THE GOVERNMENT OF THE REPUBLIC OF CROATIA

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Pursuant to Article 9a of the Air Protection Act (Official Gazette 178/04 and 60/08), and with reference to Articles 5 and 7 of the Stockholm Convention on Persistent Organic Pollutants (Official Gazette – International Treaties 11/06), the Government of the Republic of Croatia, at its session on 5 December 2008 adopted the following

DECISION

ON THE ADOPTION OF THE NATIONAL IMPLEMENTATION PLAN FOR THE STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS

I

The National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (hereinafter referred to as the Plan) is hereby adopted.

The Plan referred to in paragraph 1 of this item represents an integral part of this Decision.

II

The Ministry of Environmental Protection, Physical Planning and Construction, in co-operation with the Ministry of Agriculture, Fishery and Rural Development; Ministry of Regional Development, Forestry and Water Management; Ministry of Health and Social Welfare, and Ministry of the Economy, Labour and Entrepreneurship, is in charge of establishing a working group for monitoring the fulfilment of obligations ensuing from the Plan and reporting to the Government of the Republic of Croatia on the implementation of the Plan.

The Ministry of Environmental Protection, Physical Planning and Construction shall submit a two year report to the Government of the Republic of Croatia on the fulfilment of obligations ensuing from the Plan.

III

The Ministry of Environmental Protection, Physical Planning and Construction is responsible for the submission of the Plan to the Secretariat of the Stockholm Convention on Persistent Organic Pollutants.

IV

This decision shall enter into force on the day of its adoption, and shall be published in the Official Gazette.

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Reg. No.: 5030105-08-1

Zagreb, 5 December 2008

Prime Minister
Ivo Sanader, m.p.

1 INTRODUCTION

The countries of the world adopted the Stockholm Convention on Persistent Organic Pollutants on 23 May 2001 in Stockholm. The Convention is aimed at reducing, and where appropriate preventing, the release of twelve persistent organic pollutants into the environment (aldrin, chlordane, DDT, dieldrin, eldrin, heptachlor, hexachlorobenzene, mirex and toxaphene, PCB, HCB, PCDD/PCDF). The Convention entered into force on 17 February 2004. It prescribes the requirements to be fulfilled by each party to the Convention in order to achieve elimination of production, use, import and export of persistent organic compounds at the global level. The above mentioned would lead to significant reduction or complete elimination of the release of the said compounds into the environment.

The Republic of Croatia signed the Stockholm Convention on Persistent Organic Pollutants on 23 May 2001. The Proposal of the National Implementation Plan for the Stockholm Convention was prepared in late 2004 within the framework of the two year project entitled "Initiation of activities which will facilitate timely implementation of the Stockholm Convention on Persistent Organic Pollutants in the Republic of Croatia" (UNIDO Project No: GEF/CRO/02/007), and was adopted by the Commission for monitoring project implementation. Pursuant to the Convention obligations, the Republic of Croatia shall submit the National Implementation Plan to the Convention Secretariat within two years from the date of entry into force of the Stockholm Convention for the Republic of Croatia.

The Republic of Croatia ratified the Stockholm Convention in November 2006 and became a party to the Convention in April 2007.

During 2008, the Proposal of the National Implementation Plan for the Stockholm Convention (hereinafter referred to as the NIP) was revised, primarily in the part referring to legislative and institutional changes.

1.1 Objectives of the Stockholm Convention

The Stockholm Convention (hereinafter referred to as: the Convention) is aimed at reducing and eliminating the release of twelve persistent organic pollutants (POPs).

Persistent organic pollutants are organic compounds resistant to photolytic, chemical and biological degradation. They have the characteristic of low solubility in water and high solubility in fats and as such accumulate in the fatty tissues of living organisms. They are present in the environment in low levels, but are transported through air and water over great distances and consequently are widespread throughout the world, even in places where they have never been used.

Organochlorine compounds are a group of POPs. Organochlorine compounds include all organic compounds containing one or more atoms of chlorine. Organochlorine pesticides (OCPs) such as DDT, aldrin, dieldrin, hexachlorobenzene (HCB**),** hexachlor-cyclohexane

(HCH) and heptachlor, as well as polychlorinated biphenyls (PCB), are two groups of widely used persistent organic pollutants.

The Convention shall apply to:

– products (PCB, pesticides, insecticides, rodenticides, fungicides) – (aldrin, chlordane, DDT, dieldrin, eldrin, heptachlor, hexachlorobenzene, mirex and toxaphene);

– polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF), two groups of compounds known under common name "dioxins", which have never been applied and which are not natural compounds. These two groups of compounds include a total of 210 congeners, some of which are highly toxic and therefore they have raised interest for their monitoring and assessment/evaluation. Dioxins (PCDD) and furans (PCDF) are produced as undesirable by-products in thermal processes and chemical reactions mostly thorough two mechanisms: *de nuovo* synthesis from the basic elements: carbon, hydrogen, oxygen and chlorine (usually with a catalyst at temperatures from 250 do 500°C) or through generation from precursors (chlorinated organic substances used in various chemical processes) at temperatures from 200 to 450°C. Emission of PCDD/PCDF into the environment occurs directly by release and/or transfer through air, water, soil, products and waste. These four groups include more than 400 compounds, some of which have been proven to be carcinogenic, while many others are considered potentially carcinogenic. Due to their characteristics and effects, and their widespread presence in all parts of the biosphere, even in humans, organochlorine compounds remain the most researched compounds;

– products used to control the spread of disease, e.g. DDT against malaria.

Chemicals to which the convention applies are listed in Annexes A (Part I and II), B (Part I and II) and C. Annex D lists the requirements and criteria for the inclusion of new chemicals to the Convention list.

The Convention requirements which apply to chemicals are contained in three Articles:

– Article 3 applies to produced chemicals; the Article prescribes measures to reduce or eliminate the release from intentional production and use;

– Article 5 applies to products produced as a consequence of the release from unintentional production, caused by human activities, and

– Article 6 prescribes measures to reduce or eliminate the release from stockpiles and wastes of all twelve chemicals or group of chemicals.

1.2. Requirements of the Stockholm Convention which refer to pesticides

The parties to the Stockholm Convention shall:

– prohibit and/or take legal and administrative measures required to eliminate the production, use, import and export of products used as pesticides (aldrin, dieldrin, eldrin, heptachlor, hexachlorobenzene, mirex and toxaphene) listed in Annex A to the Convention;

– supervise/monitor the use of pesticides in laboratory-research purposes, their presence in products and articles in traces;

– restrict the import and export of pesticides, except under requirements listed in Article 4 of the Convention (exceptions reported to the Convention Secretariat), or for the purposes environmentally sound disposal of pesticides;

– develop and implement strategies for identifying stockpiles, products and articles in use, as well as waste containing pesticides;

– prohibit the recovery, recycling, reclamation, and direct or indirect use of pesticides;

– manage stockpiles in a safe, efficient and environmentally sound manner until the moment they became waste;

– take appropriate measures for environmentally sound handling, collection, transport and storing of pesticides, and disposal of waste containing pesticides in such a way that their content is removed from such waste. Disposal should be performed in an environmentally sound manner and in accordance with international rules, standards, and guidelines.

1.3. Requirements of the Stockholm Convention which refer to DDT

The parties to the Stockholm Convention shall:

– eliminate the production and use of DDT with exemptions according to Annex B – Part I for:

– disease vector control use in accordance with the guidelines of the World Health Organisation,

– production and use of DDT as an intermediate in the production of dicofol,

– promoting research and development of DDT replacement compounds.

Other requirements related to DDT are the same as for pesticides listed in Annex A to the Stockholm Convention.

Annex B– Part II lists the requirements under which production and use of DDT are permitted.

1.4. Requirements of the Stockholm Convention which refer to PCB

Of the 209 potential isomers of polychlorinated biphenyls, there are usually 100 isomers found in commercial mixtures.

Commercial PCBs present a mixture of congeners of varying degrees of chlorination. Depending on the content of chlorine (most often ranging from 48 to 60%), their colour varies from light yellow to brown. Less chlorinated products (e.g. Arochlorine 1221 with 21% Cl)

are moderately viscose liquids, while more chlorinates ones (e.g. Arochlorine 1260 with 60% chlorine) are solids. Industrial production of PCBs began in 1929 in the USA, and reached its peak in 1970. It is assessed that nearly 1,200,000 tonnes were produced between 1930 and 1980. The most significant producers of PCBs are: Monsato (USA), Bayer (Germany), Rhone Poulenc and PCUK (France); Kanegafuchi (Japan), Cros (Spain), Cafaro (Italy) and the Eastern European countries, while there was no PCB production in the Republic of Croatia. Depending on the producer and chemical content, various PCB mixtures were available on the market under different names. Generally speaking, the choice of name had a reference to occurrence of a specific number of atoms (e.g. AROCHLORINE 1248 is a mixture of PCBs which contains 48% chlorine, CLOPHEN A60, PHENCLOR DPC and KANECHLOR 600 are products of different producers containing approximately 60% chlorine).

All parties to the Stockholm Convention shall:

– eliminate the use of PCBs in equipment (e.g. transformers, capacitors or other receptacles containing liquid stockpiles) by 2025;

– identify, label and remove from use equipment containing greater than 10% PCBs and volumes greater than 5 litres;

– identify, label and remove from use equipment containing greater than 0.05% PCBs and volumes greater than 5 litres;

– identify, label and remove from use equipment containing greater than 0.005% PCBs and volumes greater than 0.05 litres;

– prohibit the import or export of PCBs and equipment containing PCBs (except for the purpose of environmentally sound waste management);

– prohibit recovery of liquids with a PCB content above 0.005% for the purpose of reuse in other equipment, except for maintenance and servicing operations;

– achieve environmentally sound management of waste containing PCBs as soon as possible, but no later than 2028;

– develop and implement strategies for determining stockpiles, products and articles in use, and waste containing PCBs;

– manage stockpiles in a safe, efficient and environmentally sound manner until they become waste;

– take appropriate measures to ensure environmentally sound handling, transport and storage of PCBs, as well as management of waste containing PCBs in a manner to remove content of chemicals with PCBs from waste or to prevent transformation in such a way as to exhibit the characteristics of PCBs. Management should be performed in an environmentally sound manner and in accordance with international rules, standards, and guidelines;

– prohibit recovery, recycling, reclamation, direct or indirect use of PCBs;

– develop appropriate strategies for identifying contaminated sites, and for the environmentally sound remediation of those sites;

– every five years prepare a report on the improvement in relation to elimination of PCBs for submission to the Conference of the Parties, in accordance with Article 15 of the Convention.

1.5. Requirements of the Stockholm Convention which refer to articles released unintentionally from anthropogenic sources (PCDD/PCDF; HCB; PCB)

Persistent organic pollutants when they are released unintentionally from anthropogenic sources:

– polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF),

– hexachlorobenzene (HCB),

– polychlorinated biphenyls (PCB).

Polychlorinated dibenzo-p-dioxins and dibenzofurans, hexachlorobenzene and polychlorinated biphenyls are unintentionally formed and released from thermal processes involving organic matter and chlorine as a result of incomplete combustion or chemical reactions. The following industrial source categories have the potential for the release of these chemicals to the environment:

(a) waste incinerators, including co-incinerators of municipal, hazardous or medical waste or sewage sludge;

(b) cement kilns firing hazardous waste;

(c) production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching;

(d) the following thermal processes in the metallurgical industry:

– secondary copper production,

– sinter plants in the iron and steel industry,

– secondary aluminium production,

– secondary zinc production.

Polychlorinated dibenzo-p-dioxins and dibenzofurans, hexachlorobenzene and polychlorinated biphenyls may also be unintentionally formed and released from the following source categories, including:

(a) open burning of waste, including burning of fields,

(b) thermal processes in the metallurgical industry not mentioned in Part II,

(c) residential combustion sources,

(d) fossil fuel-fired utility and industrial boilers,

(e) firing installations for wood and other biomass fuels,

(f) specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranyl,

(g) crematoria,

(h) motor vehicles, particularly those burning leaded gasoline,

(i) decomposition of animal carcasses,

(j) textile and leather dyeing (with chloranyl) and finishing (with alkaline extraction),

(k) shredder plants for the treatment of end of life vehicles,

(l) smouldering of copper cables,

(m) waste oil refineries.

The parties to the Stockholm Convention shall:

– promote the application of available, feasible and practical measures that can achieve a realistic and meaningful level of release reduction or source elimination;

– promote the development of and, where it is deemed appropriate, require the use of substitute or modified materials, products and processes to prevent the formation and release of the chemicals listed in ANNEX C of the Convention;

– promote and introduce the use of best available techniques (BAT) for new sources within source categories (Part II and III of Annex C), which may form and release compounds listed in Annex C into the environment, as soon as possible but no later than four years after the entry into force of the Convention;

– promote the use of BATs and best environmental practices (BEPs) for existing sources, within the source categories listed in Part II and III of Annex C, and for new sources, within source categories such as those listed in Part III of Annex C.

2. NATIONAL CHARACTERISTICS

2.1. Geographical location and population

General information:

Croatia is an Adriatic and central European country. It stretches in a form of a bow from the Danube in the northeast to Istria in the west and Boka Kotorska in the southeast. The mainland covers an area of 56,594 km^2, and the area of the territorial sea around 31,067 km^2. Croatia is located at the crossroads between central Europe and the Mediterranean.

Geographical position:

Croatia is located amongst densely inhabited and economically developed European countries. Many internationally important roads pass through Croatia. The importance of the geographical position of the Republic of Croatia is further increased by the Adriatic Sea, which forms the deepest and northernmost inlet of the Mediterranean Sea, penetrating towards the heart of the European continent. The most important transport links are the Sava River basin and Adriatic, followed by the Drava River basin and several vertical transport links from the Austrian and Hungarian border towards the Adriatic (Rijeka and Split).

Natural and geographical characteristics:

Croatia is divided into three major natural and geographical units:

– Pannonian and peri-pannonian area, including the lowlands and hilly parts of eastern and northwest Croatia. Mountains higher than 500 m are rare and have island-like characteristics. The largest part of that area is used for agricultural production and livestock breeding. Slavonia and Baranja in the east is favourable for crop growing, humid valleys and hilly parts have many forests, while the northwestern part is strongly oriented towards Zagreb and is the most industrially developed part.

– Hilly and mountain area, which generally divide Pannonian Croatia from coastal Croatia, is a less developed region. Its future development shall be based on its transport importance, further development of the timber industry, the insufficiently used potential for the production of healthy food, and the development of winter and rural tourism.

– The Adriatic area includes border coastal area, separated from the inland by high mountains. It is (predominantly) a karst region with extremely dry summers. Very few watercourses usually flow towards the sea through narrow gorges. The Croatian coastal area is divided into the northern (Istria and Kvarner) and southern part (Dalmatia), with a well specified horizontal division into island, coastal and inland belts. The Croatian Adriatic coast is among the most indented in Europe with 1,285 islands, islets and crags. The largest island is Krk (410 km^2), followed by Cres (404 km^2), Brač (395 km^2), Hvar (300 km^2), Pag (285 km^2), Korčula (276 km^2). The largest peninsulas are Istria and Pelješac, and the largest bay is Kvarner.

The area and length of the Republic of Croatia's territory:

Total country area: 87,661 km^2

Territorial area (mainland): 56,594 km^2

Territorial area (sea): 31,067 km^2

Length of the coast with islands: 5,835.3 km

Length of the mainland coast: 1,777.0 km

Length of the island coast: 4,058.0 km

Population:

According to the last population census (2001), a population of 4,437,460 (female 51.84%, male 48.16%) was registered on the territory of the Republic of Croatia. The birth rate has been in constant decline in the Republic of Croatia over the past decade. Of the population, 54% of people live in 122 urban areas. Croatia's largest city, and also its capital, is Zagreb with approximately 800,000 inhabitants. The three other major cities, Split, Rijeka and Osijek, have a total population of more than 400,000 inhabitants. A population density of 78.4 inhabitants per square metre of its territory places Croatia among medium-populated European countries.

2.2 Social and political system

The Republic of Croatia became an independent country in 1991 during the process of disintegration of the former Yugoslav state. The Republic of Croatia became a member of the United Nations on 22 May 1992. It has established and maintains diplomatic relations with 167 countries.

Pursuant to the Constitution of the Republic of Croatia, adopted on 22 December 1990, Croatia was established and defined as a single and indivisible democratic and social state. The power in the Republic of Croatia comes from the people and belongs to the people as a community of free and equal citizens.

In the Republic of Croatia, the state power is structured on the principle of the division of power: legislative (Croatian Parliament), executive (President of the Republic of Croatia) and judiciary. The principle of division of power involves forms of international co-operation and the mutual examination of power holders as prescribed by the Constitution and other regulations. In the Republic of Croatia, acts are required to be in compliance with the Constitution and other regulations in conformity the Constitution and the law. All citizens are obliged to abide by the Constitution and to respect the legal order of the Republic of Croatia.

The Croatian Parliament is a representative body of citizens and holder of legislative power in the Republic of Croatia. Furthermore, the Parliament also conducts control of the executive power. The Croatian Parliament has one president and one or more vice presidents. The Croatian Parliament decides on adoption and amendments to the Constitution, adopts acts, adopts the State Budget, decides on war and peace, adopts acts expressing the policy of the Croatian Parliament, adopts the National Security and Defence Strategy of the Republic of Croatia, proclaims referendums, conducts elections, appointments and dismissals in line with the Constitution and the law, supervises activities of the Government of the Republic of Croatia and other officials responsible to the Croatian Parliament, in compliance with the Constitution and the law, grants amnesty for criminal acts, and performs other activities established by the Constitution.

The President of the Republic of Croatia represents the Republic of Croatia both in the country and abroad, and oversees the regular and harmonised action and stability of state authorities. The President of the Republic of Croatia is responsible for defending the

independence and territorial integrity of the Republic of Croatia. The President of the Republic of Croatia is elected for a period of five years on the basis of general and equal voting rights at direct elections by secret ballot. No person may be elected President of the Republic of Croatia more than two times.

The Government of the Republic of Croatia carries out executive power in compliance with the Constitution and the law, and its structure, operation and decision making are prescribed by the Act on the Government of the Republic of Croatia and the Government's rules of procedure. The Government of the Republic of Croatia proposes acts and other regulations to the Croatian Parliament, proposes the State Budget and final account, implements acts and other decisions of the Croatian Parliament, adopts regulations for the implementation of acts, runs foreign and home policy, provides guidelines and supervises the activities of the state administration, takes care of the economic development of the country, provides guidelines for the activities and development of public services, conducts other activities established by the Constitution and the law. The Government of the Republic of Croatia is responsible to the Croatian Parliament. The Government of the Republic of Croatia consists of the Prime Minister, Deputy Prime Ministers and Ministers.

Judiciary power is executed by the courts. Judiciary power is autonomous and independent. The courts arbitrate pursuant to the Constitution and the law. The Supreme Court of the Republic of Croatia, as the highest court, provides the uniform application of the law and equality for all citizens. The Constitutional Court of the Republic of Croatia consists of thirteen judges, appointed by the Croatian Parliament for a period of eight years from ranks of distinguished lawyers, especially judges, state attorneys, barristers and university law professors.

State administration bodies consist of thirteen Ministries, four central state offices, and nine state administration organisation and county state administration offices. Local self-government units in the Republic of Croatia are municipalities and cities, which perform activities of local significance not been assigned to state bodies. Major cities are local self-government units with more than 35 000 inhabitants and are centres of development for the surrounding areas. Regional self-government units are counties which perform activities of regional significance.

In the Republic of Croatia there are 21 regional self-government units: 20 counties and the City of Zagreb, and 556 local self-government units: 127 cities and 429 municipalities.

After the Croatian Parliament passed the Resolution on the Accession of the Republic of Croatia to the European Union on 18 December 2002, Croatia submitted its application for the full membership in the European Union in Athens on 21 February 2003. On 18 June 2004, the European Council granted Croatia the membership candidate status, and negotiations began on 3 October 2005 in Luxembourg.

2.3. Economic indicators

In 2006, the Croatian economy grew at an annual rate of 4.5%, while the gross domestic product (GDP) amounted to 34.2 million USD or 7,700 USD per capita. An inflation rate of 3.2% is among the lowest in the region. In 2006, the average currency rate of the Croatian monetary unit, the kuna, amounted to 7.40 HRK/EUR or 5.94 HRK/USD.

The European Union is Croatia's main foreign trade partner, accounting for 68% of the total foreign trade. The Republic of Croatia has been a member of the World Trade Organisation (WTO) since 2000 and of Central European Free Trade Association (CEFTA) since 2003.

Economic indicators for 2006 are presented in Table 1.

Table 1. Economic indicators*

	Year	
Gross domestic product (GDP), billion USD	2006	34,220
GDP per capita, thousands USD	2006	7,700
Population, million (census)	2006	4.4
Industrial production %	2006	4.5
Inflation rate %	2006	3.2
Unemployment rate %	2006	11.2
Export, billion USD	2006	10.3
Import, billion USD	2006	21.4
Foreign currency reserves CNB, billion USD, end of period	2006	5.9

*Source of data:

Central Bureau of Statistics (CBS), Croatian National Bank (CNB), Ministry of Finance (MF), Croatian Chamber of Economy, Ministry of the Economy, Labour and Entrepreneurship

2.4 Characteristics of economic sectors

2.4.1. Agriculture, fishery, forestry and food processing industry

In Croatia, there are three geographical and climate units: lowlands with a continental climate in the north, the Mediterranean coastal area in the south and the mountainous area in the central part. Various types of climate, relief and soil allow for the production of a wide range of agricultural products, from agricultural and industrial crops, to vineyards, continental and Mediterranean fruits and vegetables. Agriculture and fisheries account for 7.4% of the total GDP. Of the total 3.15 million hectares of agricultural area, 63.4% is cultivated and the rest are pastures, marshes, reeds and fishing ponds. 81.6% of the overall cultivated land is privately owned.

Livestock breeding has always been of great importance in these areas, while fisheries and the fish processing industry are traditionally the most important agricultural activities in the coastal and island part of Croatia: eleven companies perform processing activities, producing 15,500 tonnes of fish products per year. Agricultural area covers 3.137 million ha or 55.6% of the total land area, of which 34.4% was cultivated, nearly 4% is under permanent plantations, and 37% of the mainland is forested. According to latest available data, 5.5% of population is engaged in agricultural activities. According to the Agricultural Census conducted in 2003, small family farms with an average size of agricultural land of 2.59 ha prevail in the Republic of Croatia.

2.4.2 Biological diversity of agriculture

Plants: The production of agricultural, cattle feed and industrial plants is mostly based on varieties produced in domestic institutes for plant breeding. The use of foreign varieties is stressed in fruit and vineyard production, even though native grapevine varieties take a prominent place. On the official variety list there are 276 varieties of wheat, as the most important bread-making cereal, of which 90% are produced in domestic institutions for plant breeding. Corn is the second most important agricultural culture, with 612 hybrids included on the official variety list, of which 57% are domestic varieties. Besides wheat and corn, barely is a highly produced variety with 143 registered (mostly domestic) varieties. The most important industrial cultures are sugar beet (100 varieties), tobacco (75), soybean (74) and sunflower (43).

Domestic animals: The wealth of genetic diversity in Croatian livestock breeding is reflected in the great number of native breeds and populations of domestic animals, which have adapted to the local environmental breeding conditions with their own genetic and phenotypic characteristics.

Forests cover 2.1 million hectares, or 37% of total land area of the Republic of Croatia. Forest and forest land management is based on the principles of sustainable development. Consequently, the structure and composition of forests is similar to the composition of natural forests. 81% of forests are under natural ownership.

Maritime fishing is conducted by nearly 3,680 fishing units owned by professional fishermen or companies. Despite the fact that the number of vessels has increased by approximately 30% in comparison with 1999, on average these are small fishing units. The total annual fish catch is limited to approximately 145 tonnes, while the fishing quota per species is not limited.

2.4.3. Industry

Croatian industry has undergone intense changes. Effects of its all-encompassing restructuring are visible in many areas. Strengthening of import, development of production processes, introduction of quality standards, fulfilment of environmental requirements and achievement of cost-efficiency are the basic guidelines for the Croatian industry. Industry accounts for approximately 20% of gross domestic product, and employs around 267,000 workers, i.e. around 25% of the total number of workers in Croatia.

Production of food and beverages, oil derivates, chemicals and chemical products, non-metals and construction materials, electrical and optical equipment, paper, publishing, printing and shipbuilding make up a significant part of the total revenues.

Leading branches in terms of export are chemicals and chemical product production, clothing production, food and beverage production, production of machines and appliances as well as production of electrical machines and appliances. Industrial products account for 97% of the Croatian exports. Industry has the greatest share in the Croatian GDP, and as such can be concluded to be the leading branch of the Croatian economy.

2.4.4. Tourism

Croatia, one of the most important tourism destinations on the Mediterranean, has a long tourism tradition and great development potential. In 2007, tourism revenues amounted to USD 10.5 billion.

Croatia offers 212,350 beds in hotel and hotel complexes, 400,000 in private accommodation, 217,000 in camps and 50 marinas with 15,400 berths along the coast. The advantages of its tourism are, first and foremost, the preserved natural assets and environment, cultural and historical heritage, mild Mediterranean climate and proximity to European markets, as well as the possibility of active holidays in environmentally protected areas.

2.4.5. Construction

In 2007, the Croatian construction activity, an important national economic branch, employed approximately 96,000 workers in some 23,500 business entities. Its share in the GDP amounted to 6.0% and has been continuously increasing since 2001. Acts aimed at making housing loans as available as possible to citizens have been adopted in Croatia, by means of using incentive budgetary resources and savings potential collected in banks. At the same time, the foundation of housing savings trusts was made possible. These are a significant resource of domestic long-term allotted savings, and an annual bonus is awarded from budgetary funds. Large international companies have already made their entry on the Croatian investment market. As of April 2001, two companies construct and maintain motorways/state roads in Croatia, Hrvatske autoceste d.o.o. (Croatian Motorways Ltd.) and Hrvatske ceste d.o.o. (Croatian Roads Ltd.). Professional activities in relation to concessions are performed by the company Hrvatske autoceste d.o.o.

2.4.6. Transport

The favourable geographical and transport location of the Republic of Croatia has enabled the development of transport infrastructure and transport activities as one of the most important factors of the overall economic and social development of the country. The present situation of transport in Croatia is not satisfactory, in particular in terms of activities related to ports, sea and river shipping trade and railways. The share of combined transport in the overall transport of goods is insufficient. This type of transport, as one of the most contemporary and appropriate types for environmental protection, should be developed as soon as possible for the purpose of joining the already developed European combined transport lines. Road and railway infrastructure are not equally developed in all parts of Croatia. Despite the fact that many new roads have been recently constructed, it is still necessary to make great investments in both existing and new infrastructure, with emphasis on the improved connection of the coastal and continental parts of the country.

