholders: Ministry of Environment and Spatial Planning, Ministry of Health, Ministry of Energy and Mining, Serbian Environmental Protection Agency, Focal Point for Stockholm Convention, Cleaner Production Center, Industry, decision makers and other stakeholders.	Ministry of Environment and Spatial Planning (Department of Waste Management, Department for Harmonization of Environmental Protection Regulations), industry representatives, representatives of the Ministry of Health, the Ministry of Mining and Energy, Cleaner Production Centre.	Adopt the Law on Waste Management. Provide funding.	Regular activities	10000 EUR
Action 1.2: Develop a Rulebook on handling with PCB-containing equipment and waste.	The Law on Waste Management defines that a Rulebook on handling with PCB-containing equipment and waste, defining type of data required for confirming that the equipment in question contains PCB, is to be developed. In addition, the Rulebook should define design of the label and information to be provided on the label, as well as a manner of PCB-containing equipment labelling. The Rulebook should also define a manner of PCB waste disposal, decontamination of PCB-containing equipment and methods for determination of PCB content in equipment.	Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning (Department of Waste Management, Department for Harmonization of Environmental Protection Regulations).	Adopt the Law on Waste Management.	Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national expert.	1000 EUR
Action 1.3: Develop Guideline for identification, recording and environmentally safe handling of PCB-containing equipment and PCB waste, intended for the owners and the entities operating and maintaining PCB-containing	The Guideline should provide the owners or the entities operating and maintaining PCB-containing equipment with the knowledge on how to identify and record PCB-containing equipment and how to use them safely, as well as how to submit data to the Ministry of Environment and Spatial Planning in a manner defined by Rulebbok related to PCB. A section of the	Ministry of Environment and Spatial Planning (Department of Chemicals, Department of Waste	Provide funding.	Mobilization of national international expert. Regular activities carried out in the Serbian Environmental Protection Agency and the Ministry	8000 EUR

equipment and develop PCB data base software.	Guideline on identification and inventorying shall define procedures i.e. description of phases in the process related to data checking, provision of reliable data, characterisation of PCB-containing equipment and their labelling. Develop an electronic form, in a table form, to be distributed to inspectors and the owners and entities operating and maintaining PCB-containing equipment. This electronic form shall provide much easier data submission and data base maintaining. Develop PCB data base software that shall enable input of data stated in the form into the assembled data base. The software should enable easy updating and data searching.	Management), Serbian Environmental Protection Agency.		of Environment and Spatial Planning.	
Action 1.4: Develop a procedure for verification of data obtained from the owners and entities operating and maintaining PCB-containing equipment.	It is necessary to develop a procedure for verification of data input into the assembled data base. The procedure should define a party responsible for verification of data submitted by the owner or the entity operating or maintaining PCB-containing equipment, as well as the manner of data verification. Verification procedure should provide for data submitted to the Serbian Environmental Protection Agency to be checked by an inspector. It should be noted that the Law on Electronic Signature is still not adopted. The specified procedure shall provide easier verification of PCB-containing equipment data submitted by the owners and the entities operating or maintaining PCB-containing equipment. Data verification shall be carried out by environmental protection inspectors and other inspectors.	Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning (Environmental Protection Inspection, Department of Waste Management).	Provide funding.	Mobilization of national expert. Regular activities carried out in the Serbian Environmental Protection Agency and the Ministry of Environment and Spatial Planning.	1000 EUR
Action 1.5: Training of technicians for proper maintaining of PCB equipment.	Using Guideline for identification, recording and environmentally safe handling of PCB-containing equipment, intended for the owners and the entities carrying out maintenance of PCB-containing equipment it is necessary to organize training for owners and technicians who maintain PCB equipment. This training should be organized using training of trainers approach. Training of technicians is very important step for avoidance of cross-contamination with PCB. Among the training of proper equipment maintaining training should be organized for owners and technicians for proper storage of PCB-containing equipment and fluid and avoidance of leaking. Training should be based on BAT and BEP for electric equipment maintaining.	Ministry of Environment and Spatial Planning (Environmental Protection Inspection, Department of Waste Management).	Provide funding.	Mobilization of national and international experts. Cost for Trainings Organization.	30000 EUR
Action 1.6: Rising of public awareness on PCB properties and sound management of PCB.	Development of informative documents and organization of workshops for public awareness on PCB properties on human health and environment and sound management.	Ministry of Environment and Spatial Planning, Ministry of Health.	Provide funding.	Mobilization of national and international experts. Cost for informative materials development and workshops	30000 EUR

				organization.	
Action 1.7: Organise training programmes for inspection bodies, providing them with the knowledge on data collection on PCB waste and PCB-containing equipment for the purpose of inventory assembling.	Organise seminars for the inspection bodies where data types, sources and ways of data collecting for the purpose of detail PCB inventory assembling are to be defined. The seminars are necessary due to the fact that inspection bodies have not participated in preliminary inventory assembling of the equipment containing PCB during the course of the POPs project. Reference Guideline for identification, recording and environmentally safe handling of PCB-containing equipment, electronic form and adopted verification procedure shall be used for environmental inspector training in the field of data collecting (it is possible to include inspection bodies from other sectors: heat and power generation, occupational health and safety, sanitary inspection and inspection bodies of municipal self-government).	Ministry of Environment and Spatial Planning (Environmental Protection Inspection, Department of Waste Management), Secretariat for Environmental Protection of the Autonomous Province of Vojvodina, municipal inspection, Serbian Environmental Protection Agency.	Provide funding.	Mobilization of national expert. Regular activities carried out in the Serbian Environmental Protection Agency and the Ministry of Environment and Spatial Planning.	20000 EUR
Action 1.8: Develop a study on identification of PCB used in the plastic, polymer, coating and paint production industries as well as in construction industry.	Due to a multi-purpose PCB use and incomplete data on locations and quantities of PCB used in plastic, polymer, coating and paint production industries, as well as in construction industry, there is a need for a special study to be developed, considering a procedure for identification and estimation of PCB quantities used in construction industry, as well as estimated PCB-related environmental pollution. The study should also recommend the best option for disposal of identified PCB-containing construction material.	Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning (Department of Chemicals, Department of Waste Management).	Provide available data from the companies which have been placing PCB-containing products on the market.	Mobilization of national expert.	4000 EUR
Action 1.9: Assemble an inventory of PCB-containing equipment and PCB waste.	Preliminary inventory of PCB-containing equipment and PCB waste assembled within the scope of the POPs project is not final and needs to be completed. Inventory assembling is based on data which shall submit the owners and entities operating or maintaining PCB-containing equipment, as well as inspectors conducting data verification. Basic information on quantities of obsolete PCB have been obtained during preparation of preliminary inventory, but this information must be verified and further analysed through an estimate of current situation related to recorded stockpiles, post-conflict and industrial facilities, remains from open and partially open sources, as well as disposal sites which may be contaminated with PCB. Development and implementation of the inventory assembled for PCB containing or contaminated equipment and PCB waste, as well as PCB containing or contaminated oils, obsolete stocks in industrial facilities/zones, post-conflict zones, dumps, mine shafts, partially closed and open systems should be carried out in accordance with EU standards.	Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning (Environmental Protection Inspection), owners i.e. entities carrying out maintenance of PCB-containing equipment.	Adopt the Law on Waste Management. Establish data base. Study on identification process and assessment of amount of used PCB is prepared. Increase number of employees in the Serbian Environmental Protection Agency working on the data base assembling. Coordinate activities of responsible institutions and the laboratory involved in PCB-	Mobilization of national and international experts. Providing of sampling and screening equipment.	300000 EUR

	For the purpose of inventory assembling it is planned to form appropriate teams which shall be trained to carry out efficient inventory compiling. These teams should be formed by district and should include environmental inspectors and inspectors from other fields (e.g. energy sector, occupational health and safety, sanitary inspection and inspection of the local self-government). For the purpose of efficient inventory assembling, necessary funding need to be provided through donations, enabling mobilisation of national experts for the purpose of inventory assembling management, as well as provision of necessary instructions. It is also necessary to obtain sampling and screening equipment in order to determine if equipment contain or are contaminated with PCB. In addition, before the start of inventory assembling it is necessary to conduct activities aimed to raise awareness among the owners of equipment and waste containing or contaminated with PCB.		based fluid analysis and accredited in accordance with the methods whose use is obligatory in the EU.		
Action 1.10: Updating the inventory of PCB-containing equipment and PCB waste.	Inventory updating is necessary since some equipment shall gradually be put out of use or will be decontaminated. Inventory updating shall provide newly obtained information on PCB-containing equipment or PCB waste to be timely and regularly included in the inventory. This shall provide a basis for report development and implementation of appropriate measures. Inventory updating shall be conducted based on data submitted by the owners of PCB-containing equipment or entities operating and maintaining PCB-containing equipment, as well as data obtained by inspectors during regular control.	Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning (Environmental Protection Inspection), owners i.e. entities carrying out maintenance of PCB equipment.	Successfully complete Actions 1.1 – 1.8.	Regular activities carried out in the Serbian Environmental Protection Agency and the Ministry of Environment and Spatial Planning.	20000 EUR
Action 1.11: Prepare a report on PCB-containing equipment to be submitted to the European Environmental Protection Agency, in accordance with obligations imposed by the Stockholm Convention.	Based on data provided in the updated inventory, reports to be submitted to the Secretariat of the Stockholm Convention shall be developed every five years. Reports shall be prepared in a way defined by the Convention. In addition, an appropriate report shall be developed and submitted to the European Environmental Protection Agency annually, in accordance with the obligation of reporting to this EU body. The report should provide all data on the quantities of PCB-containing equipment, data on out-of-use PCB-containing equipment, as well as data on the quantities of PCB waste collected, treated, disposed of or exported for the purpose of ultimate disposal.	Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning (Department of Waste Management).	Update the inventory of PCB-containing equipment. Establish a system for timely and regular data input on PCB-containing equipment, as well as PCB waste.	Regular activities carried out in the Serbian Environmental Protection Agency and the Ministry of Environment and Spatial Planning. Mobilization of national expert.	10000 EUR

Action 1.12: Adopt the methods of PCB detection/analysis recommended or prescribed by international institutions and accreditation procedures for laboratories carrying out PCB-related analyses.	In order to use the same methods as those recommended or prescribed as obligatory in the EU, it is necessary to adopt the EU standards as national standards. This procedure is carried out by the Serbian Institute for Standardization. In addition, specified methods need to be adopted and stated in the PCB-related sub-legal regulation. Resulting from stated obligation the laboratories will have to obtain accreditation for investigations and analyses in accordance with legally prescribed methods.	Serbian Institute for Standardization, Accreditation Boards of Serbia, Ministry of Environment and Spatial Planning, laboratories.		Mobilization of national experts.	4000 EUR

Specific goal no. 2: Disposal or decontamination of PCB-containing equipment and disposal of PCB waste					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 2.1: Environmentally sound disposal of PCB waste identified during preliminary inventory assembling within the scope of the POPs project.	A plan for PCB waste disposal shall be developed for the waste identified during preliminary inventory assembling within the scope of the POPs project. Depending on the provided waste storage and related risks, as well as the waste owner, the plan should define selected PCB waste disposal option. PCB waste identified and described in the preliminary inventory should be exported for the purpose of its ultimate disposal. Temporary disposal or export of soil, sand, construction debris etc. contaminated with PCB identified in the preliminary inventory should be carried out. In accordance with the above, it is necessary to organise an urgent export of more than 100 damaged pyralene-containing condensers, type MKS – S 16 from disposal area in Bor. The material is currently placed and disposed on a layer of metallurgical slag extracted from the reverberatory furnace. The disposal area was selected to be outside the zone of regular working activities. The disposal area covers about 800 m^2. UNEP has conducted a risk estimate for the specified disposal site containing damaged and destroyed condensers. Afterwards, a program for removal of condenser batteries from the disposal site has been developed but was never implemented.	Ministry of Environment and Spatial Planning (Environmental Protection Inspection), owners i.e. entities operating and maintaining PCB-containing equipment and PCB waste.	Provide funding.	Funds needed for export of PCB waste for the purpose of its ultimate disposal.	500000 EUR
Action 2.2: Develop a plan for replacement i.e. disposal or decontamination of PCB-containing equipment detected in industrial facilities in Serbia by operator.	A plan of replacement i.e. disposal or decontamination of PCB-containing equipment must be developed by the owner of PCB equipment or the entity providing their maintenance. The plan must define deadlines for replacement i.e. disposal or decontamination of PCB-containing equipment which must be in accordance with deadlines defined in the Law on Waste Management. During preliminary inventory assembling it has been determined that small number of PCB-containing equipment owners has developed the plan specified. During regular inspection visits, the inspectors should instruct the owner or the user of PCB-containing equipment to develop the above specified plan, if the one has not been assembled. Based on such plans it will be possible to prepare a National Operations Plan for disposal/decontamination of PCB-containing equipment and PCB waste.	Owners i.e. entities carrying out maintenance of PCB-containing equipment, Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning (Environmental Protection Inspection).	Adopt the Law on Waste Management and the Regulation on handling of PCB-containing equipment and PCB waste.	Regular activities of the owners or entities providing management of PCB-containing equipment.	-
Action 2.3: Develop a National Operations Plan for disposal/decontamination of PCB-containing equipment and waste.	National Operations Plan should be developed in order to provide timelier and more efficient disposal or ultimate disposal of PCB-containing equipment and PCB waste. The Plan is	Ministry of Environment and Spatial Planning	Adopt the Law on Waste Management and the Regulation on	Mobilisation of national and international experts. Regular activities carried	52000 EUR

	developed based on the inventory data, data obtained from the plans of PCB-containing equipment, replacement prepared by the owners and entities that operate and maintain this equipment. The most appropriate option of PCB-containing equipment and PCB waste management shall be defined in the Plan, as well as respective deadlines in accordance with the Law on Waste Management. Operations Plan should provide techno-economic analysis and propose the best option for waste handling, depending on the type of equipment, number of equipments and other PCB-contaminated waste (contaminated sand, sawdust, textile and other contaminated products). Based on determined quantities, types and characteristics of PCB waste, the Plan should also consider a need for construction of PCB waste treatment facility/device. Knowledge and experience of national experts obtained in the field of PCB treatment should be consulted during the Plan preparation. If it is concluded that construction of treatment facility is a favourable option, such facility will have to fulfil all requirements with respect to cost-effectiveness, technical and technological development and environmental protection.	(Department of Waste Management).	handling with PCB-containing equipment and PCB waste. Provide funding.	out in the Ministry of Environment and Spatial Planning.	
Action 2.4: Establish centralised and/or regional storage facilities for hazardous waste.	Preliminary inventory indicate that significant number of PCB equipment have been declared waste and taken care of within the premises of the respective owner. Since such storage is unsafe, it is necessary to construct or establish storage facilities which shall fulfil technical requirements defined for hazardous waste disposal. This action shall be carried out in accordance with the action related to construction of centralized storage for all waste types.	Ministry of Environment and Spatial Planning.	Adopt the Law on Waste Management and sub-legal regulations related to provision of permits allowing regular operation, construction of storage facility, conditions for collection, transport and other elements related to temporary storage management. Provide funding for storage construction and define and provide storage location. Provide public understanding that storage assembling is necessary.	Funds needed for centralised storage construction.	-
Action 2.5: Safe disposal i.e. decontamination of	In accordance with the Law on Waste Management, the owners	Ministry of	Adopt the Law on	Funds needed for	20000000

PCB-containing equipment with a volume larger than 5 dm^3 and PCB concentrations above 0.05% until 2015 and PCB equipment with a volume larger than 5 dm^3 and PCB concentrations in the range 0.05-0.005% upon cessation of their use.	of PCB-containing equipment are obliged to provide safe disposal i.e. decontamination of all equipment with a volume larger than 5 dm^3 and PCB concentrations above 0.05% until 2015. Other owners of PCB-containing equipment with a volume larger than 5 dm^3 and PCB concentrations in the range 0.05-0.005% are obliged to provide safe disposal i.e. decontamination upon cessation of their use. However, Electric Power Utility of Serbia, which is one of the owners of PCB devices/equipment (about 3.7% of total number of transformers identified in the preliminary inventory) has developed a plan for replacement i.e. disposal (export) and decontamination of PCB-containing equipment. Accordingly, it is preferred for the Electric Power Utility of Serbia to carry out specified replacement i.e. disposal and decontamination of PCB equipment before the defined deadline i.e. until 2011. Within this activity it is planed to establish temporary storage(s) for this equipment until final disposal.	Environment and Spatial Planning (Department of Waste Management), owners i.e. entities operating and maintaining PCB-containing equipment.	Waste Management and sub-legal regulations. Provide funding.	disposal and treatment/ decontamination of PCB waste, as well as procurement of new equipment.	EUR Necessary funding will be determinate after finalisation Actions 1.9 and 2.3.

3.3.3 Action plan for uPOPs (PCDD/PCDF, PCB and HCB)

Main goal is: Reduction of environmental releases of uPOPs, resulting in reduced effects on human health and the environment and prevented POPs penetration into the food chain.

Specific goals of Action plan for uPOPs (PCDD/PCDF, PCB and HCBs) are:

- Reduction of uPOPs releases from open burning (landfill fires, uncontrolled open waste burning, waste container burning, agriculture burning, forest fires),
- Improved legal framework and institutional capacity building for BAT/BEP implementation to improve control and supervision over releases of uPOPs into environmental media (air, water and soil) from Annex 2 and 3 facilities,
- Reduction and minimization of emission of uPOPs from industrial and other facilities by implementation of BAT/BEP in industries,
- Reduced emission of uPOPs resulting from fossil fuel combustion for house heating and transport,
- Improved legislation and sampling and analysis of uPOPs,
- Education, awareness raising, updating inventories and reporting.

ACTION PLAN DEVELOPED FOR UPOPs (PCDD/PCDF, PCB AND HCB)

MAIN GOAL

Reduction of environmental releases of uPOPs, resulting in reduced effects on human health and the environment and prevented POPs penetration into the food chain

Specific goal no. 1: Reduction of uPOPs releases from open burning (landfill fires, uncontrolled open waste burning, waste container burning, agriculture burning, forest fires)

Action	Description	Key player	Preconditions	Resources	Budget
Action 1.1: POPs release control under the integrated system for waste management in Republic of Serbia.	Results of the preliminary inventory assembled indicate that fires at existing municipal waste landfills are one of the main sources of uPOPs releases, primarily PCDD/PCDF and PAHs. At the moment there are no sanitary landfills in Serbia that fully fulfil EU standards. Only municipal landfill in Vranje partially fulfils EU standards. There are 180 officially registered municipal landfills in Serbia. In rural areas waste is disposed of at illegal waste dumps or is burned, causing environmental pollution. Existing landfills generally do not fulfil requirements defined in national legislation. Numerous landfills are located next to the river banks and often in zones with high danger of groundwater pollution. Building of regional centres for waste management which shall completely fulfil provisions of EU legislation is foreseen by the National Waste Management Strategy, as well as the Draft National Environmental Protection Program as a short-term and a medium-term goal. In addition, construction of this centres shall result in reduction of methane emissions i.e. reduction of greenhouse gas emissions. In that way, these projects may be treated as CDM projects. However, better waste handling and disposal management at the existing landfills can significantly contribute to emission reduction. Covering the disposed waste with appropriate covers and similar actions are some of the measures aimed at emissions reduction. It is also necessary to establish a system for sound management of some waste streams (e.g. plastic waste) in order to avoid open burning plastics and uPOPs emission. There is a need to: – Support the BAT/BEP implementation for municipal, industrial and hospital waste management at large in accordance with the waste management hierarchy to optimize avoidance, reuse and recycling of waste; – Establish a concept for final waste treatment for waste fractions which can not be recycled or reused. Evaluation of BAT co-incineration capacity and the necessity and options of BAT waste incineration capacity with optimized energy	Ministry of Environment and Spatial Planning (Department of Waste Management, Department for Harmonization of Environmental Protection Regulations, Department of Integrated Permits), Serbian Environmental Protection Agency Ministry of Mining and Energy.	Provide an agreement and identification of responsibilities of municipal self government and autonomous province. Adopt the Law on Waste Management. Provide funding. Implement a plan for regional waste management centre establishing.	Regular activities of employees of the Ministry of Environment and Spatial Planning, Serbian Environmental Protection Agency and Ministry of Mining and Energy. Mobilization of national experts.	5000000 EUR

	recovery. Integrated permission and control of these facilities; – Support the establishment of regional (municipal) BAT waste landfills for the remaining inert waste; – Support the development of an appropriate taxation scheme for waste disposal (fees for landfilling, industrial waste and private waste).				
Action 1.2: Better address other open burning categories (agriculture, forest fires and building fires) by appropriate control and other measures.	Preliminary inventory has also indicated that forest fires and fires in agricultural land represent a significant source of uPOPs emissions. Frequent fires in industrial facilities indicate that more care and increased supervision is necessary. From all the above reasons increased fire prevention control, specially during the summer months, must be provided	Ministry of Internal Affairs Ministry of Agriculture, Forestry and Water Management	Implement fire protection measures. Provide institutional stability. Provide coordination of activities of different ministries.	Regular activities carried out in the Ministry of Internal Affairs.	1000000 EUR
Action 1.3: Improve supervision in order to reduce the fire occurrences associated with waste disposal containers (waste burning in waste disposal containers).	In accordance with data provided in the preliminary inventory, as well as known information on dangers from emissions of uPOPs releases generated by waste burning in waste disposal containers, it is necessary to more strictly control the maintenance of municipal waste containers. This action must be carried out in accordance with municipal self-governments and their inspection bodies, as well as state bodies in charge of the issue considered. Since current national regulations do not precisely define penalties to be imposed upon the entity responsible for specified situation, it is necessary to more precisely define control and penalties related to this issue.	Municipal self-government, Ministry of Internal Affairs.	Mobilize utility inspection bodies i.e. establish a function of utility police.	Regular activities carried out in the Ministry of Internal Affairs, municipal self-government.	100000 EUR
Action 1.4: Address open burning of POPs releases from waste recycling in industry sector.	In order to establish appropriate control and other measures to avoid POPs releases from industry it is necessary to increase knowledge of SME facilities in order to avoid uPOPs releases from inappropriate operations (e.g. pilot project in specific sector / recycling of metals covered by rubber or plastics, avoidance of waste containing chlorine burning) .	Ministry of Environment and Spatial Planning, Municipal self-government.	Provide an agreement and identification of responsibilities of municipal self government and autonomous province. Adopt the Law on Waste Management. Provide funding. Implement a plan for regional waste management centre establishing.	Mobilization of national and international experts for program development aimed to harmonize industry activities with BAT/BEP.	1000000 EUR
Action 1.5: Address open burning by making the proper waste management system in household (e.g. uncontrolled open	In order to establish appropriate control and other measures to avoid POPs releases from household it is necessary to establish appropriate waste management system for plastic waste from	Ministry of Environment and Spatial Planning	Provide an agreement and identification of responsibilities of	Regular activities of employees of the Ministry of Environment	1000000 EUR

burning of plastic in households).	households.	(Department of Waste Management), Serbian Environmental Protection Agency Municipal self-government.	local authorities. Enforce of Law on Waste Management. Provide funding.	and Spatial Planning, Serbian Environmental Protection Agency and local authorities. Mobilization of national experts. Funds needed.	