2.4.7. Infrastructure

Roads: Total of 28,788 km out of which state roads 7,869 km, county roads 10,544 km, local roads 10,375 km.

Railways: 2,726 km of railroads

Pipelines: 601 km oil pipelines, 1,625 km gas pipelines

Transport activity share in GDP amounts to 9%, and in overall number of workers just over 6%.

2.4.8. Utility services

The utility services system is an integral system, regulated by the Utility Services Act, which lays down the principles, operating methods and financing of utility services. Utility services are performed as a public service. Local self-government units perform utility services and are required to ensure their continuous and quality performance, and the maintenance and functionality of utility facilities. Utility services may be performed exclusively by: companies, public institutions and service–owned plants, which are established by local self-government units, legal and natural persons on the basis of a concession contract or utility service accreditation.

2.4.9. Trade

Distributive trade occupies a significant place in the overall economy of the Republic of Croatia. Approximately 45% of all economic entities are engaged in trade activity. Its significance is also reflected in the realisation of added value in the GDP (10.8% in 2007). In 2007, trade employed 18% of the total number of workers employed in the economy of the Republic of Croatia.

2.4.10. Education

The entry of Europe into the global information society has made learning a life-long process in all areas. Croatia also faces the challenge of adjusting its educational system to new economic and social needs. Encouraging the development of medium and small enterprises and their adaptation to business conditions on the global market has resulted in flexibility of educational activities within the chamber system.

2.5. Environmental status

2.5.1. Air protection

There is a long tradition of monitoring air quality in Croatia, which began as early as in the 1960s.

The reduction of pollutant emissions was particularly evident in the early 1990s, when industrial production was downsized and large emission sources were shut down (Bakar Coke Plant, Sisak Ironworks, Šibenik Aluminium Plant).

Pursuant to the Regulation on determining areas and residential areas according to air quality (OG 68/08), the Republic of Croatia has been divided in 6 residential areas including urban and industrial areas (Zagreb, Sisak, Kutina, Rijeka, Osijek and Split) and 7 areas. For the most part, air quality is category I for sulphur dioxide (SO_2), carbon monoxide (CO) and benzene. Limit values for nitrogen oxides (NO_x) and particles (PM_{10}) are exceeded primarily due to transport in Zagreb, Rijeka and Osijek, while increased concentrations of ozone are present throughout the coastal area. In industrial areas, major sources of air pollution, according to specific parameters H_2S, and NH_3, are the oil refineries in Sisak and Rijeka and the Petrokemija factory in Kutina.

The Air Protection Act (OG 178/04 and 60/08) prescribes that if category II of air quality is reached on an area, it is necessary to prepare the Plan for the reduction of air pollution in order to gradually achieve limit values. In an area where category III of air pollution is reached, it is necessary to issue a decision on the preparation of a restoration programme for a

stationary source and the term within which it is to be prepared. In an area in which the category III air quality is the consequence of combined sources (such as transport, household furnaces and the like), an integrated restoration programme shall be prepared. Polluters shall implement and finance measures for reducing emissions into the air.

2.5.2. Fresh waters

Croatia is relatively rich in water, with relatively large rivers and the karst landscape, which is particularly interesting for the water regime. The quantity of its own water is assessed at nearly 7,000 m^3 per capita annually, and taking into account the border and inter-border waters, without the Danube and Neretva Rivers, to nearly 17, 000 m^3. Drinking water reserves are relatively large. 85% of the water supply is pumped from underground water reserves. 75% of the population is connected to the public water supply system. 43% of the population is connected to the sewage system, though this is primarily in urban areas. The typical sewage system is a mixed one. In rural areas, drainage of waste waters is exclusively by means of septic tanks. Most rivers are one level of water quality below the desired level. Croatia has a small number of utility wastewater treatment plants. Just a few smaller cities have mechanical and biological plants for waste water treatment (Daruvar, Đurđevac, Gospić, Virovitica) while among larger cities, only Zagreb possesses a central mechanical and biological waste water treatment plant . The connection of towns to treatment plants is as follows: 38 pre-treatment plants, 24 primary treatment plants, 46 secondary treatment plants and one tertiary treatment plant. Furthermore, of the 28% of waste water subjected to treatment in Croatia, 43% receive primary treatment, and 57% receive secondary treatment (Source: Water Management Strategy).

Water quality and quantity are monitored through a widely structured national network. The quality of surface and underground waters has not changed significantly over the last five years. Most surface waters are classified as being of quality level II and III. Due to more densely populated areas and industrial development, pollution pressures are more evident in the Danube basin than in the Adriatic basin.

Industrial waste waters are released into public sewage systems or receivers with or without treatment. At the national level, approximately 30% of the total industrial waste waters is released into sewage systems and receivers without previous treatment. The chemical and petrochemical industry and food processing industry release the largest amounts of waste waters, while it is assessed that wood and food processing industry have the greatest pollution burdens. Among the dispersed pollution sources, the prevailing ones are agriculture and transport, though their effects are not systematically monitored. Cross-border effects of pollution sources are not significant and are exclusively of a local character. Where necessary, they are resolved within the framework of concluded bilateral agreements.

2.5.3. Waste management

Approximately 13 million tonnes of waste are annually generated in Croatia (3 tonnes per capita). Technological waste accounts for up to three quarters of waste. Municipal waste participates with 13% in the total amount of waste, and separated secondary raw materials (more than 95% from technological waste) make up to 11% of the total waste. Nowadays, disposal is the primary method for solid waste management.

In line with the Waste Management Plan of the Republic of Croatia for the period 2007–2015 (OG 85/07) nearly 92% of the population is included in the organised collection of municipal waste. Approximately 98% of the total disposed waste ends up on 160 official (large) landfills which are, with few rare exceptions, all constructed without basic protection measures. In addition to municipal waste, hazardous waste is also disposed of at 80 landfills, and evident environmental pollution has been established at 40 landfills. Only seven landfills have an operational permit. Methane emissions from landfills account for 4.5% of the total greenhouse gas emission in Croatia. The restoration of several industrial and hazardous waste landfills is an outstanding issue. No hazardous waste landfills have been constructed to date. Among economic instruments, fees for environmental burdening caused by waste were introduced and their payment was initiated in 2004, and as of December 2005 fees for the disposal of packaging waste, or fees for using single-use packaging were introduced for the purpose of promoting the use of returnable packaging. The assessed amount of total produced municipal waste in the Republic of Croatia amounts to 1.31 million tonnes per year. Tourist waste amounts to 44,362 t, separately collected waste produced by the population to 26,937 t, and compost green waste from public areas approximately to 15,000 t. The amount of waste disposed at landfills is assessed at 1.04 million t. Separate collection of specific waste components (paper, cardboard, glass packaging, PET packaging, beverage cans, and household appliances is conducted in an organised manner in all counties with lesser or greater intensity, i.e. in more than fifty cities and municipalities. In the Republic of Croatia, waste is collected according to a “hold system”, meaning that sorted components are disposed of in the prescribed places: containers 1-3 m^3 located on public areas of residential areas, in recycle yards, at recycle islands, in systems of separate collection of biodegradable waste and the like. In the Republic of Croatia, there are seven recycle yards, approximately 4,000 paper containers, approximately 4,000 containers for waste glass packaging, approximately 1,300 containers for PET packaging and approximately 600 containers for beverage cans.

In line with the Waste Management Plan of the Republic of Croatia for the period 2007–2015 (OG 85/07), 74.5% of waste is related to biodegradable waste, meaning that it is assessed that 756,175 t of biodegradable waste was produced in 1997.

2.5.4. Nature protection

Due to its geographical position and relief diversity and with respect to its size, Croatia has a great diversity of habitat types, or ecosystems, which is particularly evident in the karst area. Around 8.0% of its territory is under protection within the framework of 325 protected areas, of which eight are national parks, ten are nature parks, two strict nature reserves, etc. There are 400 endemic plant and mushroom varieties and 40 animal species. The number of endangered species is continuously growing, for example 226 spermatophyte plant species and 41 mammal species are threatened. At the national level, special attention has been paid to the protection of biological diversity with the adoption of the Strategy for the Protection of Biological and Landscape Diversity and Action Plan (1999).

2.5.5. Soil and forests

Of the total area of Republic of Croatia’s mainland, agricultural land makes up nearly 50%, forest soil 44% and arid soil (soil for technological purposes) 6.0%. The overall loss of cultivated agricultural land in the period 1959–1998 is 203,000 ha or 5,200 ha per year according to statistical indicators, and taking into consideration the fact that areas of pastures, marshes, reeds and fishing ponds have increased by 44,000 ha, this means that the total loss of

agricultural land in that period amounts to 159,000 ha or 4,000 ha per year. Approximately 85% of forested land has great production potential. A characteristic common of all forests is that they are mainly natural. Monitoring of the status of forest decay in Croatia shows the variation of damage on the main forest types in the period from 1992 to 1998. The percentage of significantly damaged trees varied from 15.6% to a maximum of 30.3% (1995) with a slightly decrease trend, thus the overall damage of all types in 2000 amounted to 21%. Damage of forest trees in the Republic of Croatia has never exceeded the European average.

2.5.6. Situation in the coastal and island area

A large part of the Adriatic Sea is still oligotrophic and clean. In the summer of 1988, 1989, 1991, 1997 and 2000, sea blooms of stronger intensity was observed in the northern Adriatic as a consequence of increased eutrophication. Sea blooms were also observed in some parts of the central Adriatic. According to the Database of Indicators on the Situation in the Marine Environment, Fisheries and Mariculture (kept by the Croatian Environment Agency), data on sea blooms must be available for all years starting from 1998 to 2007. For the time being, data are collected within the framework of the Adriatic project.

The inflows of the northern Adriatic rivers have the greatest influence on the concentration of nutrient salts. Of these rivers, the Po River accounts for more than half the total phosphorous and nitrogen, or nearly 75% of inorganic forms of nutrient salts. The majority of that inflow is of anthropogenic origin. Centralized sewage systems have only been constructed in major urban and industrial centres. Less than 35% of wastes waters are released into the sewage systems, and less than 10% are treated in devices for waste water treatment. Fires present one of the major threats in coastal areas.

2.5.7. Management of chemicals

The application of the Chemicals Act became effective as of 21 December 2005. Its implementation has improved the existing legal grounds and removed deficiencies of the sector approach to chemical management. Even though it is still too slow, the number of companies having established systems for the implementation of sanitary safety and environmental protection programme, HSE programme and ISO 9000 and ISO 14000 systems is gradually increasing.

2.5.8. Transport

The majority of transport is conducted by roads. Vehicles are outdated, and the quality of fuel is below that in developed countries. In terms of its influence on air quality in urban areas, transport is one of major risk factors for both health and the environment, primarily due to the low quality of liquid fuel (high concentration of lead, sulphur and benzene). Its improvement is among the most important priorities.

2.5.9. Cleaner production for the purpose of environmental protection

Mechanisms for promoting adjustment of the economy for cleaner production have not yet been created. A relatively small number of companies has introduced the ISO 9000 quality system, and even fewer the ISO 14000 quality system. The legal, institutional and technical bases for prevention, readiness and response in case of occupational accidents, accidents

during transport of hazardous substances, sudden water pollution, sudden sea pollution and environmental accidents have been developed.

2.5.10. Biological safety

Apart from industrial biotechnology, which includes the genetic modification of important microorganisms, the genetic modification of plants and animals for commercial purposes does not take place in Croatia. The use and import of genetically modified food is regulated by law.

2.5.11. Radiation

According to the criteria of the IAEA (International Atomic Energy Agency**)**, Croatia is among the type B countries: wide use of radiation sources in industry, medicine and research, but without commercial nuclear reactors. Disposal of low and medium level active nuclear waste has not been permanently resolved, though there are temporary solutions. Around 50 m^3 of used ionized radiation sources and other used radioactive substances, whose total activity amounts to approximately 1.4 TBq, is temporarily stored. Preparatory activities for the selection and construction of a permanent landfill site have been conducted.

2.5.12. Noise

To date, the issue of noise protection in Croatia has not received enough attention, in particular in the early phases of planning and designing. There is still a lack of data required for the calculation of noise emissions, which should be determined by measurements. The main noise sources have not been established, the number of persons exposed to this form of "pollution", and issues of jurisdiction are not clearly regulated. In 2003, the Croatian Parliament passed the Noise Protection Act (OG 20/03) which regulates measures of protection from noise on the mainland, water and in the air as well as supervision over the implementation of these measures for the purpose of preventing or reducing noise and eliminating threats to human health.

2.6. Health and environment

Pollution of the air, water and soil, inappropriate waste management and excessive noise and exposure to non-ionised and ionised radiation can increase the number of ill persons or aggravate the situation among those already ill. It is assessed that poor water quality in Croatia presents a health threat for 10 to 15% of the population. Another specific danger are landmines and other explosive devices, which are a consequence of the war. It is assessed that more than 10% of the state territory is still polluted with landmines. Drinking water from public water supply services is under constant supervision by public health protection services, sanitary inspection and public health protection control laboratories, and results show that the number of unsuitable samples at the national level is continuously less than 10% (7.2–9.5%). Sanitary safety of food during its production, transport and import to the Republic of Croatia is continuously monitored.

2.6.1. Environmental protection priorities

In order to improve environmental quality, it is necessary to undertake many activities and make very large investments. As expected, priorities lay in the area of solid waste and waste water management where significant investment projects have to be conducted in the next few

years (such as construction of new waste landfills, reclamation of most existing landfills, urgent construction of sewage systems in nearly 70 towns and construction of twenty waste water treatment plants). Special attention must be paid to hazardous waste management. Restoration of 230 waste landfills is currently underway, as are projects for the collection of packaging, tyres and oil, and used vehicles. In 2007, the Ordinance on medical waste management was passed, thereby initiating the disposal of this type of waste.

Use of fuels with reduced sulphur content, and re-directing merchandise and passengers to environmentally acceptable types of transport will improve air quality.

In 2007, the Government of the Republic of Croatia recognised renewable energy sources as an environmental protection priority. At the beginning of that year, 500 kilometres of gas pipelines were constructed, making gas, as the most environmentally acceptable energy source, available to most parts of Croatia. However, the gasification of Dalmatia is yet to follow. The construction of wind power plants has also been initiated, primarily in the coastal area, and two biofuel factories have also been opened (in Ozalj and Virovitica). (www.vlada.hr)

3. INSTITUTIONAL AND LEGAL FRAMEWORK IN THE REPUBLIC OF CROATIA

This section outlines the current institutional and legal infrastructures which shall serve as the foundation and framework within which the NIP shall be implemented. It also specifies forms of international and regional co-operation involving Croatia in the area of POP compounds.

3.1. Environmental protection and sustainable development policy in Croatia

Environmental protection policy is under the competence of the Ministry of Environmental Protection, Physical Planning and Construction, with the exception of water protection and management which falls under the competence of the Ministry of Regional Development, Forestry and Water Management. Legislation for the purpose of environmental protection consists of acts, regulations and ordinances. Acts are proposed by the Government and passed by the Croatian Parliament subject to prior discussion by the Board for the Physical Planning and Environmental Protection of the Croatian Parliament. The following acts and regulations apply to POP compounds: Environmental Protection Act, Air Protection Act, Regulation on limit values of pollutant emissions from stationary sources, Waste Act, Ordinance on requirements for handling waste, Waters Act, Regulation on water classification, Regulation on hazardous substances in water, Ordinance on limit values of hazardous and other substances in waste water, Poisons Act, Chemicals Act, and Plant Protection Act.

The most important acts in the field of environmental protection in Croatia are: National Environmental Protection Strategy (OG 46/02), National Environmental Action Plan (OG 46/02), Environmental Protection Act (OG 110/07), Air Protection Act (OG 178/04 and 60/08), Plan for the improvement of protection and air quality in the Republic of Croatia for the period from 2008 to 2011 (OG 61/08), Waste Management Strategy (OG 130/05), Waste Act (OG 178/04, 111/06, 60/08), Water Management Strategy (OG 91/08) and Waters Act (OG 107/95, OG 150/05).

3.1.1. National Environmental Protection Strategy

The Strategy contains the basis for guidance and harmonisation of economic, technical, scientific, educational, organisational and other measures, as well as measures for the fulfilment of international obligations aimed at environmental protection. The Environmental Protection Strategy contains the environmental pollution status according to specific parts. Furthermore, it proposes objectives and criteria for conducting integrated environmental protection according to environmental parts as well as priority protection measures. It also contains the basis of equal economic development and efficient environmental protection, the basis for ensuring the most favourable technical, production, and economic measures for environmental management, and short and long term measures for preventing and restricting environmental pollution and the order of their realisation and deadline for their undertaking. It also contains the basis for environmental monitoring, an overview of entities requiring restoration of the threatened environment and basic requirements for its performance, resources and assessment of funds required for the implementation of environmental protection measures, basis for providing guidance and improving environmental education and training, as well as scientific and research activities in the area of environmental protection.

3.1.2. National Environmental Action Plan

The National Environmental Action Plan is a document ensuing from the National Environmental Protection Strategy. It specifies all action plans according to chapters from the National Environmental Protection Strategy.

3.1.3. Environmental Protection Act

The Environmental Protection Act (OG 110/07) specifies environmental protection and sustainable development principles, protection of environmental components and protection of the environment against burdens, environmental protection entities, sustainable development and environmental protection documents, environmental protection instruments, environmental monitoring, information systems, providing access to environmental information, public participation in environmental issues, providing the right to access administration of justice, liability for damage, financing and instruments of general environmental protection, administrative and inspectional supervision.

The general objectives of the Act are to ensure integral preservation of environmental quality, preservation of biological and landscape diversity, rational use of natural assets and energy in the most favourable manner for the environment, as the basic requirement for healthy life and grounds for sustainable development. The Act further defines the environment as an asset of special interest for the Republic of Croatia which thus enjoys its special protection. The Act specifies that environmental projects can affect the quality of life, human health, flora and fauna within the framework of sustainable development.

Apart from the provisions of this Act which apply to the obligations ensuing from the Aarhus Convention, one of the most significant novelties is the establishment of integrated environmental protection requirements as a direct response to the IPPC Directive EU requirements (Directive 2008/1/EC). In practice this means that a company shall obtain integrated environmental protection requirements in accordance with the Environmental Protection Act prior to the initiation of construction and putting into operation, and prior to any significant changes in operation or reconstruction of an installation intended for the performance of the activity which may cause emissions polluting soil, air, water or sea. These

integrated environmental protection requirements are established for the purpose of integrated environmental protection by means of preventing, reducing and wherever possible eliminating pollution, primarily at its source, as well as ensuring methodical management of natural resources by supervising pollution and establishing a sustainable balance between human activities and socioeconomic development on the one hand, and natural assets and regenerative capacities of nature on the other. The Act also contains provisions regulating the prevention of major accidents involving hazardous substances where procedures and regulations are in compliance with the SEVESO II Directive (96/82/EC).

3.1.4. Air Protection Act

The Air Protection Act (OG 178/04 and OG 60/08) prescribes measures and methods for organising, conducting and supervising protection and improvement of air quality as an environmental component of general public importance, and under the special protection of Republic of Croatia. The protection and improvement of air quality, for the purpose of sustainable development, is based on environmental protection principles prescribed by the Environmental Protection Act and international law.

The Act regulates the basic objectives of air protection, planning documents and public participation in their preparation, manner of monitoring and establishing air quality at both the national and local level, classification of areas according to the assessed category of air quality, recording and monitoring emissions from stationary sources, performance of professional activities in relation to monitoring air quality and air emissions, measures for the prevention and reduction of air pollution, economic instruments, supervision, offences and pecuniary fines.

Subordinate legislation enabling its complete implantation is passed pursuant to the Act.

The Plan for the improvement of protection and air quality in the Republic of Croatia for the period from 2008 to 2011 (OG 61/08) is the implementing document of the Air Protection Strategy, and is an integral part of the Environmental Protection Strategy. It contains principles and measures for establishing objectives and priorities, assessment of air quality status, objectives and measures for the protection and improvement of air quality, including interdepartmental, priority measures and activity and dynamics of implementing measures along with the cost-benefit analysis. The plan overtakes all existing measures and adds additional measures proven, by analysis, to be essential for the realisation of the established objectives, but which are not based on regulations at the moment of writing this document, or are based on regulations which are in preparation, i.e. under transposition from the European Union *acquis communitaire*.

3.1.5. Water Management Strategy

The priority task of water management is the preparation of planning documents at all levels of water management, including those deriving from processes related to Croatia's accession to the European Union. In the course of which, basic positions and development policy of the Republic of Croatia, and the social importance of water, are taken into consideration as established by the Constitution and acts, from which the following may be concluded:

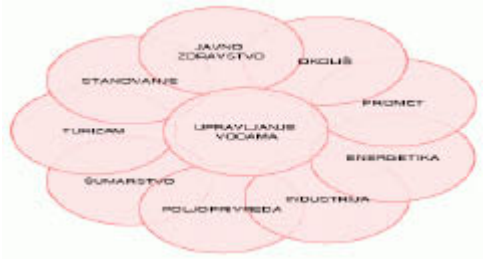
– waters are a public asset and under the special protection of the Republic of Croatia and may not be under private ownership;

– waters are an irreplaceable requirement for life and work and are to be used under the conditions prescribed by law;

– the overall water resources at the disposal of the Republic of Croatia represent a valuable natural and developmental asset and should be managed in a rational and sustainable manner;

– overall water requirements and the organised water regime must be equally and justly met throughout the national territory,

– criteria and priority in water management shall be established at the national level, starting from the obligation of complete environmental protection and realisation of general, economic and sustainable development, in accordance with the national developmental policy.



CONNECTION OF WATER MANAGEMENT WITH THE SOCIOECONOMIC ENVIRONMENT

3.1.6. Waters Act

The Act regulates the legal status of water and water assets, manner and conditions of water management (use of waters, management of watercourses and other waters and protection from harmful water effects), manner of organising and conducting activities and tasks aimed at achieving water management, basic requirements for the performance of water management activities, authorities and duties of state administration bodies and other state bodies, local self-government units and administration and other legal entities, as well as other issues important for water management.

3.2. Roles and responsibilities of ministries, agencies and other governmental institutions in relation to POPs management

3.2.1. Monitoring of specific compounds

3.2.1.1. POP pesticides

The Ministry of Agriculture, Fishery and Rural Development is the central body for issuing permits and prescribing conditions for use of pesticides in the Republic of Croatia.

The Ministry of Health and Social Welfare is responsible for the issuing of:

– permits for import of active substances used to form various pesticides if they are classified as hazardous chemicals;

– permit for import of prepared pesticide formulations in the area of public health which are classified as hazardous chemicals;

– Decision approving the placement of biocidal preparations on the market.

The Ministry of Health and Social Welfare also determines the maximum permitted amount of pesticides which can be found in products at the time of their market placement, as well as the permit for the household use of pesticides.

The Ministry of Agriculture, Fishery and Rural Development is in charge of registration, i.e. issuing authorisations for the distribution of plant protection products and authorisations for the distribution of products used in the field of veterinary medicine for the protection of animals from parasites.

The Institute for Plant Protection in Agriculture and Forestry in the Republic of Croatia is competent for products used in the area of agriculture and forestry, while the research of pesticide efficiency in the field of veterinary medicine is conducted by the Faculty of Veterinary Medicine of the University of Zagreb.

Croatian Waters issue the permit for substances which may end up in waters.

3.2.1.2. PCB

Management of devices and fluids containing PCBs is under the competence of the State Inspectorate of the Ministry of Environmental Protection, Physical Planning and Construction.

Control and inspection of devices containing PCBs are conducted by occupational safety inspectors within the State Inspectorate.

Ministry of Environmental Protection, Physical Planning and Construction is competent for the management of waste containing PCBs as well as other hazardous waste. The Ministry issues authorisation to companies handling hazardous waste. Equipment containing PCBs which is excluded from use is defined as waste containing PCBs and as such is within the competence of the environmental protection inspector whose activity is within the competence of the Ministry of Environmental Protection, Physical Planning and Construction.

The Croatian Environmental Agency keeps records of delivered forms in line with the Ordinance on the management of polychlorinated biphenyls and polychlorinated terphenyls (OG 105/08).

3.2.1.3. PCDD/PCDF, HCB and PCB

The control of PCDD/PCDF, HCB and PCB emissions is under the competence of the Ministry of Environmental Protection, Physical Planning and Construction and the Ministry of the Economy, Labour and Entrepreneurship.

In 1991, the Republic of Croatia became a party to the Convention on Long-Range Transboundary Air Pollution of 1979 (LRTAP Convention) and to the Geneva Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP Protocol). Consequently, it has

committed itself to establishing the levels of annual pollutant emission into the air on the national territory.

The Croatian Environmental Agency compiles the annual report on emission of pollutants into the air on the territory of the Republic of Croatia.

Calculation of emissions includes eleven main sectors, and the following pollutants (SO_2, NO_x, CO, NMVOC, NH_3) substances (TSP, PM_{10}, $PM_{2.5}$) heavy metals (Cd, Pb, Hg, As, Cr, Cu, Ni, Se, Zn) and persistent organic pollutants (PAH, HCH, DIOX).

The report serves as a document which fulfils obligations of the Republic of Croatia assumed under international agreements and as the basic indicator of undertaken measures which the Republic of Croatia is obliged to fulfil for the purpose of reducing emission of pollutants into the air.

The Directorate for Labour and the Labour Market of the Ministry of the Economy, Labour and Entrepreneurship is competent for passing regulations governing parameters in the workplace:

1. Occupational Safety and Health Act (OG 59/96, 94/96, 114/03, 100/04, 86/08 and 116/08);

2. Ordinance on occupational health and safety when working with substances containing polychlorinated biphenyls, polychlorinated naphthalenes and polychlorinated terphenyls (OG 7/89);

3. Ordinance on maximum permissible concentrations of harmful substances in the atmosphere of work premises and areas and on biological limit values (OG 92/93);

4. Ordinance on conditions under which legal entities may perform occupational safety activities (OG 114/02 and 126/03);

5. Ordinance on the inspection of work environment and higher risk machinery and appliances (OG 114/02 and 126/03);

3.2.2. Competence for control and monitoring of POPs compounds in the environment and humans

Monitoring of POPs compounds in various matrices may be viewed from two perspectives:

– control for the purpose of verifying levels and comparing them to levels prescribed by acts, ordinances and regulations, or

– monitoring the distribution and level of compounds for research purposes, i.e. for the evaluation of burdens that persistent pollutants present to the environment and humans.

For routine controls performed by public health institutes, methods for determining levels of POPs compounds are usually arranged and mutually aligned, and inter-laboratory examinations of analytical procedures quality are also conducted from time to time.

Environmental monitoring programmes are also conducted at research institutions (Institute for Medical Research and Occupational Health and the Ruđer Bošković Institute, both from Zagreb) within the framework of scientific projects. However, the number of analysed samples and sampling frequency are primarily restricted by financial resources which limit the hiring of a greater number of researchers and equipment procurement.

With regard to the number of laboratories possessing equipment and personnel capable for POPs analysis in various matrices, it is assessed that in Croatia has sufficient capacities and know-how for the analysis of OCPs and PCBs in samples from taken from the environment, food and biological samples collected from humans.

However, the results are not uniform, with respect to the number of examined compounds. This is likely the result of laboratory equipment in county laboratories that conduct analyses.

PCDD/PCDF analyses present a problem due to lack of appropriate sophisticated instruments, i.e. a lack of financial support required for that type of analysis.

The testing of analytical procedure quality is also conducted for certain matrices which have to be tested prior to their use in line with acts and ordinances. Such example is the analysis of PCBs in heating and waste oils, for which the examination of related analytical procedure quality was conducted by the State Office for Metrology. The assessment and acceptance of European standards for sampling, treatment and analysis of various samples is currently underway within the activities of the State Office for Metrology. This will harmonise analytical methods for various samples though it is primarily aimed at controlling those samples. In relation to research activities, as elsewhere in the world, there is a freedom of choosing sampling and analytical methods depending on the research objectives. However, all methods have to be validated in accordance with accepted international criteria.

3.2.2.1. Monitoring of waters

Monitoring of waters, organised by Croatian Waters, is also conducted in laboratories which have successfully participated in inter-laboratory testing of analytical procedure quality for specific environmental indicators.

Croatian Waters organises the monitoring of organochlorine pesticide concentrations in waters (rivers and accumulations). However, the results are not harmonised in relation to number of examined compounds, which is likely the result of the laboratory potentials of regional laboratories conducting analyses. Furthermore, Croatian Waters monitors the concentrations of PCBs in sediment and biota at measuring stations on the Kupa and Sava River, and the sediment of the Mirna, Raša, Neretva, Cetina, Jadro, Krka and Zrmanja Rivers.

The Ministry of Regional Development, Forestry and Water Management issues water rights permits for the placement of chemical preparations on the market which can enter into waters.

Monitoring of pesticide concentrations is also conducted in marine sediments (and in marine organisms) at certain measuring stations within the framework of certain projects. However, systematic monitoring is not carried out.

Even though systematic monitoring of pesticide concentrations in marine sediments (and marine organisms) is not conducted, in accordance with the Marine Strategy Directive and the Waters Directive, it will also be necessary to carry out continuous monitoring at sea.

3.2.2.2. Monitoring in samples of animal origin

Integrated monitoring of POPs compounds in samples from the environment, food and humans is not organised in Croatia. Partial monitoring programme for monitoring levels of certain POPs in samples of animal origin has been organised by the Ministry of Agriculture, Forestry and Water Management at the national level.

3.2.2.3. Monitoring in foodstuffs

Physical and chemical analysis of pesticides and their residues in foodstuffs is conducted by the Croatian National Institute of Public Health, while county institutes for public health determine only the presence of pesticide residues in foodstuffs. There are no binding regulations in acts and ordinances for the systematic monitoring of all pesticides, including pesticides belonging to the group of persistent organic pollutants, and thus there is no institutional competence.

3.3. The Republic of Croatia and its international obligations concerning environmental protection

In the field of environmental protection, the Republic of Croatia co-operates at several levels: multilateral, regional, subregional and bilateral. This cooperation is based on a series of international legal instruments (conventions, agreements, contracts and the like) and programmes to which the Republic of Croatia is a party or participant. Several international and binding documents have been signed and are pending ratification by the Croatian Parliament.

In relation to most signed international environmental protection instruments and most programmes it conducts, the Republic of Croatia must make amendments to its legislative system, and provide resources for their implementation (as they are frequently related to restriction of emissions in specific technological processes, adjustment to new technologies, and most often adjustment of the present technological system to more modern and demanding production methods). Often, it is necessary to initiate administrative and institutional changes within the existing environmental protection system for the purpose of fulfilling those obligations. It is extremely important to note that the Republic of Croatia has committed itself in many provisions of international treaties it has signed, at both the global and regional levels, to make access to environmental information and public participation in achieving environmental protection objectives an important segment of socioeconomic development.

3.4. International treaties

The Republic of Croatia is a party to thirty international treaties with various effects.

List of international treaties ratified by the Republic of Croatia:

A. General

• Convention on Environmental Impact Assessment in a Transboundary Context (Espoo 1991):

Official Gazette – International treaties (hereinafter referred to as OG– IT) 6/96, entered into force in the Republic of Croatia on 10 September 1997.

• Protocol on Strategic Environmental Assessment (Kiev 2003):

The Republic of Croatia signed the Protocol in 2003.

• Convention on the Transboundary Effects of Industrial Accidents (Helsinki 1992):

OG-IT 7/99, entered into force in the Republic of Croatia on 19 April 2000, and that date is published in OG-IT 10/01.

• Protocol on Pollutant Release and Transfer Registers (Kiev 2003):

The Republic of Croatia signed the Protocol in 2003.

• Convention on Access to Information**,** Public Participation in Decision-Making and Access to Justice in Environmental Matters:

OG-IT 01/07.

• Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade:

OG-IT 4/07.

B. Climate change

• United Nations Framework Convention on Climate Change (Rio de Janeiro 1992):

• OG-IT 02/96, entered into force in the Republic of Croatia on 7 July 1996.

• Kyoto Protocol to the United Nations Framework Convention on Climate Change (Kyoto 1999):

• OG-IT 05/07, entered into force in relation to Republic of Croatia on 27 August 2007.

C. Atmosphere

• Geneva Convention on long-range transboundary air pollution (Geneva 1979):

On the basis of the succession notification, the Republic of Croatia became a party to the Convention as of 8 October 1991 (OG-IT 12/93).

• Protocol to the Convention on long-range transboundary air pollution from 1979 on long-term financing of the cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP) (Geneva 1984):

Pursuant to the succession notification, the Republic of Croatia became a party to the Convention as of 8 October 1991 OG-IT 12/93.

• Protocol to the 1979 Convention on Long-range Transboundary Air Pollution on Further Reductions of Sulphur Emissions (Oslo 1994):

OG-IT 17/98 and corrigenda OG 3/99, entered into force in the Republic of Croatia on 27April 1999.

• Protocol to abate acidification, eutrophication and ground-level ozone to the Convention on Long-range Transboundary Air Pollution (Göteborg 1999):

Published in OG-IT 04/08 and entered into force in the Republic of Croatia on 5 January 2009.

• Protocol to the 1979 Convention on Long-range Transboundary Air Pollution concerning the control of emissions of volatile organic compounds or their transboundary fluxes:

OG-IT 10/07, entered into force in the Republic of Croatia on 01 June 2008.

• Protocol to the 1979 Convention on Long-range Transboundary Air Pollution concerning the control of emissions of nitrogen oxides or their transboundary fluxes:

OG-IT 10/07, entered into force in the Republic of Croatia on 01 June 2008.

• Protocol on Heavy Metals to the 1979 Convention on long-range transboundary air pollution:

OG-IT 05/07, entered into force in the Republic of Croatia on 05 December 2007.

• Protocol to the 1979 Convention on Long Range Transboundary Air Pollution on Persistent Organic Pollutants (Aarhus 1998):

OG-IT 05/07, entered into force in the Republic of Croatia on 05 December 2007.

• Stockholm Convention on Persistent Organic Pollutants (Stockholm 2001):

OG-IT 11/06, entered into force in the Republic of Croatia on 30 April 2007.

• Vienna Convention for the Protection of the Ozone Layer (Vienna 1985):

Pursuant to the succession notification, the Republic of Croatia became a party to the Convention as of 8 October 1991 (OG-IT 12/93).

• Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal 1987):

Pursuant to the succession notification, the Republic of Croatia became a party to the Convention as of 8 October 1991 (OG-IT 12/93).

• Amendment to the Montreal Protocol on substances that deplete the ozone layer (London 1990):

OG-IT 11/93, entered into force in the Republic of Croatia on 13 January 1994

• Amendment to the Montreal Protocol on substances that deplete the ozone layer (Copenhagen 1992):

OG-IT 8/96, entered into force in the Republic of Croatia on 12 May 1996.

• Amendment to the Montreal Protocol on substances that deplete the ozone layer (Montreal 1997):

OG-IT 10/00 entered into force in the Republic of Croatia on 7 December 2000, and that date is published in OG-IT 14/00.

• Amendment to the Montreal Protocol on substances that deplete the ozone layer (Beijing 1999):

Published in OG-IT 12/01, entered into force in the Republic of Croatia on 24 July 2004.

D. Sea

• Barcelona Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona 1976):

Pursuant to the succession notification, the Republic of Croatia became a party to the Convention as of 8 October 1991 (OG-IT 12/93).

• Protocol for the prevention of the pollution of the Mediterranean Sea by dumping from ships and aircraft (Barcelona 1976):

Pursuant to the succession notification, the Republic of Croatia became a party to the Convention as of 8 October 1991 (OG-IT 12/93).

• Amendment to the Barcelona Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona 1995):

OG-IT 17/98, entered into force in the Republic of Croatia on 9 July 2004.

• Amendment to Protocol for the prevention of the pollution of the Mediterranean Sea by dumping from ships and aircraft or incarnation at sea (Barcelona 1995):

OG-IT 17/98.

• Protocol concerning cooperation in combating pollution of the Mediterranean Sea by oil and other harmful substances in cases of emergency (Malta 2002):

OG-IT 12/03, entered into force in the Republic of Croatia on 17 March 2004.

• Protocol concerning specially protected areas and biological diversity in the Mediterranean (Barcelona 1994 and Monaco 1995):

OG-IT 11/01 entered into force in the Republic of Croatia on 12 May 2002.

• Protocol for the protection of the Mediterranean Sea against pollution from land-based sources (Athens 1980):

Pursuant to the succession notification, the Republic of Croatia became a party to the Convention as of 8 October 1991 (OG-IT 12/93).

• Protocol for the protection of the Mediterranean Sea against pollution from land-based sources and activities (Syracuse 1995):

OG-IT 3/06.

• Protocol for the Protection of the Mediterranean Sea against Pollution resulting from Exploration and Exploitation of the Continental Shelf, the Seabed and its Subsoil (Madrid 1994):

The Republic of Croatia has signed the Protocol.

• Protocol on the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal (Smyrna 1996):

The Republic of Croatia has not signed the Protocol.

• Act on Ratification of Amendments to the Protocol for the protection of the Mediterranean Sea against pollution from land-based sources (Syracuse 1995):

OG-IT 3/06.

• Protocol on integrated management of Mediterranean coastal areas (Barcelona 2008):

The Republic of Croatia has signed the Protocol.

E. Soil

• United Nations Convention to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa (Paris 1994):

OG-IT 11/00, entered into force in the Republic of Croatia on 4 January 2001.

F. Waste

• Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel 1992):

OG-IT 3/94, entered into force in the Republic of Croatia on 7 August 1994.

G. Waters

• Convention on Cooperation for the Protection and Sustainable Use of the River Danube (Sophia 1994):

Published in OG-IT 2/96.

• Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki Convention, 1994), published in OG-IT 4/96, and the relevant Protocol on Water and Health, published in OG-IT 4/06.

3.5. Regional cooperation

At the regional cooperation level in 1998 the Republic of Croatia ratified the amendment to the *Convention for the Protection of the Mediterranean Sea against Pollution* and *Amendments to the Protocol for the prevention of the pollution of the Mediterranean Sea by dumping from ships and aircraft*. The ratification of the 1994 *Protocol for the Protection of the Mediterranean Sea against Pollution resulting from Exploration and Exploitation of the Continental Shelf, the Seabed and its Subsoil* is in preparation. Furthermore, as of early 1992, the Republic of Croatia is involved in the *Environmental Programme for the Danube River Basin* programme. The main objective of this programme is to promote the development of environmental protection in the Danube River basin, with water protection above all, and to strengthen the river basin management, as defined in the *Convention on Cooperation for the Protection and Sustainable Use of the River Danube* (OG – IT 2/96).

3.6. Subregional and bilateral cooperation

The Republic of Croatia takes part in activities of the Croatian-Italian-Slovenian Commission for the Protection of the Adriatic Sea and the Stability Pact, and is active with neighbouring countries in particular on issues of water protection. Environmental protection issues assume a special significance in bilateral forms of cooperation, as they are solved directly.

3.7. Regulations in the area of production and intentional occurrence of POPs compounds

Currently, no production of POPs takes place or is planned in the Republic of Croatia. Legislation prohibits potential future production of POP pesticides, while potential future production of PCBs is not expressly prohibited. With regard to unintentional occurrence of POPs compounds, there is a legal obligation for industry and industrial processes (potential chemical sources referred to in ANNEX C to the Stockholm Convention) on the application of BATs, while the incineration of weeds and waste is not prohibited.

A review of the part of the regulations to be adjusted and amended, and possibly prepared, shall be further elaborated in action plans and strategies.

3.8. Management of POPs, implementation and management control

The Chemicals Act (OG 150/05 and 53/08) regulates chemicals management, procedures for the protection of human health, property and environment from the harmful effects of chemicals and prescribes mandatory requirements that have to be fulfilled by legal and natural persons producing, distributing or using chemicals in the Republic of Croatia. This Act regulates the establishment of the content, manner and requirements for exchanging information on chemicals, classification, labelling and packaging of chemicals, with regard to

the level of hazard they present, and other requirements, obligations and methods for safe chemicals management. This Act includes the group of POPs from the Convention list.

4. ASSESSMENT OF THE PRESENT SITUATION OF POPs COMPOUNDS IN THE REPUBLIC OF CROATIA

The present situation in Croatia in relation to management and issues of POPs compounds is not satisfactory and equal in terms of all twelve compounds/groups of compounds included on the Convention list. The level of knowledge on POPs compounds and their negative effects for the environment and human health is satisfactory within scientific and expert institutions in the country, while the level of knowledge amongst the general population is at a relatively low level. Therefore it is necessary to initiate national programmes for the education and training of Croatian citizens in the near future. Apart from the above, it is necessary to legally prescribe and provide financing of the programme for systematic monitoring of POPs compounds in the environment and humans.

4.1. POPs pesticides – ANNEX A – Part I of the Stockholm Convention

Within the domain of chemicals from ANNEX A – Part I, the basic institutional and legal frameworks required for the implementation and application of the Convention are in place, and the production of these chemicals does not take place and is not planned. The use and production of these compounds is legally prohibited in Croatia.

In relation to the time of production and application of these compounds in the Republic of Croatia, POPs can be divided into three groups:

– those which never had authorisation for distribution in the Republic of Croatia (mirex),

– those which were mass produced and used before being prohibited 20 or more years ago (DDT, hexachlorobenzene, chlordane, heptachlor, aldrin, dieldrin, endrin, toxaphene),

– those used until recently (lindane – still not included on the Stockholm Convention list).

Most of pesticides from the group of POPs compounds (Table 2) listed on the Stockholm Convention list were prohibited in Republic of Croatia in the late 1960s and in the 1970s. Lindane, which is not on the Stockholm Convention list, and which also belongs to POPs pesticides was the last compound to be prohibited in Croatia in 2001, the same year as in the European Union. Nowadays, a total of 743 products for plant protection and 280 active substances are authorised in the Republic of Croatia, none of which are included on the list of POPs of the Stockholm Convention or Rotterdam Convention.

Table 2. List of active substances from the pesticide group included in POPs and the year of their prohibition

ACTIVE SUBSTANCE	PERMITTED FROM	PROHIBITED FROM
Aldrin	1958	1972
DDT	1944	In Agriculture 1972
Dieldrin	1958	1972
Endrin	1957 (from 1971 just as rodenticide)	29 May 1989

HCB	1962	11 July 1980
Heptachlor	1956	July 1973
Chlordane	Data not available before 1955	1971
Mirex	never permitted for plant protection in the Republic of Croatia	
Toxaphene	1957	27 April 1982
Dicofol	1949	2001
Hexachlorocyclohexane (HCH)	1944	1972
Kelevane	18 December 1969	31 December 1977
Lindane	1944	1972*

*According to the List of poisons whose production, sale and use are banned (OG 29/05); lindane was not prohibited prior to 2005. In the regulation from 1972, lindane is prohibited in specific plant protection products containing lindane.

When issuing a decision on termination of the use of the above mentioned active substances, the use of already existing stockpiles was permitted in order to prevent accumulation of stockpiles of those substances. Though the prohibition of POPs pesticides dates back to 20-30 or more years, inventory of POPs pesticides established data on POPs pesticides residues in food, animals and humans on the territory of the Republic of Croatia. This is the consequence of their intensive use in the past, their long persistence and slow degradation. The levels of POPs pesticides in environmental components and humans in the Republic of Croatia are lower than those in developed and Western European countries, where their use was much more intense.

4.1.1. Regulations from the area of POPs pesticides

In Croatia, pesticides may have the following purposes:

– protection of plants and plant products;

– protection of animals from pests;

– prevention of harmful insects on humans;

– in public health (municipal hygiene);

– for the prevention of wood and textiles pests;

– as general use items (sprays and other formulas for household use with minimum effective amounts of active pesticide substances).

In Croatia, pesticides are placed on the market in line with the provisions of various acts and ordinances under the competence of various ministries. There are various institutions proposing the application of pesticides pursuant to their research, and the competent ministries issue decisions granting authorisation for distribution of a certain pesticide.

Furthermore, there are provisions concerning the prohibition of placing pesticides on the market. The list of regulations is provided in Table 3.

Table 3. List of regulations prescribing the distribution, import, export, use, storage, disposal and management of pesticides

PLANT HEALTH – PLANT PROTECTION PRODUCTS AND PESTICIDE RESIDUES

Ordinance on the conditions to be fulfilled by legal persons in the wholesale and retail sale of plant protection products, and manner and procedure for training workers who keep and sell plant protection products OG 40/96, 96/98, 155/04, 8/06

Ordinance on uniform principles for the evaluation and authorisation of plant protection products OG 116/06, OG 80/07

Ordinance on the procedure for authorisation of plant protection products OG 57/07

Ordinance on the labelling of plant protection products OG 11/07

Act on Plant Protection Products OG 70/05

Ordinance on the dossier requirements for the evaluation of active substances contained in plant protection products OG 53/06

Ordinance on the documentation for assessment and authorisation of plant protection products OG 59/06

Ordinance on the amount of fee and manner for distribution of resources in the procedure for registration of plant protection products, assessment of active substance and issuing authorisation for plant protection products OG 94/07

Ordinance on the methods of sampling for the official control of pesticide residues in and on products of plant and animal origin OG 77/08

List of active substances permitted for use in plant protection products in the Republic of Croatia OG 80/08

Registry of authorised plant protection products OG 10/08

Order prohibiting the placing on the market and use of plant protection products containing certain active substances OG 109/07

Ordinance on maximum pesticide residue levels in food and feed OG 119/07

Ordinance on the conditions to be fulfilled by legal persons in the wholesale and retail sale of plant protection products, and manner and procedure for training workers who keep and sell plant protection products OG 40/96, 96/98, 155/04, 8/06

Ordinance on uniform principles for the evaluation and authorisation of plant protection products OG 116/06, OG 80/07

Ordinance on the procedure for authorisation of plant protection products OG 57/07

Ordinance on the labelling of plant protection products OG 11/07

Ordinance on the establishment of border crossing points for transport of plant protection products (OG 21/08)

POISONS/CHEMICALS

Biocidal Products Act OG 63/07, OG 38/08

Ordinance on the documentation for evaluation of an active substance in biocidal products, documentation for evaluation of biocidal products, procedures for evaluation of biocidal

products and their use and on the biocidal product types with their description and common principles for evaluation of biocidal products OG 90/08

Ordinance on the list of active substances in biocidal products OG 90/08

Ordinance on the list of existing active substances permitted in biocidal products OG 90/08

Ordinance on the list of existing active substances not permitted in biocidal products OG 90/08

Ordinance on conditions regarding special protective measures when working with poisons for legal persons using poisons for scientific and research purposes OG 148/99

List of poisons intended for municipal hygiene, disinfection, pest control, odour removal and decontamination OG 151/02

Ordinance on minor quantities of poisons for laboratory and scientific purposes 39/03

Chemicals Act OG 150/05, OG 53/08

Ordinance on the filling out of the Safety Technical Certificate OG 111/06

Ordinance establishing the method for keeping registers of dangerous chemicals and the method and deadlines for submitting data from these registers OG 113/06

Ordinance on special conditions which must be met by legal persons carrying out production, trade, use or disposal of poisons and conditions which must be met by natural persons carrying our retail trade or use of poisons 68/07

Ordinance on new substances OG 61/07

Ordinance on classification, labelling and packaging of chemicals OG 23/08

List of dangerous chemicals whose placing on the market is prohibited or restricted OG 17/06

Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade OG-IT 4/07

Ordinance on conditions and manner of acquiring knowledge and examinations on protection from poisons OG 62/99

Ordinance on the conditions and method of storage of gaseous poisons from Group I OG 92/99

WATERS

Waters Act OG 107/95

Regulation on hazardous substances in water OG 78/98

National Water Protection Plan OG 8/99

Regulation on water classification OG 77/98

Ordinance on sanitary quality of drinking water OG 47/08

Act on Amendments to the Waters Act OG 150/05

VETERINARY MEDICINE

Act on Veterinary Medicinal Products and Veterinary Medical Devices OG 79/98

Ordinance on quality control of veterinary medicinal products, medicated pre-mixes and veterinary medical devices, and on storing methods and method of keeping the register on conducted quality control OG 148/99

List of prepared veterinary medicinal products, medicated pre-mixes and veterinary medical devices approved for use OG 73/00

Act on Veterinary Medicinal Products OG 84/08

Ordinance establishing principles and guidelines of good manufacturing practice for veterinary medicinal products OG 120/07

Order on the prohibition on the use of certain veterinary medicinal products in animals used for human consumption OG 120/07

Amendments to the List of prepared veterinary medicinal products, medicated pre-mixes and veterinary medical devices approved for distribution OG 119/07

List of veterinary medicinal products, medicated pre-mixes and veterinary medical devices which are removed from the list of prepared veterinary medicinal products, medicated pre-mixes and veterinary medical devices approved for distribution OG 119/07

Veterinary Act OG 41/07

List of veterinary medicinal products, medicated pre-mixes and veterinary medical devices which are removed from the list of prepared veterinary medicinal products, medicated pre-mixes and veterinary medical devices approved for use OG 121/05

Ordinance on the conditions governing the preparation, placing on the market and use of medicated feedstuffs OG 101/05

List of veterinary medicinal products, medicated pre-mixes and veterinary medical devices which are removed from the list of prepared veterinary medicinal products, medicated pre-mixes and veterinary medical devices approved for use OG 159/04

ENVIRONMENT

Environmental Protection Act OG 110/07

Waste Act OG 178/04, 111/06, 60/08

National Environmental Protection Strategy OG 46/02

National Environmental Action Plan OG 12/01

Ordinance on environmental impact assessment OG 85/06

AGRICULTURE

Agricultural Land Act OG 66/01, 87/02, 90/05

Ordinance on the protection of agricultural land from pollution caused by harmful substances OG 15/92

Act on Plant Protection Products OG 70/05

Plant Health Act OG 75/07

List of active substances permitted for use in plant protection products OG 8/08

Register of authorised plant protection products OG 10/08

Ordinance on the registration procedure for plant protection products OG 57/07

Ordinance on the documentation for evaluation and registration of plant protection products OG 59/06

Ordinance on the dossier requirements for the evaluation of active substances contained in plant protection products OG 53/06

4.1.2. Past, present and future production of POPs pesticides

In the period during which the use of POPs pesticides was permitted, several producers were placing various pesticide formulas on the market. It is necessary to stress that the quantities which were produced in Croatia as part of the former Yugoslavia were intended for use in the entire state. In the period from 1969-1972, INA Kutina produced NPK fertilizer (12:12:12) with 1% aldrin, which was soon after prohibited. From 1975 to 2005, it produced volatilized fertilizer (Florin 3). Though endrin was used as dieldrin in its early uses in 1959 (first uses as of 1958), due to the high level of threat it presented for users and the environment, it was used

in small amounts exclusively as rodenticide as a concentrated emulsion. In detailed reports on insecticide use for sugar beet crops, endrin is not mentioned after 1959, meaning that its use was already terminated by that time.

POPs pesticides are not produced in Croatia, and active substances which would be used to produce prepared POPs pesticides formulas for distribution are not imported. In Croatia today, there are numerous registered preparations which have gradually replaced toxicologically unfavourable analogue pesticides, including POPs.

Future production is not planned and is not possible, as the production of POPs pesticides is prohibited in Croatia.

Until their prohibition, POPs pesticides were used in line with the authorisation for use. The prohibition of their application did not cause significant problems as more environmentally acceptable and less toxic and less harmful pesticides were placed on the market. Prior to their prohibition, POPs pesticides were applied for elimination of many pests. In relation to their widespread use against pests, and cultures on which they were used, they were applied in significant amounts. Tables 4 -7 illustrate the use of POPs pesticides per year.

Table 4. Use of active substances contained in POPs pesticides (kg year^{-1}) in Croatia from 1962 to 1976

Active substances	Year 1962	1963	1964	1965	1966
Aldrin	-	-	48 353	9 982	13 448
DDT agriculture	-	-	1 784	1 196	14 051
DDT in forestry	-	2312	-	53428	280
Dieldrin	-	-	610	186	5 298
Endrin	-	-	172	78	132
HCH	126 000	> 280 000	176 212	166 800	35 610
Heptachlor	-	-	-	-	-
Chlordane	-	-	-	-	-
Lindane	8 000	-	12 450	4 293	15 906
Toxaphene	5 200	6 400	5 395	1 728	790

Active substance	Year 1967	1968	1969	1970	1971
Aldrin	53 400	496	64 821	39 260	21 840
DDT agriculture	16 325	4 183	6 051*	5 450	4 296
DDT in forestry	-	600	-	-	2363
Dieldrin	1980	142	284	132	1

						278
Endrin	120	84	94	164	131	
HCH	271 800	126 338	203 406	2 900	32 150	
Heptachlor	-	370	1 175	1 264	2 336	
Chlordane	-	-	320	380	452	
Lindane	7 948	8 066	6 304	15 172	17 126	
Toxaphene	5 375	2 025	2 250	1 625	2 463	

*without forestry and fruit-growing

	Year				
Active substance	1972	1973	1974	1975	1976
Aldrin	0	0	0	0	0
DDT agriculture	1 078	0	0	0	0
DDT in forestry	4912	884	8437	6907	8437
Dieldrin	0	0	0	0	0
Endrin	60	86	160	92	0
HCH	4 380	0	0	0	0
Heptachlor	0	0	0	0	0
Chlordane	3 918	5 940	6 479	56 430	123 375
Lindane	0	0	0	0	0
Toxaphene	22 612	28 015	26 509	20 061	19 597
DDT agriculture	2 765	3 953	1 573	3 604	4 420

Table 5 Use of DDT in Croatia (active substance: kg year^{-1})

	Year								
	1947	1948	1949	1950	1951	1952	1954	1955	1956
Forests	26	82	4807	2371 + 67	165	0	756	6020	4919
Potato	0	162	325	165	olives 590	1700	?	?	312

During 1945, 1946, 1953, 1967 and 1969 DDT was not applied

	Year										
	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1968
Forests	5360	1584	0	0	268	0	2312	262	53428	280	600
Sugar beet	280	180	128	32	44	72	0	48	0	0	0

Table 6 Use of DDT (active substance: kg year^{-1}) in Croatia in the period 1971-1975

	Year				
	1971	1972	1973	1974	1975
Use of DDT	2363	4912	884	8437	6907

Table 7 Use of DDT (active substance: kg year^{-1}) in Croatia for treatment of forests in the period 1979–1987 (data obtained from the Institute of Forestry, Jastrebarsko)

	Year							
	1979	1980	1981	1982	1984	1985	1986	1987
Use of DDT	4	75	399	551	16 450	679	360	140

In the above mentioned period, forested areas in Croatia covered 23.7% of Yugoslav territory. Great oscillations may be observed in relation to use of organochlorine pesticides due to climatic conditions, crop sequences, lack of foreign currencies for import of preparations, the occurrence of resistance, and activities of the reporting and forecasting service and use of integrated plant protection, i.e. the combination of agrotechnical procedures, in some cases mechanical elimination and the use of plant protection products only in case of pests above the harmful level and alternate use of products form different groups (e.g. in forestry). This has, to a certain degree, slowed the collection of POPs pesticide residues in the environment. Due to these prohibitions and the existing regulations, POPs pesticides are currently not used and their use is not possible. When issuing a permit for the distribution and use of pesticides, among other things, attention is paid to choosing those which are not persistent.