Specific goal no. 2: Improved legal framework and institutional capacity building for BAT/BEP implementation to improve control and supervision over releases of uPOPs into environmental media (air, water and soil) from Annex 2 and 3 facilities					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 2.1: Develop a section of the Guidelines for Integrated Permit Issuance related to reduction and elimination of uPOPs.	It is necessary to promote the use of best available technique (BAT) and best environmental practice (BEP), as well as implementation of specially defined emission limit values or pollution source performance standards. Besides the BAT/BEP, other measures also represent integral elements of the process aimed at integrated permit obtaining, which commenced upon the Law on Integrated Pollution Prevention and Control was adopted, as well as the related sub-legal regulations were developed. However, procedure for integrated permit provision has still not started. For that reason it is necessary to help the operators by developing an appropriate guideline, explaining very complicated regulatory procedure. In addition, this section of the guidelines would significantly help the employees of state bodies, as well as other POP-releasing entities which are not obliged to be subjected to the IPPC procedure. This section of the guidelines should be extended and adjusted to the material already being prepared by Department of Integrated Permits of the Ministry of Environment and Spatial Planning. The form and the content of the guidelines should agree with those of similar documents developed within the scope of various EU projects, such as the Manual for Terms of Reference Development in Different Phases of Project Management Cycle or the Guide for Project Environmental Impact Assessment.	Ministry of Environment and Spatial Planning (Department of Integrated Permits).	Provide funding.	Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national and international experts.	9000 EUR
Action 2.2: Organize seminars for state employees and operators on implementation of BAT/BEP during the process of integrated permit obtaining and further control of BAT/BEP implementation aimed at reduced unintentional POP production.	State institutions and municipal self-government play an important role in the process of integrated permit issuance, BAT/BEP introduction, determination of emission limit values, pollutant control and similar. The state of knowledge of their employees needs to be improved. It is specially important to organize appropriate training programmes on the state level, for employees of the Division of Supervision and Control and Division of Planning and Management (Department for Integrated Pollution Prevention and Control, Department for Cleaner Production,	Ministry of Environment and Spatial Planning (Department of Integrated Permits, Department of Project Management), Secretariat for	Provide funding and professional capacities. Develop IPPC Guideline.	Mobilization of national and international experts.	56000 EUR

	Department for Impact Assessment and similar). Training programmes would address the issues such as identification of emission sources, their significance, techniques for reduction or elimination of uPOPs. In addition, BAT/BEP implementation procedures would also be considered. In order to raise public awareness and train the operators on BAT/BEP implementation aimed at reduction or elimination of unintentional POPs releases it is necessary to organize and carry out several training programmes for the employees of state institutions and national and international experts. These two-day seminars would provide information on the reasons and sources of unintentional POPs releases, as well as the options for their reduction or elimination. The programme would specially be oriented towards the processes and equipment used for POPs emission reduction. Serbian Chamber of Commerce and Cleaner Production Centre of Serbia, are some of the organisations which should participate in organisation and realisation of specified seminars. Seminars should be organized on the regional level, with number of participants not exceeding 30. Seminars are particularly important for municipal self-governments, even if they are not to be included in the procedure for integrated permit issuance in the upcoming period.	Environmental Protection of the Autonomous Province of Vojvodina, municipal self-government.			
Action 2.3: Capacity building/development in the Ministry of Environment and Spatial Planning, aimed to enable proper selection of waste incineration facilities depending on the waste types, including municipal waste.	Thermal treatment of waste represents one of the waste treatments in accordance with the waste management hierarchy. Nowadays, a large number of waste incineration facilities are present worldwide, providing incineration of municipal waste as well as incineration of special waste types. Waste incineration facilities in the EU and leading industrial countries are subject to strict control, both with respect to emissions of certain pollutants and efficiency of their operation. In addition, all these facilities are economically self-sufficient and operate with no state subsidies. Besides usual incinerators, there are other thermal processes which are mostly still in development and are not commercially available. There are some exceptions with respect to certain special waste types. However, in many EU candidate countries, as well as in many other world developing countries, different thermal processes for ultimate waste disposal are often offered and recommended in spite of the fact that they are still not appropriately developed to be implemented in commercial facilities. Different lobbying and consulting companies are offering these facilities with no consideration of the type of waste planned to be treated. The biggest problem is a fact that mentioned consulting and lobbying companies are offering their services to authorities at different levels of decision making which do not have appropriate technical knowledge necessary to make the right	Ministry of Environment and Spatial Planning (Department for Project Management, Department of Integrated Permits, Department of Waste Management, Environmental Protection Inspection).	Provide funding.	Mobilization of at least one national expert and at least one international expert.	26000 EUR

	decision. For that reason it is necessary to significantly increase the state of knowledge in all involved authorities with respect to technical and economic characteristics of facilities used for thermal waste treatment in order to ensure that right decisions are going to be made when required.				
Activity 2.4: Establish appropriate legislation and standards for measurements, control and supervision of emissions, data storage and reporting of uPOPs together with other relevant emission parameters. Harmonization of these requirements with standards in the EU.	In order to reduce emission of uPOPs and reduce the number of sources it is necessary to provide more efficient emission control, supervision and monitoring. One of the first actions to be carried out in order to provide better conditions for conducting measurement, control and supervision is to develop appropriate legal and more importantly sub-legal regulations. It is necessary to develop new rulebooks and legal acts related to emission limit values, maximum permissible levels of pollutants in ambient air, requirements imposed upon expert organisations in order to become certified for conducting emission measurement and measurement of ambient concentrations, obligation for implementation of appropriate, precisely defined national and international standards for measurements and analysis. These activities should be carried out based on the experiences of other countries obtained through various projects on capacity building in certain fields such as air, water and soil protection and control of industrial pollution. In accordance with the EU standards, some measurement methods have been specified as referent/recommended or mandatory. These methods should be adopted and included in Serbian standards and then in appropriate Rulebook declared as recommended or mandatory. In order for this action to be implemented it is necessary to provide a list of standards related to measurements of emissions and ambient concentrations i.e. sampling and analysis of unintentionally produced POPs, present at locations of emission sources and in the environment. The list is to be submitted to the Serbian Institute for Standardization.	Ministry of Environment and Spatial Planning (Department of Air Protection, Department of Waste Management, Department of Water and Soil Protection, Department for Harmonization of Environmental Protection Regulations), Ministry of Agriculture, Forestry and Water Management, Serbian Institute for Standardization, Accreditation Board of Serbia.	Adopt the Law on Air Protection, Law on Water Management, Law on Waters, and Law on Soil. Provide funding. Provide institutional stability. Coordinate activities of authorities and all entities involved.	Regular activities carried out in the Ministry of Environment and Spatial Planning, Serbian Institute for Standardization and Accreditation Board of Serbia. Mobilization of national experts for preparation of national legislation, and supervision and selection of standards. Mobilization of national experts for pro-bono translation.	46000 EUR

Specific goal no. 3: Reduction and minimization of emission of uPOPs from industrial and other facilities by implementation of BAT/BEP in industries					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 3.1: Implementation of BAT/BEP measures in metal industries, co-incineration and incineration and reduction of uPOPs emissions from power plants and operations in oil refineries listed in	One of the main goals defined in the National Environmental Programme for the sector of industry is reduction of SO_2, NO_X, VOC, PAH, particle and other emissions to air from industrial facilities which do not fulfil EU standards. In addition, implementation of cleaner production and environmental	Operators.	Introduce new emission limit values in accordance with the ones defined in the EU legislation.	Funds needed for reconstruction of facilities.	5000000 EUR

Annex 2 and 3 of the Convention (and other relevant sources).	management systems in industrial facilities shall also be carried out, as well as implementation of integrated permit system in industrial facilities in accordance with the Law on Integrated Pollution Additional activities include modernization of production technologies and construction of flue gas treatment plants, as well as introduction of environmentally friendly technologies. Besides, results obtained during the preliminary inventory assembling indicate that the largest sources of uPOPs are ferrous and non-ferrous metal industries (metal processing industries), existing small capacity waste incineration facilities, thermal power plants. Apart from the industry, traffic sector also represents a significant emission source, primarily due to low quality fuel used and old-dated vehicle fleet. In order to improve operation of existing facilities it is necessary to implement appropriate BAT/BEP. Implementation of BAT/BEP also needs to be taken into account when considering construction of new facilities. These activities require considerable infrastructure investments, many of them already foreseen by the National Environmental Protection Programme and the Strategy for Energy Sector Development in the Republic of Serbia, as well as the Implementation Program for the Strategy for Energy Sector Development.		Provide strict implementation of the IPPC Law. Provide funding.		
Action 3.2: Develop economic instruments for implementation of BAT/BEP and for obtaining related IPPC permits for the sectors in Activity 3.1.	Having in mind that economic instruments are the best way for integration of economic and environmental aspects of economic development, it is necessary to introduce appropriate economic instruments which would have simulative effects on the process of IPPC permit issuing. While implementing economic instruments it is particularly important to precisely define the goals, include all interested parties, analyse the effects of the instruments on the economy and level of stimulation they have produced.	Environmental Protection Fund in cooperation with national experts from specific fields.		Regular activities carried out in the Environmental Protection fund and Ministry of Environment and Spatial Planning. Mobilization of national experts.	10000 EUR
Action 3.3: Improving the knowledge of personnel employed in state institutions with respect to BAT/BEP review and analysis, comparison of existing conditions and processes with equipment employed in BAT/BEP, as well as a manner of providing comprehensive and long-term monitoring of releases to the atmosphere.	Having in mind that implementation of BAT/BEP and integral permit obtaining represents a long process, besides changes in technological processes carried out by an operator, significant engagement of personnel employed in state institutions is also required. For that reason it is necessary to organize continuing education of state employees, informing them on the best ways to carry out negotiations with the operators, supervise implementation of specific processes and technologies, define emission limit values (ELVs), select adequate emission measuring time periods aimed to generate the most realistic emission profile etc. Training is carried out for all emission sources listed under the Action 3.1.	Ministry of Environment and Spatial Planning (Project Management Department, Department of Integrated Permits, Department for Standards and Cleaner Production, Department for Water Protection,	Provide professional capacities to conduct monitoring activities. Provide funding.	Mobilization of national experts for program development aimed to harmonize industry activities with IPPC provisions. Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national and international experts.	72000 EUR

		Environmental Protection Inspection), municipal self-government.			

Specific goal no. 4 Reduced emission of uPOPs resulting from fossil fuel combustion for house heating and transport					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 4.1: Develop and implement a district heating programme.	Results of the preliminary inventory indicate that incineration of waste, fossil fuel, biomass and other fuels in small furnaces represent one of significant sources of unintentional POPs releases. One of the emission reduction measures is a replacement of household furnaces and small boiler houses by district heating systems. Centralised heat supply is installed in 50 towns in Serbia, whereat total heat capacity of installed boilers equal 6597 MWt. Installed consumer demand equal 6000 MWt, where 82% represent a demand of residential sector and 18% of business sector. In towns where they are installed, district heating systems provide heat to approximately 60% of households. However, households connected to the district heating systems represent only 24,5% of total households in Serbia i.e. households heated by heat produced in heat plants represent only 16% of total number of households. National Environmental Protection Programme defines, as one of the short-term and medium-term goals, connection of individual households in towns with more than 20000 inhabitants to district heating systems. Besides, as defined in the Implementation Program for the Strategy for Energy Sector Development, existing heat lines are planned to be extended in order to provide for 100000 more heat consumers to be heat-supplied from existing and future heat sources. The said measure is planned to be carried out until 2012. Out of specified number of new consumers, 70000 will be household consumers, while 30000 will be from the public and municipal utility sectors.	Ministry of Mining and Energy, municipal self-government.	Provide gas distribution system of required capacity. Acceptable price of district heating, compared to other household heating options. Provide funding.	Funds needed for investing into new district heating capacities, as well as refurbishment and modernisation of existing systems.	-
Action 4.2: Continue to develop and extend gas distribution network.	As described in Activity 4.1, district heating systems provide a way for unintentional POPs releases, originating from household and small furnaces where fossil and other fuel types are being combusted, to be reduced. In addition, gas distribution system of required capacity, providing gas to heat plants and boiler houses, is stated as one of the preconditions for the said action. Besides district heating system, another way to reduce specified emissions is to replace existing household solid-fuel-burning furnaces with gas furnaces. In accordance with data specified in National Environmental Protection Programme, Strategy for Energy Sector	Ministry of Mining and Energy, Public Company "Srbija gas" and other gas-providing public companies.	Provide gas distribution system of required capacity. Decision of state authorities on gas distribution to parts of Serbia not covered by current gas distribution network.	Funds needed for investing into new district heating capacities, as well as refurbishment and modernisation of existing systems.	-

	Development until 2015 and Implementation Program for the Strategy for Energy Sector Development until 2015, only 7% of households (170000) and about 1200 industrial consumers are currently connected to gas distribution systems. In total fuel consumption, gas share equals 56%, liquid fuel (heavy oil) share 24% and the share of coal consumption equals 20%. 14% of households in Serbia use district heating as a primary heat supply option, 33% use electricity, 39% coal, 7% wood and 7% natural gas. Gas distribution network is not provided in east and south and partially west parts of the country. National Environmental Protection Programme foresees extension of gas distribution network for the purpose of connecting new industrial consumers, as well as households and small entrepreneurs. Strategy for Energy Sector Development of the Republic of Serbia defines five top priorities in further development of Serbia. These priorities mainly include activities in the gas-related field, as follows: – Modernization of existing gas distribution network; – Research aimed at new gas reserve discovering; – Construction of new transport routes aimed to provide increased safety of gas supply; – Construction of local distribution networks aimed to increase number of heat consumers in the construction sector. Republic of Serbia has signed an international Energy Community South East Europe Treaty (ECSEE) related to the electricity and gas market. With respect to all above mentioned facts, as well as the environment effects of natural gas use, a necessity for rapid development of gas distribution network is evident. Main direction of gas distribution system development are defined in a document titled "Strategy, Spatial Plan of the Republic of Serbia and National Action Plan for Extension of Gas Distribution Network in Serbia". These preconditions are also defined in other strategic documents (Strategy for Energy Sector Development and similar).		Acceptable price of natural gas heating, compared to other household heating fuels or options.		
Action 4.3: Increase energy efficiency of energy producing and industrial facilities in traffic and construction.	Necessity for implementation of this Action is manifested in the results of assembled preliminary inventory with respect to unintentionally produced and emitted POP from the sector of thermal heat/power generation in the Republic of Serbia. In accordance with the Strategy for Energy Sector Development and Implementation Program for the Strategy for Energy Sector Development, one of five top priorities represents a rational use of better quality fuels and increase of energy efficiency in energy production, distribution and use. The specified priority is primarily important for harmonization of energy production with actual energy consumption, but also for reduction of environmental impact caused by the energy production sector, positive effect on	Ministry of Mining and Energy, Agency for Energy Efficiency.	Develop the Law on Rational Use of Energy. Establish an Energy Efficiency Fund.	Regular activities carried out in the Ministry of Mining and Energy.	-

	economic efficiency, better living standard of Serbian citizens and reduction of import dependence. Increased energy efficiency has been recognized as one of the top priorities in the strategy for economic development of Republic of Serbia until 2012, as well as in National Environmental Protection Programme. In addition, rational use of energy and increased energy efficiency in sectors of industry and construction are defined as key elements in energy policies of many countries worldwide. In addition, these issues also represent key factors of sustainable development.				
Action 4.4: Improved control of service shops carrying out technical control of the vehicles, as well as control of exhausts gases during technical control of the vehicles.	Results of the preliminary inventory indicate that the most prominent source of detected PAH emissions (approximately 20% of total PAH emissions) is a sector of road traffic. Vehicle fleet in Serbia is in relatively bad condition. Currently there are about 2 million registered cars in the country, with the number rapidly increasing. Air pollution originating from traffic has increased over the last five years due to large number of used vehicles imported in that period. Air pollution is partially caused by bad fuel quality in Serbia, but also by improper operating regimes of car motors. However, one of the main reasons is improper implementation of Regulation on Motor Vehicle Exhaust Emissions. Although exhaust emissions from motor vehicles are controlled at least once a year during regular technical control of the vehicle, the effects on emission reduction are absent. The main reasons represent unsatisfactory control of the vehicles, irresponsible behaviour of certified service shops, but also old dated and insufficiently controlled and maintained measuring equipment. For all the reasons specified, it is necessary to organize better control of the personnel employed in service shops and better control of vehicles during regular annual technical control. There are more than 300 service shops certified to carry out technical control of the vehicles in Serbia. These services usually have 1 or 2 devices for measuring vehicle exhaust gases. As defined in regulations, the service shops are obliged to carry out calibration of their equipment. In order to provide better control of vehicle exhaust gases it is necessary to refurbish the existing equipment or procure new one and provide better control of service operation. Procurement of new measuring devices is necessary, while the existing one need to be better maintained.	Ministry of Internal Affairs.	Provide coordination of activities carried out by different ministries. Provide funding. Prescribe more strict control of vehicle technical condition.	Equipment procurement. Regular activities carried out in the Ministry of Internal Affairs related to the control of technical condition of vehicles.	-
Action 4.5: Develop a rulebook on fuel quality, harmonized with EU legislation.	Efficient measures for controlling emissions from mobile sources are being conducted. These measures are closely related to new regulation on air protection from emissions resulting from fuel combustion processes. For some fuel types and emissions (petrol, diesel, vehicle emissions) appropriate standards have been defined. However, these standards are largely not harmonized with EU legislation. In accordance with the National Environmental	Ministry of Mining and Energy.	Provide institutional stability. Modernisation of oil treatment/ refinement facilities.	Regular activities carried out in the Ministry of Mining and Energy. Mobilization of national expert.	20000 EUR

	Protection Programme, as well as the Strategy for Energy Sector Development until 2015 and the Implementation Program for the Strategy for Energy Sector Development until 2015 for the period 2007-2012, it is planned to revise some standards adopted for earlier specified products, especially those related to the sulphur content in liquid fuel (Directive 99/32/EC) and quality of petrol and diesel fuel (Directive 98/70/EC). National Integration Program defines that until 2012 at the latest, a technical regulations introducing provisions of the Directive 1999/32 on reduction of sulphur in certain liquid fuels and amended Directive 93/12/EEC and Directive 2003/17/EC, amended Directive 98/70/EC related to the quality of petrol and diesel fuel must be developed. Starting from 2010 all manufactured and imported vehicles are obliged to fulfil emission standards defined in Directives 98/69/EC and 2001/100/EC.				

Specific goal no. 5 Improved legislations and sampling and analysis of uPOPs					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 5.1: Evaluation of the options for uPOPs analysis in Serbia.	To estimate the amount of uPOPs samples possibly generated in Serbia each year. On this estimate decide if and to which extent unintentionally POPs analysis capacity (including PCDD/PCDF) should be established in Serbia or if the analysis should be done within international collaborations. In this assessment instrumental analysis and bio-assays for measuring dioxin-like toxicity will be considered.	Ministry of Environment and Spatial Planning (Department of Air Protection, Project Management Department)	Provide institutional stability. Adopt the Law on Air Protection.	Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national and international experts.	18000 EUR
Action 5.2: Development of a monitoring concept and possibly capacity for monitoring of uPOPs emission from industry.	a) Development of monitoring strategy of industrial emissions; In course of general improvement of the monitoring concept of industry emissions in Serbia it will be evaluated which monitoring strategy for uPOPs is the most appropriate. Development of sampling capacity of uPOPs from industrial emissions. b) Capacity building of emission sampling and (possibly) analysis for PCDD, PCDF and dioxin-like PCB; c) Trial campaign for uPOPs and new POPs	Ministry of Environment and Spatial Planning. (Department of Air Protection, Department for Project Management Department, Accreditation Board of Serbia.	Provide institutional stability. Adopt the Law on Air Protection.	Regular activities carried out in the Ministry of Environment and Spatial Planning and the Accreditation Board of Serbia Mobilization of national and international experts.	500000 EUR
Action 5.3: Development of a strategy for food and feed monitoring of uPOPs.	Maximum permissible POPs concentrations in food should be harmonized with values defined in EU legislation. It is necessary to prescribe and specify congeners and the units in which results of the analyses are to be reported. Methods of analysis should be harmonized in order to provide uniform interpretation of the results (analytics and data processing).	Ministry of Agriculture, Forestry and Water Management, Ministry of Health.	Provide institutional stability. Adopt the Law on Food Safety.	Regular activities carried out in the Ministry of Agriculture, Forestry and Water Management and the Ministry of Health. Mobilization of national	8000 EUR

				and international experts.	
Action 5.4: Monitoring of uPOPs in air.	To estimate the air quality in Serbia each year should conduct monitoring of uPOPs releases. Monitoring of uPOPs should be connected with national network for air quality control according to Law of Air Protection.	Ministry of Environment and Spatial Planning. (Department of Air Protection) Serbian Environmental Protection Agency.	Enforcement of Law on Air Protection and corresponding by-laws.	Regular activities carried out in the Ministry of Environment and Spatial Planning and the Serbian Environmental Protection Agency. Mobilization of national and international experts.	210000 EUR

Specific goal no. 6 Education, awareness raising, updating inventories and reporting

Action	Description	Key player	Preconditions	Resources	Budget
Action 6.1: Evaluate and possibly improve the emission factor used for the calculations of uPOPs released (PCDD, PCDF, HCB and PAH) from the different emission factor data basis (UNEP Toolkit, EMEP, own data, etc), highlight inconsistencies in these data basis and suggest improvements.	An obligation of mandatory measurement of uPOPs releases shall be imposed upon some facilities. In that way, emission factors recommended in the appropriate guidelines to be used for emission calculation may be checked. In addition, emission factors defined for other facilities, for which mandatory emission measurements are not prescribed may also be checked.	Ministry of Environment and Spatial Planning (Department of Air Protection), Environmental Protection Agency, Authorised and accredited laboratories.	Provide funding. Improve laboratory analyses and investigations. Procurement and installation of continuous sampling equipment.	Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national and international experts.	280000 EUR
Action 6.2: Organize training programmes for employees of the Serbian Environmental Protection Agency providing them with the knowledge on uPOPs inventory assembling and harmonize the activity with establishing PRTR and other inventories and databases.	The results of the preliminary inventory have indicated that certain faults are present at different levels of the inventory assembled. Insufficiently developed system of statistical data processing, as well as the absence of certain statistical data (e.g. landfill fires, number of burnt containers etc.) and insufficiently trained personnel responsible for filling out the forms and similar have been identified as some of the problems observed. In addition, preliminary inventory was assembled by the project consultant so it is necessary to transfer the knowledge used to the employees of the Serbian Environmental Protection Agency for the purpose of future regular reporting. Apart from the employees of the Serbian Environmental Protection Agency it is necessary to organize a seminar for environmental inspectors, especially provincial-level environmental inspectors, where data collecting for the purpose of uPOPs inventory assembling would be addressed. It is necessary to, in cooperation with the Serbian Environmental Protection Agency, define type of data, a way of data collecting and data sources to be used for uPOPs inventory assembling. Forms developed and used during preliminary inventory assembling should be used as a basis for identifying missing data,	Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning (Department of Air Protection, Department of Water and Soil Protection, Department of Waste Management, Environmental Protection Inspection), Secretariat for Environmental Protection of the Autonomous Province of	Increase number of employees in the Serbian Environmental Protection Agency assembling the Integral Cadastre of Pollutants.	Regular activities carried out in the Serbian Environmental Protection Agency and state and provincial-level inspectors. Mobilization of national expert.	38000 EUR

	their type and sources.	Vojvodina.			
Action 6.3: Improvement and update inventory of uPOPs.	In accordance with the provisions of the Stockholm Convention and obligatory reporting to the European Environmental Protection Agency it is necessary to assemble the inventory of uPOPs in certain time periods.	Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning.	Increase the number of employees in the Serbian Environmental Protection Agency assembling the Integral Cadastre of Pollutants.	Regular activities carried out in the Serbian Environmental Protection Agency and Ministry of Environment and Spatial Planning. Mobilization of national expert.	20000 EUR
Action 6.4: Fulfilling the reporting requirements. Prepare reports on uPOPs releases to be submitted to the Stockholm Convention Secretariat.	Based on the results of the assembled inventory, a report to be submitted to the Secretariat of the Stockholm Convention every five years, as well as annual report for the European Environmental Protection Agency, shall be prepared in accordance with obligations related to such reporting. Each report should provide data on the sources and annual quantities of uPOPs releases.	Environmental Protection Agency, Ministry of Environment and Spatial Planning (Department of Air Protection).	Update the inventory of uPOPs. Provide timely and regular input of new data on produced POPs.	Regular activities carried out in the Serbian Environmental Protection Agency and Ministry of Environment and Spatial Planning. Mobilization of national expert.	10000 EUR
Action 6.5: Awareness rising on uPOPs for policy makers, industry and public. (Harmonize activity on uPOPs education with general POPs/New POPs Education in the frame of Sustainable Development and Sustainable Consumption and Production policy).	Reduced emissions of uPOPs shall be provided by appropriate adaptation of production processes, regulated by issuance of integrated permit and acceptance and approval of environmental impact assessments developed. For that reason, operators and state employees need to be appropriately trained for carrying out the above activities. In addition, uPOPs are also emitted during uncontrolled burning of municipal and other waste. In order to reduce uPOP releases it is necessary to inform the public on the effects of such waste burning on human health. In order to conduct specified education and informing programmes, a detail education plan shall be developed, specifying guidelines and materials that need to be prepared, number of necessary training programmes, as well as the number of participants joining each programme. With respect to planed public informing, special attention should be paid to information on harmful effects of unintentionally produced and released POPs on human health. This information should be included in the primary school environmental protection programmes. Public informing should be carried through appropriately developed brochures and their distribution to the entities deliberately causing fires (throwing embers in municipal waste containers, open-field burning of agricultural residues) as	Ministry of Environment and Spatial Planning (Department of Chemicals, PR services, Department of Air Protection).	Provide funding.	Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national experts.	36000 EUR

	well as public forum organized on the topic ***"Harmful effects of uncontrolled burning of waste, waste containers and heating fuels on human health and the environment".*** Public forums are aimed to increase public awareness and knowledge and represent one of many locally conducted actions for public informing on POPs-related issues. This activity would be carried out in cooperation with municipalities which have been identified as the most significant polluters (improper handling and uncontrolled burning of waste, heating fuel, containers etc.). In order for this action to be efficiently carried out it is necessary to form a workgroup or an expert team which would coordinate and manage specified activities.				
Action 6.6: Adopt all standards EU standards and recommendation with respect to emission factors for uPOPs and declare them as Serbian standards.	Based on the result of the Action 6.1 as well as the appropriate EU standards emission factors for sources of unintentionally emitted POPs shall be defined. Defined emission factors shall be later used for detail inventory assembling.	Serbian Environmental Protection Agency, Serbian Institute for Standardization	Complete Action 6.1 and collect data on emission measurements.	Regular activities carried out in the Serbian Environmental Protection Agency and the Ministry of Environment and Spatial Planning. Mobilization of national expert.	4000 EUR

3.3.4 Action plan for contaminated area

Main goal of Action plan for contaminated area is: Reduction of environmental pollution through recovery and remediation of identified POPs-polluted areas.