POPs pesticides which contain active substance prohibited on the Convention List are not used in forestry. The practice of using plant protection products with POPs components is disabled as POPs pesticides are neither produced nor used in the Republic of Croatia.

The Directorate for Forestry of the Ministry of Regional Development, Forestry and Water Management keeps data on plant protection products, their amounts and active substances for each specific product. Data are updated annually and legislative compliance in relation to use permits for certain products is examined. The public company Croatian Forests (Hrvatske šume) and the Institute for Forestry at Jastrebarsko use protection products the most and their cooperation in the exchange of data on their use with the Ministry is exemplary. DDT was prohibited 40 years ago, however, its use was documented in the Institute for Forestry as late as 1986, though in symbolic amounts and for scientific purposes.

4.1.3. Export and import of POPs pesticides

As POPs pesticides are not produced in the Republic of Croatia, they are not exported to any country in the world.

The import of chemicals classified as dangerous is permitted only if the Ministry Health and Social Welfare has previously issued a decision for import of the chemical or prepared pesticide formula that is registered for use. The Ministry of Health and Social Welfare, or the Ministry of Agriculture, Fisheries and Rural Development shall approve each import. The importer is obliged by law to timely notify crossing of such cargo over the national border (at least three days in advance) in order to prepare conditions for the supervision of the cargo.

The importer shall also keep the register on distribution of hazardous chemicals and deliver it to the Croatian National Institute of Toxicology at the beginning of each year for the previous year. A competent sanitary inspection or plant protection inspection or veterinary inspection, located at the border crossing, approves the import of a certain pesticide pursuant to the permit issued by the competent ministry and register confirming that the product is registered for use in the Republic of Croatia. During import, customs control uses the approval of the competent Ministries and therefore significant oversights are not expected in that area.

The probability of illegal trade with POPs pesticides is low, as they are also prohibited in neighbouring countries and adequate replacements are available in Croatia. The regulations on activities of agricultural and veterinary pharmacies regulate that only pesticides with the approval of the Ministry Health and Social Welfare, or the Ministry of Agriculture, Fisheries and Rural Development may be placed on the market. For the purpose of determining POPs pesticide residues in water, soil, food, plants and plant products, various institutions import small amounts of POPs pesticides for use as standards in laboratory analyses.

The Republic of Croatia has ratified the Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade, which entered into force on 14 February 2008. The Convention promotes common responsibility and cooperation among Convention parties in international trade with specific hazardous chemicals and pesticides for the purpose of protecting human health and the environment from potential/possible pollution, and ensures control and decision making on the import or export of chemicals which are the subject of the Convention, including POPs pesticides and industrial chemicals and efficiently controls their international trade.

4.1.4. Existing stockpiles, waste containing POPs pesticides, landfill sites and locations contaminated by POPs pesticides

The existence of POPs pesticides stockpiles was not established during the inventory of POPs pesticides.

Products, including pesticides, currently in use do not contain POPs pesticides and therefore the occurrence of waste containing POPs pesticides is not likely. To date, there have been no special landfill sites for storing waste containing POPs pesticides. It may be assumed that certain amounts of waste containing POPs pesticides have been disposed of at municipal landfills and covered with layers of garbage over the course of thirty years, however, it is very difficult to detect such waste at these sites. The exception may be the remaining empty packaging of old pesticides.

Sites for the disposal of hazardous waste, i.e. POPs pesticides, have not yet been designated. As there are other types of persistent compounds for which landfill sites will have to be established, it is also necessary to anticipate the possibility of disposing POPs pesticides that might turn up at these locations.

According to the available data, which are scarce and frequently presented in a non-uniform manner, locations contaminated by POPs pesticides have not yet been established. Based on data concerning the use of POPs pesticides, it will be necessary to establish several areas in in Croatia where the presence of POPs pesticides should be examined. Considering the doses or concentrations of application, and bearing in mind that the use of pesticides has been in line

with permit recommendations, there is no great likelihood that there are locations considerably contaminated by POPs pesticides.

4.1.5. Present capacities/potentials for examination of POPs pesticides

It is necessary to stress that laboratories for physical and chemical analysis in Croatia are not adequately equipped. Namely, the lack of data is not merely the consequence of non-existing legislation and monitoring but also of inadequate equipment in most laboratories primarily owing to insufficient financial resources for their proper fitting. Devices are old and imprecise, and workers are not trained for using latest devices and technologies. This means that organising monitoring in the area of plants and plant products, foodstuffs and soil, in addition to the appropriate legal framework, also calls for the formation of several laboratories in accordance with the EU regulations in which examinations using new precise equipment should be conducted to determine residues of POPs compounds, and other persistent chemicals to soon be included on the list of POPs compounds.

There is no need to establish new laboratories for water monitoring, instead existing laboratories should be improved.

4.1.6. Conclusion

The compiled data indicate that POPs pesticides are neither produced nor used in Croatia.

Furthermore, POPs pesticides are neither imported nor exported. During inventory of POPs pesticides, it was established that there are no locations contaminated by POPs pesticides or stockpiles of POPs pesticides.

With regard to the in the environment levels of POPs pesticides that are systematically monitored in accordance with the legal framework, it is proposed that legislation be adopted for the purpose of systematic and continuous monitoring of POPs pesticide levels in all environmental components and in humans. The existing data, which have been gathered through various projects or analysis of inspectional samples, have not been collected continuously and within the framework of the national monitoring programme. Furthermore, it is necessary to regulate collection of results obtained from continuous and systematic monitoring of POPs pesticide amounts in the central register.

Due to inadequate equipment of laboratories for the performance of the required analyses, it is necessary to provide resources for fitting these laboratories, procurement of equipment, and training of experts for related activities. Though a decreasing trend is observed with respect to POPs pesticide residues in analysed samples of plant and animal origin, water, soil and humans, reliable data on residues are required for the purpose of establishing the actual situation which is in accordance with many international treaties and regulations and with the Stockholm Convention.

4.2. Polychlorinated biphenyls (PCB) – Annex A, Part II

PCBs have never been produced on the territory of the Republic of Croatia, but equipment containing PCBs (transformers, capacitors) has been produced and therefore liquids containing PCBs were imported. Most demands relate to the adjustment and modification of

the legal and institutional framework are related to PCBs. Namely, the import and use of PCBs in closed and semi-closed systems is still permitted in the Republic of Croatia.

Furthermore, there is no real control during the import of PCBs and equipment containing PCBs.

In addition to PYRALEN, the most frequently used PCB is ASKAREL, which in fact is a mixture of tetrachlorobenzene containing 60–80% PCBs.

4.2.1. Analysis of existing data on amount of equipment containing PCBs

In 1993, the national institutions of the Republic of Croatia competent for heath care, the environment and economic development initiated a series of activities for reducing potential threats related to equipment and devices containing PCBs or contaminated by PCBs. In the period from 1993-1997, the company APO d.o.o., in cooperation with the Ministry of Labour and Social Welfare, and occupational safety and health inspectors, examined and analysed inspectional records on the supervision of equipment containing PCBs and survey, and thus created a database of entities owning devices containing PCBs (transformers, capacitors), liquids containing PCBs and waste contaminated by PCBs.

For the purpose of inventory, the database was processed by county, by the age of installation, and by equipment status (in operation, faulty, or on stand-by) as the basis for preparation of the National Implementation Plan.

For the purpose of supplementing and updating the database, a questionnaire has been prepared and forwarded to 400 new addresses. Primarily, the survey included entities which were insufficiently covered by the analysis and collection of data on PCBs such as hotels, hospitals and larger economic entities not previously reported to possess equipment and devices containing PCBs.

Cooperation has been instated with state, county and scientific institutions, Ministry of Environmental Protection, Physical Planning and Construction, Ministry of Finance, Customs Administration, Croatian Chamber of the Economy, Institute for Medical Research and Occupational Medicine, Ruđer Bošković Institute, Croatian National Institute of Public Health and county institutes for public health.

Data on the import and export of PCBs in the Republic of Croatia, manner and sites of PCBs implementation in the Republic of Croatia and national capacities for monitoring, control, analysis of PCBs and environmental monitoring related to PCBs have been collected and compiled.

In the Republic of Croatia, an inquiry was forwarded to manufacturers of equipment which possible use PCB-based fluids regarding whether they use PCBs as cooling fluids.

4.2.2. Regulations from the PCBs area

The handling of equipment containing PCBs, the disposal and transport of waste containing PCBs, and the maximum permitted concentrations of PCBs in specific media are regulated by the following legal acts in the Republic of Croatia:

– Ordinance on occupational and health safety when working with substances containing polychlorinated biphenyls, polychlorinated naphthalenes and polychlorinated terphenyls (OG 7/89)

– Waste Act (OG 178/04, 111/06, 60/08)

– Regulation on categories, types and classification of waste with a waste catalogue and list of hazardous waste (OG 50/05)

– Basel Convention on the control of transboundary movements of hazardous wastes and their disposal (OG – IT 3/94)

– Act on the Transport of Hazardous Substances (OG 79/07)

– Ordinance on the occupational exposure limit values of hazardous substances and on biological limit values (OG 92/93)

– Ordinance on maximum residue levels of pesticides in food and feed (OG 117/07)

– Ordinance on toxins, metals, metalloids and other harmful substances in food (OG 16/05)

– Ordinance on protection of agricultural land against pollution by harmful substances (OG 15/92)

– Regulation on hazardous substances in water (OG 78/98)

– Regulation on water classification (OG 77/98)

– Ordinance on undesirable and prohibited substances in animal feed (OG 118/07)

– Chemicals Act (OG 150/05, OG 53/08)

– List of dangerous chemicals for which the placement on the market is prohibited or restricted (OG 17/06)

– Ordinance on waste management (OG 23/07, 111/07)

– Ordinance on management of polychlorinated biphenyls and polychlorinated terphenyls (OG 105/08)

– Ordinance on management of sludge from water purification devices when sludge is used in agriculture (OG 38/08)

Until 2006, there were no legal acts in Republic of Croatia prohibiting the import of PCBs and restricting the use of PCBs in closed systems.

The new Chemicals Act (OG 150/05 and 53/08) and the List of dangerous chemicals for which the placement on the market is prohibited or restricted (OG 17/06) prescribe that it is prohibited to distribute and use PCBs, with the exception of maintenance of existing equipment until the termination of its operations, i.e. until the said equipment becomes waste.

In September 2008, the Ordinance on polychlorinated biphenyls and polychlorinated terphenyls management (OG 105/08) was adopted, laying down the disposal of PCBs until 31 December 2010. Furthermore, it also prescribed the prohibition of placing on the market of PCBs and equipment containing PCBs after this date. The Ordinance also stipulates the obligation of the owner of PCB equipment to deliver the list of equipment with PCB volumes exceeding 5 dm^3 to the Ministry competent for environmental protection and the Croatian Environment Agency by 31 March 2009.

4.2.2.1. Legal framework for handling devices containing PCBs during operation

The Ordinance on occupational health and safety when working with substances containing polychlorinated biphenyls, polychlorinated naphthalenes and polychlorinated terphenyls (OG 7/89) is in force in the Republic of Croatia. This is the only official act regulating the handling of devices containing PCB/PCTs, and labelling and protection when operating these devices. The Ordinance allows for the use of PCBs in closed systems subject to special approval of the competent inspectorate and at sites which are protected from fire.

The Chemicals Act (OG 150/05, 53/08) and the List of dangerous chemicals for which the placement on the market is prohibited or restricted (OG 17/06) prescribe the prohibition of placement on the market and use PCBs, with the exception of maintaining existing equipment until the end of its operation or until the said equipment becomes waste. This ensures the prohibition of PCBs import, while the import of equipment containing PCBs shall be prohibited after 31 December 2010 (Ordinance on management of polychlorinated biphenyls and polychlorinated terphenyls, OG 105/08).

4.2.2.2. Legal framework for disposal of out-of-use devices containing PCBs and waste containing PCBs

Waste management is regulated by the Waste Act (OG 60/08) and Ordinance on waste management (OG 23/07 and 111/07) and classification and categorization of waste is conducted pursuant to the Regulation on categories, types and classification of waste with a waste catalogue and list of hazardous waste (OG 50/05).

According to the Regulation on categories, types and classification of waste with a waste catalogue and list of hazardous waste (OG 50/05) which is its integral part, “transformers and capacitors containing PCBs or PCTs” are listed under the key number *16 02 01 and represent hazardous waste. Other types of waste containing PCBs or PCTs are also classified in the Catalogue as hazardous waste (e.g. *13 01 01 and *13 03 01 for waste oils containing PCBs or PCTs).

Thermal treatment with pre-conditioning is recommended for all such types of waste. Devices containing PCBs or PCTs and liquids containing PCBs are incinerated in hazardous waste incineration plants (after treatment cases can be disposed of at hazardous waste landfills). Waste oils containing PCBs are handled in accordance with the Regulation on categories, types and classification of waste with a waste catalogue and list of hazardous waste (OG 50/05) depending on their PCB and halogen content.

The Regulation on categories, types and classification of waste with a waste catalogue and list of hazardous waste (OG 50/05) entered into force in 2005. Waste containing PCBs is still not unified in this Regulation under a special category, but is categorized into several subgroups:

– waste under code Q12 “Polluted matter (e.g. oils contaminated by PCBs/polychlorinated biphenyls, etc.)”,

– in the category A-10 as waste showing one of the properties of hazardous waste listed in Annex II of the Regulation and containing substances containing PCBs and/or PCTs (e.g. dielectrics, etc.),

– in the category C32 as waste components referred to in item 1.B, which make them hazardous if they have the properties described in Annex II and contain substances containing polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs),

– in the category H13 as substances and preparations capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics of hazardous waste listed in Annex II (explosive, carcinogenic, etc.). The value of PCBs in that case has to exceed 100 mg/kg of dry matter,

– A1 Metal and metal-bearing wastes; A1180 Waste electrical and electronic assemblies or scrap (2) containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or contaminated by Annex I constituents (e.g. cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III (note the related entry on list B, B1110);

– A3180 Wastes, substances and articles containing, consisting of or contaminated by polychlorinated biphenyl, polychlorinated terphenyls, polychlorinated naphthalene or polybrominated biphenyl or any other polybrominated analogues of these compounds, at a contrition level of 50 mg/kg or more;

– C49 – any congener of polychlorinated dibenzo-furan;

– C50 – any congener of polychlorinated dibenzo-p-dioxin;

– C51 – hydrocarbons and their oxygen; nitrogen and/or sulphur compounds not otherwise taken into account in this Regulation.

– RA. – Waste primarily containing organic components which can contain metals and other inorganic materials: RA 010 Waste substances and articles containing, consisting of or contaminated by polychlorinated biphenyl and/or polychlorinated terphenyls and/or or polybrominated biphenyl or any other polybrominated analogues of these compounds, at a concentration level of 50 mg/kg or more;

– RC. Waste which can contain either inorganic or organic components; RC010 – each element from the same group as well as polychlorinated dibenzofuran; RC 020 – each element from the same group as well as polychlorinated dibenzodioxin.

According to the Waste Act (OG 178/04, 111/06, 60/08) the import of hazardous waste in the Republic of Croatia including waste contaminated by PCBs is prohibited. In 1994, the Republic of Croatia ratified the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal (OG – IT 3/94). In accordance with the Basel Convention, “waste substances and articles containing or contaminated by polychlorinated

biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs)" (code Y10) are classified as the category of waste to be controlled as hazardous waste (Annex I). In accordance with the Basel Convention it is possible to export hazardous waste only to countries which have not prohibited the import of hazardous waste subject to the written consent of competent institutions of the importing countries. Furthermore, it is necessary to minimise transboundary movement of hazardous waste, that is performed in line with environmentally friendly and efficient waste management, and conducted in such a manner as to protect human health and the environment from harmful consequences of such movement.

4.2.2.3. Legal framework for the transport of waste PCBs and equipment contaminated by PCBs

The transport of PCBs and equipment containing PCBs shall be conducted in accordance with the provisions of the Act on Transport of Hazardous Substances (OG 79/07). That Act is based on the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR). In line with the ADR, PCBs are classified as hazardous substances which, while being transported, present danger for transport participants, people and the environment (class 9). PCBs have a risk category of 2b (substances which accidentally catch on fire may create dioxins), while devices containing PCBs are risk category 3. A vehicle transporting PCBs and PCB contaminated waste must be technically sound and equipped and labelled in accordance with the prescribed standards. The transport of PCBs has to be conducted with special caution measures in line with the prescribed standards. PCBs transport has to be conducted in line with required caution measures, primarily during daylight, and the consignment has to fulfil the requirements for safe transport.

4.2.2.4. Legally permitted PCBs concentrations in specific media

Legally permitted PCBs concentrations in the atmosphere, water, food and agricultural land are prescribed in the Republic of Croatia.

The Ordinance on maximum permissible concentrations of harmful substances in the atmosphere of work premises and areas and on biological limit values (OG 92/93) lays down limit values for polychlorinated biphenyls in work areas. In relation to the above, various MPC values were given depending on chlorine content in the mixture of PCB compounds.

Polychlorinated biphenyls with a chlorine content of 42%, whose permitted concentrations in the working atmosphere is 0.1 ppm or 1 mg m^{-3}, are classified under ordinal number 116, CAS number 53469-21-9. Polychlorinated biphenyls with a chlorine content of 54% are listed under ordinal number 117, CAS number 11097-69-1, with a specified MPC value of 0.05 ppm or 0.5 mg m^{-3}. For both compound groups, there is a warning regarding their potential carcinogenic effects CA-2 and their possible resorption via skin.

The Regulation on hazardous substances in water (OG 78/98) classifies polychlorinated biphenyls into the A category of substance as "hazardous substances proven to be a threat to the environment and humans and for which limit values in water systems are prescribed, i.e. their release into waters is prohibited". The maximum permitted concentration of polychlorinated biphenyls is prescribed by the said Regulation and by the Regulation on water classification (OG 77/98) which lays down limit values for waters from category I to V. Depending on the category of water, concentrations range from 0.01-0.2 μg L^{-1}. Namely, for

category I water, the PCB concentration limit value is <0.01 μgL^{-1}, for category II waters 0.01-0.02 μg L^{-1}, for category III waters 0.02-0.04 μg L^{-1}, for category IV waters 0.04-0.2 μg L^{-1} and for category V waters >0.2 μg L^{-1}.

The Ordinance on the protection of agricultural land against pollution caused by harmful substances (OG 15/92) prescribes that the maximum amount of PCBs in city sludge and compost made of city sludge and waste can amount to 0.05 mg kg^{-1} of dry matter.

The Ordinance on toxins, metals, metalloids and other harmful substances in food (OG 16/05) lays down the permitted amount of polychlorinated biphenyls in food (edible part).

Table 8. Maximum permitted concentrations of PCBs in food

Type of food	Maximum permitted amount of PCBs ng/g fat
Eggs and egg products	200
Poultry and poultry products	200
Milk	
	100
– fresh milk	
	100
– thermally processed	
	100
– dairy products	

Table 9. Maximum permitted concentrations of PCBs in food

Type of food	Maximum permitted amounts of PCBs mg/kg
Food for infants and small children	0.2
Fish and shellfish	2.0 *
Red meat	3.0 **

* Specified in relation to the edible part

** Specified in relation to the amount of fat

4.2.3. Previous, current and future use of PCBs and equipment containing PCBs

According to compiled data, PCB mixtures have never been produced in the Republic of Croatia. According to data provided by manufacturers of transformers and capacitors, 26 transformers were produced in the Republic of Croatia in 1975 (of which 16 were disposed of), type 2 TBN 1600-12/K, in which a PCB-based cooling oil system was installed at the Petrokemija – Kutina factory.

During the manufacturing of other devices of various types and sizes, PCB-based dielectrics and cooling oil systems were not used.

Furthermore, the production of PCBs or equipment containing PCBs is not planned.

PCBs compounds have been used and are still used in Croatia primarily in closed systems (as dielectrics in transformers and capacitors). The use of equipment containing PCBs is permitted until 31 December 2010.

4.2.4. Quantities of PCBs in closed systems (transformers, capacitors)

The quantity of PCBs in a specific device depends on the power and size of the device. As most equipment in the Republic of Croatia is old, there are no detailed technical data as to the quantity of dielectrics in the device. Therefore, this section specifies data on total weight of a device containing PCBs as the amount of PCBs in the closed system. Such an estimate is commonplace and in relation to the replacement and final disposal of devices containing PCBs, it is always necessary to take into account the total weight of the device to be disposed of, and not merely the amount of dielectric/insulation material.

The quantity of PCBs in closed systems is shown according to data collected during inventory, when the following amounts of PCBs compounds were identified in closed systems:

22 859 capacitors: 655,705 kg

311 transformers: 735,900 kg.

Total quantity of identified equipment containing PCBs amounts to 1,391,605 kg.

Prior to the implementation of the PCBs inventory project, there were 480 economic entities in the database with recorded equipment or waste containing PCBs (including Croatian Electric as the largest owner of devices containing PCBs). After updating the database, a further 20 entities possessing equipment or waste containing PCBs were recorded.

In line with the US Environmental Protection Agency (EPA), the timetable of device replacement may be prepared on the basis of optimum duration of electric devices, if those devices have not been put out of use earlier for some other reasons. Thus, 15 years is defined as the optimum duration for capacitor batteries (according to the US standards) for compensation of reactive power on low-voltage, 20 years on high-voltage and 40 years for transformers.

4.2.5. Status analysis of equipment containing PCBs

Analysis of the equipment status included determining the equipment in operation, faulty or on stand-by. Table 10 displays the number and weight of operational, faulty or stand-by capacitors by county.

Table 10. Number and weight of operational, faulty or stand-by capacitors in the Republic of Croatia, by county

	Number of capacitors				Capacitor weight /kg			
COUNTY	In operation	Faulty	Stand-by	Total	In operation	Faulty	Stand-by	Total

Zagreb	2411	205	129	2745	97,116.3	2.647,1	8,284.8	108,048.2
Krapina-Zagorje	397	43	1	441	13,685.6	1,321.2	44.0	15,050.8
Sisak-Moslavina	2406	274	8	2688	34,249.6	1,937.8	262.1	36,449.5
Karlovac	811	67	24	902	28,044.3	11,607.8	1,868.0	41,520.1
Varaždin	493	13	12	518	10,281.9	561.0	516.0	11,358.9
Koprivnica-Križevci	686	59	44	789	14,204.1	2,065.6	1,214.6	17,484.3
Bjelovar-Bilogora	683	26	29	738	11,772.2	790.4	661.2	13,223.8
Primorje-Gorski Kotar	1804	338	196	2338	66,722.8	5,813.4	5,340.5	77,876.7
Lika-Senj	60	2	0	62	0	0	0	0
Virovitica-Podravina	225	9	0	234	8,284.8	431.4	0.0	8,716.2
Požega-Slavonia	813	14	9	836	22,013.4	393.1	257.8	22,664.3
Brod-Posavina	3262	165	17	3444	86,588.4	4.519.0	851.8	91,959.2
Zadar	520	8	31	559	12,740.9	223.4	411.1	13,375.4
Osijek-Baranja	1368	21	203	1592	59,669.6	343.8	6,618.0	66,631.4
Šibenik – Knin	522	132	59	713	26,604.0	5,328.0	2,491.0	34,423.0
Vukovar-Srijem	147	12	2	161	3,155.6	358.8	57.0	3,571.4
Split-Dalmatia	2032	546	147	2725	46,137.3	3,080.2	3.230,8	52,448.3
Istria	445	28	27	500	10,416.2	531.6	1,078.8	12,026.6
Dubrovnik-Neretva	205	7	17	229	10,472.2	200.8	474.8	11,147.8
Međimurje	620	23	2	645	16,896.0	748.0	86,0	17,730.0
TOTAL	19910	1992	957	22.859	579,055.2	42,902.4	33,748.3	655,705.9

The analysis of equipment status in the Republic of Croatia established that the majority of capacitors are in operation (87.1% or 19,910 items of total weight 579,055.2 kg), followed by faulty capacitors (8.7%, or 1,992 items of total weight 42,902.4 kg), and capacitors on stand-by (4.2% or 957 items of total weight 33,748.3 kg).

In relation to territorial distribution, i.e. by county, the county recording the greatest number of capacitors in operation is Brod-Posavina County, followed by Zagreb County and Sisak-Moslavina County. The largest number of faulty capacitors was registered in Split-Dalmatia County followed by Sisak-Moslavina County. The most stand-by capacitors are located in Osijek-Baranja County, Primorje-Gorski Kotar County and Split-Dalmatia County.

The smallest number of capacitors is registered in Lika-Senj County (60 items in operation, 2 faulty items) but their weight is not known. Following are Vukovar-Srijem County and Dubrovnik-Neretva County.