Specific goals of Action plan for contaminated areas are:

- Provide regulatory institutional conditions for identification and remediation of contaminated areas,
- Develop preliminary studies addressing the areas potentially contaminated by POPs,
- Identify, prioritize and where possible remediate areas contaminated by POPs.

ACTION PLAN DEVELOPED FOR CONTAMINATED AREAS

MAIN GOAL

Reduction of environmental pollution through recovery and remediation of identified POPs-polluted areas

Specific goal no. 1: Provide regulatory institutional conditions for identification and remediation of contaminated areas					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 1.1: Establish expert bodies responsible for setting criteria for determining POPs-contaminated areas, principles and locations for conducting preliminary investigations, remediation procedures for POPs-containing matrices and POPs-contaminated sites, as well as consideration, adoption and approval of proposed remediation plans and activities and remediation effect monitoring.	It is necessary to gather the experts who would in cooperation with the Ministry employees define criteria for determining POPs-contaminated areas, evaluate plans and remediation activities proposed to be carried out at contaminated sites and select the most cost-effective remediation measures (individually for each contaminated location, additionally providing public participation). The group assembled will also monitor the effects of remediation activities performed.	Ministry of Environment and Spatial Planning (Department of Water and Soil Protection, Environmental Protection Inspection).	Provide funding.	Mobilization of national and international experts.	12000 EUR
Action 1.2: Establish criteria for identification of areas contaminated with POPs, recovery and remediation procedures developed for environmental matrices where POPs have been detected and remediation of POPs-contaminated areas.	Define a set of parameters to be used in analysis of the current condition of certain area. Define criteria, with respect to defined set of parameters, for an area to be declared contaminated, as well as possible combined effects of more pollutants (synergy). In addition, define general criteria imposed upon POPs transformation/decontamination procedures with respect to elimination of any related environmental risk, as well as earlier positive results that have resulted from the use of examined transformation/decontamination procedure.	Ministry of Environment and Spatial Planning.	Provide an agreement and identification of responsibilities of responsible institutions.	Regular activities carried out by the ministries. Mobilization of national and international experts.	28000 EUR
Action 1.3: Organize employee training in the Ministry of Environment and Spatial Planning and training of other national experts on proper selection and efficiency of remediation procedures and techniques.	Educating ministry employees on decontamination and/or remediation technologies and techniques. Educating ministry employees on implementation of appropriate remediation technologies and procedures in accordance with a level of contamination, characteristics and practiced use of the area, scope of remediation activities and expected results.	Ministry of Environment and Spatial Planning	Provide funding.	Mobilization of national and international experts.	38000 EUR

Specific goal 2: Develop preliminary studies addressing the areas potentially contaminated by POPs					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 2.1: Develop preliminary investigation in potentially contaminated areas.	Preliminary investigation is carried out in potentially contaminated locations, selected based on the type of POPs-related activities, natural characteristics and sensitivity of the location, as well as existing data obtained from up-to-date POPs monitoring.	Ministry of Environment and Spatial Planning (Department of Water and Soil Protection,	Provide funding. Provide coordinated actions of all entities involved, ministries, local self-government	Regular activities carried out in the ministries and municipal self-government. Mobilization of national	112000 EUR

		Environmental Protection Inspection), Serbian Environmental Protection Agency, Ministry of Agriculture, Forestry and Water Management, Ministry of Health, Ministry of Mining and Energy, municipal self-government, Serbian Institute for Hydrometeorology, Institute of Public Health, liable entities, expert team.	etc.	and international experts.	
Action 2.2: Provide extended data on potentially contaminated areas not provided in the preliminary investigation.	In order to develop a detail study on potentially contaminated areas, it is necessary to add all parameters which have not been provided in the preliminary investigation.	Ministry of Environment and Spatial Planning (Department of Water and Soil Protection, Environmental Protection Inspection), Serbian Environmental Protection Agency , Ministry of Agriculture, Forestry and Water Management, Ministry of Health, Ministry of Mining and Energy, municipal self-government, Serbian Institute for Hydrometeorology, Institute of Public Health, liable entities, expert team.	Provide funding. Provide coordinated actions of all entities involved, ministries, local self-government etc.	Funds needed for investigation of contaminated areas	250000 EUR
Action 2.3: Develop a study on potentially contaminated areas.	A detail study describing the area and providing a basis for later prioritizing and treatment planning need to be developed for each contaminated area.	Ministry of Environment and Spatial Planning (Department of Water	Provide funding. Provide coordinated actions of all entities involved.	Mobilization of national and international experts. Regular activities carried out in the ministries and	130000 EUR

		and Soil Protection, Environmental Protection Inspection), expert team.		municipal self-government.	
Action 2.4: Assemble an inventory of sites potentially contaminated by POPs.	In the first phase of the contaminated area management it is necessary to assemble an inventory of sites potentially contaminated by POPs. The inventory shall provide basic data on the location, pollutant and related impact on the ecosystems. The inventory shall list all areas where POPs have been detected in soil in concentrations which are deemed to represent a source of significant health and environmental risks.	Serbian Environmental Protection Agency, Ministry of Environment and Spatial Planning, Ministry of Agriculture, Forestry and Water Management.	Increase number of employees in the Serbian Environmental Protection Agency working on the soil quality monitoring. Action 3.2 of Action plan for contaminated areas completed.	Mobilisation of national consultant. Funds provided. Regular activities carried out in the Serbian Environmental Protection Agency.	30000 EUR

Specific goal no. 3: Identify, prioritize and where possible remediate areas contaminated by POPs					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 3.1: Identify and prioritize areas contaminated by POPs and develop a list of priorities for recovery and remediation.	Based on the studies developed within the scope of Action 2.3 it is necessary to identify areas contaminated by POPs. Based on the developed methodology, a list of priorities for recovery and remediation of identified areas should be prepared.	Ministry of Environment and Spatial Planning, Serbian Environmental Protection Agency, expert team.	Provide coordinated actions of all entities involved. Provide cooperation of different sectors. Actions 2.1-2.3 completed.	Mobilization of national and international experts. Regular activities carried out in the Ministry of Environment and Spatial Planning, Serbian Environmental Protection Agency, Institute of Soil Science.	50000 EUR
Action 3.2: Develop action plans for treatment of the areas contaminated by POPs.	Based on characteristics of the areas and determined priorities it is necessary to develop an action plan for their treatment. The action plan shall provide information on the main treatment measures (recovery, decontamination or remediation), time deadlines, responsible entities, funding.	Ministry of Environment and Spatial Planning (Department of Water and Soil Protection, Environmental Protection Inspection).	Provide coordinated actions of all entities involved. Provide an agreement and identification of responsibilities of responsible and expert institutions.	Regular activities carried out in the ministries. Mobilization of national and international experts.	55000 EUR
Action 3.3: Select remediation procedures for the POPs-contaminated areas.	Appropriate remediation procedure should be selected for each area identified as potentially polluted by POPs. Selection is to be made based on the current situation, expected results and costs.	Ministry of Environment and Spatial Planning (Department of Water and Soil Protection, Environmental Protection Inspection), expert team.	Provide funding. Provide coordinated actions of all entities involved.	Regular activities carried out in the ministries. Mobilization of national and international experts.	60000 EUR

Action 3.4: Cary out remediation of the POPs-contaminated areas.	Based on the Activities 3.1-3.3 remediation of POPs-contaminated areas shall be commenced. However, at the time of the Action Plan development, POPs-contaminated areas have not yet been identified nor prioritized. Still, activities on recovery and remediation of contaminated areas are carried out in accordance with a legal obligation of an entity for which it has been determined to cause environmental degradation to carry out necessary remediation activities. Activities of this type will be continued.	Ministry of Environment and Spatial Planning (Department of Water and Soil Protection, Environmental Protection Inspection), entities for remediation implementation.	Provide funding.	Funds needed for remediation.	15000000 EUR
Action 3.5: Monitor effects of remediation.	It is necessary to establish a system for remediation performance monitoring. Key pollution indicators and parameters indicating the current state of the environment should be monitored at specific time intervals in areas where remediation measured have been carried out. Based on the results of environmental monitoring, effects and performed remediation will be determined, followed by recommendation of future actions to be carried out at the location considered.	Ministry of Environment and Spatial Planning (Department of Water and Soil Protection, Environmental Protection Inspection), Serbian Environmental Protection Agency, expert team, selected service providers from the previous Action.	Conducted remediation/ recovery programmes.	Mobilization of national and international experts.	60000 EUR

3.3.5 Action plan for institutional and regulatory measures aimed at Stockholm Convention implementation and reporting

Main goal is: Develop appropriate institutional capacities and harmonized national legislation for reduction or elimination of POPs, in accordance with the Stockholm convention and EU *Acquis.*

Specific goals of Action plan for institutional and regulatory measures aimed at Stockholm convention implementation and reporting are:

- All relevant national legislation addressing POPs, all harmonized with EU *acquis* and international conventions adopted,
- Capacity building in state regulatory bodies and institutions, bodies of autonomous province and municipal self-government, improved cross-sector cooperation and coordination of POPs management improved,
- System for regular reporting on POPs reduction measures and related effects based on collected and processed data on POPs sources and generated POPs quantities established.

ACTION PLAN DEVELOPED FOR INSTITUTIONAL AND REGULATORY MEASURES AIMED AT STOCKHOLM CONVENTION IMPLEMENTATION AND REPORTING

MAIN GOAL

Develop appropriate institutional capacities and harmonized national legislation for reduction or elimination of POPs, in accordance with the Stockholm convention and EU *acquis*

Specific goal no. 1: All relevant national legislations addressing POPs, all harmonized with EU *acquis* and international conventions adopted					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 1.1: Impose an obligation for analysis of PBT-characteristics of plant protection products, biocides and industrial chemicals before their placement on the market, as well as prohibit the use or impose other administrative procedures for mandatory risk management of chemical with PBT characteristics.	In accordance with Article 3 of the Stockholm Convention all parties to the Convention are obliged to develop appropriate legislation with the aim of preventing the production and use of new pesticides or new industrial chemicals which exhibit the characteristics of POPs. In addition, provisions of the Convention set a basis for estimation of the main characteristics of these chemicals. Law on Chemicals, Law on Biocidal Products and Law on Plant Protection Products are adopted. Based on the provisions of the Law on Chemicals, one of the identified short-term goals is preparation of basic sub-legal regulation i.e. Rulebook on Classification, Labelling and Packaging of Chemicals, which shall prescribe PBT-related criteria. In addition, the Law shall provide conditions for prohibiting and imposing other measures upon considered substances, aimed to reduce the risks caused by their use.	Ministry of Environment and Spatial Planning (Department of Chemicals, Department for Normative and Legal issues, Department of Environmental Protection Regulation Harmonization) Ministry of Agriculture, Forestry and Water Management (Department of Pesticides and Fertilizers).	Adopt the Law on Chemicals and the Law on Biocidal products. Provide funding. Provide professional capacities. Provide institutional stability.	Regular activities carried out in the ministries. Mobilization of national experts and international experts.	8000 EUR
Action 1.2: Develop the Rulebook on handling with PCB-containing equipment and waste.	Described under Action 1.2 of the Action Plan developed for PCB.				-
Action 1.3: Carry out analysis aimed to define adequate emission limit values in order to control emissions of uPOPs; legally prescribe determined emission limit values as mandatory.	Law on Air Protection is adopted during May 2009. It is necessary to prepare a Draft Law on Waters and relevant regulations on soil, as well as sub-legal regulations on emission limit values and maximum ambient concentrations. In addition, it is necessary to consider and determine realistic limit values to be prescribed with respect to technological processes used in Serbia for incineration and co-incineration. Since co-incineration is not practiced in Serbia, it is necessary to adopt appropriate emission limit values from EU legislation.	Ministry of Environment and Spatial Planning (Department of Air Protection, Soil Protection Group, Department of Water and Soil Protection), Ministry of Agriculture, Forestry and Water	Adopt the Law on Air Protection, Law on Waste Management, Law on Waters, and Law on Soil.	Regular activities carried out in the ministries. Mobilization of national experts. Funding provided.	40000 EUR

		Management (Water Divisions).			
Action 1.4: Define a manner for conducting Obsolete Pesticides and POPs waste management and conditions and procedures for obtaining permits allowing temporary hazardous waste storage, disposal and treatment.	Described under Action 1.2 of the Action Plan developed for obsolete pesticides (pesticide waste).				-
Action 1.5: Develop and adopt the Law on Fire Protection which would regulate fire prevention measures.	Valid Law on Fire Protection (Official Gazette of RS No. 37/88) regulates the issues of protection of people and assets from fires. The Law prescribes an obligation for all necessary measures to be conducted in order to prevent fire breaking and spreading, provide early detection and extinguishing, save human lives and assets endangered by fire, as well as provide aid in repairing fire-caused damages. The Law was adopted 20 years ago and many of its provisions are out dated and not harmonized with changes that have occurred in the meantime. A certain discrepancy is present with respect to areas of jurisdiction of the state government, municipal self-government, certain ministries etc. Some provisions of the Law related to fire protection organisation are inappropriate for current situation. Issues of fire protection funding are not appropriately resolved. Penalties foreseen are not precisely defined. The Law is not harmonized with the valid law on municipal self-government, law on planning and construction, law on occupational protection, law on personal and property insurance, laws addressing the field of education and similar, and for that reason need to be replaced by newly developed and adopted Law on Fire Protection.	Ministry of Internal Affairs (Department of Protection and Rescue)	Adopt the Law on Protection and Rescue.	Regular activities carried out in the Ministry of Internal Affairs. Mobilization of national experts.	8000 EUR
Action 1.6: Establish criteria for identification of areas contaminated with POPs, recovery and remediation procedures developed for environmental matrices where POPs have been detected and remediation of POPs-contaminated areas.	Described under Action 1.2. of the Action Plan developed for contaminated areas.				-
Action 1.7: Develop technical guidelines for POPs waste management (PCB, POPs and pesticide waste, uPOPs).	This Action is in accordance with Article 6 of the Stockholm Convention and refers to development of technical guidelines for collection, storage and separation of POPs waste from other types of waste, in accordance with the Guideline under the Basel Convention. The Secretariat of the Basel Convention has developed a set of technical guidelines for environmentally sound management of different waste types. It is necessary to	Ministry of Environment and Spatial Planning (Department of Waste Management, Department of Chemicals).	Provide funding.	Regular activities carried out in the ministries. Mobilization of national and international experts.	20000 EUR

	develop similar guidelines in Serbian language and in accordance with needs and plans of the state government related to destruction of this type of waste.				
Action 1.8: Develop a rulebook on fuel quality, harmonized with EU legislation.	Described under Action 4.5 of the Action Plan developed for uPOPs.				-
Action 1.9: Define a manner for conducting pesticide packaging management.	Described under Action 2.1 of the Action Plan developed for obsolete pesticides (pesticide waste).				-
Action 1.10: Adopt all EU standards and recommended procedures for POPs measurements in environmental media and food and declare them as national standards.	In accordance with EU legislation, some investigation methods are defined as the referent/recommended or mandatory methods. It is necessary to adopt these methods and declare them to be the standard methods in Serbia and then, in appropriately developed regulations, recommend or define their obligatory use. In order for this Action to be carried out it is necessary to prepare a list of standards that refer to POPs measurements in the environmental media, waste and food and submit to the Serbian Institute for Standardization. (Described under Action 1.12 of the Action Plan developed for PCB, Actions 2.4. and 6.6. of the Action Plan developed for uPOPs.	Serbian Institute for Standardization Key parties involved in preparation of a list of standards that need to be adopted as Serbian standards: Ministry of Environment and Spatial Planning , Ministry of Health, Ministry of Agriculture, Forestry and Water Management, Serbian Environmental Protection Agency	Provide institutional stability. Provide coordinated activities of all ministries involved, the Serbian Institute for Standardization, agencies and all entities engaged.	Regular activities carried out in the Serbian Institute for Standardization, Ministry of Environment and Spatial Planning , Ministry of Health and Ministry of Agriculture, Forestry and Water Management. Mobilization of national experts for pro-bono translation.	-

Specific goal 2: Capacity building in state regulatory bodies and institutions, bodies of autonomous province and municipal self-government, improved cross-sector cooperation and coordination of POPs management improved					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 2.1: Organise training programmes for all-level authority bodies responsible for the issues of pesticide waste management, especially management of POPs waste and waste packaging.	Described under Action 1.4 and 2.2 of the Action Plan developed for obsolete pesticides (pesticide waste).				-
Action 2.2: Capacity building for authorities and inspection for sound pesticides waste management.	Described under Action 1.3 of the Action Plan developed for obsolete pesticides (pesticide waste).				-

Action 2.3: Pilot demonstration inventory project for one selected district, for POPs and other waste pesticides and propose a solution for their ultimate disposal.	Described under Action 1.4 of the Action Plan developed for obsolete pesticides (pesticide waste).				-
Action 2.4: Develop a section of the Guidelines for Integrated Permit Issuance related to reduction and elimination of uPOPs.	Described under Action 2.1 of the Action Plan developed for uPOPs. (PCDD/PCDF, PCB and HCB).				-
Action 2.5: Organise seminars for authority bodies responsible for BAT/BEP introduction, process of integrated permit issuance and further control of BAT/BEP implementation aimed at reduction of uPOPs releases.	Described under Action 2.2 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				-
Action 2.6: Improving the knowledge of personnel employed in state institutions with respect to BAT/BEP review and analysis, comparison of existing conditions and processes with equipment employed in BAT/BEP, as well as a manner of providing comprehensive and long-term monitoring of releases to the atmosphere.	Described under Action 3.3 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				-
Action 2.7: Awareness rising on uPOPs for policy makers, industry and public. (Harmonize activity on uPOPs education with general POPs/New POPs education in the frame of Sustainable Development and Sustainable Consumption and Production policy).	Described under Action 6.5 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				-
Action 2.8: Capacity building/development in the Ministry of Environment and Spatial Planning, aimed to enable proper selection of waste incineration facilities depending on the waste types, including municipal waste.	Described under Action 2.3 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				-

Action 2.9: Organise seminars for employees of the Ministry of Environment and Spatial Planning and other national experts, providing them with the knowledge they need to properly estimate different remediation procedures and techniques.	Described under Action 1.3 of the Action Plan developed for contaminated areas.				-
Action 2.10: Organize training programmes for employees of the Serbian Environmental Protection Agency providing them with the knowledge on uPOPs inventory assembling and harmonize the activity with establishing PRTR and other inventories and databases.	Described under Action 6.2 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB)				-
Action 2.11 Organize training programmes for inspection bodies, providing them with the knowledge on data collection on PCB waste and containing equipment for the purpose of inventory assembling.	Described under Action 1.7 of the Action Plan developed for PCB.				-
Action 2.12: Capacity Building of administration.	Based on the review of current legal system and related capacities, this Action should define additional capacities required for introduction and implementation of regulatory measures defined in the Action plan. This should include administrative capacitates in the Chemicals Agency, as well as provision of technical support, including chemical risk assessment. In addition, it is necessary to built capacities in the sector of industry which does not have any experience and needs proper training in order to fulfil obligations defined in the Law on Chemicals, Law on Biocidal Product and the Law on Plant Protection Products. Chemicals Agency is planned to be established in the period of six months following the adoption of the Law on Chemicals i.e. until the end of 2009. Establishment of Chemicals Agency shall initiate a joint project with the Swedish Chemicals Agency (KemI), on capacity building in the field of chemical management. The project shall be continued through IPA 2008 and organisation of advance training programmes for the employees of the Serbian Chemicals Agency, while the industrial sector should carry out capacity building in the same field by itself. The basis for this process shall be provided by appointment of a technical advisor on chemicals and setting up a help-desk.	Ministry of Environment and Spatial Planning (Department of Waste Management, Department of Chemicals), Ministry of Agriculture, Forestry and Water Management (Department of Pesticides and Fertilizers).	Adopt the Law on Chemicals.	Regular activities carried out in the ministries. Mobilisation of national and international experts.	24000 EUR

Action 2.13: Institutional Capacity building for hazardous waste management, especially management of POPs waste.	This Action refers to institutional reinforcement in the field of hazardous waste management in accordance with international legislation and EU legislation. Until the end of 2011 the Ministry of Environment and Spatial Planning shall carry out IPA 2008 project titled "Strengthening institutional capacity in the field of hazardous waste management". The program shall strengthen administration capacities and establish a national system for hazardous waste management.	Ministry of Environment and Spatial Planning (Department of Waste Management).	Adopt the Law on Waste Management	Regular activities carried out in the ministries. Mobilisation of national and international experts.	20000 EUR

Specific goal no. 3: System for regular reporting on POPs reduction measures and related effects based on collected and processed data on POPs sources and generated POPs quantities established					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 3.1: Develop a precise internal procedure for obtaining relevant information, to be used by the designated National Focal Point for informing the Secretariat of Stockholm Convention.	Data related to POPs quantities are colleted by the Serbian Environmental Protection Agency. Article 9, paragraph 3 of the Convention states that parties to the Convention are obliged to establish a state body to act as a National Focal Point for the exchange of information with the Secretariat of Stockholm Convention. For the purpose of the Secretariat informing it is necessary to precisely develop appropriate internal procedure. The procedure must define a scope of liabilities of designated National Focal Point, in accordance with Articles 9.3 and 9.4 of the Convention. It is necessary to define a manner and time for Serbian Environmental Protection Agency to submit data to the designated National Focal Point in order for the Focal Point to timely forward the data to the Secretariat of the Convention. National Focal Point also receives data from other ministries/bodies (ministry regulating the field of agriculture, energy). These ministries/organisations shall be members of a Joint Body, planned to be established within the scope of the Action 3.12. It is necessary to develop a data verification procedure.	Ministry of Environment and Spatial Planning (Department of Chemicals), Serbian Environmental Protection Agency.	Provide cross-sector cooperation.	Regular activities carried out in the ministries. Mobilisation of national and international experts.	44000 EUR
Action 3.2: Assemble an inventory of uPOPs.	Described under Action 6.3 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				-
Action 3.3: Fulfilling the reporting requirements. Prepare reports on uPOPs releases to be submitted to the Stockholm Convention Secretariat.	Described under Action 6.4 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB)				-
Action 3.4: Assemble the inventory of POPs and	Described under Action 2.4 of the Action Plan developed for				-

other pesticides.	obsolete pesticides (pesticide waste).				
Action 3.5: Develop reports on pesticide waste and POPs pesticides, to be submitted to the European Environmental Protection Agency and the Secretariat of Stockholm Convention.	Described under Action 2.5 of the Action Plan developed for obsolete pesticides (pesticide waste).				-
Action 3.6: Develop Guideline for identification, recording and environmentally safe handling of PCB-containing equipment and PCB waste, intended for the owners and the entities operating and maintaining of PCB equipment and develop PCB data base software.	Described under Action 1.3 of the Action Plan developed for PCB.				-
Action 3.7: Develop a procedure for verification of data obtained from the owners, users or entities operating or maintaining PCB-containing equipment.	Described under Action 1.4 of the Action Plan developed for PCB.				-
Action 3.8: Develop a study on identification of PCB used in the plastic, polymer, coating and paint production industries as well as in construction industry.	Described under Action 1.8 of the Action Plan developed for PCB.				-
Action 3.9: Assemble and regularly update an inventory of PCB-containing equipment and PCB waste.	Described under Actions 1.9 and 1.10 of the Action Plan developed for PCB.				-
Action 3.10: Prepare a report on PCB-contained equipment to be submitted to the European Environmental Protection Agency, in accordance with obligations imposed by the Stockholm Convention.	Described under Action 1.11 of the Action Plan developed for PCB.				-
Action 3.11: Assemble an inventory of sites potentially contaminated by POPs.	Described under Action 2.4 of the Action Plan for contaminated areas.				-

Action 3.12: Establish a Joint Body for chemicals management aimed to provide an integral management of chemicals in Serbia and coordinate the activities conducted towards implementation of the Stockholm, Rotterdam, Helsinki and Basel Conventions.	The Activity refers to establishment of a special body aimed to provide coordination of activities on implementation of related Conventions, all addressing the issue of chemicals management. Developing cooperation with respect to activities conducted on implementation of stated Conventions shall contribute for the set goals to be reached and shall provide more efficient use of national capacities, as well as avoidance of already conducted activities to be repeated. The main goal is to use experiences and results of individual Conventions in national actions towards improving the state of the environment. Joint Body shall be after establishment of Chemicals Agency. One of the activities of the Body shall refer to coordination of activities carried out towards implementation of the Stockholm, Rotterdam, Helsinki and Basel Conventions. Described under Action 1.1 of the Action Plan developed for PCB. Described under Action 1.1. of the Action Plan developed for obsolete pesticides (pesticide waste).	Ministry of Environment and Spatial Planning (Department of Chemicals).	Adopt the Law on Chemicals. Provide funds needed for regular activities of the Secretariat of the Joint Body.	Regular activities carried out in the future Chemicals Agency, as well as the Secretariat of the Joint Body.	-

3.3.6 Action plan for monitoring

Main goal of this Action plan is: Provide decision makers, public and international institutions the information on POPs presence in the environment and biota, obtained through regular monitoring and organised system of data collection and reporting

Specific goals of Action plan for monitoring are:

- Developed or changed/amended regulations on POPs measurement in environmental media, food and biological matrices,
- Carrying out monitoring of POPs in environmental media and biological samples (animal and human-derived) in a manner prescribed in relevant laws and programs.

ACTION PLAN DEVELOPED FOR MONITORING

MAIN GOAL

Provide decision makers, public and international institutions the information on POPs presence in the environment and biota, obtained through regular monitoring and organised system of data collection and reporting

Specific goal no. 1: Developed or changed/amended regulations on POPs measurement in environmental media, food and biological matrices					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 1.1: Adopt all EU standards related to POPs measurements in environmental media and food and declare them as national standards.	Described under Action 1.10 of the Action Plan developed for institutional and regulatory measures for implementation of the Stockholm Convention.				-
Action 1.2: Prescribe and/or harmonize PCDD/PCDF (PAH) emission limit values, measurement methods and frequencies for measurement of POPs emissions from waste incineration facilities and other facilities in accordance with EU legislation and legislation of the member countries.	Before prescribing PCDD/PCDF (PAH) emission limit values it is necessary to carry out analysis of national facilities, excluding the waste incineration facilities, in order to determine realistic limit values. Since currently there are no waste incineration facilities in Serbia, emission limit values for those facilities shall be imported from EU legislations.	Ministry of Environment and Spatial Planning (Department of Waste Management, Department of Air Protection, Department for Harmonization of Environmental Protection Regulations).	Provide institutional stability. Adopt the Law on Air and the Law on Waste Management.	Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national and international experts.	166000 EUR
Action 1.3: Define the zones where PAH are measured within the scope of ambient air quality monitoring and define deadlines for reaching the target values.	Based on the Law on Air Protection it is necessary to define zones where PAH are measured, required measurement methods, as well as deadlines for reaching the target values.	Ministry of Environment and Spatial Planning, Serbian Environmental Protection Agency, Serbian Hydrometeorological Institute, municipal self-government	Provide institutional stability. Adopt the Law on Air.	Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national and international experts.	54000 EUR
Action 1.4: Prescribe maximum permissible concentrations of POPs in running and still surface waters, as well as emission limit values in wastewaters from process and facilities, all in accordance with the Water Framework Directive and other EU legislation.	Before prescribing maximum permissible concentrations of POPs in a manner defined in EU legislation it is necessary to carry out analysis of national facilities. However, it is also necessary to adopt target water quality and related target POPs concentrations in a manner defined in the Water Framework Directive.	Ministry of Agriculture, Forestry and Water Management – Water Division, Ministry of Environment and Spatial Planning, Serbian	Provide institutional stability. Adopt the Law on Waters.	Regular activities carried out in the Ministry of Agriculture, Forestry and Water Management and the Ministry of Environment and Spatial Planning. Mobilization of national	54000 EUR

		Hydrometeorological Institute.		and international experts.	
Action 1.5: Prescribe maximum permissible concentrations of POPs in soil and sediment depending on the characteristics and practiced land use, as well as propose/ recommend the use of standard methods in a manner defined in some EU countries.	Rulebook on Permitted Amounts of Hazardous and Harmful Substances in Soil and Water for Irrigation and Methods of Their Testing ("Official Gazette of RS" No. 23/94) does not define maximum permissible concentrations for POPs in agricultural soil. Since the Law on Agricultural Soil ("Official Gazette of RS" No. 62/06) authorises maximum permissible concentrations (MPC) to be prescribed in new Rulebook which will specify MPC for POPs. Standards and methods for analysis of industrial soil and soil in urban areas are defined in the Law Amending the Law on Environmental Protection. This Law authorises the Government to define criteria and procedures for determining and declaring the state of endangered environment, whereat MPC for POPs in the soil shall also be prescribed.	Ministry of Environment and Spatial Planning, Ministry of Agriculture, Forestry and Water Management.	Provide institutional stability. Adopt the Law Amending the Law on Environmental Protection and the Law on Agricultural Land.	Regular activities carried out in the Ministry of Environment and Spatial Planning and the Ministry of Agriculture, Forestry and Water Management. Mobilization of national and international experts.	166000 EUR
Action 1.6: Revise and prescribe maximum permissible POPs concentration in food. Recommend/prescribe the use of standard investigation methods, as defined in the EU.	Described under Action 5.3 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				-
Action 1.7: Prescribe parameters (maximum permissible concentrations) for declaring the waste to be POPs waste and way of its handling. Use of standard methods should be prescribed in accordance with EU legislation.	It is necessary to harmonize maximum permissible POPs concentrations in waste with corresponding values defined in the EU. As one of the future actions, fulfilment of obligations imposed upon the waste owner needs to be controlled.	Ministry of Environment and Spatial Planning (Department of Waste Management, Department for Harmonization of Environmental Protection Regulations).	Provide institutional stability. Adopt the Law on Waste Management.	Regular activities carried out in the Ministry of Environment and Spatial Planning.	-
Action 1.8: Develop environmental monitoring programmes and define related POPs measurements.	Based on the obligations given in corresponding laws and new laws, environmental monitoring programmes are planed to be developed, providing monitoring of pollutant concentrations in air, water and soil. Current monitoring programs need to be improved so as to provide programs appropriate for POPs measurement. Appropriate programs should define exact sampling positions, number and type of data to be submitted, methodology, way for quality control provision, time and frequency of data submitting. In addition, it is necessary to select key players and participants in the monitoring program.	Ministry of Environment and Spatial Planning, Ministry of Agriculture, Forestry and Water Management (Water Division and department responsible for the issues of agricultural	Provide institutional stability. Develop and adopt system laws as defined in Actions 1.2-1.5.	Regular activities carried out in the Ministry of Environment and Spatial Planning, Serbian Environmental Protection Agency and Serbian Hydrometeorological Institute. Mobilization of national and international experts.	30000 EUR

		soil).			
Action 1.9: Develop projects for POPs measurements in biological matrices in samples of animal and plant origin.	Law on Chemicals has confirmed a possibility for project of systematic measurement of risk control measures to be developed. In that way it is possible to develop programs for measurement of POPs concentrations in biological matrices in samples of animal and plant origin. In order to make an appropriate project it is necessary to determine the POPs exposure level based on the measurement of POPs in biological samples of relevant animal species, as well as in human milk and serum samples. Control group (general population) must be specified, as well as potentially exposed group and perhaps a sub-group of vulnerable population. In addition, it is also necessary to specify minimum required sample number and volume, as well congeners to be examined. Appropriate programs should define exact sampling positions, number and type of data to be submitted, methodology, way of quality control provision, time and frequency of data submitting. In addition, it is necessary to select key players and participants in the monitoring program implementation. Specified projects shall also include analysis of POP impact on bioindicator biota types. Data obtained would serve as a basis for identification of areas potentially contaminated by POPs.	Ministry of Environment and Spatial Planning, Ministry of Health, Ministry of Agriculture, Forestry and Water Management, scientific institutes and universities/faculties.	Provide institutional stability. Provide funding. Adopt the Law on Chemicals.	Mobilization of national and international experts. Regular activities carried out in the Department for Chemicals or the future Chemicals Agency, Institute for Nature Protection.	166000 EUR

Specific goal no. 2: Carrying out monitoring of POPs in environmental media and biological samples (animal and human-derived) in a manner prescribed in relevant laws and programmes					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 2.1: Carry out projects developed for measurement of POPs concentrations in biological animal and human derived matrices.	Carry out projects developed for measurement of POPs concentrations in biological animal and human derived matrices, in a planned manner.	Scientific institutes and universities/faculties, Ministry of Environment and Spatial Planning (Department for Chemicals), Ministry of Health, Serbian Environmental Protection Agency.	Provide funding.	Funds: Budget, Environmental Protection Fund, funds of the future Chemicals Agency, EU funds and fund of other international organisations.	160000 EUR
Action 2.2: Evaluation of the options for uPOPs analysis in Serbia.	Described under Action 5.1 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				-
Action 2.3: Development of a monitoring concept and possibly capacity for monitoring	Described under Action 5.2 of the Action Plan developed for uPOPs(PCDD/PCDF, PCB and HCB).				-

of uPOPs emission from industry.					
Action 2.4: Conduct monitoring according to developed programmes for measurement of POPs in the environment.	Conduct monitoring according to developed programmes, including POPs, in accordance with projects developed for water, air and soil quality measurement, as well as current and future laws and programmes which shall be defined in appropriate sub-legal regulations.	Serbian Environmental Protection Agency, Serbian Hydrometeorological Institute, authorised and accredited laboratories Municipal self-government and some institutions of provincial government.	Provide funding. Improved laboratory analyses.	Funds: Budget, Funds provided by the municipal self-government and Autonomous Province.	1000000 EUR
Action 2.5: Evaluate and possibly improve the emission factor used for the calculations of unintentional POPs released (PCDD, PCDF, HCB and PAH) from the different emission factor data basis (UNEP Toolkit, EMEP, own data, etc.), highlight inconsistencies in these data basis and suggest improvements.	Described under Action 6.1 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				-
Action 2.6: Improve laboratory work (expert organisations for carrying out measurements).	1. Analyse and improve capacities of the Republic of Serbia for conducting monitoring of POPs in environmental matrices (experts, equipment, institutional stability, financing) through development and implementation of the plan referring to the work of laboratories and with respect to straightening the analytical and technical, expert and inspection capacities. 2. Establish an official system of cross-laboratory result comparison (through laboratory accreditation or authorisation system) with regional and internationally recognized laboratories, for the purpose of inter-calibration and provision of data uniformity.	Ministry of Environment and Spatial Planning, Ministry of Health, Ministry of Agriculture, Forestry and Water Management, Serbian Environmental Protection Agency, Accreditation Board of Serbia, Institute of Public Health, Scientific institutes and universities/faculties accredited and authorised laboratories.	Provide funding. Provide coordinated activities of different ministries.	Mobilization of national and international experts. Regular activities carried out in the Serbian Environmental Protection Agency and the Ministry of Environment Protection and Spatial Planning. Funds provided through: UN, EU, WHO funds and programmes, bilateral cooperation programmes, the State Budget of the Republic of Serbia, UN and EU donations.	268000 EUR

3.3.7 Public informing, awareness-raising, education strategy and Action plan for strategy implementation

Main goal of this Action plan is: Increase public awareness on danger and risks caused by POPs.

Specific goals of Public informing, awareness-raising, education strategy and Action plan for strategy implementation are:

- Developed a system for regularly informing the public on POPs and provisions of the Stockholm Convention,
- Developed a system for regularly conducting activities on POPs-related education and provisions of the Stockholm Convention.

PUBLIC INFORMING, AWARENESS-RAISING, EDUCATION STRATEGY AND ACTION PLAN FOR STRATEGY IMPLEMENTATION

MAIN GOAL

Increase public awareness on danger and risks caused by POPs

Specific goal no. 1: Developed a system for regularly informing the public on POPs and provisions of the Stockholm Convention					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 1.1: Develop a detail plan for informing the public on the harmful effects of POPs and ways some target groups can contribute to reduction of POPs emission into the environment.	In accordance with Article 10 of the Convention, the signatory countries to the Convention are obliged to, within its capabilities, promote and facilitate awareness among its policy and decision makers with regard to POPs, develop and implement, especially for women, children and the least educated, of educational and public awareness programmes on POPs, as well as on their health and environmental effects and on their alternatives, improve public participation in addressing POPs and their health and environmental effects and in developing adequate responses, including opportunities for providing input at the national level regarding implementation of this Convention. In addition, the parties shall carry out training of workers, scientists, educators and technical and managerial personnel, development and exchange of educational and information materials at the national and international levels and development and implementation of education and training programmes at the national and international levels. For the purpose of carrying out the above specified public education and informing it is necessary to develop a detail education plan which would determine training guidelines and materials that need to be prepared, as well as the number of training programmes that need to be organized, including the number of expected participants. Public informing actions should focus on information related to harmful effects of POPs on human health, which should be incorporated into environmental protection programmes of the primary syllabus. Informing of adult population should be carried out through brochure preparation and its distribution to the parties deliberately causing fires (throwing embers in municipal waste containers, open-field burning of agricultural residues). In order to efficiently implement detail education plan and related activities it is necessary to form a workgroup/expert team which would coordinate and manage the activities.	Ministry of Environment and Spatial Planning (Department for Chemicals, PR services, Department of Air Protection).	Provide funding.	Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national experts.	18000 EUR
Action 1.2: Prepare informative material on POPs	For the purpose of informing and education of primary school	Ministry of	Provide funding.	Regular activities carried	20000

for education programmes addressing the environmental problem solving, as well as programmes of state education system, all aimed to increase public participation in environmental problem solving.	children it is necessary to prepare informative pamphlets, posters and other informative materials and distribute them to teachers and children in "Eco school" and other schools. For this reason, it is necessary to develop text and other educational material on POPs management which is to be integrated into official education programmes.	Environment and Spatial Planning, Ministry of Education.		out in the Ministry of Environment and Spatial Planning. Mobilization of national experts.	EUR
Action 1.3: Inform the public about the necessity of providing hazardous waste storage and hazardous waste treatment plant.	A problem related to the necessary export of detected POPs quantities should be solved by construction of transfer station i.e. centralized storage facility for hazardous waste. Accordingly, industry representatives, as well as the public need to be informed on the necessity of providing such storage facilities and the plant. Related informing should be carried out through locally organised public forums, town's institutes of public health and TV specials. These actions should be carried out by individuals who will present the information to specific target groups in the most appropriate manner. Information presented should not be purely technical, but should also point out the advantages related to construction of considered storage facilities and plant and technology of waste treatment and disposal.	Ministry of Environment and Spatial Planning (Department of Waste Management, Department for Integrated Permissions, PR services).		Regular activities carried out in the Ministry of Environment and Spatial Planning and municipal self-government. Mobilization of national experts.	16000 EUR
Action 1.4: Develop reference manuals for handling pesticide waste and waste pesticide packaging.	Described under Action 2.2. and 2.3 of the Action Plan developed for obsolete pesticides (pesticide waste).				10000 EUR
Action 1.5: Demonstration how to solve problem of pesticides waste from private households.	Described under Action 1.7 of the Action Plan developed for obsolete pesticides (pesticide waste).				-
Action 1.6: Awareness rising on uPOPs for policy makers, industry and public. (Harmonize activity on uPOPs education with general POPs/New POPs Education in the frame of Sustainable Development and Sustainable Consumption and Production policy).	Described under Action 6.5 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				90000 EUR
Action 1.7: Awareness rising on new POPs chemicals recently included in Annex of Stockholm convention.	It is necessary to inform public on new POPs chemicals by organizing seminars and preparing of leaflets	Ministry of Environment and Spatial Planning (Department of Chemicals)	Provide funding.	Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national expert.	4000 EUR

Action 1.8: Organise public pools (to check the effects of conducted activities) each 5 years, 2010 and 2015.	In November 2007, the first investigation of public opinion on POPs in Serbia has been carried out. The results have indicated lack of activities on national level, as well as the absence of educational, training programmes and lectures on environmental issues and problem solving options. In order to check the effects of all Action plans developed for POPs-related issues, as well as the Strategy on Informing, public awareness raising and educational programmes, it is necessary to organize investigation of public opinion on POPs every 5 years, following the adoption of the Action plans. The most appropriate way to investigate the public opinion on POPs-related issues is to include the issues in the public opinion pools carried out on the environmental issues.	Ministry of Environment and Spatial Planning (Department of Chemicals, Department of Waste Management) Ministry of Agriculture, Forestry and Water Management (Water Directorate).	Provide funding. Developed evaluation programme during training organisation.	Regular activities carried out in the Ministry of Environment and Spatial Planning. Mobilization of national experts.	10000 EUR

Specific goal no. 2: Developed a system for regularly conducting activities on POPs-related education and provisions of the Stockholm Convention.					
Action	**Description**	**Key player**	**Preconditions**	**Resources**	**Budget**
Action 2.1: Capacity building for industry and other stakeholders for sound pesticides waste management.	Described under Action 1.3 of the Action Plan developed for obsolete pesticides (pesticide waste).				-
Action 2.2: Develop Guideline for identification, recording and environmentally safe handling of PCB-containing equipment, and PCB waste intended for the owners and the entities operating and maintaining of PCB equipment and develop PCB data base software.	Described under Action 1.3 of the Action Plan developed for PCB.				-
Action 2.3: Training of technicians for proper maintain of PCB equipment (avoidance of cross-contamination and environment contamination).	Described under Action 1.5of the Action Plan developed for PCB.				-
Action 2.4: Organize seminars for operators on implementation of BAT/BEP during the process of integrated permit obtaining and further control of BAT/BEP implementation aimed at reduced uPOPs production..	Described under Action 2.2 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				-
Action 2.5: Develop a section of the Guidelines for Integrated Permit Issuance related	Described under Action 2.1 of the Action Plan developed for uPOPs (PCDD/PCDF, PCB and HCB).				-

to reduction and elimination of uPOPs.					
Action 2.6: Capacity Building of administration.	Described under Action 2.12 of the Action Plan developed for institutional and regulatory measures aimed at Stockholm Convention implementation and reporting				-
Action 2.7: Capacity building for hazardous waste management, especially management of POPs waste.	Described under Action 2.13 of the Action Plan developed for institutional and regulatory measures aimed at Stockholm Convention implementation and reporting				-
Action 2.8: Make an overview of import (use) of new POPs chemicals.	As on the last meeting of Conference of the Parties in May Annexes of the Stockholm Convention extend for new 9 chemicals it is necessary to overview if new POPs chemicals are imported as chemicals or as chemicals in articles as well as if those chemicals are produced in Serbia. This activity should be conducted periodically depending on frequency of Stockholm Convention list extending.	Ministry of Environment and Spatial Planning (Department of Chemicals, Department of Waste Management) Ministry of Agriculture, Forestry and Water Management (Directorate of Plant protection, Department of Pesticides and Fertilizers)	Provide funding.	Mobilization of national expert.	4000 EUR
Action 2.9: Include POPs-related issues in accredited programmes of the Institute for Nature Protection developed for teacher/professor education and official education programmes of primary and secondary schools, as well as universities.	Having in mind that Serbia ratified the Stockholm Convention, it is necessary to include POPs-related issues in official education programs in order to enable teachers/professors to get familiar with the issues and include them in the activities of school children, specially having in mind that school-period is the time when children awareness of the environmental problems start to form. Starting from the premise that education and communication provide a support to nature and environmental protection, primarily providing an efficient way to find partners for environmental protection projects and to raise public participation in decision making and implementation of adopted measures and principles. The Institute for Nature Protection systematically organizes educational programmes for broad public, especially for teachers. In addition, POPs-related issues should be included in official education programmes of primary and secondary schools, as well as in courses offered at state universities.	Ministry of Environment and Spatial Planning (Department of Chemicals, PR services) Institute for Nature Protection.	Initiation of educational programmes and their integration in official State programmes for primary and secondary education, aimed at public awareness rising and more active participation of the public in environmental problem solving.	Mobilization of national expert. Regular activities carried out in the Ministry of Environment and Spatial Planning and Institute for Nature Protection.	2000 EUR

3.4 Preliminary cost assessment of the NIP

A cost assessment of the NIP is based upon:

1. Preliminary Inventories (Inventory on PCB, POPs pesticides and on uPOPs (PCDD/PCDF, PCB and HCB)),
2. Action Plans: Action Plan for Obsolete Pesticides (pesticide waste), Action Plan for PCB, Action Plan for uPOPs (PCDD/PCDF, PCB and HCB), Action Plan for Contaminated Areas, Action Plan for Institutional and Regulatory Measures Aimed at Stockholm Convention Implementation and reporting, Action Plan for Monitoring, Public Informing, Awareness-Raising and Education Strategy and Action Plan for the Strategy Implementation.