Table 11 shows the number and weight of operational, faulty or stand-by transformers by county in the Republic of Croatia

Table 11. Number and weight of operational, faulty or stand-by transformers in the Republic of Croatia, by county

	Number of transformers				Weight of transformers /kg			
COUNTY	In operation	Faulty	Stand-by	Total	In operation	Faulty	Stand-by	Total
Zagreb	30	0	0	30	28,750.0	0	0	28,750.0
Krapina-Zagorje	0	0	0	0	0	0	0	0
Sisak-Moslavina	57	0	0	57	244.874.0	0	0	244.874.0
Karlovac	108	0	12	120	261,889.0	0	57,680.0	319,569.0
Varaždin	4	0	0	4	4.970.0	0	0	4.970,0
Koprivnica-Križevci	1	0	0	1	102.0	0	0	102,0
Bjelovar-Bilogora	0	0	0	0	0	0	0	0
Primorje-Gorski Kotar	12	0	0	12	27,110.0	0	0	27,110.0
Lika-Senj	0	0	0	0	0	0	0	0
Virovitica-Podravina	3	0	0	3	4,070.8	0	0	4,070.8
Požega-Slavonia	0	0	0	0	0	0	0	0
Brod-Posavina	19	0	1	20	41,460.0	0	0	41,460.0
Zadar	1	0	0	1	950.0	0	0	950.0
Osijek-Baranja	23	0	1	24	29,690.0	0	0	29,690.0
Šibenik – Knin	2	0	0	2	3,990.0	0	0	3,990.0
Vukovar-Srijem	0	0	0	0	0	0	0	0
Split-Dalmatia	4	0	0	4	2,302.0	0	0	2,302.0
Istria	23	0	0	23	21,180.0	0	0	21,180.0
Dubrovnik-Neretva	8	0	1	9	4,800.0	0	0	4,800.0
Međimurje	1	0	0	1	2,060.0	0	0	2,060.0
TOTAL	296	0	15	311	678,201.8	0	57,680.0	735,877.8

The analysis of data on transformers established that the majority of transformers are in operation (95.1% or 289 items of total weight 670,997.8 kg), followed by stand-by transformers (4.9% or 15 items of total weight 57,680 kg). No faulty capacitors were recorded.

The counties recording the greatest number of transformers in operation are Karlovac County and Sisak-Moslavina County. The highest number of stand-by transformers was also registered in Karlovac County.

No transformers were registered in Krapina-Zagorje County, Koprivnica-Križevci County, Bjelovar-Bilogora County, Lika-Senj County, Požega-Slavonia County, Vukovar-Srijem County and Međimurje County, which does not mean that they do not exist in the mentioned counties, but that there was no response to questionnaires during the surveys.

4.2.5.1. Analysis of equipment by age

Tables 12 and 13 show data concerning the number and weight of operating, faulty or stand-by capacitors in the Republic of Croatia by county and depending on the year of production as the basis for determining the timetable of device replacement.

Table 12. Number of capacitors depending on their production year in the Republic of Croatia, by county

COUNTY	Capacitor number							
	By 1970	1971-75	1976-80	1981-85	1986-90	After 1990	Unknown	Total
Zagreb	328	329	1,219	518	2	33	316	2,745
Krapina-Zagorje	89	137	158	28	6	0	23	441
Sisak-Moslavina	1.139	190	1,104	95	21	0	139	2,688
Karlovac	65	217	486	18	0	0	116	902
Varaždin	62	63	141	216	0	0	36	518
Koprivnica-Križevci	513	96	112	68	0	0	0	789
Bjelovar-Bilogora	182	62	276	198	0	0	20	738
Primorje-Gorski Kotar	325	503	746	248	47	0	469	2,338
Lika-Senj	0	0	62	0	0	0	0	62
Virovitica-Podravina	19	55	114	36	10	0	0	234
Požega-Slavonia	25	38	640	106	11	0	16	836
Brod-Posavina	2,430	22	749	210	15	0	18	3,444
Zadar	88	422	13	34	0	0	2	559
Osijek-Baranja	676	156	418	132	91	3	116	1,592
Šibenik – Knin	0	695	18	0	0	0	0	713
Vukovar-Srijem	4	4	129	0	0	0	24	161
Split-Dalmatia	932	317	950	359	30	0	137	2,725
Istria	33	157	95	48	27	0	140	500
Dubrovnik-Neretva	0	0	101	90	0	0	38	229
Međimurje	66	15	245	308	0	0	11	645
Total	6976	3478	7776	2712	260	36	1621	22,859

Table 13 Weight of capacitors depending on their production year in the Republic of Croatia, by county

	Capacitor weight/kg							
COUNTY	By 1970	1971-75	1976-80	1981-85	1986-90	After 1990	Unknown	Total
Zagreb	10,696.1	6,508.2	77,302.8	9,567.8	30.0	16.5	3,926.8	108,048.2
Krapina-Zagorje	2,597.2	5,315.6	5,478.8	567.8	360.0	0	731.4	15,050.8
Sisak-Moslavina	3,880.8	3,559.4	26,243.0	112.5	323.4	0	2,330.4	36,449.5
Karlovac	1,059.8	2,416.2	30,547.6	1,302.0	0	0	6,194.4	41,520.0
Varaždin	63.0	426.8	5,610.6	4,610.5	0	0	648.0	11,358.9
Koprivnica-Križevci	8,835.5	3,307.1	2,504.1	2,837.6	0	0	0	17,484.3
Bjelovar-	2,426.6	2,905.2	5,437.8	2,454.2	0	0	0	13,223.8

Bilogora								
Primorje-Gorski Kotar	4,497.9	18,440.8	30,886.5	5,814.6	2,163.0	0	16,073.9	77,876.7
Lika-Senj	0	0	0	0	0	0	0	0
Virovitica-Podravina	583.8	1,563.6	5.263.2	825.6	480.,0	0	0	8,716.2
Požega-Slavonia	670.0	984.0	18,427.3	1,502.6	610.0	0	470.4	22,664.3
Brod-Posavina	65,682.0	572.0	18,892.2	5,454.8	855.0	0	503.2	91,959.2
Zadar	3,366.0	9,407.4	332.0	210.0	0	0	60.0	13,375.4
Osijek-Baranja	39,408.4	7,739.4	11,001.8	5,109.6	2,138.0	27.0	1.207,0	66,631.2
Šibenik – Knin	0	33,883.0	540.0	0	0	0	0	34,423.0
Vukovar-Srijem	117.6	58.8	2,667.0	0	0	0	728.0	3,571,4
Split-Dalmatia	7,934.7	8,953.6	27,108.4	7,043.4	0	0	1.408,0	52,448.1
Istria	526.4	4,849.3	2,750.8	801.4	0	0	3,098.7	12,026.6
Dubrovnik-Neretva	0	0	4,505.0	3,472.8	0	0	3,170.0	11,147.8
Međimurje	2,987.0	537.0	10,398.0	3,533.0	0	0	275.0	17.730,0
TOTAL	155,332.8	111,427.4	285,896.9	55,220.2	6,959.4	43.5	40.825,2	655,705.4

The analysis of capacitor age in the Republic of Croatia established that the majority of capacitors were produced from 1976–1980 (34.0%), followed by capacitors produced to 1970 (30.5%). The fewest capacitors were produced after 1990 (0.2%). For 1.1% of capacitors, it was not possible to establish their year of production.

Tables 14 and 15 show data concerning the number and weight of transformers depending on their age, by county

Table 14. Number of transformers in the Republic of Croatia, based on their year of production and by county

COUNTY	Transformer number							
	By 1970	1971-75	1976-80	1981-85	1986-90	After 1990	Unknown	Total
Zagreb	5	5	7	5	4	0	4	30
Krapina-Zagorje	0	0	0	0	0	0	0	0
Sisak-Moslavina	28	5	24	0	0	0	0	57
Karlovac	36	13	10	41	10	0	10	120
Varaždin	0	0	2	2	0	0	0	4
Koprivnica-Križevci	0	0	0	1	0	0	0	1
Bjelovar-Bilogora	0	0	0	0	0	0	0	0
Primorje-Gorski Kotar	4	2	6	0	0	0	0	12
Lika-Senj	0	0	0	0	0	0	0	0
Virovitica-Podravina	0	2	0	1	0	0	0	3
Požega-Slavonia	0	0	0	0	0	0	0	0
Brod-Posavina	5	2	9	2	2	0	0	20

Zadar	0	0	1	0	0	0	0	1
Osijek-Baranja	4	6	4	2	4	0	4	24
Šibenik – Knin	0	0	0	0	0	2	0	2
Vukovar-Srijem	0	0	0	0	0	0	0	0
Split-Dalmatia	0	0	1	2	0	0	1	4
Istria	10	2	4	6	1	0	0	23
Dubrovnik-Neretva	1	0	0	8	0	0	0	9
Međimurje	0	0	1	0	0	0	0	1
TOTAL	93	37	69	70	21	2	19	311

Table 15. Weight of transformers in the Republic of Croatia, based on their year of production and by county

	Transformer weight / kg							
COUNTY	By 1970	1971-75	1976-80	1981-85	1986-90	After 1990	Unknown	Total
Zagreb	12,220.0	4,536.0	3,520.0	2,394.0	2,080.0	0	4,000.0	28,750.0
Krapina-Zagorje	0	0	0	0	0	0	0	0
Sisak-Moslavina	128,352.0	16,960.0	99,562.0	0	0	0	0	244,874.0
Karlovac	157,840.0	16,420.0	19,970.0	80,809.0	36,010.0	0	8,520.0	319,569.0
Varaždin	0	0	1,890.0	3,080.0	0	0	0	4.970.0
Koprivnica-Križevci	0	0	0	102.0	0	0	0	102.0
Bjelovar-Bilogora	0	0	0	0	0	0	0	0
Primorje-Gorski Kotar	10,870.0	4,440.0	11,800.0	0	0	0	0	27,110.0
Lika-Senj	0	0	0	0	0	0	0	0
Virovitica-Podravina	0	0	2,970.8	0	1,100.0	0	0	4,070.8
Požega-Slavonia	0	0	0	0	0	0	0	0
Brod-Posavina	11,200.0	3,600.0	17,910.0	3,560.0	5,190.0	0	0	41,460.0
Zadar	0	0	950.0	0	0	0	0	950.0
Osijek-Baranja	6,590.0	6,590.0	5,340.0	4,710.0	6,460.0	0	0	29,690.0
Šibenik – Knin	0	0	0	0	0	3,990.0	0	3,990.0
Vukovar-Srijem	0	0	0	0	0	0	0	0
Split-Dalmatia	0	0	1,890.0	250.0	0	0	162.0	2,302.0
Istria	11,440.0	0	0	7,040.0	2,700.0	0	0	21,180.0
Dubrovnik-Neretva	4,800.0	0	0	0	0	0	0	4,800.0
Međimurje	0	0	2,060.0	0	0	0	0	2,060.0
TOTAL	343,312	52,546	167,863	101,945	53,540	3,990	12,682	735,877,8

The analysis of data concerning transformers established that the majority of transformers were produced prior to 1970 (30.6%), following those produced from 1981-1985 (22.5%), and from 1976-1980 (22.2%). These are followed by transformers produced from 1971-1975 (11.9%), and those produced from 1986-1990 with 6.8%. The least present are transformers produced after 1990 (0.7%). For 6.1% of capacitors there are no data concerning their production year.

The county with largest number of oldest transformers, i.e. those produced prior to 1970, is Karlovac County, followed by Sisak-Moslavina and Istria County.

The analysis of equipment age and its presence in the total amount of equipment installed in the Republic of Croatia indicates that the optimum duration of most equipment has expired and will soon require replacement or final disposal.

4.2.6. Application of PCBs in semi-closed systems

During the inventory process, oil manufacturers specified that they have never produced oil containing PCB compounds. In line with current assessments, oils imported into the country do not contain PCB compounds. The inventory procedure could not include the use of hydraulic oils containing PCB compounds and therefore more attention should be paid to that in the future.

4.2.7. PCBs application in open systems

Polychlorinated biphenyls were previously used in open systems as plastificators in dyes, adhesives, plastics and lubricant oil formulas.

During PCB inventory, no data was collected on PCB application in open systems.

As 14 years have passed since the publication of the Ordinance on occupational health and safety when working with substances containing polychlorinated biphenyls, polychlorinated naphthalenes and polychlorinated terphenyls (OG 7/89), there is no evidence nor reasonable suspicion concerning the presence and use of PCBs in open systems.

4.2.8. Preventive measures concerning the production and use of PCBs

The use of PCBs is legally permitted only in closed systems. In accordance with the Stockholm Convention which demands the elimination of equipment containing PCBs by 2025, it is necessary to undertake preventive measures, such as:

– passing of a legal provision concerning the prohibition of importing equipment containing PCBs, transformers and capacitors;

– conducting control and supervision of equipment and devices that could possibly contain PCBs upon entering the country;

– passing of legal provisions prescribing deadlines for device replacement, obligation to report equipment failures and related accidents;

– preparing a timetable for the replacement of current equipment in operation, taking into account its age, the economic situation in the Republic of Croatia, and European regulations laying down deadlines for the replacement of devices containing PCBs.

4.2.9. Import of equipment containing PCBs

The majority of equipment containing PCBs, capacitors and transformers, was purchased and imported into Croatia while it was still a part of Yugoslavia (until 1991), from the Slovenian factory ISKRA – Semič, Serbian factories MINEL – Ripanj and AVALA – Beograd, and from the former USSR and GDR as well as from other European and world manufacturers (ASEA – Sweden). Devices purchased from Slovenia and Serbia were not registered as imported equipment, and thus it is not possible to establish the amount of such equipment purchased and imported into Croatia at that time.

It is also not possible to obtain data on the potential import of equipment containing PCBs for the period since 1991. Namely, the customs tariff, which provides means for obtaining data on import of certain articles into the Republic of Croatia, does not have a specific tariff number for transformers/capacitors containing PCBs and therefore there are no data concerning amounts of equipment containing PCBs imported since 1991.

According to data obtained from the Ministry of Labour and Social Welfare, there was a single application for the approval of PCB use in closed systems, submitted by Petrokemija d.d. pursuant to Article 2 of the Ordinance on occupational health and safety when working with substances containing polychlorinated biphenyls, polychlorinated naphthalenes and polychlorinated terphenyls (OG 7/89).

4.2.10. Import of liquids containing PCBs

Concerning the import of PCBs, due to lack of time and complexity of the system for monitoring import of certain articles through customs tariff number, data on imported amounts of polyhalogenated bi/terphenyls for the period from 1996 to 2007 were obtained and specified as data on PCBs import. Namely, the customs tariff contains the same code for polychlorinated biphenyls together with polychlorinated terphenyls (PCT) and polybrominated biphenyls (PBB), and thus data on amounts imported into the Republic of Croatia can be obtained through that number. According to the data obtained from the Customs Administration of the Republic of Croatia, in the period from 01 July 1996 to 31 December 2001, a total of 167 tonnes of these liquids were imported and it is assumed that they contained only PCBs. Table 16 contains data on annual amounts of imported liquids for the specified period.

According to the data obtained from the Customs Administration of the Republic of Croatia, 2.09 kg of liquids containing biphenyls and terphenyls were imported in the period after 2002.

Table 16. Quantity of liquids containing PCBs, PCTs and PBBs imported into the Republic of from 1996–2001 *

Year of import	Amount/kg
1996 (01 July – 31 December)	15,724.40
1997	47,713.45

1998	30,954.43
1999	21,582.80
2000	37,901.91
2001	13,287.36
TOTAL (1996-2001)	167,164.35

* source: Ministry of Finance of the Republic of Croatia, Customs Administration of the Republic of Croatia.

4.2.11. Import of PCB waste

Pursuant to the Waste Act (OG 178/04, Article 47 paragraph 1), the import of hazardous waste, including waste contaminated by PCBs, into the Republic of Croatia is prohibited. According to data from the Ministry of Environmental Protection, Physical Planning and Construction, there is no import of waste containing PCBs into the Republic of Croatia.

4.2.12. Export of PCBs

The Republic of Croatia does not produce PCBs or equipment (capacitors, transformers containing PCBs) and in line with that does not export articles containing PCBs.

The only export of PCBs from the Republic of Croatia is the export of waste containing PCBs. This is conducted in accordance with the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal, and primarily concerns the export of transformers, capacitors and other PCB waste. They are exported for the purpose of their treatment in incineration plants for hazardous waste in France, Belgium or for disposal in German salt mines.

The collection and disposal of waste containing PCBs is conducted by companies authorised by the competent institutions (Ministry of Environmental Protection, Physical Planning and Construction).

During the period from 1994 to 2007, a total of 406.2 tonnes of waste containing PCBs was exported from the Republic of Croatia. Amounts of exported capacitors, transformers, liquid PCBs and other waste contaminated by PCBs are specified in table 17.

Table 17. Quantities of exported PCBs waste from the Republic of Croatia in the period 1994 – 2007*

Year of export	Amount of exported transformers and capacitors/t	Amount of exported liquids containing PCBs and other waste contaminated by PCBs/t
1994	23.2	0
1995	36.2	4.3
1996	59.6	0
1997	15.2	1
1998	38.1	4.0
1999	15.8	0

2000	43.9	0.5
2001	12.8	0
2002	13	0
2003	data unavailable	data unavailable
2004	23.8	10.5
2005	45.40	0
2006	38.45	0,65
2007	19.78	0
TOTAL (1994 – 2007)	385.23	20.95
TOTAL	406.18	

* In 1994, the Waste Act was passed (OG 178/04, 111/06, 60/08), the Basel Convention was ratified, and systematic monitoring of waste export began (source: Croatian Environment Agency).

4.2.13. Market situation and customs control

In the Republic of Croatia, the Act on Customs Tariff regulates rules concerning the method for calculating customs, rules on the classification of specific articles into tariff numbers and subheadings as well as tariff rates of the Customs Tariff specified in the Regulation on the Customs Tariff which is published annually.

In the Regulations currently in force, polychlorinated biphenyls are classified together with polychlorinated terphenyls and polybrominated biphenyls in Section VI (Products of Chemical or Allied Industries), Chapter 38 (Miscellaneous Chemical Products), Tariff number 38.24 (Prepared Binders for Foundry Moulds or Foundry Cores; Chemicals Products and Preparations of Chemical or Allied Industries (including those consisting of natural product mixtures, which are not mentioned or included elsewhere) under the following tariff headings:

Tariff heading 3824.7900 - - mixtures and preparations containing oxirane (ethylene oxide), polybrominated biphenyls (PBB), polychlorinated biphenyls (PCB), polychlorinated terphenyls (PCT) or tris (2.3- dibromo-l-propanol) phosphate;

Tariff heading 3824.8200 - - - ... containing polychlorinated biphenyls (PCB), polychlorinated terphenyls (PCT) or polybrominated biphenyls (PBB).

As of 31 December 2001, polychlorinated biphenyls have the tariff heading 27109100 – waste oils containing PCBs, PCTs and PBBs and 29029030 – other cyclic carbonhydrogens-biphenyls triphenyls.

Transformers and capacitors containing PCBs were not especially tariffed and there is no special customs control and monitoring in relation to these devices.

4.2.13.1. Potential for illegal trade

Taking into consideration that the import of PCBs is prohibited and import of equipment containing PCBs is permitted until 31 December 2010, the potential for illegal trade is assessed as relatively small.

4.2.14. Existing stockpiles, waste containing PCBs and locations for disposal

PCBs stockpiles imply equipment containing PCBs, which is sound but not in operation and on a stand-by in case of failure of a device in operation and stand-by liquid PCBs. According to the data from the database and obtained in a survey, around 57,680 kg, i.e. 15 transformer items containing PCBs which are on stand-by and around 33,7450 kg, i.e. 957 capacitor items containing PCBs on stand-by are registered on the territory of the Republic of Croatia.

Registered stockpiles of liquids containing PCBs (unused) in the Republic of Croatia amount to 1 tonne.

4.2.14.1. Wastes containing PCBs

Wastes containing PCBs include:

– Transformers and capacitors containing PCBs, that are taken out of operation and are not scheduled for further use;

– waste liquids containing PCBs;

– solid waste containing PCBs (metals, non-metals, land contaminated by PCBs), which may occur due to leakage or contamination of equipment or during the reclamation or clean-up of facilities or locations contaminated by PCBs.

Transformers containing PCBs which are scheduled for disposal are not registered on the territory of the Republic of Croatia.

Around 42,900 kg or 1,992 capacitors containing PCBs were registered for disposal and they are currently stored within industrial installations, i.e. within the factory circle of the waste owner.

Around 5 tonnes of waste liquids containing PCBs, 5 kg of waste metal contaminated by PCBs and around 12 kg of other material contaminated by PCBs are registered.

4.2.14.2. Disposal sites

In the Republic of Croatia there are legal regulations which lay down sites for disposal of PCBs, or hazardous waste in general.

Requirements which a certain premises have to fulfil in order to become a hazardous waste landfill site are provided in the Ordinance on the methods and conditions for the landfill of waste, categories and operational requirements for waste landfills (OG 117/07).

There are no legalized, organised sites for the disposal of PCBs waste, instead that waste is exported for disposal.

According to the database on landfills and waste dumps (1993–1997) there are approximately 600 sites registered in the Republic of Croatia where waste has been or is disposed of. There is a possibility of finding waste containing PCBs on all these sites.

4.2.15. National capacities for PCB monitoring

In the Republic of Croatia, PCB compounds are determined in various media such as air, soil, sediment, animal tissues, oils, human milk and serum.

The State Directorate for Waters of the Republic of Croatia (present Water Management Directorate at the Ministry of Regional Development, Forestry and Water Management), has published a list of laboratories authorised to conduct analysis of certain substances in water, including PCBs in accordance with Article 17 paragraph 5 of the Ordinance on requirements to be fulfilled by accredited laboratories (OG 78/97).

There is no official list of accredited laboratories for the analysis of PCBs in other media.

4.2.16. Premises for storing and destroying PCBs

In the Republic of Croatia there is a legal framework laying down the requirements for sites for the storing and destruction or treatment of hazardous waste, including PCB waste. Requirements that have to be fulfilled by certain premises in order to become a facility for the storage or treatment of hazardous waste are provided in the Ordinance on waste management (OG 23/07, 111/07).

Sites for the temporary storage of waste are premises within factory circles throughout the territory of the Republic of Croatia where factories temporary store their own equipment containing PCBs that is either faulty or on stand-by or in the storage facilities of companies carrying out the management of PCB waste.

4.2.17. Inspection of sites contaminated by PCBs

There is no database on sites contaminated by PCBs. On the basis of inspections, contacts with research institutions and an overview of published works on research and establishment of PCBs levels on the territory of the Republic of Croatia, and in relation to level of research and knowledge of a specific site, sites contaminated by PCBs may be divided into 3 types of sites:

1) sites suspected to be contaminated by PCBs, but where no measurements of PCB presence have been conducted. Such sites are: Sisak, Karlovac, Gospić, Osijek – Ernestinovo, Vukovar, Pakrac, Šibenik – aluminium and ferroalloy plant, Lipik – or sites which were in the zones of the heaviest war devastation.

2) sites where the presence of PCBs has been established, but not the extent and scope of PCB contamination and where land reclamation has not been performed. Such locations are electrical substations and their surroundings in Delnice, Zadar, Šibenik – Bilice, Kaštel Sućurac and Dubrovnik (Rijeka Dubrovačka).

3) sites – facilities where the presence of PCBs has been established and have undergone the reclamation procedure. Two facilities owned by HEP in which a breakdown of devices containing PCBs occurred have been treated so far.

Sites have been contaminated due to:

• war devastation in the Homeland War (1991–1995) in which many military vehicles, electrical power, industrial and other facilities were damaged or destroyed, thus possibly causing PCBs leakage;

• explosions, overheating, evaporation and leakage from transformers and capacitors;

• unprofessional handling of equipment containing PCBs, areas where non-operating devices containing PCBs are improperly disposed of;

• incidents in industrial plants;

• uncontrolled disposal of devices containing PCBs on existing, unequipped waste landfills in Croatia.

Table 18 specifies data on sites contaminated by PCBs.

Table 18. Weight portions (mg kg^{-1}) of PCBs in samples from contaminated locations

Site	Sampling site	Sampling year	Sampling depth (cm)	Number of samples	PCBs (median)
Delnice	oil pit	1996	/	2	48.935
	2 m from transformer	1996	0-10	1	0.021
Kaštel Sućurac	substation	1996	/	1	14.714
	oil from hydraulic station	1996	/	1	18.968
Kamala near Dubrovnik	oil pit	1996	/	2	17.314
	20 m from capacitor	1996	0-10	2	1.64
Bilice near Šibenik	Capacitor	1996	0-5	2	2094.151
	2.5 m from capacitor	1996	0-5	1	470.320
Zadar	1 m from capacitor	1996	0-10	4	172.909
	1 m from capacitor	1996	20-30	5	99.579
	7-14 m from capacitor	1996	0-10	2	0.286
	12.5-16 m from capacitor	1996	0-10	5	0.112
Zadar	Region Vruljica	2000	0-10	3	0.112
Korenica	Region Likograf	1997	0-10	3	0.018

Source: Picer *et al*., 1998 and 2000

The description and position of locations contaminated by PCBs, and their potential threat to the environment and human health:

– Delnice: Electrical Substation 35/10 kV is located at the exit from Delnice towards Rijeka on a plateau (around 20 metres) on the south side of the Zagreb – Rijeka motorway and is located relatively close to residential houses. The shelled transformer is located on the south side of the substation building. Soil samples were taken in the immediate vicinity of the shelled transformer and from the oil pit, which is located 7 m away from the soil sampling site.

Basis on the analysis of polychlorinated biphenyls on the soil and extract from the oil pit, it can be established with a great deal of certainty that significant contamination by polychlorinated biphenyls did not occur on the territory of the Delnice electrical substation.

– Kaštel Sućurac: Samples taken from the soil scraped off the rocks underneath the capacitor battery in the substation installation of the Split Iron Plant and oil from the hydraulic station (both from the installation in the iron plant building with a concrete surface).

The soil scraped off the rocks underneath the capacitor battery in the substation installation of the Split Iron Plant shows contamination by polychlorinated biphenyls. The level of contamination by polychlorinated biphenyls shows that there is no real threat of contamination of the surrounding land and aquatic system.

– Dubrovnik: Electrical Substation Komolac 110/35/10 kV is located near the entrance to Dubrovnik at Komolac near Dubrovnik directly by the road Ston – Dubrovnik, relatively close to (hundred metres) to Rijeka Dubrovačka, and in the immediate vicinity of residential buildings. Samples of oil mass were taken from the oil pit located in the direct vicinity of the hit battery, and land material from the channel 20 m away from the hit capacitor battery.

Samples of oil extracts taken from the oil pit of the electrical substation at Komolac near Dubrovnik did not show significant level of PCBs. Considering the distance from the shelled capacitor battery, the soil shows a significant level of polychlorinated biphenyls.

– Šibenik: the Bilice Electrical Substation 220/110/30 kV is located above the City of Šibenik at a distance of 2 km, in a valley relatively close to residential houses.

According to data obtained by HEP Prijenos d.o.o., 10 capacitor batteries were damaged in war devastation at the site of the Bilice electrical substation 210/110/30 kV.