Cost assessment is made by using a number of sources [42] and estimation techniques among them are:

1. Expert opinion about human capacity needs technical equipment, civil construction requirements and other prerequisites for implementation of the Convention:
2. Benefit transfer method (using available data from the other transitional economies, e.g. Poland and Bulgaria):
3. Financial data gathered from the local business sector and public companies.

Having in mind that the primary goal is to obtain financial cost figures with the highest possible degree of realism, the following activities have been omitted from the calculation:

- Activities that are not strictly and exclusively related with the NIP but have or may have significant implications on the POPs status in Serbia (e.g. sanitary landfill building);
- Activities that have already been provided for in some other strategic documents and included in some other action plans (e.g. energy efficiency);
- Actions that are covered by a regular activity scope of the Ministry of Environment and Spatial Planning and the Serbian Environment Protection Agency and are financed through the State budget;
- Some actions that are expected to be implemented by the business sector and public utilities.

Activities that repeated through different Action plans are consider only once during counting in order to avoid double counting.

According to a Summary Table of Cost Dynamics -Table 3.4.a, it can be concluded that the entire amount of costs, that are not expected to be covered by a business sector, local communities or by the regular state budget expenditures, is about 60209000 Euro (Figure 3.4.a).

Table 3.4.a.: Summary Table of Cost Dynamics, according to the specific action plans

Action plan	**Costs in Euro**
Action for Obsolete Pesticides (pesticide waste)	6529000
Action Plan for PCB	20990000
Action Plan for uPOPs (PCDD/PCDF, PCB and HCB)	14463000
Action Plan developed for Contaminated Areas	15825000
Action Plan for Institutional and Regulatory Measures Aimed at Stockholm Convention Implementation and reporting	164000
Action Plan for Monitoring	2064000
Public Informing, Awareness-Raising and Education Strategy and Action Plan for the Strategy Implementation	174000

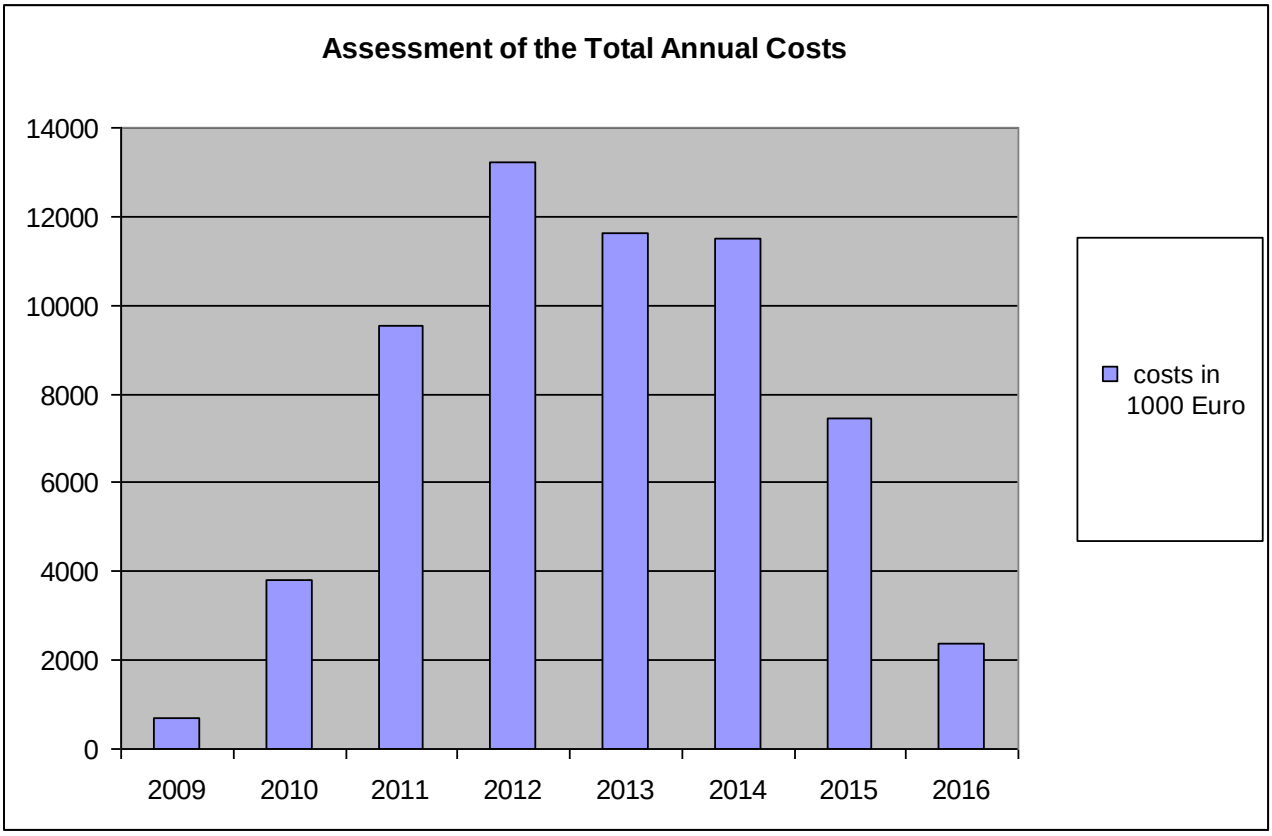


Figure 3.4.a.: Annual Cost Assessments of the NIP in Serbia, from 2009-2016

The most expensive actions are the following:

Activities	**Costs in Euro**
Destruction in Serbia or export of detected quantities of POPs, other pesticide waste and POPs and pesticide packaging for the purpose of their ultimate disposal in approved/authorised facilities, in accordance with the provisions of the Basel Convention in case of export	4200000
Safe disposal i.e. decontamination of PCB equipment with a volume larger than 5 dm^3 and PCB concentrations above 0.05% until 2015 and PCB equipment with a volume larger than 5 dm^3 and PCB concentrations in the range 0.05-0.005% upon cessation of their use	20000000
POPs release control under the integrated system for waste management in Republic of Serbia	5000000
Implementation of BAT/BEP measures in metal industries, co-incineration and incineration and reduction of uPOPs emissions from power plants and operations in oil refineries listed in Annex 2 and 3 of the Convention (and other relevant sources)	5000000
Carry out remediation of the POPs-contaminated areas	15000000

It is important to notice that all of the mentioned assessments are in fact rough estimations. Precise cost amounts will be assessed only after all of the POPs quantities will become known (i.e. when all the inventories will be prepared). The same applies for precise assessment of the contaminated soil size which will be included in remediation projects, as well as approved level and procedure for remediation. Also, in this cost assessment it was assumed that all of the POPs quantities are to be exported and ultimately disposed in approved/authorized facilities out of Serbia,

in accordance with the international regulations. A possibility of POPs destruction e.g. PCB in Serbia has been ruled out because of the following: **1.** an adequate technical facility has not been built in Serbia, yet; **2.** before the facility is to be build a feasibility study has to be made based on the precise amounts POPs quantities that are expected to be destroyed; **3.** before building of the technical facility for ultimate disposal of hazardous waste, all of the local stake holders must agree upon the exact location and the capacity of it. All the mentioned will have a significant impact on the cost levels, and the time when the facility will be operational. However, possibility for trial destruction of certain amounts of pesticides waste and packaging waste in cement plant in Republic of Serbia was considered.

It is more than obvious that the total cost assessment is a very preliminary one, and it will be a subject of further clarification, calibration and corrections.

Structure of the total costs is: Civil construction 25.4%, Equipment 19.7%, Local labour and national expert activities 1.6%, International expertise 3.5%, Costs of export and ultimate disposal of POPs abroad 38.9%.

3.4.1 Technical and financial assistance

When we speak about financial resources for NIP implementation, it could be said that total assessed amount of over 60 million Euros present costs which could only be covered either from the international sources (donations, soft-loan arrangements), as well as from the Republic of Serbia funds (the State budget, Eco-fund). Therefore it is essential to try to obtain foreign funds as much as possible, at least in amount of 50-55 million Euros, under favourable conditions. Most of the foreign funds are needed for export and final disposal of POPs and for technical equipment purchases. Therefore the expected foreign assistance can be realised not only in a form of soft loans and donations, but also in a form of hardware and know-how transfer. Also, foreign expertise and local staff training is envisaged as highly beneficial.

Urgent international financial resources are needed for following projects:

1. Sound management of PCB waste identified during preliminary inventory preparation and disposed on landfill in Bor and other locations;
2. Inventory of PCB equipment and establishment of system for sound management of PCB equipment;
3. Finding solution for special waste stream in order to minimise of uPOPs emission;
4. Finding solution for obsolete pesticide identified during preliminary inventory preparation and establishment of system for future pesticides waste quantities and new empty pesticides containers.

3.5 Timetable and structure of the total costs for implementation of Action Plans

Table 3.5.a.: Timetable and structure of the total costs for implementation of Stockholm convention in period 2009-2016

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
ACTION PLAN FOR OBSOLETE PESTICIDES (PESTICIDE WASTE)									
MAIN GOAL: Removal of POPs pesticides and pesticide waste, prevention of their future releases into the environment and inadequate management									
Specific goal no. 1: System for identification and sound pesticides packaging waste and pesticides waste management for existing pesticides waste quantities and empty pesticides containers established									
Action 1.1: Establishment and management of Pesticides Coordination Committee		10							10
Action 1.2: Define a manner for conducting Obsolete Pesticides and POPs waste management and conditions and procedures for obtaining permits allowing temporary hazardous waste storage, disposal and treatment		4							4
Action 1.3: Capacity building for authorities, inspection, industry and other stakeholders for sound pesticides waste management		14	14						28
Action 1.4: Pilot demonstration inventory project for one selected district, for POPs and other waste pesticides and propose a solution for their ultimate disposal		34	27						61
Action 1.5: Demonstration Project: Management POPs pesticides waste and stocks at previous POPs Production Facility			500	0					500
Action 1.6:Assemble national-wide inventory of waste pesticides, POPs pesticides and pesticide packaging detected in Serbia			250	254					504
Action 1.7:Demonstration how to solve problem of pesticides waste from private households			48	40					88
Action 1.8: Demonstration: repackaging and storage of pesticides waste in one district, and destruction tests in Serbia			500						500
Action 1.9: Development of Operational Plan (OP) for pesticide waste, POPs pesticides and pesticide packaging collection for substances recorded during the Actions 1.4 and 1.6, for each district nationwide defining the conditions required for carrying out related transport to destruction plant or export			11						11
Action 1.10: Adaptation of temporary storage facilities or facilities for storing pesticide waste, POPs pesticide and packaging whose owner is not known (not determined) and which have been detected during inspection			250	250					500
Action 1.11:Destruction in Serbia or export of detected quantities of POPs, other pesticide waste and POPs and pesticide packaging for the purpose of their ultimate disposal in approved/authorised facilities, in accordance with the provisions of the Basel Convention in case of export		300	550	550	750	700	650	700	4200

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
Specific goal no. 2: System for identification and sound pesticides packaging waste and pesticides waste management for future pesticides waste quantities and new empty pesticides containers established									
Action 2.1:Develop a system, organize capacity building, develop regulatory and financial measures for pesticides packaging waste	0	14	24						38
Action 2.2:Develop a system, organize capacity building and develop regulatory and financial measures to avoid and recurrence of obsolete pesticides	0	22	21						43
Action 2.3:Develop reference manuals for pesticide waste and waste pesticide packaging management		10							10
Action 2.4:Assemble the inventory of POPs and other pesticides			4	4	4	4	4		20
Action 2.5:Develop reports on pesticide waste and POPs pesticides, to be submitted to the European Environmental Protection Agency and the Secretariat of Stockholm Convention			2	2	2	2	2	2	12
TOTAL 1	**0**	**408**	**2201**	**1100**	**756**	**706**	**656**	**702**	**6529**
ACTION PLAN DEVELOPED FOR PCB									
MAIN GOAL: Disposal or decontamination of PCB-containing equipment and disposal of PCB waste and prevention of PCB releases from PCB-containing equipment and PCB waste into the environment									
Specific goal no. 1: Improved control over the PCB equipment, phase-out and over the PCB waste									
Action 1.1: Establishment of Coordination Committee for PCB management		10							10
Action 1.2: Develop a Rulebook on handling with PCB-containing equipment and waste.	1								1
Action 1.3: Develop Guideline for identification, recording and environmentally safe handling of PCB-containing equipment and PCB waste, intended for the owners and the entities operating and maintaining of PCB equipment and develop PCB data base software	8								8
Action 1.4: Develop a procedure for verification of data obtained from the owners and entities operating or maintaining PCB-containing equipment	1								1
Action 1.5: Training of technicians for proper maintaining of PCB equipment		30	0						30
Action 1.6: Rising of Public Awareness on PCB properties and sound management of PCB		30	0	0					30
Action 1.7: Organise training programmes for inspection bodies, providing them with the knowledge on data collection on PCB waste and equipment for the purpose of inventory assembling		10	10						20

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
Action 1.8: Develop a study on identification of PCB used in the plastic, polymer, coating and paint production industries as well as in construction industry			4						4
Action 1.9: Assemble an inventory of PCB-containing equipment and PCB waste		150	150						300
Action 1.10: Updating the inventory of PCB-containing equipment and PCB waste			4	4	3	3	3	3	20
Action 1.11: Prepare a report on PCB-containing equipment to be submitted to the European Environmental Protection Agency, in accordance with obligations imposed by the Stockholm Convention			2	2	2	2	1	1	10
Action 1.12: Adopt the methods of PCB detection/analysis recommended or prescribed by international institutions and accreditation procedures for laboratories carrying out PCB-related analyses		4							4
Specific goal no. **2:** Disposal or decontamination of PCB-containing equipment and disposal of PCB waste									
Action 2.1: Environmentally sound disposal of PCB waste identified during preliminary inventory assembling within the scope of the POPs project			500						500
Action 2.2: Develop a plan for replacement i.e. disposal or decontamination of PCB-containing equipment detected in industrial facilities in Serbia by operator		0							0
Action 2.3: Develop a National Operations Plan for disposal/decontamination of PCB-containing equipment and waste			52						
Action 2.4: Establish centralised and/or regional storage facilities for hazardous waste				0	0				
Action 2.5: Safe disposal i.e. decontamination of PCB equipment with a volume larger than 5 dm^3 and PCB concentrations above 0.05% until 2015 and PCB equipment with a volume larger than 5 dm^3 and PCB concentrations in the range 0.05-0.005% upon cessation of their use.			3000	5000	4000	4000	4000		20000
TOTAL 2	**10**	**234**	**3722**	**5006**	**4005**	**4005**	**4004**	**4**	**20990**

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
ACTION PLAN DEVELOPED FOR UPOPs (PCDD/PCDF, PCB AND HCB)									
MAIN GOAL: Reduction of environmental releases of uPOPs, resulting in reduced effects on human health and the environment and prevented POPs penetration into the food chain									
Specific goal no. 1: Reduction of uPOPs releases from open burning (landfill fires, uncontrolled open waste burning, waste container burning, agriculture burning, forest fires)									
Action 1.1:POPs release control under the integrated system for waste management in Republic of Serbia		200	1000	1000	1000	1000	400	400	5000
Action 1.2: Better address other open burning categories (agriculture, forest fires and building fires) by appropriate control and other measures		100	200	200	200	100	100	100	1000
Action 1.3: Improve supervision in order to reduce the fire occurrences associated with waste disposal containers (waste burning in waste disposal containers).		20	20	20	20	20			100
Action 1.4: Address open burning of POPs releases from waste recycling in industry sector		200	200	200	200	200			1000
Action 1.5: Address open burning by making the proper waste management system in household (e.g. uncontrolled open burning of plastic in household)		200	200	200	200	200			1000
Specific goal no. 2: Improved legal framework and institutional capacity building for BAT/BEP implementation to improve control and supervision over releases of uPOPs into environmental media (air, water and soil) from Annex 2 and 3 facilities									
Action 2.1: Develop a section of the Guidelines for Integrated Permit Issuance related to reduction and elimination of uPOPs		9							9
Action 2.2: Organize seminars for state employees and operators on implementation of BAT/BEP during the process of integrated permit obtaining and further control of BAT/BEP implementation aimed at reduced unintentional POP production		27	29						56
Action 2.3: Capacity building/development in the Ministry of Environment and Spatial Planning, aimed to enable proper selection of waste incineration facilities depending on the waste types, including municipal waste		26							26
Activity 2.4: Establish appropriate legislation and standards for measurements, control and supervision of emissions, data storage and reporting of uPOPs together with other relevant emission parameters. Harmonization of these requirements with standards in the EU		46							46
Specific goal no. 3: Reduction and minimization of emission of uPOPs from industrial and other facilities by implementation of BAT/BEP in industries									

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
Action 3.1: Implementation of BAT/BEP measures in metal industries, co-incineration and incineration and reduction of uPOPs emissions from power plants and operations in oil refineries listed in Annex 2 and 3 of the Convention (and other relevant sources)		500	1500	1000	1000	1000			5000
Action 3.2: Develop economic instruments for implementation of BAT/BEP and for obtaining related IPPC permits for the sectors in activity 3.1		10							10
Action 3.3: Improving the knowledge of personnel employed in state institutions with respect to BAT/BEP review and analysis, comparison of existing conditions and processes with equipment employed in BAT/BEP, as well as a manner of providing comprehensive and long-term monitoring of releases to the atmosphere		12	12	12	12	12	12		72
Specific goal no. 4: Reduced emission of uPOPs resulting from fossil fuel combustion for house heating and transport									
Action 4.1: Develop and implement a district heating programme	0	0	0	0	0	0			0
Action 4.2: Continue to develop and extend gas distribution network	0	0	0	0	0	0			0
Action 4.3: Increase energy efficiency of energy producing and industrial facilities in traffic and construction	0	0	0	0	0	0			0
Action 4.4: Improved control of service shops carrying out technical control of the vehicles, as well as control of exhausts gases during technical control of the vehicles	0	0	0						0
Action 4.5: Develop a rulebook on fuel quality, harmonized with EU legislation		20	0	0					20
Specific goal no. 5: Improved legislation and sampling and analysis of uPOPs									
Action 5.1: Evaluation of the options for uPOPs analysis in Serbia		18							18
Action 5.2: Development of a monitoring concept and possibly capacity for monitoring of uPOPs emission from industry		250	250						500
Action 5.3: Development of a strategy for food and feed monitoring of uPOPs		8							8
Action 5.4: Monitoring of uPOPs in air		30	30	30	30	30	30	30	210
Specific goal no. 6: Education, awareness raising, updating inventories and reporting									
Action 6.1: Evaluate and possibly improve the emission factor used for the calculations of unintentional POPs released (PCDD, PCDF, HCB and PAH) from the different emission factor data basis (UNEP Toolkit, EMEP, own data, etc.), highlight inconsistencies in these data basis and suggest improvements		100	180						280

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
Action 6.2: Organize training programmes for employees of the Serbian Environmental Protection Agency providing them with the knowledge on uPOPs inventory assembling and harmonize the activity with establishing PRTR and other inventories and databases		38							38
Action 6.3: Improvement and update inventory of uPOPs			10	10	0	0	0	0	20
Action 6.4: Fulfilling the reporting requirements. Prepare reports on uPOPs releases to be submitted to the Stockholm Convention Secretariat			10	0	0	0	0	0	10
Action 6.5: Awareness rising on uPOPs for policy makers, industry and public. (Harmonize activity on uPOPs education with general POPs/New POPs Education in the frame of Sustainable Development and Sustainable Consumption and Production policy)		12	0	8	0	8	0	8	36
Action 6.6: Adopt all standards EU standards and recommendation with respect to emission factors for unintentional POPs and declare them as Serbian standards			4						4
TOTAL 3	**0**	**1826**	**3645**	**2680**	**2662**	**2570**	**542**	**538**	**14463**
ACTION PLAN DEVELOPED FOR CONTAMINATED AREAS									
MAIN GOAL: Reduction of environmental pollution through recovery and remediation of identified POPs-polluted areas									
Specific goal no. 1: Provide regular institutional conditions for identification and remediation of contaminated areas									
Action 1.1: Establish expert bodies responsible for setting criteria for determining POPs-contaminated areas, principles and locations for conducting preliminary investigations, remediation procedures for POPs-containing matrices and POPs-contaminated sites, as well as consideration, adoption and approval of proposed remediation plans and activities and remediation effect monitoring		12	0						12
Action 1.2: Establish criteria for identification of areas contaminated with POPs, recovery and remediation procedures developed for environmental matrices where POPs have been detected and remediation of POPs-contaminated areas		28							28
Action 1.3: Organize employee training in the Ministry of Environment and Spatial Planning and training of other national experts on proper selection and efficiency of remediation procedures and techniques		20	18						38
Specific goal 2: Develop preliminary studies addressing the areas potentially contaminated by POPs									
Action 2.1: Develop preliminary investigation in potentially contaminated areas		50	62						112

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
Action 2.2: Provide extended data on potentially contaminated areas not provided in the preliminary investigation				250					250
Action 2.3: Develop a study on potentially contaminated areas					130				130
Action 2.4: Assemble an inventory of sites potentially contaminated by POPs		0	5	5	5	5	5	5	30
Specific goal no. 3: Identify, prioritize and where possible remediate areas contaminated by POPs									
Action 3.1: Identify and prioritize areas contaminated by POPs and develop a list of priorities for recovery and remediation						50			50
Action 3.2: Develop action plans for treatment of the areas contaminated by POPs							55		55
Action 3.3: Select remediation procedures for the POPs-contaminated areas								60	60
Action 3.4: Carry out remediation of the POPs-contaminated areas				4000	4000	4000	2000	1000	15000
Action 3.5: Monitor effects of remediation				12	12	12	12	12	60
TOTAL 4	**0**	**110**	**85**	**4267**	**4147**	**4067**	**2072**	**1077**	**15825**
ACTION PLAN DEVELOPED FOR INSTITUTIONAL AND REGULATORY MEASURES AIMED AT STOCKHOLM CONVENTION IMPLEMENTATION AND REPORTING									
MAIN GOAL: Develop appropriate institutional capacities and harmonized national legislation for reduction or elimination of POPs, in accordance with the Stockholm convention and EU acquis									
Specific goal no. 1: All relevant national legislation addressing POPs, all harmonized with EU *acquis* and international conventions adopted									
Action 1.1: Impose an obligation for analysis of PBT-characteristics of plant protection products, biocides and industrial chemicals before their placement on the market, as well as prohibit the use or impose other administrative procedures for mandatory risk management of chemical with PBT characteristics	8								8
Action 1.2: Develop Rulebook on handling with PCB-containing equipment and waste	0								0
Action 1.3: Carry out analysis aimed to define adequate emission limit values in order to control emissions of uPOPs; legally prescribe determined emission limit values as mandatory	40								40
Action 1.4: Define a manner for conducting Obsolete Pesticides and POPs waste management and conditions and procedures for obtaining permits allowing temporary hazardous waste storage, disposal and treatment		0							0
Action 1.5: Develop and adopt the Law on Fire Protection which would regulate fire prevention measures		8							8

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
Action 1.6: Establish criteria for identification of areas contaminated with POPs, recovery and remediation procedures developed for environmental matrices where POPs have been detected and remediation of POPs-contaminated areas		0							0
Action 1.7: Develop technical guidelines for POPs waste management (PCB, POPs and pesticide waste, uPOPs)	0	20							20
Action 1.8: Develop a rulebook on fuel quality, harmonized with EU legislation		0	0	0					0
Action 1.9: Define a manner for conducting pesticide packaging management	0	0							0
Action 1.10: Adopt all EU standards and recommended procedures for POPs measurements in environmental media and food and declare them as national standards	0	0	0	0	0	0	0	0	0
Specific goal 2: Capacity building in state regulatory bodies and institutions, bodies of autonomous province and municipal self-government, improved cross-sector cooperation and coordination of POPs management improved									
Action 2.1: Organise training programmes for all-level authority bodies responsible for the issues of pesticide waste management, especially management of POPs waste and waste packaging	0	0	0						0
Action 2.2: Capacity building for authorities and inspection for sound pesticides waste management		0	0						0
Action 2.3: Pilot demonstration inventory project for one selected district, for POPs and other waste pesticides and propose a solution for their ultimate disposal		0	0						0
Action 2.4: Develop a section of the Guidelines for Integrated Permit Issuance related to reduction and elimination of uPOPs		0							0
Action 2.5: Organise seminars for authority bodies responsible for BAT/BEP introduction, process of integrated permit issuance and further control of BAT/BEP implementation aimed at reduction of uPOPs releases		0	0						0
Action 2.6: Improving the knowledge of personnel employed in state institutions with respect to BAT/BEP review and analysis, comparison of existing conditions and processes with equipment employed in BAT/BEP, as well as a manner of providing comprehensive and long-term monitoring of releases to the atmosphere		0	0	0	0	0	0		0
Action 2.7: Awareness rising on uPOPs for policy makers, industry and public. (Harmonize activity on uPOPs education with general POPs/New POPs Education in the frame of Sustainable Development and Sustainable Consumption and Production policy)		0	0	0	0		0	0	0

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
Action 2.8: Capacity building/development in the Ministry of Environment and Spatial Planning, aimed to enable proper selection of waste incineration facilities depending on the waste types, including municipal waste		0	0	0	0	0	0	0	0
Action 2.9: Organise seminars for employees of the Ministry of Environment and Spatial Planning and other national experts, providing them with the knowledge they need to properly estimate different remediation procedures and techniques		0	0						0
Action 2.10: Organize training programmes for employees of the Serbian Environmental Protection Agency providing them with the knowledge on uPOPs inventory assembling and harmonize the activity with establishing PRTR and other inventories and database		0	0						0
Action 2.11: Organize training programmes for inspection bodies, providing them with the knowledge on data collection on PCB waste and containing equipment for the purpose of inventory assembling		0							0
Action 2.12: Capacity Building of administration	12	12							24
Action 2.13: Institutional capacity building for hazardous waste management, specially management of POPs waste	6	7	7						20
Specific goal no. 3: System for regular reporting on POPs reduction measures and related effects based on collected and processed data on POPs sources and generated POPs quantities established									
Action 3.1: Develop a precise internal procedure for obtaining relevant information, to be used by the designated National Focal Point for informing the Secretariat of Stockholm Convention	0	44							44
Action 3.2: Assemble an inventory of uPOPs			0	0	0	0	0	0	0
Action 3.3: Fulfilling the reporting requirements. Prepare reports on uPOPs releases to be submitted to the Stockholm Convention Secretariat			0	0	0	0	0	0	0
Action 3.4: Assemble the inventory of POPs and other pesticides			0	0	0	0	0		0
Action 3.5: Develop reports on pesticide waste and POPs pesticides, to be submitted to the European Environmental Protection Agency and the Secretariat of Stockholm Convention			0	0	0	0	0	0	0
Action 3.6: Develop Guideline for identification, recording and environmentally safe handling of PCB-containing equipment and PCB waste, intended for the owners and the entities operating and maintaining of PCB equipment and develop PCB data base software	0								0

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
Action 3.7: Develop a procedure for verification of data obtained from the owners, users or entities operating or maintaining PCB-containing equipment	0								0
Action 3.8: Develop a study on identification of PCB used in the plastic, polymer, coating and paint production industries as well as in construction industry			0						0
Action 3.9: Assemble and regularly update an inventory of PCB-containing equipment and PCB waste		0	0	0	0	0	0	0	0
Action 3.10: Prepare a report on PCB-contained equipment to be submitted to the European Environmental Protection Agency, in accordance with obligations imposed by the Stockholm Convention			0	0	0	0	0	0	0
Action 3.11: Assemble an inventory of sites potentially contaminated by POPs		0	0	0	0	0	0	0	0
Action 3.12: Establish a Joint Body for chemicals management aimed to provide an integral management of chemicals in Serbia and coordinate the activities conducted towards implementation of the Stockholm, Rotterdam, Helsinki and Basel Conventions	0								0
TOTAL 5	**66**	**91**	**7**	**0**	**0**	**0**	**0**	**0**	**164**
ACTION PLAN DEVELOPED FOR MONITORING									
MAIN GOAL: Provide decision makers, public and international institutions the information on POPs presence in the environment and biota, obtained through regular monitoring and organised system of data collection and reporting									
Specific goal no. 1: Developed or changed/amended legislation on POPs measurement in environmental media, food and biological matrices									
Action 1.1: Adopt all EU standards related to POPs measurements in environmental media and food and declare them as national standards	0	0	0	0	0	0	0	0	0
Action 1.2: Prescribe and/or harmonize PCDD/PCDF (PAH) emission limit values, measurement methods and frequencies for measurement of POPs emissions from waste incineration facilities and other facilities in accordance with EU legislation and legislation of the member countries	0	64	102						166
Action 1.3: Define the zones where PAH are measured within the scope of ambient air quality monitoring and define deadlines for reaching the target values	0	24	30						54
Action 1.4: Prescribe maximum permissible concentrations of POPs in running and still surface waters, as well as emission limit values in wastewaters from process and facilities, all in accordance with the Water Framework Directive and other EU legislation		24	30						54

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
Action 1.5: Prescribe maximum permissible concentrations of POPs in soil and sediment depending on the characteristics and practiced land use, as well as propose/recommend the use of standard methods in a manner defined in some EU countries		64	102						166
Action 1.6: Revise and prescribe maximum permissible POPs concentration in food. Recommend/prescribe the use of standard investigation methods, as defined in the EU		0							0
Action 1.7: Prescribe parameters (maximum permissible concentrations) for declaring the waste to be POPs waste and way of its handling. Use of standard methods should be prescribed in accordance with EU legislation	0	0							0
Action 1.8: Develop environmental monitoring programmes and define related POPs measurements	10	10	10						30
Action 1.9: Develop projects for POPs measurements in biological matrices in samples of animal and plant origin	24	40	102						166
Specific goal no. 2: Carrying out monitoring of POPs in environmental media and biological samples (animal and human-derived) in a manner prescribed in relevant laws and programmes									
Action 2.1: Carry out projects developed for measurement of POPs concentrations in biological animal and human derived matrices	20	20	20	20	20	20	20	20	160
Activity 2.2: Evaluation of the options for uPOPs analysis in Serbia		0							0
Activity 2.3: Development of a monitoring concept and possibly capacity for monitoring of uPOPs emission from industry		0	0						0
Action 2.4: Conduct monitoring according to developed programmes for measurement of POPs in the environment	125	125	125	125	125	125	125	125	1000
Action 2.5: Evaluate and possibly improve the emission factor used for the calculations of unintentional POPs released (PCDD, PCDF, HCB and PAH) from the different emission factor data basis (UNEP Toolkit, EMEP, own data, etc.), highlight inconsistencies in these data basis and suggest improvements		0	0						0
Action 2.6: Improve laboratory work (expert organisations for carrying out measurements)		28	80	160					268
TOTAL 6	**179**	**399**	**601**	**305**	**145**	**145**	**145**	**145**	**2064**

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
PUBLIC INFORMING, AWARENESS-RAISING, EDUCATION STRATEGY AND ACTION PLAN FOR STRATEGY IMPLEMENTATION									
MAIN GOAL: Increase public awareness on danger and risks caused by POPs									
Specific goal no. 1: Developed a system for regularly informing the public on POPs and provisions of the Stockholm Convention									
Action 1.1: Develop a detail plan for informing the public on the harmful effects of POPs and ways some target groups can contribute to reduction of POPs emission into the environment	0	6	12						18
Action 1.2: Prepare informative material on POPs for education programmes addressing the environmental problem solving, as well as programmes of state education system, all aimed to increase public participation in environmental problem solving	0	7	13						20
Action 1.3: Inform the public about the necessity of providing hazardous waste storage and hazardous waste treatment plant	4	4	4	4					16
Action 1.4: Develop reference manuals for handling pesticide waste and waste pesticide packaging		10							10
Action 1.5:Demonstration how to solve problem of pesticides waste from private households		0	0						0
Action 1.6: Awareness rising on uPOPs for policy makers, industry and public. (Harmonize activity on uPOPs education with general POPs/New POPs Education in the frame of Sustainable Development and Sustainable Consumption and Production policy)		10	10	10	15	15	15	15	90
Action 1.7: Awareness raising on new POPs chemicals recently included in Annex of Stockholm convention		4							4
Action 1.8: Organise public pools (to check the effects of conducted activities) each 5 years, 2010 and 2015		5					5		10
Specific goal no. 2: Developed a system for regularly conducting activities on POPs-related education and provisions of the Stockholm Convention									
Action 2.1: Capacity building for industry and other stakeholders for sound pesticides waste management		0	0						0
Action 2.2: Develop Guideline for identification, recording and environmentally safe handling of PCB-containing equipment, and PCB waste intended for the owners and the entities operating and maintaining of PCB equipment and develop PCB data base software		0							0

YEARS	2009	2010	2011	2012	2013	2014	2015	2016	Total 1000 €
Action 2.3: Training of technicians for proper maintaining of PCB equipment (avoidance of cross-contamination and environment contamination)		0	0						0
Action 2.4: Organize seminars for operators on implementation of BAT/BEP during the process of integrated permit obtaining and further control of BAT/BEP implementation aimed at reduced unintentional POP production		0	0						0
Action 2.5: Develop a section of the Guidelines for Integrated Permit Issuance related to reduction and elimination of uPOPs		0							0
Action 2.6: Capacity Building of administration	0	0							0
Action 2.7: Capacity building for hazardous waste management, specially management of POPs waste	0	0	0						0
Action 2.8:Make an overview of import (use) of new POPs chemicals		4							4
Action 2.9: Include POPs-related issues in accredited programmes of the Institute for Nature Protection developed for teacher/professor education and official education programmes of primary and secondary schools, as well as universities		2							2
TOTAL7	**4**	**52**	**39**	**14**	**15**	**15**	**20**	**15**	**174**
SUMARY	**259**	**3125**	**10297**	**13372**	**11730**	**11508**	**7439**	**2476**	**60209**

NOTE : **All cost indicated in blue represent rough approximations, with exact values to be determined only after total POPs quantities have been detected i.e. after the final inventories of specific chemicals have been assembled (obsolete pesticides, PCB). The same stands for contaminated areas which are to be addressed in specifically developed remediation projects.**

Annex 1 List of new POPs chemicals

Table 1: List of new POPs chemicals

Chemical substance, commercial name, CAS number	Type of chemical substance	Annex	Activity	Note
Chlordecone, *Trade name: Kepone , GC*-1189 CAS No. 143-50-0	Pesticide	Part I A	Production	None
			Use	None
Hexabromobiphenyl *Trade name: FireMaster* CAS No. 36355-01-8	Brominated flame retardant	Part I A	Production	None
			Use	None
Lindane, γ- hexachlorocyclohexane (γ-HCH) CAS No.58-89-9	Insecticide	Part I A	Production	None
			Use	Human health pharmaceutical for control of head lice and scabies as second line treatment
α- hexachlorocyclohexane (α- HCH) CAS No.319-84-6	By products of lindane production, Insecticide	Part I A	Production	None
			Use	None
β- hexachlorocyclohexane (β- HCH) CAS No.319-85-7	By products of lindane production, Insecticide	Part I A	Production	None
			Use	None

Commercial pentabromodiphenyl ether (C-pentaBDE) Tretrabromodiphenyl ether and pentabromodiphenyl ether *Trade names: Bromkal, Great Lakes DE71, FR1205/1215* CAS No.40088-47-9 and 32534-81-9	Industrial chemical, Brominated flame retardant	Part I A Part III A [(1)] Part IV A	Production	None
			Use	Articles in accordance with the provisions of Part IV of this Annex
Commercial octabromodiphenyl ether (C-octaBDE) Hexabromodiphenyl ether and heptabromodiphenyilether CAS No.68631-49-2, 207122-15-4, 446255-22-7 and 207122-16-5	Industrial chemical, Brominated flame retardant	Part I A Part III A [(2)] Part IV A	Production	None
			Use	Articles in accordance with the provisions of Part IV of this Annex
Perfluorooctane sulfonic acid (CAS No: 1763-23-1), its salts[a] and perfluorooctane sulfonyl fluoride (CAS No: 307-35-7) [a] For example: potassium perfluorooctane sulfonate (CAS No. 2795-39-3); lithium perfluorooctane sulfonate (CAS No. 29457-72-5); ammonium perfluorosulfonate (CAS No. 29081-56-9); diethanolammonium perfluorooctane sulfonate (CAS No. 70225-14-8); tetraethylammonium perfluorooctane sulfonate (CAS No. 56773-42-3); didecyldimethylammonium perfluorooctane sulfonate (CAS No. 251099-16-8)	Industrial chemical/surfactant	Part I B* Part III B [(3)]	Production	Acceptable purpose: In accordance with part III of this Annex, production of other chemicals to be used solely for the uses below. Production for uses listed below. Specific exemption: As allowed for Parties listed in the Register.
			Use	Acceptable purpose: In accordance with part III of this Annex for the following acceptable purposes, or as an intermediate in the

				production of chemicals with the following acceptable purposes: • Photo-imaging • Photo-resist and anti-reflective coatings for semi-conductors • Etching agent for compound semi-conductors and ceramic filters • Aviation hydraulic fluids • Metal plating (hard metal plating) only in closed-loop systems • Certain medical devices (such as ethylene tetrafluoroethylene copolymer (ETFE) layers and radio-opaque ETFE production, in-vitro diagnostic medical devices, and CCD colour filters) • Fire-fighting foam • Insect baits for control of leaf-cutting ants from *Atta spp.* and *Acromyrmex spp.* Specific exemption: For the following specific uses, or as an intermediate in the production of chemicals with the following specific uses: • Photo masks in the semiconductor and liquid crystal display (LCD) industries • Metal plating (hard metal plating) • Metal plating (decorative plating) • Electric and electronic parts for some

				colour printers and colour copy machines • Insecticides for control of red imported fire ants and termites • Chemically driven oil production • Carpets • Leather and apparel • Textiles and upholstery • Paper and packaging • Coatings and coating additives • Rubber and plastics
Pentachlorobenzene, PeCB CAS No. 608-93-5	Industrial chemical	Part I A Parts I,II, III C [4]	Production	None
			Use	None

* Acceptable purposes including, inter alia: photo-imaging, fire fighting foam, and insect baits for leaf-cutting

[1] Decision SC-4/18: Listing of tetrabromodiphenyl ether and pentabromodiphenyl ether;

[2] Decision SC-4/14: Listing of hexabromodiphenyl ether and heptabromodiphenyl ether;

[3] Decision SC-4/17: Listing of perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride;

[4] Decision SC-4/16: Listing of pentachlorobenzene;

Annex 2 Release routes into the environment and environmental behaviour of released POPs

*Table 2:***Release routes into the environment and environmental behaviour of released POPs**
(Release routes into the environment of uPOPs and their environmental behaviour)

Environmental medium	*PCDD/PCDF*	*PCB*	*HCBs*	*PAH*
Air	PCDD produced during combustion/burning processes, can travel long distances (as vapour or in particles) in the atmosphere. Once in the atmosphere, PCDD/PCDF can be transported over long distances before their ultimate disposal into water, soil or vegetation. PCDD/PCDF distribution between the vapour (gas) and solid phase depend on numerous factors. However, this distribution considerably influences PCDD/PCDF transport. Uptake of atmospheric PCDD/PCDF by plant leaves represent a crucial mechanism for PCDD/PCDF transfer into the food chain.	Smaller quantities of PCB can be detected on outer metal surfaces of PCB-containing equipment. These days, sources of PCB releases can be disposal sites with disposed of transformers, condensers and other PCB contaminated waste, polluted sludge or illegally exposed waste. Pollution can result from industrial or municipal waste incineration. Transformer or condenser explosion or overheating can lead to significant PCB releases into the environment.	HCBs can be widely present in ambient air, but mainly in small quantities. Only small quantities of HCBs, generated as by-products in certain production processes, may be released to air, depending on technologies employed. HCBs are transported over long distances in the troposphere due to their stability and slow degradation. HCBs can be removed from the air through atmospheric deposition onto soil or water.	**Environmental transport of PAH mainly depends on the state of aggregation of PAH compounds (solid – in particles or gas – as vapour) at ambient temperatures. High-molecular-mass PAH mainly occur in solid state (solid particles) and are transported over shorter distances in the environment. Low-molecular-mass PAH evaporate into the environment and thereby are transported over longer distances.** **PAH levels increases during the winter periods, by at least an order of magnitude compared to values occurring during summer periods. Dominant PAH emission source during the winter period is residential heating, while during the summer the most prevailing are releases from road traffic.**
Water	**Due to their poor water solubility, POPs present in water are mostly mixed with sediments or suspended material. Water sediments can represent an important naturally occurring removal route for all global releases. Photolytic and evaporation processes can provide removal of TCDD compounds from the water.**	**Surface water contamination with PCB can occur through atmospheric precipitation, direct emission from source points or through waste.** **Once in water, PCB are absorbed by sediments and organic substances. Strong adsorption on sediments lowers the evaporation rate. Based on water solubility and n-octanol/water partition coefficient, lower chlorinated PCB congeners shall be weakly bound, as opposed to higher isomers.**	**HCBs are widely present in the environment due to their mobility and resistance to degradation. Once they reach the sediments, HCBs tend to accumulate. At certain point desorption process shall occur, creating a permanent source of HCBs in the environment, even if HCBs flow into the system has been stopped. Chemical and biological degradation is not considered important for HCBs removal from water and sediments. Evaporation and sedimentation accompanied by adsorption represent the most important processes for HCBs removal from water.**	**Since PAH are hydrophobic and thus poorly water soluble, they are characterised by low water-affinity. However, in spite of the fact that most PAH are released into the environment through the atmosphere, considerable concentrations are also present in the hydrosphere, due to low values of the Henry's constant. Since PAH have higher affinity for organic phase than for the water, distribution coefficients between organic solvents are high.**

Release routes into the environment of uPOPs and their environmental behaviour - continued

Environmental medium	*PCDD/PCDF*	*PCB*	*HCBs*	*PAH*
Soil	Since PCDD/PCDF are poorly water soluble, their transport in soil can occur only in presence of some other substance acting as a natural adhesive. PCDD that have reached the soil can be adsorbed on organic substance. These PCDD shall not reach groundwaters, but could get into the atmosphere through the earth particles or to the surface waters through surface waste particles.	Poor water solubility and strong adsorption on soil particles, limit the soil "soaking". Today, there is a natural phenomenon that could be considered as redistribution of PCB initially introduced into the natural environment. Such redistribution includes evaporation from soil and water into the atmosphere and migration from the atmosphere through dry/wet deposition, followed by re-evaporation. Since evaporation and degree of degradation vary among PCB congeners, such redistribution leads to a change in composition of PCB mixtures present in the environment.	Evaporation is the most important HCB removal mechanism from the soil surface. On the other hand, slow aerobic (half-life from 2,7 to 5,7 years) and anaerobic biodegradation (half-life from 10,6 to 22,9 years) are the main processes for HCB removal from deeper layers.	**The main sources of PAH present in the soil are atmospheric deposition, carbonisation of plant material, wastewater deposit and waste substances in particles. The level of soil contamination depends on the factors such as degree of soil cultivation, porosity and humus content.** **Sedimentation of contaminated waste contributes to increase PAH concentrations in the geosphere.** **PAH are strongly adsorbed on organic fractions present in the soil and deposits. Concentrations of certain PAH compounds contained in deposits are generally an order of a magnitude higher than PAH concentrations present in atmospheric precipitation.**
Biota	**Poor water solubility contributes to bio-concentration of PCDD in aquatic organisms. The same is true for plants, although deposition on the leaves and strong bonds can be significant.** **Population is mainly exposed to PCDD emissions originating from combustion processes and mobile sources.** **PCDD get into the human organisms through meat, milk, eggs, fish and similar products, since they easily accumulate in animal tissues.**	**Human exposure to PCB mainly results from contaminated food intake, inhalation and absorption in the working environment through skin. They are easily accumulated in food. PCB are deposited in human and animal adipose tissue, imposing toxic effects. They mostly affect liver and skin, but gastrointestinal tract, immune and nervous systems as well. PCDF contained in commercial PCB mixtures significantly contribute to toxicity of those products.**	**HCBs are bioaccumulative substances (BCF values vary from 375 to > 35000). There are data on HCB flow through the food chains.**	**There is very little data available on the manner in which PAH enter the biosphere. Since their affinity for organic fractions in deposits, soil and biosystem is high, PAH are accumulated in aquatic organisms in water and deposits, as well as in their food.**

Annex 3 Effects on human health

Table 3 - Effects on human health

Effects and risks of exposure to HCBs

Effect	HCBs
Exposure	Due to their bioaccumulation in the food chain (aquatic and land), general population is exposed to HCBs mainly through food, primarily meat, poultry, fish, milk and related products. Due to such exposure, hexachlorobenzene has been detected in human adipose tissue and breast milk. Professional exposure can still occur among workers in chlorinated solvent production plants and workers involved in production and use of hexachlorobenzene-added pesticides. Workers involved in disposal and treatment (incineration) of materials contaminated with hexachlorobenzene or hazardous waste may be more exposed than the rest of the population.
Toxic effects	Hexachlorobenzene is a toxic organochlorine compound which affects the liver, kidneys, skin, thyreoidea, causes neurological, endocrine, immune and developmental effects and may be potentially fatal for humans. Studies have additionally shown that hexachlorobenzene causes reproductive toxicity and increases the risk of cancer. The organs (systems) most sensitive to HCBs are liver, ovaries and central nervous system.
Mortality	Epidemiological studies have shown that cases of lethal peroral hexachlorobenzene poisoning were recorded. Lethal dose for a person weighing 70 kg is estimated to be 0,05-0,2 g/day i.e. 0,7-2,9 mg/kg/day.
Neurotoxicity	Acute peroral poisoning (a case of mass poisoning through hexachlorobenzene contaminated bread) has been followed by the following effects: weakness, tremor and loss of sensory functions.
Hepatotoxicity	It is well known that ingestion of hexachlorobenzene can result in porphyria. High porphyria precursors levels in urine indicate that hexachlorobenzene influence the metabolism of porphyrin in the liver, leading to histopatologic changes in the liver.
Nephrotoxicity	Experimental studies have shown that toxic effects primarily affect the kidneys.
Endocrine effects	Hexachlorobenzene causes harmful effects to human endocrine system, with toxic effects primarily affecting the thyreoidea.
Effects on muscular and skeletal systems	Exposure to hexachlorobenzene may be related to arthritis and osteoporosis development.
Effects on skin	Even after peroral exposure, hexachlorobenzene may cause skin lesions. Skin lesions mostly occur at sun-exposed parts of the body i.e. face and arms.
Reproductive toxicity	Miscarriages and premature births have been recorded. However, their number was not considerably higher than the number of cases registered in unexposed population.
Toxic effects on human growth and development	After the above mentioned mass poisoning with contaminated bread, children of exposed mothers have experienced dramatic development disturbance, including high mortality rate. The related study has clearly classified hexachlorobenzene in the group of toxic substances influencing human growth and development.
Immunotoxicity	HCB can influence the operation of immune system. Increased HBC levels in organism influence immune system markers and increases susceptibility to infections.
Carcinogenity	It is shown that incidence of thyroid cancer and soft tissues sarcoma has been considerably increased, while incidence of brain tumour has increased lightly in population exposed to hexachlorobenzene.
Genotoxicity	Increased frequency of micronuclei presence in lymphocytes of workers exposed to the mixture of solvents including hexachlorobenzene has been recorded.