The shelled capacitor batteries are located on the southern side of the electrical substation field. The soil around batteries is covered by concrete for a distance of some twenty metres around and therefore land samples were taken from a smaller crack in the immediate vicinity of the shelled capacitors, and from another crack 2.5 meters away from the first site.

The soil underneath shelled capacitor batteries shows a considerable level of soil contamination and, in general, the highest level of soil contamination by polychlorinated biphenyls in the karst region of Croatia.

– Zadar: Electrical Substation 110/35 kV is located in northeastern part in close proximity to the City of Zadar. On its southern side, the substation is close to residential houses and gardens, and somewhat further away, on its northern side.

The results of soil analysis of the examined area show significant contamination by polychlorinated biphenyls.

According to the data obtained by HEP Prijenos d.o.o., 13 capacitor batteries were damaged by artillery in the war devastation at the site of the Zadar electrical substation TS 110/35 kV.

Based on the geological and pedological data on the soil of the Republic of Croatia, it may be established that karst sites are particularly sensitive to potential contamination by polychlorinated biphenyls. The reason for this is the porosity of karst fields, due to which PCBs can easily penetrate into underground waters. In majority of Croatian karst regions and particularly those caught by the war, issues concerning waste disposal and treatment of contaminated sites have not been solved and meanwhile, the majority of this region is rich in water springs and well fields. Most of the karst region belongs to the area of very sensitive ecosystems. Aggravation of water quality in those areas could cause unforeseen consequences for water supply and life in rivers and the sea.

Contamination of agricultural areas represents a direct hazard for human health. The regions with the greatest agricultural potential and the best opportunities for the development of agriculture, i.e. Slavonia and Baranja, suffered massive war devastation. These areas were the sites of direct conflicts in which many military vehicles and industrial installations were damaged. Preliminary soil examinations were conducted around Vukovar for the purpose of establishing contamination by polychlorinated biphenyls. The results of 15 soil samples analysis did not show significant local soil contamination.

In order to obtain the big picture of soil contamination status in the Republic of Croatia, it is recommended that systematic analysis be conducted in all areas suspected to be contaminated by PCBs.

Basis on the analyses conducted to date and the data provided in the previous section, there is some suspicion of major contaminations by PCBs compounds of two karst sites (Bilice and Zadar). It is necessary to assess the real threat to spring waters and watercourses at those sites, land absorption properties and potential for the elimination of PCBs from the land and water.

4.2.18. Present experiences concerning reclamation of sites contaminated by PCBs in Croatia

To date, reclamation of sites contaminated by PCBs have been conducted at just two sites in Croatia:

– Komolac – contamination caused by war destruction

Based on information obtained by workers of Croatian Electric (HEP) concerning PCBs contamination in the electromagnetic facility of the Network Tone Frequency (NTF) command at Komolac near Dubrovnik damaged in the war, reclamation of this facility was conducted in 1994. The reclamation works were conducted by the company C & G d.o.o. from Zagreb. The building in which the network tone frequency command is located was shelled and damaged. This resulted in physical damage of the network tone frequency

command building, which caused overvoltage or a short circuit at the capacitor. Overburdening of the capacitor led to the explosion of the capacitor, impregnated with PCBs, which caused a smaller extent of contamination of the network tone frequency command premises, and medium intensity soot contamination (containing PCBs). The reclamation of spilt liquids containing PCBs was carried out using absorptive materials: sawdust, cloth and special absorption material. Mechanically removed surfaces were levelled and painted. The network tone frequency command facility at Komolac is the first war damaged facility contaminated by PCBs to undergo reclamation.

– PLOMIN thermal power plant – contaminated due to operation of devices containing PCBs

The project of reclamation of PCBs contamination in the Plomin thermal power plant (conducted in 1991) included maintenance and replacement of pyralene transformers, reclamation of premises contaminated by PCBs, temporary storage, transport and destruction of PCBs and pyralene transformers.

4.2.19. Conclusions

Based on the compiled data, the following can be concluded:

In the Republic of Croatia, there are regulations on the prohibition of import of equipment containing PCBs (applicable to 31 December 2010);

The deadlines for the disposal of equipment containing PCBs are established by the Ordinance on the management of polychlorinated biphenyls and polychlorinated terphenyls (OG 105/08), which lays down the management of equipment containing PCBs to 31 December 2010;

The same Ordinance prescribes the obligation of a PCB equipment owner to submit the list of equipment with PCBs whose volume exceeds 5 dm^3 to the competent body by 31 March 2009;

• in the Republic of Croatia liquids containing PCBs are not manufactured;

The import of liquids containing PCBs was recorded, but in the period since 2002 is very small (cca 2 kg);

• the import of waste containing PCBs and other hazardous waste is prohibited;

• according to the data from the database and the 2003 survey in the Republic of Croatia, around 57,680 kg or 15 transformers containing PCBs which are on standby-by as well as 33,7450 kg or 957 standby-by capacitors with PCBs were recorded;

• around 5 tonnes of waste liquids containing PCBs, 5 kg of waste metal contaminated by PCBs and around 12 kg of other material contaminated by PCBs were recorded;

• around 600 sites where waste has been or is disposed were recorded. At all these sites, it is possible to find disposed waste containing PCBs;

• on the territory of the Republic of Croatia there are no legalized, equipped sites for the disposal of waste containing PCBs, but such waste is exported for disposal;

The total amount of PCBs in closed systems in the Republic of Croatia is 1,391,593 kg, i.e. 22 859 capacitors of total weight 655,705.9 kg and 311 transformers of total weight 735,887.8 kg;

The largest owner of capacitors containing PCBs in the Republic of Croatia is Croatian Electric, which owns 3,660 capacitor items (total weight of around 100 tonnes), or 15% of the total weight of all capacitors in the Republic of Croatia.

The largest owner of transformers containing PCBs in the Republic of Croatia is the chemical industry with 56 transformers with the total weight of around 238.5 tonnes, which makes up 33% of the total weight of all transformers in the Republic of Croatia, and textile and metal processing industry with 34 transformers with the total weight of around 177 tonnes, which makes up 25% of the total weight of all transformers in the Republic of Croatia.

• in the Republic of Croatia there are no legalised sites for storing/disposal/treatment of waste containing PCBs;

• waste containing s PCBs is exported from the Republic of Croatia for disposal;

• the institutional and legal framework governing the area of defining responsibility for environmental contamination by PCBs is established and further prescribed by the Environmental Protection Act;

• the major reason for land contamination by PCBs is war devastation which took place during the Homeland War (1991–1995);

• total level of PCBs contamination is also affected by peaceful reasons: unprofessional handling of equipment containing PCBs, incineration of industrial and municipal waste in uncontrolled conditions, evaporation and leaking from transformers and capacitors.

4.3. DDT – Annex B to the Stockholm Convention

DDT has never been synthesized on Croatian territory though various formulations have been prepared. Agricultural use of DDT was prohibited in Croatia in 1972. DDT was not used for the purpose of preventing disease spread in the last fifty years, as there was no occurrence of malaria in that period, and the application and production of dicofol was prohibited. Available data on the production, use, export are given in Section 2.3.1 along with other POPs pesticides.

4.4. Situation assessment in relation to accidental production and release of PCDD/PCDFs, PCBs and HCBs – Annex C to the Stockholm Convention

In the area of chemicals from the ANNEX C there is legislation governing the obligation to monitor and measure PCDD/PCDF emissions into the air, but not HCBs and PCBs. As the major source of emissions in Croatia is the combustion of fuel in power generating installations, and uncontrolled combustion processes caused by burning wood for the heating of households, it is necessary to educate the population and undertake activities for the purpose of stimulating the use of fuels that decrease emissions of these compounds (coal, wood – natural gas). In the future, it will be necessary to stipulate and prescribe continuous monitoring of emissions of PCDD/PCDFs, HCBs and PCBs.

4.4.1. Regulations from the area of PCDD/PCDFs

The text below specifies acts and implementing regulations which refer to environmental emissions of PCDD/PCDFs:

– Air Protection Act (OG 178/04, 60/08)

– Regulation on monitoring pollutant emissions from stationary sources into the air (OG 21/07)

– Ordinance on monitoring air quality (OG 155/05)

– Waters Act (OG 150/05)

– Regulation on hazardous substances in water (OG 78/98)

– Agricultural Land Act (OG 66/01, 87/02, 90/05)

– Ordinance on the protection of agricultural land from the contamination with hazardous substances (OG 15/92)

The Act on the Ratification of the Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Nitrogen Oxides and their Transboundary Fluxes (OG – IT 11/06)

Reports on PCDD/PCDF emissions are a part of regular annual reports on pollutant emissions into the air from the territory of the Republic of Croatia. The balance of persistent organic pollutant emissions, including PCDD/PCDF, was initiated in the Republic of Croatia in 1996 in accordance with the international EMEP/CORINAIR methodology, officially adopted by the executive body of the Convention on Long-Range Transboundary Air Pollution. The obligation of specifying emissions ensues from the Air Protection Act (OG 178/04 and 60/08). The calculation of dioxins and furans emissions was conducted in line with the SNAP 97 nomenclature of the EMEP/CORINAIR methodology.

Due to the lack of time and insufficient financial resources, the inventory did not include emissions of PCBs and HCBs into the environment. This part shall be included during the NIP implementation.

4.4.2. Calculation of PCDD/PCDF emissions

The chemical methodology entitled *Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases* (UNEP 2001) is used for the inventory of PCDD/PCDF UNEP, and it ensures an integrated, consistent and clear inventory of PCDD/PCDF emissions into the environment.

The UNEP methodology proposes five basic steps in the procedure of dioxin and furan inventory:

(1) identification of main categories of PCDD/PCDF sources,

(2) identification of sub-categories, existing activities and potential ways of spreading PCDD/PCDF into the environment,

(3) collection of data on specific processes,

(4) quantification of PCDD/PCDF sources, calculation of emissions by means of emission factors,

(5) cumulative inventory results.

Pursuant to the UNEP methodology, the main PCDD/PCDF sources are divided into 10 categories, and each category consists of several subcategories, as shown in Table 19. The table also presents potential pathways for the spread PCDD/PCDF into the environment, with symbols for the major potential pathway (X) and additional potential pathways which should also be taken into consideration (x).

Table 19. Main categories and subcategories of sources and potential pathways for the spread of PCDD/PCDFs into the environment

No.		Main categories and subcategories of sources PCDD/PCDF	Potential pathways for spreading PCDD/PCDF				
			air	water	soil	products	waste
1		Waste incineration plants	X				X
	a	Incineration of solid municipal waste	X	(x)			x
	b	Incineration of hazardous waste	X	(x)			x
	c	Incineration of medical waste	X	(x)			x
	d	Incineration of waste grinding residues	X				x
	e	Incineration of municipal sludge	X	(x)			x
	f	Incineration of waste wood mass and biomass	X				x
	g	Incineration of animal carcasses	X				x
2		Production of iron and coloured metals	X				X
	a	Sintering of iron ores	x				x
	b	Coke production	x	X	x	x	x
	c	Iron and steel production	x				x
	d	Copper production	x				x
	e	Aluminium production	x				x
	f	Lead production	x				x
	g	Zinc production	x				x
	h	Brass production					
	i	Magnesium production		X			x
	j	Production of other coloured metals	x	X			x
	l	Scraps from metal grinding	x				x
	m	Thermal treatment of materials	x	(x)	x		x
3		Production of energy and heating	X				X
	a	Use of fossil fuels	X				X
	b	Use of biomass	X				X
	c	Incineration of waste disposal gas	X				X

	d	Household furnaces (biomass) and cooking	X				X
	e	Household furnaces (fossil fuels)	X				X
4		Production of mineral products	X				X
	a	Cement production	X				X
	b	Lime production	X				X
	c	Brick production	X				X
	d	Glass production	X				X
	e	Ceramic production	X				X
	f	Asphalt preparation	X				X
5		Transport	X				
	a	Four stroke engine	X				
	b	Two stroke engine	X				
	c	Diesel engines	X				(x)
	d	Devices on heavy heating oils	X				(x)
6		Uncontrollable burning processes	X				X
	a	Burning of biomass	X	(x)	(x)		x
	b	Waste burning and fires	X	(x)	(x)		X
7		Production and use of chemicals and consumer goods	X	X		X	X
	a	Production of pulp and paper	x	X		x	x
	b	Chemical industry	x	X	(x)	x	x
	c	Oil industry (refineries)	x				x
	d	Textile industry		X		x	
	e	Leather industry		X		x	
8		Various	X	X	X	X	X
	a	Drying of biomass (wood)	x				
	b	Cremating	x				X
	c	Steaming (smokehouses)	x			x	X
	d	Chemical cleaning		X	x	x	
	e	Smoking tobacco	x				
9		Waste disposal		X	X		
	a	Waste disposal landfills and illegal waste landfills					
	b	Treatment of sewage sludge					
	c	Dumping waste into rivers, lakes and the sea					
	d	Disposal of waste oil (non-thermal)					
10		Identification of potential focal points	Records possible by expert on site assessment				
	a	Production of chlorinated organic substances			X		
	b	Chlorine production			X		
	c	Formulation of chlorinated phenols			X		
	d	Use of chlorinated phenols	x	X	x	x	

e	Production and processing of wood fabric		X	X	x	X
f	Transformers and capacitors filled with PCBs				x	X
g	Illegal waste landfills from category 1-9	x	X	X		X
h	Locations of accidents		X	x		X
i	Extraction of sediments (treatment)					X
j	Locations where there is clay			x		

Quantification of PCDD/PCDF sources, calculation of emissions by means of external factors

The following equation is the basis for the calculation of annual PCDD/PCDF emissions into the environment:

Emission (PCDD/PCDF)/year = emission factor x activity (1)

Emission factor is the mass of the emitted pollutant per activity unit, determined by measurement or on the basis of experience from observation of similar processes. It is expressed in terms of the toxic equivalent (I-TEQ) in relation to 2,3,7,8-tetrachlordibenzo-p-dioxine (TCDD), calculated with the international model of equivalent toxicity factor, per weight unit of input raw material or output product (e.g. µg I-TEQ per tonne of produced cement).

Activity is the annual consumption of input raw material or annual production of specific industrial products (e.g. tonnes of cement/year).

Annual emission of PCDD/PCDF is expressed in grams I-TEQ per year.

In some cases, the following equation is used to calculate annual PCDD/PCDF emissions:

Emission of (PCDD/PCDF)/year = concentration x flow (2)

Flow is expressed as the mass flow of released gas, liquid or solid material per year e.g. m^3 $year^{-1}$ or tonne $year^{-1}$. It is calculated as the product of mass or volume flow per hour (m^3 h^{-1} or t h^{-1}) and number of working hours per year (h $year^{-1}$).

Annual PCDD/PCDF emission is determined by two factors:

1. Flow or activity expressed as the product (e.g. cement, steel, etc.), input raw material (e.g. hazardous waste, coal, diesel, etc.) or output substance from processes (e.g. waste water),

2. Emission factors (EF) which are either applied or are taken from the UNEP manual Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP, 2001), or reliable data from conducted measurement (e.g. ng TEQ L^{-1}) or the product of factors from the Toolkit and data from the conducted measurement.

Total emission is obtained by summing the annual emissions of specific sub-categories in order to obtain emission according to the potential pathway of the spreading of PCDD/PCDFs into the environment for all ten major categories, after which the main categories of dioxin and furan sources are summed up.

Previous monitoring of PCDD/PCDF emissions into the environment in the Republic of Croatia

Reports on PCDD/PCDF emissions are an integral part of regular annual reports on pollutant emissions into the air from the territory of the Republic of Croatia. The balance of persistent organic pollutant emission, including PCDD/PCDF, was initiated in the Republic of Croatia in 1996 in line with the EMEP/CORINAIR international methodology, officially adopted by the executive body of the Convention on Long-Range Transboundary Air Pollution (CLRTAP). The obligation of expressing emissions stems from the Air Protection Act (OG 178/04, 60/08). The calculation of dioxin and furan emission was conducted in line with the SNAP 97 nomenclature of the EMEP/CORINAIR methodology for 2000 and is presented in Table 20.

Table 20. Emission of PCDD/PCDF from specific sectors in Croatia in accordance with SNAP 97 nomenclature of the EMEP/CORINAIR methodology, for 2000

1. COMBUSTION IN PUBLIC THERMAL PLANTS; HEATING PLANTS AND ENERGY TRANSFORMATION INSTALLATIONS

Fuel	EF (ng t^{-1})	Consumption (t $year^{-1}$)	Emission (g I-TEQ $year^{-1}$)	Total (g g I-TEQ $year^{-1}$)
stone coal	165.0	569,800	0.09402	
coke (ref. Sisak)	165.0	0	0.00000	
extra light heating oil	21.4	1,100	0.00002	
heating oils	100.5	392,000	0.03940	
natural gas	0.00102*	519,200,000	0.00053	
refinery gas	1.0	262,400	0.00026	0.13

* EF in ng m^{-3}

2. COMBUSTION IN SMALL SCALE ECONOMY, INSTITUTIONS, HOUSEHOLDS, AGRICULTURE, FORESTRY AND FISHERY

Fuel	EF (ng t^{-1})	Consumption (t $year^{-1}$)	Emission (g I-TEQ $year^{-1}$)	Total (g g I-TEQ $year^{-1}$)
dark coal	50,000.0	21,500	1.07500	
brown coal	50,000.0	16,200	0.81000	
heating wood	87,000.0	1,043,000	90.74100	
extra light heating oil #	1,000.0	402,700	0.40270	
extra light heating oil	21.4	4,400	0.00009	
heating oils	1,000.0	25,400	0.02540	
heating oils	100.5	37,000	0.00372	
natural gas #	0.00102*	609,300,000	0.00062	
natural gas □	0.00102*	53,000,000	0.00005	
liquefied oil gas #	1.0	69,000	0.00007	
liquefied oil gas □	1.0	0	0.00000	93.06

* EF in ng m^{-3} #- general consumption □- public boiler plants and heating plants

3. COMBUSTION IN INDUSTRY

Fuel	EF (ng t^{-1})	Consumption (t $year^{-1}$)	Emission (g I-TEQ $year^{-1}$)	Total (g g I-TEQ $year^{-1}$)
stone coal	165.0	53,200	0.00878	
dark coal	165.0	28,200	0.00465	
brown coal	165.0	14,400	0.00238	
coke	165.0	37,700	0.00622	
wood (burnable waste)	60,000.0	173,250	10.39500	
extra light heating oil	21.4	72,200	0.00155	
heating oils	100.5	543,400	0.05461	
refinery gas	1.0	40,700	0.00004	
natural gas □	0.00102*	844,500,000	0.00086	
liquefied oil gas #	1.0	23,600	0.00002	10.47

* EF in ng m^{-3}

4. PRODUCTION PROCESSES WITHOUT FUEL CONSUMPTION

Process	EF (ng t^{-1})	Consumption (t $year^{-1}$)	Emission (g I-TEQ $year^{-1}$)	Total (g g I-TEQ $year^{-1}$)
steel production (EL)	70,000.0	71,021	4.97147	4.97

5. ROAD TRANSPORT

Fuel	EF (ng t^{-1})	Consumption (t $year^{-1}$)	Emission (g I-TEQ $year^{-1}$)	Total (g g I-TEQ $year^{-1}$)
engine lead gasoline	500.0	262.100	0.13105	
diesel fuel	n.p.	557.800		
liquefied gas	1.0	9.800	0.00001	0.13

6. OTHER MOVABLE MACHINES

EF (ng t^{-1})	Consumption (t $year^{-1}$)	Emission (g I-TEQ $year^{-1}$)	Total (g g I-TEQ $year^{-1}$)
n.p.	53.200		
n.p.	72.300		
100.5	1.400	0.00014	0.0001

7. TREATMENT AND DISPOSAL OF WASTE

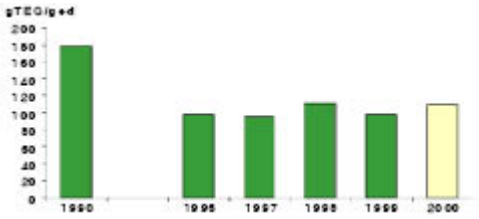
EF (ng t^{-1})	Consumption (t $year^{-1}$)	Emission (g I-TEQ $year^{-1}$)	Total (g g I-TEQ $year^{-1}$)

89,000,0	3,152	0.28053	0.28
		Total	109.05

In 2000, dioxin and furan emissions were increased approximately 11 per cent in comparison with 1999 due to increased consumption of heating wood in households.

The trend of dioxin and furan emissions is shown in Figure 1.

Figure 1 Trend of dioxin and furan emissions in Croatia



4.4.3.1. Assessment of dioxin and furan emissions into the environment during 2001

In the procedure for the assessment of dioxin and furan emissions into the environment, available data and existing reports of the Ministry of Environmental Protection, Physical Planning and Construction, various publications of the Central Bureau of Statistics, Croatian Chamber of Economy (HGK) and EKONERG, hazardous waste incineration plant – PUTO have been analysed. The methodology which was use for the assessment of dioxin and furan emissions in 2001 is UNEP Toolkit (Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases, UNEP 2001).

Main category 1 – Waste incineration plants

Subcategory 1b – hazardous waste incineration plant was recognised as the potential source of PCDD/PCDF emissions into the environment in this category

Subcategory 1b: Hazardous waste incineration plant

The PUTO hazardous waste incineration plant was in operation in Zagreb until 1 August 2002.

In 2001 3,967 t of hazardous waste was treated in the hazardous waste incineration plant. The PCDD/PCDF level was measured in the dry waste gas in the installation two times per year (LGA – Report on carrying out of emission measurements in the waste gas of the hazardous waste incineration plant, 2001). In case of both measurements, emission exceeded the value of 0.1 ng I-TEQ m^{-3} prescribed by the Regulation on limit values of pollutant emissions from stationary sources (OG 140/97).

In order to decrease uncertainty concerning the assessment of PCDD/PCDF emissions into the environment from the hazardous waste incineration plant, UNEP Toolkit emission factors are used. Emission factors range from 0.5 μg I-TEQ t^{-1}, for installations with best available technology, to do 35,000 μg I-TEQ t^{-1} for installations without an air pollution control system.

For the existing technology of hazardous waste incineration at PUTO, controlled burning and existing air pollution control system, in the assessment of PCDD/PCDF releases into

environment, an EF for air of 350 µg I-TEQ t^{-1} and an EF for residue/waste of 900 µg I-TEQ t^{-1} are used.

The assessment of PCDD/PCDF released into the environment from the main category 1 – waste incineration plant is shown in Table 21.

Table 21. Assessment of PCDD/PCDF emissions into the environment from the main category 1 – waste incineration plants

		EF (µg I-TEQ t^{-1})			Annual release (g I-TEQ $year^{-1}$)		
Class	Source category	Air	residue/waste Hovering particles	Ash	Amount(t)	Air	Residue/waste
2	Hazardous waste incineration plant Controlled burning, minimum air pollution control system	350	900	NO	3,967	1.4	3.6

* NO – not defined

Main category 2 – Production of iron and other coloured metals

The Croatian metal industry includes production of steel, seamed and seamless steel pipes, concrete steel, wire-rod, reinforcement construction nets, aluminium processing, metal casting, ferroalloys production and metal processing activities. In terms of total revenue in 2001, the major producers of metal and metal products are TLM Šibenik d.d., Dalekovod d.d. Zagreb, Ironworks Sisak, Trgometal d.d. Zagreb, Jedinstvo PMD Krapina, MIV Varaždin, Limex Donji Miholjac and others.

The following subcategories were recognised as potential sources of PCDD/PCDF emissions into the environment:

2c – production of iron and steel,

2d – secondary production of copper,

2e – secondary production of aluminium,

2f – secondary production of lead.

Subcategory 2c: Production of iron and steel

The ironworks in Sisak and Split (seam and seamless pipes, cold processing of pipes, steel beams, rolled concrete smooth and ribbed steel, rolled and drown wire) use a share of domestic raw materials in production (steel waste, lime, dolomite), while other raw materials are imported (ferroalloys, steel blocks, cold and hot rolled strips, hot rolled seamless pipes etc.). Capacities are insufficiently used, and the ironworks are technologically outdated.

Foundries in Croatia produce around 35,000 t casts per year. Despite the fact that foundries are technologically outdated, they produce high quality casts which are used in demanding industries such as car and shipbuilding industry.

In 2001, 208,229 t of steel and iron were produced in Croatia. Taking into consideration the technological outdatedness and the minimum air pollution control system, relevant EFs from the UNEP Toolkit were applied in the assessment. Depending on the technological process, these range from 4.3 do 10 µg I-TEQ t^{-1} for air and from 0.2 to 15 µg I-TEQ t^{-1} for residues/waste.

Subcategories 2d,2e,2f: Secondary production of copper, aluminium and lead

In 2001, a total of 2,060 t copper products, 52,385 t aluminium products and 1,165 t lead products were produced (secondary production).

The assessment of PCDD/PCDF released into the environment from the main category 2 – production of iron and other coloured metals is shown in Table 22.

Table 22. Assessment of PCDD/PCDF releases into the environment from the main category 2 – production of iron and other coloured metals

Subcategory	Class	Source category	Amount (t)	Emission factor (µg I-TEQ t^{-1})		Release (g I-TEQ $year^{-1}$)	
				Air	Waste	Air	Residue/ waste
		Production of iron and other coloured metals – TOTAL	263,839			3.11	22.33
c		Production of iron and steel– installations and foundries – Total	208,229			1.2	0.13
	1	Ironworks and Steelworks	57,993	10	15	0.6	0.1
	2	Foundry	150,236	4.3	0.2	0.6	0.03
d	2	Secondary production of copper	2,060	50	630	0.1	1.3
e	2	Secondary production of aluminium	52,385	35	400	1.8	20.9
f	2	Secondary production of aluminium	1,165	35	ND	0.01	0

* ND – not defined. Water, soil and products are not an important pathway for the release of PCDD/PCDF into the environment

Main category 3 – Production of power and heating

This category refers to combustion in thermal energy and power transformation installations, industrial combustion, and household combustion (biomass and fossil fuels).

In this category, the following subcategories were recognised as potential sources of PCDD/PCDF releases into the environment:

– 3a, 3b – installations using fossil fuels and biomass,

– 3d, 3e – household furnaces (biomass and fossil fuels).

The assessment of PCDD/PCDF emissions into the environment from the main category 3 – production of power and heating is shown in Table 23.