Effects and risks of exposure to PCB

Effect	PCB
Exposure	Detection of PCB in blood, adipose tissue and milk indicates exposure of general population, whereby total concentration in the organism mostly results from exposure to contaminated food. It is estimated that with respect to professional exposure, exposure through inhalation is more than ten time higher than skin exposure. At the moment, professional exposure may occur during reparation of PCB containing devices, in certain accidental situation and during activities related to PCB contaminated waste.
Toxic effects	Toxic effects resulting from exposure to PCB, both of humans and animals, include effects on liver, thyreoidea, skin and eyes, immune system, central nervous system development obstruction, reproductive toxicity and carcinogenicity.
Mortality	Cases of lethal poisoning with polychlorinated biphenyls have not been recorded in human population. However, some studies considering professional exposure have indicated increased mortality rate due to cardiovascular diseases and cancer.
Respiratory effects	Following a professional exposure, PCB can cause negative respiratory effects such as irritation of upper respiratory tract and changes in lung function.
Cardiovascular effects	Numerous studies of professional exposure have analysed possible relation between PCB and increased risk of cardiovascular diseases. The only definite conclusion with respect to these effects is related to increased mortality rate due to cardiovascular diseases stated among workers engaged in condenser production for more than five years.
Gastrointestinal effects	Gastrointestinal symptoms, anorexia, sickness, vomiting, abdominal pain and loss of weight are the symptoms occurred among workers exposed to different Aroclor elements. Statistically significant correlation has been recorded between loss of appetite and increased PCB levels in blood.
Hepatotoxicity	PCB can also lead to liver enzymes, lipids and cholesterol related disorders. Increased serum levels of certain liver enzymes indicate induction of microsomal enzymes and possible damage. Porphyria, indicating liver failure, has been observed among workers, but also in children whose mothers had been exposed.
Neurotoxicity	Neurological effects have been intensively analysed among human and animal population. PCB cause neurobehavioral effects in newborns and small children whose mothers have been exposed to biphenyls. Results of epidemiological studies in children have indicated disturbance in reflex function, memory, learning and lower IQ coefficient. Although conclusions related to effects in humans are not consistent, experimental studies provide evidence that PCB cause neurotoxic effects.
Endocrine effects	PCB may affect endocrine system in several ways: directly affecting the hormones, certain enzymes, transport proteins, receptors, endocrine glands and regulation systems. Such effects lead to disturbed nervous system development, reproduction and induction of hormone sensitive tumours. The most important endocrine effect of PCB is development of thyroid hormonal disorders and possible agonistic or antagonistic estrogen response.
Effects on skin and eyes	It is known that PCB lead to skin lesions, including skin irritation, chloracnes and skin and nail pigmentation. These effects have been observed as a result of professional exposure and following an accidental ingestion of high PCB doses. Effects to the eyes include hypersecretion of large glands, puffy eyelids and abnormal conjunctival pigmentation. Effects to the eyes almost always become evident after the appearance of chloracnes and can also manifest if exposure has been interrupted, probably resulting from PCB accumulation in adipose tissue.
Immunotoxicity	There are records indicating immune system disorders in grown humans and children, especially children exposed *in utero* or through mother's breast milk.
Reproductive toxicity	Exposure to PCB causes menstrual cycle disturbances and influences spermatozoid production and morphology. These effects are related to conception problems, increased abortion incidence and premature births, as well as sterility.
Toxic effects on human growth and development	PCB may affect thyreoidea and thyroid hormones which are extremely important for structural and functional aspects of brain development and reproductive organs. In addition, it has been shown that there is a correlation between increased PCB concentrations in blood of the mothers and risk of the birth of low weight babies. Since exposure to PCB is continued through breastfeeding, PCB may continue to affect baby's growth

	and development.
Carcinogenity	Carcinogenity has been studies in retrospective studies evaluating cancer related mortality rate among workers involved in PCB production and condenser reparation, as well as in studies where correlation between cancer and PCB levels in serum and adipose tissue of general population has been examined.
Genotoxicity	Studies investigating genotoxic potential of PCB have analysed numerous critical effects: gene mutations in bacteria and cell cultures, chromosomal aberrations in cells of human lymphocytes and bone marrow cells of mice and rats, formation of micronuclei in marrow cells of mice and rats and sperm mutations in rats. Specified in vitro and in vivo tests of genotoxic effects of PCB in most cases have been negative.

Effects and risks of exposure to PCDD

Effect	PCDD
Exposure	With respect to general population, more than 90% of daily intake of PCDD and other dioxin-like compounds originate from food i.e. meat, dairy products and fish. Professional exposure mostly occurs through inhalation of contaminated air or skin resorption resulting from the contact with chlorinated dibenzodioxin containing materials.
Toxic effects	Exposure to 2,3,7,8-TCDD leads to cancer development, causes skin changes (**chloracnes), affects the liver, thyreoidea, cardiovascular, respiratory, immune and reproductive systems and causes neurotoxic effects. Numerous studies carried out on workers exposed to high PCDD doses have shown increased mortality rate due to cancer.**
Mortality	Results of some studies have indicated statistically significant increase of cause-specific mortality rate. For example, cases of accidental poisoning among workers have indicated significant risk of lethal outcome due to cardiovascular diseases, especially isochemical heart disease. Workers engaged in production of phenoxy herbicides and chlorophenols are in significant risk of lethal outcome of accidental poisoning due to cancer development.
Respiratory effects	Available data show that acute exposure to high PCDD doses can cause respiratory problems, mainly due to irritation of upper respiratory tract. However, results of large number of studies indicate that respiratory system is not the primary target of 2,3,7,8-TCDD toxic effects.
Cardiovascular effects	Some studies have recorded increased mortality risk due to cardiovascular diseases, especially isochemical heart disease. However, other studies did not confirm statistically significant increase of cardiovascular diseases such as acute myocardial infarction, angina pectoris, cardiac arrhythmia, hypertension or problems with peripheral circulation.
Hepatotoxicity	Exposure to 2,3,7,8-TCDD leads to induction of microsomal enzymes in the liver, both in humans and animals, no matter on the path and length of the exposure. Results of biochemical studies in workers exposed to 2,3,7,8-TCDD in herbicide production have indicated disturbance in metabolism of porphyrins, lipids, carbohydrates and proteins. Histopathological changes in the liver have also been proven.
Neurotoxicity	In individuals exposed to high 2,3,7,8-TCDD doses peripheral neuropathy has been observed, as well as encephalopathy, sensory functions damages and reduced nerve impulse conduction. All results obtained up to date indicate that neurological effects are observed following an exposure to relatively high levels or after exposure to doses that cause toxic dermal effects. Neurological effects may be temporary, making them difficult to be diagnosed if analyses are carried out after a period of time e.g. few years after exposure.
Endocrine effects	Exposure to high PCDD concentrations can lead to long term disturbances in glucose metabolism (increased incidence of diabetes) and discrete, subclinical disorders of thyreoidea function (significant reduction of T3 hormone levels and increased TSH levels). Endocrine disrupting effects on humans are not limited to diabetes and thyreoidea, but have been recorded to cause disturbances in reproductive hormones.
Effects on skin and eyes	Chloracnes represent the most recognisable effect of exposure to 2,3,7,8-TCDD and similar compounds. Chloracnes are formed as a result of high dioxins doses, both in humans and animals and their presence indicates exposure to dioxins and dioxine-like chemicals. However, absence of chloracnes does not exclude possible PCDD exposure. The first sign of chloracne appear on the face, especially below the eyes and behind the ears. With increased exposure, they spread to other parts of the face and neck, upper sections of the arms, chest, beck, stomach, outer thighs and genitals. Skin changes can appear immediately after exposure (in a 2 day period) or several months after the exposure.

Effects on weight	Although weight loss in people has not been adequately documented, numerous studies confirm that weight loss syndrome may develop.
Immunotoxicity	Number of studies on immunotoxic potential of PCDD to humans is relatively small. Some of the studies have shown considerable increase of incidence of infections and parasitic diseases among workers exposed to 2,3,7,8-TCDD. However, in vitro tests on human cells have shown dose-dependant immunosuppressive response. Although results of the test conducted on humans are inconsistent, animal immune system is one of the most sensitive to PCDD exposure.
Reproductive toxicity	In order to determine a correlation between exposure to PCDD and reproductive toxicity in humans, numerous investigations have been carried out, including analysis of spontaneous abortions, anomalies and size of testicles, number and morphology of spermatozoids, testosterone levels, follicle-stimulating hormone (FSH) levels and luteinizing hormone (LH) levels.
Toxic effects on human growth and development	Toxic effects on human development have been examined in several studies with contradictive results, specially related to the type of disturbances and targeted organ/system. During developmental phase, human reproductive system is specially sensitive to toxic effects of 2,3,7,8-TCDD.
Carcinogenity	Numerous epidemiological studies have examined cancer-related effects of 2,3,7,8-TCDD. Typical result with respect to workers exposed to high doses has been increased mortality rate due to cancer. The most frequent types of cancer have been soft tissue sarcomas, lymphomas, respiratory and gastrointestinal cancer. Increased risk of benign neoplasms formation has also been recorded. Cancer related potential of 2,3,7,8-TCDD is manifested through its tumour promoting effects. IARC has classified 2,3,7,8-TCDD in the Group 1 carcinogens (carcinogenic to humans) based on limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in animals.
Genotoxicity	While some studies have shown increased incidence of chromosomal aberrations in foetal tissue (but not in the tissue of the mother), other provided no evidence on increased incidence of chromosomal aberrations or changes in sister chromatids.

Effects and risks of exposure to PCDF

Effect	PCDF
Exposure	General population is exposed to PCDF mainly through air inhalation, food ingestion and much less through water and exposure to certain products. Workers employed in sawmills, textile, leather and paper industry, production of certain chemicals in industries using PCB, may be exposed to higher PCDF levels than the general population. Among general population, groups consuming more fat-rich fish or those living and working in proximity of incinerators may potentially be exposed to higher PCDF concentrations.
Toxic effects	Manifestation of Yusho and Yu-Cheng poisoning include very serious health effects such as skin lesions (long term eruption on the skin, hyperpigmentation), effects to the eyes (hypersecretion of lachrymal glands), increased sensitivity to respiratory infections (chronic bronchitis), neurological signs and symptoms (reduced nerve impulse transmission speed, neurobehavioral disorders). Less dramatic effects observed in Yusho and Yu-Cheng patients included less severe hematologic changes (anaemia) and subclinical changes in liver function (ultra structural changes of hepatocyte and serum triglycerides*).* Some of these effects, specially effects on the skin and eyes and neurobehavioral disorders, have also been observed among children whose mothers had been exposed.
Mortality	In Yu-Cheng incident, lethal result occurred in ≈ 1% f the victims, half of them due to benign and malignant liver diseases. Peroral experimental studies have indicated extreme toxicity of PCDF. Doses of several µg/kg result in lethal outcome after acute and subchronic exposure. Congeners substituted in the 2,3,7,8-positions, specifically 2,3,7,8-tetra-CDF and 2,3,4,7,8-penta-CDF are considered to be among the most toxic.
Respiratory effects	If humans are exposed to high doses, chronic bronchitis and other side effects (cough, bronchial hypersecretion) may develop.
Cardiovascular effects	Available literature does not provide any data related to cardiovascular effects resulting from PCDF exposure.
Gastrointestinal effects	In Yu-Cheng incident, gastrointestinal effects of PCDF exposure like vomiting and diarrhoea, have been recorded.
Haematological effects	Humans exposed to 2,3,7,8-substituted furans may experience haematological effects. Clearly manifested haematological effects observed among Yu-Cheng patients were anaemia and leukocytosis.
Hepatotoxicity	PCDF primarily affect the liver, both in humans and animals.
Nephrotoxicity	Although renal effects have not bee recorded in Yusho and Yu-Cheng patients, experimental data indicate that mild kidney and urinary tract disorders can develop among humans exposed to high doses.
Neurotoxicity	PCDF cause peripheral neuropathy in humans. Usual neurological symptoms observed in Yusho and Yu-Cheng patients have been weakness, limb paralysis and neuralgia, as well as reduced impulse transmission speed along sensory and motor neurons. However, there are no data that would indicate the type of mechanism which is causing the reduced impulse transmission speed. In addition, neurobehavioral disorders and other toxic effects related to central nervous system development have been recorded among children whose mothers were exposed to PCDF during the above mentioned accidental poisoning.
Effects on skin and eyes	Effects on skin and the eyes are the most noticeable and the frequent manifestation of PCDF toxic effects. Characteristic changes on the skin (chloracnes) include follicular and sweat canal clogging, appearance of acne, skin eruptions, dark pigmentation of gingival tissue and buccal mucosa, lips, nails, as well as nail deformation.
Immunotoxicity	Clinical examinations among humans exposed to PCDF have shown that this group of compounds increases susceptibility to respiratory and skin infections, causes immune system disorders, including reduction of antibodies and leukocytes.
Reproductive toxicity	Although there are no exact data that would indicate reproductive toxicity of PCDF, experimental data show that such effects are possible. Namely, irregular menstrual cycles and reduced urinal estrogen excretion have been recorded.
Toxic effects on human growth and development	During Yusho and Yu-Cheng incident numerous toxic effects of PCDF have been observed among children whose mothers have been exposed. Such toxic effects included skin lesions similar to those formed on the skin of the adults, increased perinatal mortality rate of babies with dermal lesions, low weight at birth, neurobehavioral disorders, but without increased incidence of congenital malformations.
Carcinogenity	There is no hard evidence stating that PCDF causes cancerogenous effects in humans. Studies in humans have shown considerable increase of

	mortality rate due to liver cancer. Experiments provide some evidence that PCDF may cause liver and skin cancer.
Genotoxicity	Relatively little information is available concerning genotoxic effects of PCDF, both on humans and animals. In vitro tests have shown no mutagenic effects of PCDF. However, PCDF may cause genotoxic activity of other compounds through their activation up to reactive intermediates.

Effects and risks of exposure to PAH

Effect	PAH
Exposure	Exposure of general population to PAH is mainly a result of active or passive inhalation of tobacco smoke, inhalation of contaminated air and food ingestion. Professional exposure may result from processes in oil refineries, metal industry, coal production etc. With respect to professional exposure, inhalation is a dominant route of PAH uptake, although dermal introduction may also be of importance.
Toxic effects	Critical toxic effect of PAH is its cancer-causing effect, occurring both in humans and animals. Human exposure to PAH mixture mainly leads to lung cancer as a result of PAH inhalation or skin cancer as a result of dermal exposure.
Mortality	There are no data in the literature on human mortality rate.
Neurotoxicity	Neurotocix effects have not been specifically investigated neither on humans or animals. Experimental studies of acute, subchronic and chronic toxicity have not indicated significant neurotoxic potential of PAH.
Respiratory effects	Non-cancer effects on human respiratory system are manifested through difficult breathing, throat and chest irritation, chest pain, bleeding and irregular X-ray scan.
Cardiovascular effects	PAH represent one of the constituents of tobacco smoke, whereby smoking is a well known risk factor for arteriosclerosis.
Gastrointestinal effects	Antracen may cause toxic effects on human gastrointestial tract.
Hepatotoxicity	It was not recorded that PAH causes hepatotoxic effects on humans.
Haematological effects	Single intraperitoneal dose of benzo[a]pyrene in mice leads to spleen reduction and hemosiderosis. Benzo[a]pyrene is toxic if applied directly to bone marrow cell culture. Although results of haematology analysis in humans are somewhere contradictive, the data together with experimental findings and the fact that PAH specially affect highly proliferative tissues, indicate potential risk from haematological effects.
Effects on skin	PAH mixture can causes skin damage, both in humans and animals. However, only specific effects of benzo[a]pyrene have been analysed up to now. Chronic and hyperkeratotic dermatitis are frequent among workers exposed to tar.
Reproductive toxicity	Since testicles and ovaries contain highly proliferative cells, reproductive system is potentially susceptible to toxic effects of PAH. However, there are no data that would demonstrate reproductive toxicity of PAH, while few available experimental data have been based only on the effects of benzo[a]pyrene.
Toxic effects on human growth and development	Investigations of toxic effects on human development have not been carried out. However, results of in vitro tests indicate that hormonal function of placenta may be endangered as a result of benzo[a]pyrene exposure.
Immunotoxicity	Among workers exposed to benzo[a]pyrene suppression of humoral immune response has been observed. Lower levels of serum immunoglobulins (IgG and IgA) have been recorded in workers exposed to high concentrations of PAH mixtures (fluoranthene, perylene, pyrene, benzo[a]pyrene, chrysene, benzo[a] anthracene, dibenz[a,h] anthracene and benzo[g,h,i]perylene).
Carcinogenity	Data on human carcinogenic effects are exclusively related to the effects of PAH mixtures. In that way, it is difficult to estimate cancer causing potential of specific constituent, specially having in mind their interaction. However, results of epidemiological studies indicated increased mortality rate among workers of different profiles and among smokers, due to lung cancer.
Genotoxicity	All PAH except three (acenaphtene, acenaphthylene and fluoren) have exhibited mutagenic activity in at least one in vitro test. The most analysed benzo[a]pyrene causes genetic disorders in prokaryotic, eucaryotic and mammalian in vitro cells, further causing large number of genotoxic effects (genetic mutations in somatic cells, chromosome damage in somatic and germinative cells, formation of DNA adducts, unplanned DNA synthesis, sister chromatid exchange and neoplastic cell transformation). In human cell cultures, benzo[a]pyrene binds to DNA and causes genetic mutations, chromosomal aberrations, sister chromatid exchange and unplanned DNA synthesis.

Annex 4 Risks and minimal risk levels

Risk	HCBs	PCB	PCDD	PCDF	PAH
Subpopulation at increased risk	Certain factors (genetic factors, age, heath condition, nutrition habits, exposure to other substances) can cause certain population groups to manifest different or more intensive response to hexachlorbenzene exposure. Namely, the above specified factors influence the level of detoxification or excretion of hexachlorbenzene or compromise function of the organs affected by hexachlorbenzene.	Individuals with compromised liver function, like it is the case with liver cirrhosis and hepatitis B or with reduced capacity for glucuronide synthesis, are classified into the population group at increased risk with respect for toxic PCB effects.	2,3,7,8-TCDD can affect metabolism of pro-carcinogens and speed up their transformation to active intermediates through induction of enzymes involved in those metabolic processes. Induction of human enzymes is probably related to genetic polymorphism, and for that reason individuals having Ah receptor with high affinity for 2,3,7,8-TCDD may belong to the group at increased risk of specific tumour development.	Available literature does not provide data related to specially sensitive subgroups of general population. However, differences in PCDF exposure response may depend on concentrations of Ah receptors in certain tissues/cells. Having in mind toxic effects on human development, it is expected children to be more sensitive than the adults to certain effects of polychlorinated furans.	Certain categories of general population may be particularly sensitive to toxic effects of PAH. Individuals whose aryl hydrocarbon hydroxylase (AHH) is especially sensitive to induction, individuals with inappropriate nutrition practice, genetic defects which reduce efficiency of DNA reparation or with immunodeficiency are at increased risks. Specially sensitive to toxic effects of PAH may be individuals with damaged liver or skin diseases, women in reproductive period and foetus in different phases of development.
Risk to children	Data on human exposure indicate that children represent special risk group. Namely, levels of hexachlorobenzene in blood and tissues of small children were higher than the values recorded in blood of their mothers, while symptoms of poisoning manifested earlier in children than in mothers.	The same as the rest of the population, children are exposed to biphenyls mainly through food, specifically meat, fish, and poultry. Children represent a special risk group since compared to adult population, they grow rapidly, have lower capacity for biotransformation of PCB and considerable less adipose tissue for biphenyls disposal. Exposure of the foetus is a	There are little data on toxic effects imposed in children. Available data indicate that children are specially susceptible to dermal effects of PCDD. Experimental data have additionally shown that the foetus in various phases of development is particularly sensitive to the effects of dioxins related to development of reproductive, immune and nervous systems. Effects that manifest the first are	-	-

		result of PCB passage through the placenta. PCB are accumulated in milk which may represent significant source of exposure for small children. Passage through the placenta is of special importance. Potential exposure through milk and effects on the growth and development of small children are particularly considered for the same reasons are mentioned previously.	the ones related to neurobehavioral disturbances and disturbances of reproductive system development.		
Minimal risk levels	Minimal risk level (MRL) of 0,008 mg/kg/day is established for acute (≤ 14 days) peroral exposure. Minimal risk level of 0,0001 mg/kg/day is established for medium length peroral exposure (15-364 days). Minimal risk level of 0,00005 mg/kg/day is established for chronic (≥ 365 days) peroral exposure.	Minimal risk level of 0,03 µg/kg/day is established for medium length peroral exposure (15-364 days). Minimal risk level of 0,02 µg/kg/day is established for chronic (≥ 365 days) peroral exposure.	Minimal risk level (MRL) of 0,0002 (2×10^{-4}) µg/kg/day is established for 2,3,7,8-TCDD and acute peroral exposure (≤ 14 days). Minimal risk level of 0,00002 (2×10^{-5}) µg/kg/day is established for 2,3,7,8-TCDD and medium length peroral exposure (15-364 days). Minimal risk level of 0,000001 (2×10^{-6}) µg/kg/day is established for 2,3,7,8-TCDD and chronic (≥ 365 days) peroral exposure.	Minimal risk level (MRL) of 0,001 µg/kg/day is established for acute (≤ 14 days) peroral exposure and 2,3,4,7,8-pentaCDF. Minimal risk level of 0,00003 µg/kg/day is established for medium length peroral exposure (15-364 days) and 2,3,4,7,8-pentaCDF.	**Acenaphtene.** Minimal risk level of 0,6 mg/kg/day is established for medium length peroral exposure (15-364 days). **Fluoranthene.** Minimal risk level of 0,4 mg/kg/day is established for medium length peroral exposure (15-364 days). **Fluorene.** Minimal risk level of 0,4 mg/kg/day is established for medium length peroral exposure (15-364 days). **Anthracene**. Minimal risk level of 10 mg/kg/day is established for medium length peroral exposure (15-364 days).