Table 23. Assessment of PCDD/PCDF emissions into the environment from the main category 3 – production power and heating

		Source category	Amount (t)		Emission factor (µg I-TEQ t^{-1})	Release (g I-TEQ $year^{-1}$)	
Subcategory	Class		Air	Residue/waste		Air	Residue/waste
		Production of power and heating – TOTAL			1,286,822	105.68	20.6
a		Installations using fossil fuels – total			176,645	0.4	0.3
	2	Coal furnaces	10	14	19,645	0.2	0.3
	3	Heavy fuel furnaces	2.5	ND	45,100	0.1	0
	4	Light fuel or gas furnaces	0.5	ND	111,900	0.1	0
b	2	Installations using biomass- total	50	15	12,200	0.6	0.2
d	2	Household furnaces – biomass	100	20	1,043,000	104.3	20.1
e		Small scale economy, institutions– fossil fuels – total			54,977	0.38	?
	1	Coal furnaces	70	5	543	0.04	?
	2	Oil furnaces	10	NA	30,019	0.3	0
	3	Natural gas furnaces	1.5	NA	24,415	0.04	0

* ND – not defined, NA – not applicable, pathway of PCDD/PCDF release into the environment is not relevant

Main Category 4 – Production of mineral products

The production category of mineral products includes mineral products production processes at high temperatures. In 2001, the following was produced in Croatia (according to subcategories):

– 4a – cement production: 3,246,120 t cement

– 4b – lime production: 252,613 t lime

– 4c – brick production: 1,862,506 t brick

– 4d – glass production: 142,201 t glass

– 4e – ceramics production: 56,530 t

– 4f – asphalt preparation: 441,331 t tarmac

The Assessment of PCDD/PCDF emissions into the environment is shown in Table 24.

Table 24. Assessment of PCDD/PCDF emissions into the environment from the main category 4 – mineral products production

Sub cat.	Class	Source category	Emission factor (µg I-TEQ t^{-1})		Amount (t)	Release (g I-TEQ $year^{-1}$)	
			Air	Residue/waste		Air	Residue/waste
		Mineral products production – TOTAL			5,919,917	2.333	0.01
a	3	Cement furnaces	0.05	0.003	3,246,120	0,2	0.01
b	1	Lime	10	ND	171,229	1.7	0
c	1	Brick	0.2	ND	1,862,506	0.4	0
d	2	Glass	0.015	ND	142,201	0.002	0
e	2	Ceramics	0.02	ND	56,530	0.001	0
f	1	Asphalt (preparation)	0.07	ND	441.331	0.03	0

* ND – not defined

Main category 5 – Transport

This category includes fuel combustion in transport. The category is divided into 4 subcategories:

– 5a – Otto – 4t (Four stroke engine)

– 5b – Otto – 2t (Two stroke engine)

– 5c – Diesel engines

– 5d – Engines using heavy heating oils

In 2001, the total amount of fuel consumption in transport amounted to around 1,323,402 t.

There are no available data on annual consumption of lead and leadless gasoline for Otto – 4s and Otto – 2s engines with or without a catalyst. Air is the only applicable way of release, and emission factors for PCDD/PCDF releases into the air is 0.1-4 μg I-TEQ t^{-1} according to the UNEP Toolkit. The assessment of PCDD/PCDF emissions into the environment is shown in Table 25.

Table 25. Assessment of PCDD/PCDF emissions into the environment from the main category 5 – transport

Subcat.	Class	Source category	Emission factor (μg I-TEQ t^{-1}	Amount (t)	Emission/release (g I-TEQ $year^{-1}$)
			Air		Air
		Transport-TOTAL		1,323,402	0.945
a		Four stroke engines – Total		661,572	0.505
	1	Lead fuel	2.2	209,680	0.5
	2	Leadless fuel without catalyst	0.1	45,189	0.005
	3	Leadless fuel with catalyst	0.00	406,703	0
b		Two stroke engines – Total		102,630	0.33
	1	Lead fuel	3.5	52,420	0.2
	2	Leadless fuel without catalyst	2.5	50,210	0.13
c	1	Diesel engines	0.1	557,800	0.1
d	1	Devices using heavy heating oils	4	1,400	0.01

Main category 6 – Uncontrollable combustion processes

The following subcategory was recognised in this category:

– 6a – biomass burning.

The average area caught by fire per fire is 57.69 ha (in karst areas 71.63 ha, on the mainland 15.36 ha). The annual average area caught by fire is 9,917 ha, of which 53% are state forests and forested land managed by Croatian Forests, and 8,949 ha or 47% of other area (private forests and agricultural land). An average of 23 t ha^{-1} biomass burns in a forest fire (EPA 1998).

For the subcategory from the UNEP Toolkit – uncontrolled combustion processes are the main pathways of PCDD/PCDF release into the air and soil. According to the UNEP Toolkit,

the emission factor for air amounts to 5 µg I-TEQ t^{-1} while for soil it amounts to 4µg I-TEQ t^{-1}, while other emission pathways are insignificant.

The assessment of PCDD/PCDF releases into the environment is shown in Table 26.

Table 26. Assessment of PCDD/PCDF releases into the environment from the main category 6 – uncontrolled combustion processes

Subcat.	Class	Source category	Emission factor (µg I-TEQ t^{-1})		Amount (t)	Release (g I-TEQ $year^{-1}$)	
			Air	Soil		Air	Soil
6		Uncontrolled combustion processes – TOTAL			433,918	2.2	1.7
a		Fires/combustion of biomass					
	1	Forest fires	5	4	433,918	2.2	1.7

On 1 January 2009, the Directorate for Forestry established the Registry of Forest Fires– a digital database on forest fires. This will enable the quantification of biomass per unit area, and consequently input data for the calculation of burnt biomass of areas caught by fires, i.e. of released dioxin and furan.

It is not realistic to expect permanent stations for monitoring emissions of harmful substances and sampling for forests and parks due to the unpredictability of forest fires.

The public company Croatian Forests owns 3 bioenergetic installations for motor fuel from forest biomass in the surrounding forests (Gospić, Ogulin, Delnice). The installations are still in the trial phase and therefore data required for the calculation of dioxin and furan emissions are easily available.

Main category 7 – Production and use of chemicals and consumer goods

This category includes:

– 7a – production of pulp and paper,

– 7b – chemical industry.

Approximate assessment of PCDD/PCDF releases into the environment on the basis of available data on technological processes and control systems is shown in Table 27.

Main category 8 – Other

This category includes the subcategory 8e – cigarette smoking.

Data on production of cigarettes in Croatia in 2001 were used. The emission factor for the air, as the only pathway of spreading, is 0.1 µg I-TEQ t^{-1}(according to UNEP Toolkit).

The approximate assessment of PCDD/PCDF emissions into the environment is shown in Table 28.

Table 27. Assessment of PCDD/PCDF emission into the environment from the main category 7 – Production and use of chemicals and consumer goods

Subcat.	Class	Source category	Emission factor (µg I-TEQ t^{-1})				Amount	Release (g I-TEQ $year^{-1}$)			
			Air	Water	Production	Residue/ waste	(t)	Air	Water	Production	Residue/ waste
		Production and use of chemicals and consumer goods – TOTAL					726,747	0.14	0.002	0.804	0.3
A		Pulp and paper – Total					578,835			0.8	
	3	Technical paper without bleaching			0.5		533,835			0.3	
	5	Recycled paper			10		45,000			0.5	
B	2	Chemical industry – Total					147,912	0.14	0.002	0.004	0.3
		EDC/VCM, EDC/VCM/PVC	0.95	0.015	0.03	2	147,912	0.14	0.002	0.004	0.3

Table 28. Assessment of PCDD/PCDF releases into the environment from the main category 8 – Other

Subcat.	Class	Source category	Emission factor (µg TEQ t^{-1})	Amount (t)	Release (g I-TEQ $year^{-1}$)
			Air		Air
		Various		14,567	0.001
e		Cigarette smoking			
	2	Cigarettes	0.1	14,567	0.001

Main category 9 – Management /disposal of waste

In the category of management /disposal of waste data for subcategory 9d are usable data for the assessment of PCDD/PCDF releases into the environment.

Subcategory 9d: Composting

In 2001, the total amount of composted waste amounted to 183,163 t. The emission factor is applicable only for the product in accordance with the UNEP Toolkit and amounts to 15 µg I-TEQ t^{-1}. Other pathways of spreading are not applicable. Total emission amounts to 2.7 g I-TEQ $year^{-1}$.

Total assessment of PCDD/PCDF releases into the environment (2001)

Table 29 shows the total assessment of PCDD/PCDF emissions into the environment for 2001

Table 29. Total assessment of PCDD/PCDF emissions into the environment, 2001

No.	Main PCDD/PCDF source categories	Release PCDD/PCDF (g TEQ $year^{-1}$)				
		air	water	soil	products	Residue/ waste
1	Waste incineration plants	1.4				3.6
2	Production of iron and coloured metals	3.1	?	?		22.3
3	Production of power and heating	105.7?				20.6
4	Production of mineral products	2.3				0.01?
5	Transport	0.9				
6	Uncontrolled combustion processes	2.2?		1.7		?
7	Production and use of chemicals and consumer goods	0.1	0.002?		0.8	0.3?
8	Miscellaneous	0.001?			?	?
9	Management/disposal of waste	?	?	?		2.7
1-9	Total	115.7?	0.002?	1.7?	0.8?	49.5?

*displayed values are medians; empty boxes mean that a potential pathway of spread is not significant

?- potential pathway of spread is significant, but EF or activity are missing

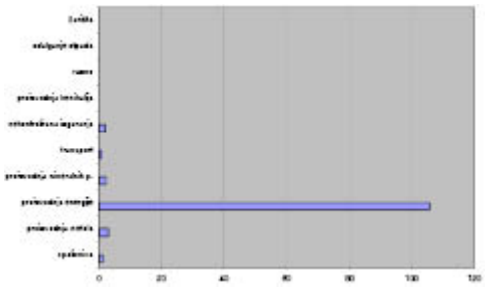
?- after the number means that the figure (data) is not representative as certain subcategories have not been fully processed

The most significant pathway of release of PCDD/PCDF is emission into the air and release into residues/waste.

The greatest emissions of dioxin and furan occur during the combustion of heating wood in households. Other significant sources are uncontrolled combustion processes, combustion of fuel in power installations (thermal power plant, boiler houses, etc.), production of iron and coloured metals, road transport, etc.

Dioxins and furans occur as by-products in industrial processes of processing and production, and combustion. They are found as waste/residue from the air pollution control system.

Figure 2. Assessment of PCDD/PCDF emissions into the environment from all sources in Croatia, in 2001



Air emission (g I-TEQ year^{-1})

Uncertainty of calculating PCDD/PCDF emissions into the environment

The assessment of calculation uncertainty is one of vital elements of dioxin and furan inventory in the Republic of Croatia. Information regarding the uncertainty of calculations is not intended to dispute the validity of the calculation, but to assist establishment of priorities and efforts for increasing calculation accuracy, as well as to help choose methodological options.

Total assessed uncertainty of PCDD/PCDF emission the environment is the combination of individual uncertainties of emission assessment elements:

– uncertainty in relation to indirect establishment of emission factors,

– uncertainty in relation to data on activities (technological processes, air pollution control systems, production),

– uncertainty in relation to individual measurements of PCDD/PCDF release levels in the environment.

Currently, the total quantitative calculation uncertainty is not specified, but relatively subjective quantitative assessments in specific categories, subcategories and specific processes have been collected for the purpose of further quantification of the assessment in the future.

4.4.4. PCDD/PCDF emissions from 2002 to 2006

In accordance with the SNAP 97 nomenclature of the EMEP/CORINAIR methodology, the calculation of dioxins and furans was conducted for the period from 2002 to 2006.

Table 30 shows the result of the dioxins and furans emission calculation.

Table 30. Result of PCDD/PCDF emission calculation from 2002 to 2006

Sector	Emission PCDD/PCDF g I-TEQ/year				
	2002	2003	2004	2005	2006
01 – Combustion in public thermal power plants, boiler houses, and installations for power transformation	0.19	0.25	0.20	0.21	0.21
02 – Combustion in non-industrial furnaces	71.74	93.06	90.05	85.99	86.39
03 – Combustion in industry	0.20	0.21	0.25	0.17	0.19
04 – Production processes	2.37	3.04	2.13	4.82	5.64
07 – Road transport	0.22	0.19	0.17	0.15	0.15
09 – Treatment and disposal of waste	0.20	0.03	0.03	0.03	0.04
TOTAL	74.9	96.8	92.8	91.4	92.6

4.4.5. Conclusions

In PCDD/PCDF inventory (according to the UNEP Toolkit), the main categories and subcategories have been recognised, as have the specific processes leading to PCDD/PCDF emissions into environmental components (soil, air, water), and into products and waste. The main pathways of PCDD/PCDF release are air emissions and the release of PCDD/PCDF into residues/waste.

The greatest dioxin and furan emissions occur during the combustion of heating wood in households. Other significant sources are uncontrolled combustion processes, combustion of fuel in power installations (thermal power plants, boiler houses, etc.), production of iron and coloured metals, road transport, etc. Dioxins and furans occur as by-products in industrial processes related to processing, production, and combustion. They are found as waste/residue from the air pollution control system.

Table 31. Result of the inventory of PCDD/PCDF emissions in 2001

Emission of PCDD/PCDF (g I-TEQ year^{-1})				
air	water	soil	products	residues/waste
115.7?	0.002?	1.7?	0.8?	49.5?

? – all results marked by a question mark are not representative as certain subcategories have not been fully processed

In the period since 2002, PCDD/PCDF inventory was conducted in accordance with the EMEP/CORINAIR methodology, and in accordance with the UNEP Toolkit. The obtained

data point to an increase of emissions in 2003 in comparison with 2002. All in all, it can be said that in 2006, dioxin and furan emissions were 41.9 per cent lower than in 1990.

According to the provisions from the Stockholm Convention, and in relation to results of the conducted inventory, the following guidelines have been established:

• to enable better insight into data on activities in specific categories and subcategories, as well as data on specific technological processes;

• to enable and conduct better insight into the status of equipment for reducing emissions and capacities of filters on installations, and in that sense correct emission factors for the assessment of PCDD/PCDF emissions;

• prescribe and organise monitoring of critical PCDD/PCDF emission sites at the national level, i.e. establish a network of stations where the level of PCDD/PCDF emissions into the environment would be measured at least twice a year;

• conduct measures for preventing the occurrence of uncontrolled burning in nature (waste burning, fires, etc.);

• apply best available techniques – BAT and best practices in environmental protection;

• improve waste management;

• avoid and reduce the use of substances known to cause PCDD/PCDF occurrence.

4.5. Review of available information on stockpiles, contaminated sites and waste

During the inventory of POPs compounds, the presence of larger stockpiles of POPs compounds and POPs waste was not established (except for equipment containing PCBs which is either faulty or on stand-by). Sites that are potentially contaminated by POPs compounds and which require further investigation to establish their level of contamination have been identified. An overview was conducted of the available results from testing and analysis from certain sites where equipment containing PCBs was destructed during the war (1991 -1995). Apart from this overview, during inventory and in cooperation with the Croatian Army and the Ministry of Defence, preliminary laboratory examination of soil in the territory of eastern Slavonia was carried out (area where a great number of military armoured vehicles were destroyed). The analysis results did not establish major local contamination by PCBs. As this is also an area of intensive agricultural production, these soil samples were tested for DDT and lindane, in addition to PCBs. The results also did not show any significant contamination at those sites.

Potentially contaminated sites were identified during the inventory and available data were compiled. Ranking of those sites has not yet been carried out due to a lack of time and resources. As it is necessary to conduct detailed sampling and analysis of those sites for the purpose of establishing priorities, that procedure will be carried out during the implementation of the NIP.

4.5.1. Requirements for exclusion in accordance with the provisions of the Stockholm Convention

Current and assessed production, use and release of POPs compounds are shown in Table 32.

Table 32. Current and assessed production, use and release of POPs compounds

Year	2002/03 (Inventory)	2005	2010	2020	2030
POPs pesticides					
Production	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)
Aldrin	0	0	0	0	0
Chlordane	0	0	0	0	0
Dieldrin	0	0	0	0	0
Endrin	0	0	0	0	0
Heptachlor	0	0	0	0	0
Hexaclorobenzene	0	0	0	0	0
Mirex	0	0	0	0	0
Toxaphene	0	0	0	0	0
Use	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)
Aldrin	0	0	0	0	0
Chlordane	0	0	0	0	0
Dieldrin	0	0	0	0	0
Endrin	0	0	0	0	0
Heptachlor	0	0	0	0	0
Hexaclorobenzene	0	0	0	0	0
Mirex	0	0	0	0	0
Toxaphene	0	0	0	0	0
DDT	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)
Production	0	0	0	0	0
Use	0	0	0	0	0
PCB	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)
Production	0	0	0	0	0
Use	1391	1391			
Closed and semi-closed systems	1391	1391	**	**	**
Open systems	*				
Release from unintentional production	(g I-TEQ)	(g I-TEQ)	(g I-TEQ)	(g I-TEQ)	(g I-TEQ)
PCDD/PCDF					
Waste incineration plants	5.0	**	**	**	**
Production of iron and other coloured metals	25.4	**	**	**	**

Power and heat production	126.3	**	**	**	**
Production of mineral products	2.3	**	**	**	**
Transport	0.9	**	**	**	**
Uncontrolled combustion processes	3.9	**	**	**	**
Production and use of chemicals and consumer goods	1.2	**	**	**	**
Management/disposal of waste	2.7	**	**	**	**
Miscellaneous	0.001	**	**	**	**
HCB	*	**	**	**	**
PCB	*	**	**	**	**

* – not defined; ** – requires definition

Based on this table, Croatia has decided not to request an exclusion, and it has no future plans of requesting an exclusion concerning the Stockholm Convention requirements.

4.6. Potential sources of persistent organic pollutants

According to available data and information, it may be concluded that there are potential sources of POPs compounds in our country.

4.6.1. Pesticides

Even though the use of organochlorine pesticides is prohibited or restricted, they can occur in uncontrolled use, in particular in households and small farms as the consequence of remaining stockpiles. There are certainly not large quantities and thus neither the environment nor humans should suffer significant global exposure.

4.6.2. Polychlorinated biphenyls

Sources of PCBs still exist in our country. It is primarily equipment containing PCBs (capacitors, transformers), as well as oil stockpiles containing PCBs (around 1 tonne). There can enter into the environment or humans due to leaking, evaporation and inadequate storage. Contamination of oil which does not originally contain PCBs can also occur due to its use in contaminated equipment and which turns it into waste oils contaminated by PCBs. From the analysis results, it is obvious that certain soils are contaminated by PCBs as a consequence of war devastation of installations which contained PCBs. Unfortunately, there are too few results of soil analysis on the national territory in order to assess the dimensions of pollution resulting from war devastation and implementation. The reason for this is the inaccessibility of certain areas due to explosive devices or property and legal restrictions, but also due to a lack of interest on the part of the competent ministries and institutions to obtain a true overview of the situation and to finance extensive studies. Therefore, these assessments are based on few results obtained through scientific research. Potential PCB sources are also waste landfills, which were mostly uncontrolled, and thus PBCs can likely be found in disposed waste. The extent of such uncontrolled disposal is not known.

4.6.3. PCDD/PCDF

PCDDs and PCDFs have never been used, but they are undesirable ingredients of synthetic products (pesticides, PCBs) or occur during industrial processes (metal industry, cement plants, pulp and paper production). They can occur as a combustion by-product, especially in uncontrolled conditions. They are also found in exhaust gases from vehicles using leaded petrol. Potential PCDD/PCDF sources are industrial installations, technological and hospital waste incineration plants, traffic, uncontrolled fires (in particular on waste landfills), uncontrolled burning of municipal, garden and technological waste, crematories, and traffic.

4.7. Presence of POPs compounds in food, environment and humans

4.7.1. POPs compounds in food

For over a decade, regular food controls have been conducted in line with valid regulations on the maximum permitted levels of these compounds in food and examination of levels in various species of freshwater and marine fish, animal fat tissues and cow milk. Very few data have been published regarding the levels of organochlorine compounds in foods of plant origin. Table 33 summarises the published results of examinations performed in the period from 1992–1996.

Table 33. Mass portion of pesticides (range of particular compound medians: HCB, α-HCH, γ-HCH, total DDT) and total PCBs in food analysed in the period from 1992–1996

	Pesticides	PCB
Beef μg kg^{-1} fat		
domestic	0-1	NA
imported	0-29	NA
Pork μg kg^{-1} fat		
domestic	0-6	12
imported	0-15	NA
Fish μg kg^{-1} edible part		
domestic	0-41	46
imported	0-16	6
Poultry μg kg^{-1} fat		
domestic	0-6	14
imported	0-39	NA
Cow milk μg kg^{-1} fat		
domestic	0-47	73
Butter μg kg^{-1} fat		
domestic	0-5	20

NA = not analysed, 0 = below determination level

Mass portions of certain organochlorine compounds in food samples were analysed in the Croatian National Institute of Public Health in the period from 1986-89 and ten years later. It is evident that mass portions of all compounds and in all foods types have decreased.

Table 34. Mass portions (average value, μg kg^{-1} fat, and for fish μg kg^{-1} wet weight) of organochlorine compounds in food samples. Number of analysed samples is specified in brackets.

	HCB	α-HCH	γ-HCH	DDT complex
Fish and fish products				
- 1986/89 (153)	5	2	25	127
- 1999 (46)	0.1	0.1	0.5	4.7
Meat and meat products				
- 1986/89 (733)	3	2	25	75
- 1999 (80)	0	1	6	62
Milk and diary products				
- 1986/89 (438)	7	3	24	83
- 1999 (52)	1	1	6	35

0 = below the level of determination

Results of determining organochlorine pesticides and PCBs in beef, pork, poultry and fish on the market in the period from 1985 to 1996 are presented in Table 31. During 1992–1996, a total of 466 food samples both from import and domestic production were analysed and compared with the results of analysis conducted in 1985 and 1986. During the period 1984-1986, fish samples were taken from the area of Rijeka and Zadar. Imported food samples were meat imported from the EU, eastern and central Europe, China, Australia and New Zealand, poultry imported from Slovenia and Hungary and fish from Argentina. It is evident that mass portions of lindane and total DDT in domestic beef and pork have significantly decreased in the observed period, while they were significantly higher in imported meat than in domestic meat. Mass portions of lindane in poultry are higher than in domestic samples, while the remaining compounds are similar.

Mass portions of organochlorine pesticides are lower in fish from the Adriatic Sea than in imported fish, while PCBs are lower in imported than in domestic fish. It is evident that mass portions of PCBs in domestic fish are significantly lower in the period 1992-1996 than in the period 1984-1988. Figure 3 presents the frequency of organochlorine pesticides and polychlorinated biphenyls in food samples. Only positive samples were evaluated.

According to the results of the Croatian National Institute of Public Health, mass portions of HCBs, lindane and total DDT in eggs from poultry farms and individual households were analysed in 2000. The results ranged from 0-30.4 μg kg^{-1} wet weight (the highest levels were determined for total DDT). If we compare the levels of total DDT in relation to the origin of eggs, it is evident that levels are significantly higher in eggs obtained from individual households.

Table 35. Comparison of mass portions (μg kg^{-1} fat, and for fish μg kg^{-1} of edible part) organochlorine pesticides and PCBs in food of animal origin analysed during a ten year period

	HCB	α-HCH	Lindane	Total DDT	Total PCB*

	Med.	Max.	Med.	Max.	Med.	Max.	Med.	Max.	Medium value	Max.
Beef										
– domestic 1985/86	0	9	0	10	1	115	18	571	-	
– domestic 1992/96	0	18	0	27	0	67	1	157	-	
– imported 1992/96	1	43	0	29	10	116	29	427	-	
Pork										
– domestic 1985/86	0	10	0	25	1	82	9	626	-	
– domestic 1992/96	0	24	0	9	0	152	0	235	-	
– imported 1992/96	0	25	0	15	13	152	15	265	-	
Poultry										
– domestic 1992/96	0	3	0	4	6	49	4	89	-	
– imported 1992/96	0	12	0	9	39	79	3	88	-	
Fish										
– domestic 1984/88	-		-		-		-		59-287	2303
– domestic 1992/96	0	0.3	0	2.1	1	10.2	1.6	159	46	117
– imported 1992/96	0	6.4	0	12.8	1.6	13.9	4.1	169.8	6	167

* mean value, total PCB according to Aroclor 1254 and Aroclor 1260

Figure 3. Frequency of organochlorine pesticides and polychlorinated biphenyls in positive food samples

4.7.2. POPs compounds in environmental samples

Systematic environmental monitoring in relation to POPs compounds in environmental samples is not organised at any level. During the late 1970s and early 1980s, the examination of OC pesticides and PCBs presence and distribution in surface, underground and drinking waters, and in the sea, sea sediments and fish was initiated in Croatia. Later examinations also included river sediments. In the past ten years, OC compounds have been analysed in soil, air, precipitation, tree leaves, coniferous tree needles, birds and dolphins. In addition to the examination of OC pesticides and total or individual PCBs, the latest research is also aimed at establishing levels of PCDD and PCDF in order to get an insight into sources and levels of these highly toxic compounds in the environment. Most analyses of organochlorine pesticides and PCBs have been conducted in surface and underground waters due to long-term monitoring of watercourses organised by the management company Croatian Waters. Monitoring of persistent organic pollutants has not been organised in other environmental components, and available results were obtained from domestic and foreign research projects. Therefore there is no systematic approach to the results and, due to the various approaches taken, their interpretation is very different.

4.7.2.1. Samples of animal origin

There are very few data on levels of organochlorine compounds in animal samples except for those referring to food. A total of 25 egg samples of yellow-legged seagull, three samples of a dead dolphin (liver, muscle and fat tissues) and two samples (liver and blood) of one dead griffon vulture and various sea and freshwater fish and shellfish were tested.

– yellow-legged seagull – analysis of yellow-legged seagull egg samples collected at three sites was performed by the Croatian National Institute of Public Health in 1994 (Table 36). Apart from these, no other examination results concerning OC compound levels in bird eggs were found.

Table 36. Levels of organochlorine compounds in yellow-legged seagull egg samples collected in 1994 on islands of the Adriatic Sea (μg kg^{-1} wet weight, arithmetic mean of positive results, range; N=number of samples; n= number of positive samples)

– griffon vulture from the island of Cres

Location	HCB	LINDANE	TOTAL DDT	PCB (Ar 1254+Ar 1260)
Island Zec/Kvarner	16 (3-47);	15 (7-61);	491 (80-1102);	4847 (998-4802);
N=10	n=10	n=8	n=10	n=10
Island Dvije	4 (4-5);	8 (4-14);	421 (220-564);	4580 (1120-10729);
Sestrice/Rovinj; N=5	n=5	n=5	n=5	n=5
Island Kraljevac/Čiovo	4 (1-8);	8 (3-14);	298 (76-664);	10667 (1298-27610);
N=10	n=10	n=9	n=10	n=10
All eggs	9 (1-47);	11 (3-61);	400 (76-1102);	7522 (998-27610);
N=25	n=25	n=22	n=25	n=25

The blood and liver of a griffon vulture which died in 2002 on the island of Cres was analysed, on suspicions that the bird had been poisoned. In its blood sample, only lindane was detected (6.75 μg L^{-1} blood), while in its liver sample, traces of HCB, γ-HCH, 4,4'-DDE-a, 4,4'-DDD-a, 4,4'-DDT and polychlorinated biphenyls were found in levels common for humans (33-501 mg kg^{-1} fat). Thus it was concluded that the bird was not poisoned by persistent organochlorine compounds and that levels of detected compounds are common for birds.