REFERENCES

1. Guidance for developing a national implementation plan for the Stockholm Convention , UNEP, World Bank, 2005 (http://www.pops.int/documents/meetings/cop_2/meetingdocs/default.htm);
2. Report on the current state of the environment in the Republic of Serbia in 2007, Serbian Environmental Protection Agency (http://www.sepa.sr.gov.yu/);
3. Statistical Office of the Republic of Serbia - Economic movement in Republic of Serbia, 2008. (KC10) (http://webrzs.statserb.sr.gov.yu/axd/saopstenja.php);
4. Statistical Office of the Republic of Serbia – Public Release (http://webrzs.statserb.sr.gov.yu/axd/novinari1.php?SifraVesti=330&Link
5. Statistical Office of the Republic of Serbia.- Analyses of the Standard of Living in the Republic of Serbia 2002-2007 (CIP - Каталогизација у публикацији Народна библиотека Србије, Београд 330.59(497.11)"2002/2007");
6. National Economic Development Strategy of the Republic of Serbia 2006-2012 (http://www.prsp.sr.gov.yu/dokumenta.jsp);
7. Environmental Performance Reviews, second review, Economic Commmission for Europe, Committee on Environmnetal Policy, 2007 (http://www.unece.org/env/epr/epr studies/serbiaII.pdf);
8. Statistical Office of the Republic of Serbia.- Statistical Yearbook of Serbia for 2008 (http://webrzs.statserb.sr.gov.yu/axd/god.htm);
9. National Strategy for Sustainable Development (http://www.odrzivi-razvoj.sr.gov.yu/cyr/strategije.php);
10. Statistical Office of the Republic of Serbia.- Statistical Yearbook of Serbia for 2004 (http://webrzs.statserb.sr.gov.yu/axd/god.htm);
11. National Waste Management Strategy (CIP - Каталогизација и публикација Народна библиотека Србије, Београд (497.11));
12. Agricultural Development Strategy Republic of Serbia (http://www.minpolj.sr.gov.yu/index.php?Itemid=75&id=64&option=com_content&task=view);
13. Energy Sector Development Strategy Republic of Serbia until 2015 (http://www.mem.sr.gov.yu/);
14. National Strategy for the Accession of Serbia-Montenegro to the European Union (http://www.seio.sr.gov.yu/code/navigate.asp?Id=12);
15. Poverty Reduction Strategy Republic of Serbia, Belgrade 2003;
16. Cleaner Production Strategy of the Republic of Serbia (ttp://www.ekoplan.gov.rs/src/search.php);
17. FAO PSMS-Pesticides Stockpile Management System (http://www.fao.org/psms/about.htm);
18. ECPA Container Management Guideline (http://www.ecpa.be/en/about-ecpa/);
19. Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases, UNEP, 2005;
20. BIPRO, Identification, assessment and prioritisation of EU measures to reduce releases of unintentionally produced/released Persistent Organic Pollutants, REFERENCE:O7.010401/2005/419391/MAR/D4, FINAL REPORT, European Commission, Brussels, 2006;
21. Report on the current state of the environment in the Republic of Serbia in 2006, Ministry of Environmental Protection and Environmental Protection Agency, 2007 (http://www.sepa.sr.gov.yu/);

22. The Kosovo Conflict, Consequences for the Environment & Human Settlements, UNEP, UNCHS, 1999;
23. From Conflict to Sustainable Development. Assessment and Clean-up in Serbia and Montenegro. 2004. United Nations Environment Programme;
24. Report on the State of the Environment in 2000 and Priority Tasks for 2001 and Later Years, Ministry of Health and Environmental Protection of the Republic of Serbia, Directorate of Environmental Protection, 2002;
25. Report on the State of the Environment and Natural Resources in 2002 and Changes Detected Compared to 2000, Ministry of Environmental Protection and Natural Resources, 2003;
26. Report on the State of the Environment in the Republic of Serbia in 2003 and 2004, Ministry of Science and Environmental Protection and Serbian Environmental Protection Agency, 2005 (http://www.sepa.sr.gov.yu/);
27. Report on the State of the Environment in the Republic of Serbia in 2005, Ministry of Science and Environmental Protection and Serbian Environmental Protection Agency, 2006 (http://www.sepa.sr.gov.yu/);
28. Annual Hydrology Report, Water Quality 2000-2006, Serbian Hydrometeorological Institute, 2006;
29. Quality of the Environment in the City of Belgrade in 2003, DEFRA, Regional Environmental Center, Environmental Protection Office in the city of Belgrade, 2004;
30. Quality of the Environment in the City of Belgrade in 2004, Regional Environmental Center, Environmental Protection Office in the city of Belgrade, 2005;
31. Quality of the Environment in the City of Belgrade in 2005, Regional Environmental Center, Environmental Protection Office in the city of Belgrade, Institute of Public Health, 2006;
32. Quality of the Environment in the City of Belgrade in 2007, Regional Environmental Center, Environmental Protection Office in the city of Belgrade, Institute of Public Health, 2008;
33. Directorate of Environmental Protection and Improvement and Department of Chemical Technology and Environmnetal Protection: report on the project Water and Soil Monitoring at the Ratno Ostrvo site, Secretariat for Urban Planning, Housing Service and environmental Protection, Novi Sad, 2001, 2002, 2003, 2004;
34. Serbian Hydrometeorological Institute, Annual Hydrology Report – 3. Water Quality, Belgrade, 2006;
35. Škrbić, B., Cvejanov, J., Đurišić-Mladenović, N.: Organochlorine pesticides and polychlorinated biphenyls in surface soils of Novi Sad and bank sediment of the Danube River, Journal of Environmental Science and Health, Part B-Pesticides, Food Contaminants and Agricultural Wastes, Vol 42, Issue 3, 2007 (311-319);
36. Pucarević, M., Čuvardić, M., Sekulić, P. i Hadžić, V.: Organic Pollutants in Bank Sediment of the Danube-Tisa-Danube Channels, Eko Conference Proceedings, Novi Sad, 2003 (159-164);
37. Institute for Field and Vegetable Crop, Novi Sad, Institute of Soil Science, Agroeconomics and Fertilizers, Agroeconomics Laboratory: Report: Analysis of Flood Surface Waters and Flooded Soil in Middle Banat, 2005;
38. Babić-Mladenović, M., Vraga, S., Popović, L., Damjanović, M.: The Pollution of the „Iron Gate“ Reservoir, First International Conference on Environmental Recovery of Yugoslavia - ENRY, Belgrade, 2001 (159-167);
39. Pacyna J.M. et al., 1999, Final report for Project POPCYCLING-Baltic. EU DGXII, Environment and Climate Program ENV4-CT96-0214;

40. Klánová, J., Čupr P., Holoubek, I.: Application of Passive Sampler for Monitoring of POPs in Ambient Air. Part II: Pilot study for development of the monitoring network in the Central and Eastern Europe (MONET_CEEC), 2006. RECETOX MU Brno. RECETOX_TOCOEN REPORTS No. 319. August 2007 (ISBN 978-80-210-4393-0);
41. Institution for Health and Environment Protection, Environmental Protection Institute, Maribor;
42. UNEP/GEF Guidance for Socio-Economic Assessment for National Implementation Plan Development and Implementation under the Stockholm Convention March 2007.

ADDITIONAL LITERATURE

- Berdowski et al. (1997) The European emission inventory of heavy metals and persistent organic pollutants. Unweltforschungsplan des Bundesministers fur Umvelt, Naturschutz und Reaktorsicherheit. Luftreinhaltung. Forschungsbericht 104 02 672/03, Berlin.;
- Blagojević, B., Sekulić, P., Stefanović, T., Stošić, S. i Jovanović, E.,: Prisustvo PAH-ova kao rizik zagađivanja zemljišta, Simpozijum Ekologija i proizvodnja zdravstveno bezbedne hrane u braničevskom okrugu, Požarevac, 2003. (148-152);
- Blagojević, B., Stefanović, T. i Stojiljković, E.: Termoelektrane kao izvor zagađenja životne sredine PAH-ovima, ELECTRA III, Treća međunarodna konferencija o upravljanju zaštitom okoline, Herceg Novi 7-11. juni 2004.;
- Boyl, K.J. and Bergstrom, J.C. (1992). Benefit Transfer Studies: Myths, Pragmatism and Idealism, *Water Resources Research,* 28 (3) : 657-663.;
- Connell Deslly W./ et al./ (1997)Introduction to Environmental Chemistry, In: Basic concepts of environmental chemistry, 145, New York.;
- PCB and PAH Releases from Incineration and Power Generation Processes, Environment Agency, England and Wales, R&D Technical Report P4-052/TR, 2002 (http://www.pops.int/documents/guidance/NIPsFinal/techrep.pdf);
- Dragun, J.: The Soil Chemistry of Hazardous Materials, Second Edition, Amherst Scientific Publishers, Amherst, Massachusetts, 1998.;
- Ecotec et al. 2001, *The Benefits of Compliance with the Environmental Acquis for the Candidate Countries*, in co-operation with EFTEC, IEEP, TME and Metroeconomica, London.;
- EFTEC & RIVM (2000) *Valuing the Benefits of Environmental Policy: The Netherlands.* Economics for the Environmental Consultancy Ltd. London and Rijksinstituut voor Volksgezond heid en Milieu.;
- Ekobilten, Grad Novi Sad, Gradska uprava za zaštitu životne sredine, godina XVI, broj 311- 321, 2006.;
- FAO: Assessing soil contamination, FAO Pesticide Disposal Series 8, Rome, 2000.;
- FAO: Baseline study on the problem of obsolete pesticide stocks, FAO Pesticide Disposal Series 9, Rome, 2001.;
- FAO: Country Guidelines, FAO Pesticide Disposal Series 11, Rome, 2001.;
- FAO: Prevention of accumulation of obsolete pesticide stocks, FAO Pesticide Disposal Series 2, Rome, 1995.;
- FAO: Training manual for inventory taking of obsolete pesticides, FAO Pesticide Disposal Series 10, Rome, 2001.;
- Federal Soil Protection and Contaminated Sites Ordinance (BBodSchV), 1999.;
- Gradska uprava- Sekreterijat za urbanizam i stambene poslove i Naučni institut za ratarstvo i povrtarstvo: Izveštaj projekta: Stanje plodnosti i zagađenosti zemljišta novosadskih bašti 2003. godine, Novi Sad, 2004.;

- Gradska uprava za zaštitu životne sredine, Naučni institut za ratrstvo i povrtarstvo: Izveštaj projekta: Program praćenja kvaliteta poljoprivrednog i nepoljoprivrednog zemljišta na teritoriji grada Novog Sada, Novi Sad, 2007.;
- Gradska uprava, Sekreterijat za urbanizam i stambene poslove i Naučni institut za ratarstvo i povrtarstvo: Izveštaj projekta: Stanje plodnosti i zagađenosti zemljišta novosadskih bašti 2004. godine, Novi Sad, 2005.;
- Gradska uprava**,** Sekreterijat za urbanizam i stambene poslove i Naučni institut za ratarstvo i povrtarstvo: Izveštaj projekta: Stanje plodnosti i zagađenosti zemljišta novosadskih bašti 2005. godine, Novi Sad, 2006.;
- Grubačević, M., Paunović, E. i Srnić-Stanimirović T.: Praćenje policikličnih aromatičnih ugljovodonika u vazduhu u Beogradu-Sadašnje stanje i perspektiva, XXXIII Savetovanje Zaštita vazduha, 2005. (43-50);
- Guidance for Socio-Economic Assessment for National Implementation Plan Development and Implementation under the Stockholm Convention, GEF , UNEP April 2005.;
- Guidelines for the identification of PCB and materials Containing PCB, First Issue, August 1999.;
- Hidrološki godišnjak, kvalitet voda 2000-2006., RHMZ, 2006. god;
- Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases, UNEP, 2005 (http://www.oztoxics.org/ipepweb/library/DioxinToolkit.pdf);
- Releases from Unintentional Production of PCDD/PCDF, HCB and PCB (Annex C Chemicals) Inventory and Action Plan (http://www.pops.int/documents/ followup/nipguide/ NIPGuidePartC5.DOC);
- EMEP/CORINAIR - SOURCES OF HEXACHLOROBENZENE EMISSIOS, 2005 (http://reports.eea.eu.int/EMEPCORINAIR4/en/sources_of_HCB.pdf);
- EMEP/CORINAIR - SOURCES OF POYCHLORINATED BIPHENYLS EMISSION, 2005 (http://reports.eea.eu.int/EMEPCORINAIR4/en/sources_of_PCB.pdf);
- Izvršno Veće Autonomne Pokrajine Vojvodine i Naučni institut za ratarstvo i povrtarstvo: Izveštaj projekta: Kontrola kvaliteta poljoprivrednog zemljišta i vode za navodnjavanje Vojvodine, Novi Sad , 2001.;
- Izvršno Veće Autonomne Pokrajine Vojvodine i Naučni institut za ratarstvo i povrtarstvo: Izveštaj projekta: Kontrola kvaliteta životne sredine na teritoriji AP Vojvodine-nepoljoprivredno zemljište, Novi Sad, 2003.;
- Izvršno Veće Autonomne Pokrajine Vojvodine i Naučni institut za ratarstvo i povrtarstvo: Izveštaj projekta: Kontrola kvaliteta životne sredine na teritoriji AP Vojvodine-nepoljoprivredno zemljište, ,ovi Sad, 2004.;
- Jakšić, J.: Koncentracioni nivoi perzistentnih organskih polutanata u vazduhu generisanih u toku ratnog akcidenta od 1992 – ’99, Magistarski rad, Univerzitet u Novom Sadu ACIMSI, Centar za inženjerstvo zaštite životne sredine, 2006.;
- Jantzen, J. and Pesic, R. (2004) Assessment of the Economic Value of Environmental Degradation in Serbia EAR & DHV.;

- Kakareka S. et al. (2000) Study for evaluation of Emission Facrors of Selected POPs from Main Activities of the CIS Countries. Belarusian in to EMER. Annual Report 1999. IPNRUE-MSC-East.Minsk-Moskow.;
- King and Mazzotta, (2004) *Ecosystem Valuation*, Univ. of Maryland, and Univ. of Rhode Island, Site funded by US Department of Agriculture and Natural Resources, Conservation Service and National Oceanographic and Atmospheric Administration, http://cbl.umces.edu/~dkingweb/default.htm.;
- Klánová, J., Čupr P., Holoubek, I.: Application of Passive Sampler for Monitoring of POPs in Ambient Air. Part II: Pilot study for development of the monitoring network in the Central and Eastern Europe (MONET_CEEC), 2006. RECETOX MU Brno. RECETOX_TOCOEN REPORTS No. 319. August 2007 (ISBN 978-80-210-4393-0).;
- Mojašević, M., Šestović, M., Elezović, I. i Vitorović, S.: Stanje ostataka lindana u zemljištu u raznim lokalitetima Srbije, Zbornik radova Jugoslovenskog savetovanja o primjeni pesticida, Neum, 1983. (637-642);
- Mojašević, M., Vitorović, S., Protić, N. i Verešbaranji, I.,: Ostaci pesticida u zemljištu: Rezultati višegodišnjih (1991-1995) ispitivanja sadržaja ostataka pesticida u zemljištima Srbije, Pestcidi, broj 14, 1999. (51-66);
- Naučni institut za ratarstvo i povrtarstvo- Novi Sad, Zavod za zemljište, agroekologiju i đubriva, Laboratorija za agroekologiju: Elaborat: Analize poplavne površinske vode i poplavljenog zemljišta na teritoriji srednjeg Banata, 2005.;
- Pearce, D. (ed.) Pearce, C. and Palmer C. (2002) *Valuing the Environment in Developing Countries.* Edward Elgar, Cheltenham UK.;
- Persistent Organic Pollutants and the Stockholm Convention: A Resource Guide (http://lnweb18.worldbank.org/essd/envext.nsf/50ByDocName/PersistentOrganic Pollutants an d the Stockholm Convention Resource Guide CIDA WorldBank 200193KBPDF /$FILE/Persistent OrganicPollutantsAResourceGuide2001.pdf);
- Pokrajinski sekretarijat za Nauku i tehnološki razvoj i Naučni institut za ratarstvo i povrtarstvo: Izveštaj o realizaciji elaborata Kvalitet poljoprivrednog zemljišta, bezbednost upotrebe pesticida i uklanjanje arsena iz vode u cilju zaštite životne sredine, projektni zadatak.;
- EMEP/CORINAIR - AN APPROACH TO ESTIMATION OF PAH EMISSIONS, 2005 (http://reports.eea.eu.int/EMEPCORINAIR4/en/BPAH.pdf);
- Protocol on Pollutant Release and Transfer Registers (http://www.unece.org/env/pp/prtr.htm);
- Pucarević, M. and Sekulić, P.: Polyciclic aromatic hydrocarbons and pesticides in soil of Vojvodina, Matica srpska, Poceedings for natural Sciences, broj 107, Novi Sad, 2004. (93-100);
- Pucarević, M., Hadžić, V. i Sekulić, P.: Uticaj gorenja rafinerije Novi Sad na zemljište, II policiklični aromatski ugljovodonici, Zbornik radova, Eko konferencija, Novi Sad, 2000. (123-128);
- Pucarević, M., Sekulić P., Vasin J., Jovanović Z. i Jokanović S.: Aerozagađenje i sadržaj policikličnih aromatičnih ugljovodonika u površinskom sloju zemljišta, XXXIII Savetovanje Zaštita vazduha, 2005. (215-218);

- Rajšić, S., Tasić, M., Novaković, V. and Vukmirović Z.: Determination of PAH Concentration in the Air of Belgrade in Summer, First International Conference on Environmental Recovery of Yugoslavia-ENRY, Belgrade, 2001. (125-127);
- Ready, R., Navrud, S., Day, B., Dubourg, R., Machado, F., Mourato, S., Spanninks, F., and Rodriquez, M.X.V. (1999), *Benefit Transfer in Europe: Are Values Consistent Across Countries?* Paper presented at seminar January 20th 2000, University College London.;
- Republika Srbija, Ministarstvo poljoprivrede, šumarstvai vodoprivrede, Direkcija za vode: P R O J E K A T: Obnova sistema za navodnjavanje i odvodnjavanje - Zemljišna studija - (Irrigation And Drainage Rehabilitation Project- Soil Study), 2006.;
- Škrbić B. (2003) Polihlorovani Bifenili, Univerzitet u Novom Sadu,Tehnološki fakultet.;
- Škrbić, B. and Miljević, N.: An evaluation of residues at an oil refinery ste following fires, Journal of Environmental Science and Health, Part A, 37 (6), 2002. (1029-1039);
- Škrbić, B., Cvejanov, J. and Đurišić-Mladenović N.: Poyciclic Aromatic hydrocarbons in Surface Soils of Novi Sad and Bank Sediment of the Danube River, Journal of Environmental Science and Health, Part A, 40, 2005. (29-42);
- Šovljanski, R. i sar. (1989): Studija o jedinstvenim kriterijumima za registrovanje zagađivača vode, vazduha i zemljišta na područjima SAP Vojvodine i potrebne hitne mere zaštite na mestima sa najizraženijim zagađivačima. Oblast: Zemljište I etapa II faze, Poljoprivredni fakultet Novi Sad, PIV Novi Sad, 1989. (1-377);
- Stanje plodnosti i sadržaja opasnih i štetnih materija u zemljištu, u cilju održivog razvoja poljoprivrede Vojvodine, Novi Sad, 2007.;
- Stevanović-Čarapina H. et al. (2003) Tehnički priručnik za postupanje sa materijalima zagađenim polihlorovanim bifenilima (PCB), Republika Srbija, Ministrastvo za zaštitu prirodnih bogastava i životne sredine, Beograd.;
- Community strategy for dioxins, furans and polychlorinated biphenyls (2001/C 322/02)(COM(2001) 593 final);
- Sumner, M. E. (Ed): Handbook of Soil Science, CRC Press, 2000.;
- Survey of Currently Available Non-Incineration PCB Destruction Technologies (2000) First Issue, Prepared by UNEP Chemicals, UNEP.;
- Turk, M.: Rezidualne količine karakterističnih kongenera polihlorovanih bifenila generisanih tokom konfliktnog perioda na prostorima bivše Jugoslavije, Magistarski rad, Univerzitet u Novom Sadu ACIMSI, Univerzitetski centar za inženjerstvo zaštite životne sredine, 2006.;
- U.S.EPA: Risk-based Concentration Table, Third Quarter, U.S. Environmental Protection agency, Region III, 1993.;
- Protocol To The 1979 Convention On Long-Range Transboundary Air Pollution On Persistent Organic Pollutants, UNECE, 1998) (http://www.unece.org/env/lrtap/status/lrtap_s.htm) ;
- Uprava za zaštitu i unapređenje životne sredine i Katedra za hemijsku tehnologiju i zaštitu životne sredine: Izvešaj projekta: Monitoring voda i zemljišta na

lokalitetu Ratnog ostrva, Sekretarijat za urbanizam, stambene poslove i zaštitu životne sredine, Novi Sad, 2001.;
- Uprava za zaštitu i unapređenje životne sredine i Katedra za hemijsku tehnologiju i zaštitu životne sredine: Izvešaj projekta: Monitoring voda i zemljišta na lokalitetu Ratnog ostrva, Sekretarijat za urbanizam, stambene poslove i zaštitu životne sredine, 2002.;
- Uprava za zaštitu i unapređenje životne sredine i Katedra za hemijsku tehnologiju i zaštitu životne sredine: Izvešaj projekta: Monitoring voda i zemljišta na lokalitetu Ratnog ostrva, Sekretarijat za urbanizam, stambene poslove i zaštitu životne sredine, 2003.;
- Uprava za zaštitu i unapređenje životne sredine i Katedra za hemijsku tehnologiju i zaštitu životne sredine: Izvešaj projekta: Monitoring voda i zemljišta na lokalitetu Ratnog ostrva, Sekretarijat za urbanizam, stambene poslove i zaštitu životne sredine, 2004.;
- EMEP/CORINAIR Emission Inventory Guidebook – 2005 (http://reports.eea.eu.int/EMEPCORINAIR4/en/page002.html);
- Guidance on Estimating Non-point Source Emissions, UNITAR, 1998 (http://www.unitar.org/cwm/publications/ current/prtr/prtr_en/prtr_tech_support_3_nov2003.pdf);
- Guidance for Facilities on PRTR Data Estimation and Reporting, UNITAR, 1998 (http://www.unitar.org/cwm/publications/ current/prtr/prtr_en /prtr_tech_support_2_nov2003.pdf);
- REGULATION (EC) No 850/2004 Of The European Parliament And Of The Council (http://europa.eu.int/eurlex/ pri/en/oj/dat/2004/l_229/l_22920040629en00050022.pdf);
- Verešbaranji, I., Šovljanski, R., Pucarević, M. i Kastori, R.: Zagađenost zemljišta Vojvodine pesticidima i njihovim metabolitima. U: Teški metali i pesticidi u zemljištu (Kastori, R. ed.), Poljoprivredni fakultet, Institut za ratarstvo i povrtarstvo, Novi Sad, 1993. (223-258);
- Vitorović, S., Elezović, I. i Mojašević, M.: Pesticidi u zemljištu sa stanovišta plodnosti i zagađivanja, Savremena poljoprivreda, Vol 1, broj 6, 1993. (52-55);
- Vojinović, V., Perić, I. i Nešković, N.: Agrohemija 5-6, 1981. (203-208);
- Vojinović, V., Perić, I., Nešković, N. i Drlić M.: Zaštita bilja 31, 1980. (77-82);
- web sites :
  - www.basel.int
  - www.dexil.com
  - www.ec.gc.ca/ceqg-rcqe/English/ceqg/default.cfm
  - www.hach.com
  - www.helcom.fi
  - www.internat.naturvardsverket.se/
  - www.oztoxics.org/ipepweb/library/PCB-Containing%20Equipment.pdf
  - www.pops.int/
  - www.pops.int/documents/followup/nipguide/NIPGUIDPartC3.DOCP
  - www.tredi.co.nz/htm/identify.htm
  - www.ekoplan. gov.rs

  - www.ekoplan. gov.rs/projekti/pops/index.php
  - www.minpolj. gov.rs
  - www.pops.int/documents/guidance
  - www.statserb. gov.rs
  - www.zdravlja. gov.rs
- Zavod za Izgradnju grada i Naučni institut za ratarstvo i povrtarstvo: Izveštaj Projekta: Utvrđivanje stanja zagađenosti zemljišta na teritoriji opštine Novi Sad, Novi Sad 2000.