– dolphin from the Adriatic Sea

Fat tissue, liver and muscle of a striped dolphin (*Stenella coeruleoalba*) found dead on the island of Krk in June 1998 were analysed. These are the only data found on levels in dolphins in our country.

Mass portions of organochlorine pesticides and their metabolites (HCB, α-HCH, β-HCH, γ-HCH, 4,4'-DDE, 4,4'-DDD and 4,4'-DDT) in dolphin samples ranged between 0.015-3.871 mg kg^{-1} fat, while levels of PCB congeners (PCB-28, PCB-52, PCB-101, PCB-138, PCB-153 and PCB-180) ranged between 0.059-2.941 mg kg^{-1} fat and total PCBs (such as Aroclor 1260) ranged between 6.148-17.383 mg kg^{-1} fat.

– fish and shellfish (marine and freshwater)

The research conducted in 1974/75 by the Ruđer Bošković Institute analysed samples of marine fish and shellfish. Organochlorine pesticides and PCBs were present in considerably higher levels than in samples analysed ten years later (Table 37). Considerably higher levels of polychlorinated biphenyls were established in fish from the Kupa River analysed in the period from 1985 to 1988 which is the consequence of the Kupa contamination caused by irregular disposal of electro-industry waste (which contained PCBs) on the territory of Bela Krajina (Slovenia).

Table 37. Range of mass portions of OC pesticides and PCBs in fish and shellfish (μg kg^{-1} wet weight; edible part) analysed from 1974 to 1988

Sample type /site/year	N	4,4'-DDE+4,4'-DDD +4,4'-DDT	Dieldrin	PCB
Marine fish and shellfish /1974-1975				
Istria	27	0-135	0-15	0-520
Rijeka	33	0-131	0-10	0-356
Zadar	18	0-113	0-4	0-390
Lošinj	29	0-870	0-13	0-624
Marine fish				
Rijeka/1983	-	1-12	0.2-0.4	48-79
Rijeka/1987	-	0-6.2	-	16-120
Freshwater fish - Kupa River				
Letovanić/1985	7	0.5-14	0.1-3.4	49-659
Sisak/1986*	47	-	-	1-42000
Petrinja/1987-1988	28	0.2-175	0.1-2.2	70-1233

N=sample number, 0=below determination levels, *basis for result stating is not specified

A study to assess the potential threat of contamination by PCBs caused by destruction of electric substations in the Homeland War was performed by the Ruđer Bošković Institute in 1997. PCBs level were examined in fish and mollusc samples from the coastal region of Zadar (sites Brodanovo, Kolovare, Vruljica marina and stream), Vransko Lake near Biograd, Šibenik (small marina in Mikulandra Bay) and Dubrovnik (Rijeka Dubrovačka at the marine and reserve sites) (Table 38). Two stations in and outside the marina in Selce near Crikvenica were the reference area. DDT levels were also determined. In samples from the Vransko Lake, levels of PCBs and DDTs were very low and thus that aquatic system may be considered as a practically clean area. In the Šibenik area, levels that would indicate potential PCB penetration from the Bilice substation that was damaged in the war were not established. In the Dubrovnik area, fish from several stations and molluscs from the marina area contained considerably high levels of PCBs, but as those compounds had not been examined at that site before the war, it could not be concluded whether the increased levels are connected to war events. The highest levels of PCBs and DDTs were detected in oysters and fish from the Zadar area. Furthermore, within that area, the highest levels of PBCs were measured in samples from the Zadar marina and Vruljica stream immediately before its inflow into the sea.

Specific fish samples contained PCBs in levels which have rarely been established in previous burden studies of these compounds in the Adriatic and Mediterranean Sea.

Table 38. Mass portions of PCBs and DDTs (μg kg^{-1} wet weight) in marine fish and molluscs analysed in 1997

Sample	Mass portion/μg kg^{-1} wet weight	
	PCB	DDT
fish (N=32)		
range	10 – 4004	0.6 – 36
Mean	259	3.0
mollusc (N=15)		
range	12,5 – 1510	1.5 – 45
mean	168	3.6

N = number of samples

Within the framework of the Adriatic project, there are data on the concentrations of PCBs, DDT compounds and lindane in shellfish (mussels) even for the period prior to 2007. Data are kept by the Croatian Environmental Agency, and have been collected in cooperation with the Institute of Oceanography and Fisheries.

4.7.2.2. Air

The first national data on mass concentrations of OC pesticides and PCBs in the air were published for samples collected in the Zagreb area during 1997. Samples were gathered at two sites: in the north of the city and in village Jakuševec at the southern edge of the city. The following OC pesticides were detected in all samples: HCB; α-, β- and γ-HCH; 4,4'-DDT and their metabolites; 4,4'-DDE and 4,4'-DDD, as well as six PCB congeners: PCB-28, PCB-52, PCB-101, PCB-138, PCB-153 and PCB-180. The concentrations of all compounds, with the exception of 4,4'-DDD and 4,4'-DDT were higher in the samples collected in Jakuševac, which was interpreted as the influence of the municipal waste landfill located in its immediate vicinity. The distribution of compounds in samples from Zagreb was similar to that of other countries. Similar results were obtained in a follow-up study performed in the period 1999-2001 at the same sites. The results are shown in Table 39.

The analysis of PCDDs and PCDFs in the air was performed in Croatia for the first time in 1993, on two samples collected in Zagreb (Ksaver) and Jastrebarsko. Samples were analysed in Norway. The mass concentration of PCDD/PCDF in the sample from Zagreb was 92.3 fg I-TEQ m^{-3} as opposed to 105 fg I-TEQ m^{-3} in the sample from Jastrebarsko. The construction of a mobile device for thermal waste treatment near the municipal waste landfill in Jakuševac initiated the measurement of PCDD and PCDF in the air collected at various sites in Zagreb: at the site of the waste incineration installation (PUTO), in the centre of Zagreb where the level of PCDD/PCDFs in the air can depend on traffic and other unspecific sources (Đorđićeva), in the industrial zone in eastern Zagreb (Žitnjak), and at the northern edge of Zagreb (Ksaverska St.). Measurements were conducted in the period from 1997 to 2000. Mass concentrations of compounds, stated as the toxic equivalent calculated using international

factors of equivalent toxicity based on the toxicity of 2,3,7,8-tetrachlororodibenzo-p-dioxine are shown in Table 40.

Table 39. Mass concentrations (pg m^{-3}) of organochlorine pesticides and polychlorinated biphenyls in air samples collected in Zagreb from 1997 to 2001

Compound	Ksaver				Jakuševec			
	1997 (N=14)		1999/2000 (N=47)		1997 (N=10)		2000/2001 (N=33)	
range	median	Range	median	range	median	range	median	
HCB	0.5-49	29	1-36	9	15-61	31	2-34	10
α-HCH	2-52	25	4-44	12	14-61	28	0.6-61	10
β-HCH	3-22	8	0.5-40	6	5-35	15	0-17	4
γ-HCH	3-80	49	12-247	53	36-91	77	6-246	75
4,4'-DDE	2-26	10	0-36	17	8-29	19	0-32	8
4,4'-DDD	2-65	11	0-101	8	3-17	7	0-27	5
4,4'-DDT	4-32	12	2-63	12	4-40	9	0.8-143	24
PCB-28	17-57	29	3-312	36	15-92	36	5-204	81
PCB-52	9-36	19	2-65	13	10-44	21	2-173	14
PCB-60	NA	NA	0-23	8	NA	NA	1-33	10
PCB-74	NA	NA	0-19	2	NA	NA	0-23	8
PCB-77	NA	NA	/	0	NA	NA	0-8	0
PCB-101	4-28	10	2-223	14	5-36	14	1-163	27
PCB-105	NA	NA	0-36	2	NA	NA	0-30	6
PCB-114	NA	NA	0-14	0	NA	NA	0-13	3
PCB-118	NA	NA	0-24	3	NA	NA	0-24	8
PCB-123	NA	NA	0-12	3	NA	NA	0-17	7
PCB-126	NA	NA	0-4	0	NA	NA	0-10	0
PCB-138	2-21	8	12-128	6	4-24	10	1-72	13
PCB-153	3-16	7	1-92	4	9-20	12	1-55	9
PCB-156	NA	NA	0-1	0	NA	NA	0-3	0
PCB-157	NA	NA	/	0	NA	NA	0-1	0
PCB-167	NA	NA	0-4	0	NA	NA	0-3	0
PCB-169	NA	NA	0-3	0	NA	NA	/	0
PCB-170	NA	NA	0-2	0	NA	NA	0-6	0
PCB-180	1-13	5	0-7	2	10-51	13	0-23	2
PCB-189	NA	NA	0-2	0	NA	NA	/	0

N – number of analysed samples; NA- not analysed; 0 – below determination levels;

Table 40. Mass concentrations of PCDD/PCDF in air samples collected in Zagreb from May 1997 to March 2001

SAMPLING SITE SAMPLING PERIOD MEAN TEMP. (°C) fg I-TEQ m^{-3}

PUTO-1	16/05-19/05/1997	22.2	39
PUTO-2	11/06-14/06/1997	23.2	12
ŽITNJAK-1	29/01-02/02/1998	-2.5	83
ŽITNJAK-2	25/02-27/02/1998	8.2	306
JAKUŠEVEC-1	16/05-19/05/1997	22.2	47
JAKUŠEVEC-2	11/06-14/06/1997	23.2	18
JAKUŠEVEC-3	16/01-19/01/1998	3.1	94
JAKUŠEVEC-4	13/02-16/02/1998	10.5	124
JAKUŠEVEC-5	16/03-19/03/1998	4.9	49
JAKUŠEVEC-6	05/11-08/11/1999	0.1	29
JAKUŠEVEC-7	10/01-13/01/2000	-0.5	25
JAKUŠEVEC-8	06/03-09/03/2000	9.8	15
ĐORĐIĆEVA-1	23/05-26/05/1997	15.4	9
ĐORĐIĆEVA-2	06/06-09/06/1997	20.1	41
ĐORĐIĆEVA-3	19/01-22/01/1998	4.6	56
ĐORĐIĆEVA-4	13/02-16/02/1998	13.7	169
ĐORĐIĆEVA-5	16/03-19/03/1998	5.8	78
ĐORĐIĆEVA-6	05/11-08/11/1999	0.1	26
ĐORĐIĆEVA-7	10/01-13/01/2000	-0.5	50
ĐORĐIĆEVA-8	06/03-09/03/2000	9.8	17
KSAVERSKA-1	23/05-26/05/1997	15.4	10
KSAVERSKA-2	06/06-09/06/1997	20.1	11
KSAVERSKA-3	02/02-09/02/1998	1.4	72
KSAVERSKA-4	02/03-04/03/1998	7.9	47
KSAVERSKA-5	31/03-03/04/1998	4.6	17
KSAVERSKA-6	02/11-05/11/1999	5.6	21
KSAVERSKA-7	17/01-19/01/2000	0.3	39
KSAVERSKA-8	28/02-03/03/2000	6.7	90

Organochlorine pesticides and polychlorinated biphenyls in airborne particle samples collected in Zagreb

The greatest portion (>90%) of low volatile compounds such as PCBs and organochlorine (OC) pesticides is present in the atmosphere as gas. The first measurements of OC compounds level in fractions of airborne PM10 and PM2.5 particles were performed on the territory of Zagreb at the measurement station in the northern part of the city (Ksaver St.) in the period from late October 2000 to late May 2001. HCB, α-HCH, β-HCH and γ-HCH, 4,4'-DDT, 4,4'-DDE and 4,4'-DDD and six indicator polychlorinated biphenyls congeners: PCB-28, PCB-52, PCB-101, PCB-138, PCB-153 and PCB-180 were determined. A total of 30 samples of airborne particles of PM10 and PM2.5 were collected over 12 subsequent days and were analysed. The results of those measurements are displayed in Table 41.

Table 41. Mass concentrations (pg m^{-3}) of compounds in airborne PM10 and PM2.5 particles collected in Zagreb from October 2000 to May 2001.

COMPOUND	PM10 (N=30)			PM2.5 (N=30)		
	n	Range*	Median	n	Range*	Median
HCB	18	1 – 21	2	16	1 – 17	1
α-HCH	12	1 – 4	0	11	0.5 – 5	0
β-HCH	27	2 – 26	11	27	4 – 36	15
γ-HCH	27	3 – 18	8	30	3 – 19	9
4,4'-DDT	25	1 – 39	5	22	2 – 28	5
4,4'-DDE	27	1 – 19	4	25	0.2 – 19	4
4,4'-DDD	9	0.5 – 7	0	11	1 – 11	0
PCB-28	13	1 – 26	0	11	1 – 19	0
PCB-52	0			1	5	0
PCB-101	2	5 – 12	0	2	2 – 8	0
PCB-138	18	0.5 – 6	1	20	0.5 – 12	1
PCB-153	11	2 – 5	0	8	2 – 10	0
PCB-180	0			0		
∑ PCB	25	0.5 – 33	4	24	1 – 28	2

N = total number of samples; n = number of positive samples; * = range in positive samples;

0 = concentration below detection levels;

∑ PCB = total concentration in six indicating PCBs congeners.

Monitoring OC compounds in airborne particles was continued at the same location in the period from the early January to late December 2002. In that period, 52 seven-day samples of airborne PM10 particles were collected and OC pesticides were determined (Table 39), while Table 40 shows the results of determining 20 PCB congeners, including six indicator congeners. The most frequently detected are PCB-28 congeners (in 65% of samples), PCB-60 (63%), PCB-101 (58%) and PCB-180 (56%). The highest mass concentrations are determined for PCB-28 and PCB-101 congeners.

Measurements of OC pesticides and PCB congeners in airborne particles conducted during 2002 did not show significant seasonal variation in the levels of these compounds. Mass concentrations of compounds sorbed on particles in the air were the same as in the period 2000/2001 and at levels characteristic for global environmental pollution, and thus did not point to any major local input of these compounds into the atmosphere.

Table 42. Mass concentrations (pg m^{-3}) of organochlorine pesticides in 52 seven-day samples of airborne PM10 particles collected in Zagreb from January to December 2002

COMPOUND	MASS CONCENTRATION / pg m^{-3}		
	n	Range[a]	Median
HCB	44	0.28 – 24.5	6.24
α-HCH	50	0.02 – 15.6	1.73
β-HCH	46	0.48 – 28.8	4.82

COMPOUND	MASS CONCENTRATION / pg m^{-3}		
	n	Range[a]	Median
γ-HCH	52	0.31 -19.0	3.22
4,4'-DDE	45	0.07 – 17.0	2.43
4,4'-DDD	20	1.18 – 20.7	0
4,4'-DDT	41	0,.12 – 8.39	3.60
∑ DDT	48	0.87 – 41.5	7.70

n – number of positive samples, [a] range in positive samples;

0 – below detection level; ∑DDT – sum of concentrations 4,4'-DDE, 4,4'-DDD and 4,4'-DDT

Table 43 Mass concentrations (pg m^{-3}) of PCB congener in 52 seven-day samples of airborne PM10 particles collected in Zagreb from January to December 2002

COMPOUND	MASS CONC./ pg m^{-3}			COMPOUND	MASS CONC. / pg m^{-3}		
	n	Range[a]	Median		n	Range[a]	Median
PCB-28 [b]	34	0.50-101	2.67	PCB-138 [b]	24	0.15-5.76	0
PCB-52 [b]	23	0.06-5.65	0	PCB-153 [b]	23	0.09-2.83	0
PCB-60	33	0.08-14.4	1.01	PCB-156	3	1.65-3.67	0
PCB-74	18	0.39-35.8	0	PCB-157	20	0.28-7.17	0
PCB-77	22	0.16-14.1	0	PCB-167	0	0	0
PCB-101[b]	30	1.13-76.4	3.78	PCB-169	12	0.29-4.65	0
PCB-105	8	0.29-2.49	0	PCB-170	1	2.91	0
PCB-114	6	0.06-1.79	0	PCB-180 [b]	29	0.02-3.07	0.08
PCB-118	22	0.54-11.8	0	PCB-189	0	0	0
PCB-123	11	0.24-5.13	0	∑ 6 PCB	48	0.12-111	12.3
PCB-126	19	0.70-4.32	0	∑ 20 PCB	52	2.39-131	22.6

n – number of positive samples, [a] range in positive samples; [b] indicating PCB congeners;

0 – below detection level; ∑6PCB – sum of 6 indicating PCB congeners;

∑PCB – sum of 20 PCB congeners

4.7.2.3. Rainwater/snow and pine needles

OC pesticides and PCBs

The few results of determining OC pesticides and PCBs in rain or snow samples collected in Croatia are summarised in Table 44. The concentration range shown for OC pesticides refer to individual compounds. Traces of dieldrin, 4,4'-DDT and its metabolites and PCBs were already registered in 1979 and 1980 in rainwater samples collected in Rijeka. In the period from 1990 1992, organochlorine compounds were measured in rainwater and snow in the area

of Zagreb and its surroundings. γ-HCH was the only OC pesticide detected in all rainwater and snow samples, and α- and β-HCH, HCB and aldrin were also frequently detected. The levels of most compounds ranged from <1–8 ng dm^{-3}. The only exception was γ-HCH, with concentrations in rain ranging from 2 to 38 ng dm^{-3}.

Table 44. OC pesticides and PCBs in rainwater and snow: concentration range (ng L^{-3}) in water phase and mass portions (ng g^{-1} dry sample) in particles

Sample	Site (sampling period)	OC pesticides	Total PCB
Rain	Rijeka (1979/80)*		
- water phase		<1 – 2	1 – 12
Rain	Zagreb (1990/92)*		
- water phase		<1 – 38	2 – 205
- particles		1 – 512	40 – 4155
Snow	Zagreb (1990/92)**		
- water phase		<1 – 4	4 – 50
- particles		1 – 242	306 – 4082

* analysed OC pesticides: dieldrin, 4,4'-DDT, 4,4'- DDE, 4,4'-DDD

** analysed OC pesticides: α-, β- and γ- HCH, HCB, aldrin, 4,4'-DDT, 4,4'- DDE, 4,4'-DDD

The results of examinations of these compounds in samples from tree leaves, in particular conifer needles reflect the presence of OC pesticides and PCBs in the air in Croatia. Plants, and in particular conifers, are considered good indicators of environmental contamination at a certain site. Conifer needles are coated with wax and thus lipophilic airborne OC compounds sorb onto them. As a single coniferous tree contains several generations of needles, it is possible to establish contamination of a wider region and/or specific site during one and several years. Samples of larch, pine, lime, juniper, and fir tree (total 22 samples) collected in 1993 and 1994 in Ogulin at several sites contained OC pesticides at levels of 0-15 ng g^{-1} of dry needles (median range per species), and PCBs (according to Aroclor 1260) at levels of 1.2-17 ng g^{-1} of dry needles (median range). In March and April 1995, samples of pine tree needles were collected in Zagreb (3 samples at various sites), on Mt. Medvednica and Mt. Velebit. The levels of OC pesticides ranged from 0-7.4 ng g^{-1} dry needles (highest levels for α- and γ-HCH), while PCBs (measured according to Aroclor 1260) ranged from 3.8-8.0 ng g^{-1} of dry needles. During 1997, samples of pine tree needles were collected in Osijek. The levels of OC pesticides ranged from 0.34-3.76 ng g^{-1} of dry needles and six indicator PCB congeners ranged from 2.91-4.54 ng g^{-1} of dry needles. During 1998, samples of needles were collected in Zagreb at seven sites and at 15 other sites in Croatia. The results are shown in Table 45.

Table 45. Organochlorine pesticides and polychlorinated biphenyls in pine tree needles (ng g^{-1} dry mass) collected during 1998

Sampling site	HCB	α-HCH	β-HCH	γ-HCH	4,4'-DDD	4,4'-DDD	4,4'-DDD	PCB-28	PCB-52	PCB-101	PCB-138	PCB-153	PCB-180	α-/γ-HC	DDE/DDT

							E	D	T						H	
Zagreb-Borongaj	1.38	0.44	0.57	1.59	0.35	0.22	0.72	1.74	5.09	1.96	1.76	0.74	0.56	0.28	0.49	
Zagreb-Opatovina	0.70	0.33	2.10	1.13	0.66	0.22	0.14	2.52	0.34	1.79	0.56	0.50	0.16	0.29	4.89	
Zagreb-Novaki	1.00	1.15	2.84	5.25	0.84	0.29	0.33	1.33	0.78	1.45	0.92	0.54	0.12	0.22	2.55	
Zagreb-Odra	0.69	0.39	2.03	2.17	1.45	0.21	0.41	1.64	0.56	2.32	1.65	0.79	0.24	0.18	3.58	
Zagreb-Trnava	0.64	0.63	3.01	3.80	0.72	0.32	0.23	3.71	0.42	2.96	1.74	0.41	0.35	0.17	3.15	
Zagreb-Ksaver	0.83	0,97	1,14	3.63	0.64	0.44	2.62	1.58	2.80	2.72	0,69	0.74	0.48	0.27	0,24	
Zagreb-Jakuševec	1.55	1.27	0.96	4.91	0.72	0.50	2.65	0.68	6.63	1.63	1.23	1.30	0.54	0.26	0.27	
Zagreb – median	0.83	0.63	2.03	3.63	0.72	0.29	0.41	1.64	0.78	1.96	1.23	0.74	0.35	0.26	3.15	
Jastrebarsko	0.64	0.99	0.29	0.60	0.95	0.41	1.18	1.88	0.25	1.22	0.63	0.48	0.15	1.66	0.80	
Karlovac	0.83	0.58	0.68	1.46	0.43	0.19	0.43	1.72	7.25	1.44	1.36	0.80	0.61	0.40	1.00	
Kamanje	0.49	0.42	1.77	1,45	0.86	0.37	0.29	2.35	0.58	1.84	0.79	0.56	0.14	0.29	2.94	
Ludbreg	1.04	0.47	0.47	0.98	0.48	0.15	0.45	1.07	3.72	1.10	0.81	0.51	0.49	0.48	1.07	
Bednja	1.05	0.91	0.31	1.01	1.43	0.09	0.32	2.86	0.86	3.13	1.94	0.94	0.19	0.90	4.52	
Krapina	1.57	0.99	0.51	0.22	1.42	0.55	0.55	2.50	0.77	1.97	1.22	1.07	0.20	4.48	2.60	
Čakovec	1.84	0.27	0.6	1.30	2.56	0.25	0.39	5.87	2.68	3.25	2.39	1.27	0.34	0.21	6.56	
Koprivnica	1.07	0.27	0.36	2.04	0.67	0.09	0.35	2.23	0.68	1.10	1.05	0.40	0.19	0.13	1.94	
Našice	0,81	0.47	0.49	1.49	0.38	0.19	0,23	1.70	3.28	1.08	1.60	1.16	2.83	0.32	1.65	
Požega	0,85	0.37	1.62	1.95	1.00	0.27	0,67	3.50	8.31	2.10	3.17	2.05	2.61	0.19	1.49	
Županja	0.92	0.07	0.59	1.34	1.78	0.10	0.22	3.20	0.49	1.75	1.29	0.94	0.27	0.05	8.08	
Vinkovci	0.85	0.55	1.36	3.81	0.97	0.31	0.78	0.82	5.03	1.24	0.88	0.7	0.42	0.14	1.24	
Dubrovnik	0.42	0.05	0.26	0.26	1.16	0.37	1.05	1.57	1.33	2.17	1.24	0.87	0.40	0.20	1.11	
Kaštel Sućurac	0.63	0.26	0.13	2.18	1.03	0.11	0.19	3.38	1.96	1.69	0.96	0.47	0.34	0.12	5.52	
Plomin	0.61	1.31	0.40	5.93	2.38	0.35	0.72	3.57	0.93	4.08	2.13	1.42	0.24	0.22	3.29	
Median of all samples	0.84	0.47	0.59	1.54	0.90	0.26	0.42	2.06	1.13	1.82	1,23	0.78	0.34	0.24	2.58	

Pine tree samples were collected from the same tree at five coastal sites: at Križišće and on the island of Krk at Baška, Dobrinj, Omišalj and Punat. Samples were collected on two occasions, in 1992 and 2000, for the purpose of examining the temporal trends of pesticide levels. The results are shown in Table 46.

Table 46. Mass portions of organochlorine pesticides in pine tree needles (ng g^{-1} of dry needles) collected in 2000 and 1992 on the same sites

Sampling site	Year	HCB	α-HCH	β-HCH	γ-HCH	4,4'-DDE	4,4'-DDD	4,4'-DDT	PCB
Križišće	2000	0.14	0.60	1.10	0.10	0.40	0.20	0.90	6.4•
	1992	0.50	0.40	0	0.50	1.20	0.30	0.40	2.2*
Krk- Dobrinj	2000	0.03	0.03	0.20	0.10	0.70	0.20	0.20	8.7•
	1992	0.60	0.0	0	0.70	0. 80	0.40	0.40	1.4*
Krk-Punat	2000	0.30	0.10	1.20	0.10	1.00	0.20	0.30	11.4•
	1992	0.50	0.20	0	0.70	2.10	0.30	0.50	3.1*
Krk-Omišalj	2000	0.20	0.50	1.10	1.10	0.50	0.40	0.70	6.5•
	1992	0.40	0.30	0	0.50	1.20	0.40	0.60	1.4*
Krk-Baška	2000	0.10	0.05	0.20	0.30	0.30	0.20	0.10	6.8•
	1992	0.30	0.20	0	0.50	1.60	0.30	0.50	2.5*
Median	2000	0.10	0.08	1.05	0.10	0.50	0.20	0.30	6.5•
	1992	0.50	0.30	0	0.50	1.20	0.30	0.50	1.7*

0 – below determination level; * according to Aroclor 1260; • sum of 20 PCB congeners

PCDD/PCDF

Besides OC pesticides and PCBs, rainwater and snow samples collected in the area of Zagreb in the period from 1990 to 1992 also detected traces of the following compounds: PCDD and PCDF. Of the individual congeners, 2,3,7,8-TCDF (1 pg L^{-1}), 1,2,3,4,6,7,8-HpCDF (1 pg L^{-1}), OCDF (2 pg L^{-1}), 1,2,3,4,6,7,8-HpCDD (1 pg L^{-1}) and OCDD (2 pg L^{-1} in snow and 6 pg L^{-1} in rain) were identified in both snow and rain. These levels were, depending on the congener, lower or comparable to levels established in rain samples collected in developed countries of the world.

4.7.2.4. OC compounds in soil

There are few data on the level of persistent OC compounds in the soil in Croatia, as systematic examinations have not yet been performed. Levels of total PCBs were determined in samples of surface soils collected in several industrial and power installations, around airports and in urban and rural areas located close to such potential sources of pollution. The results of these examinations are summarised in Table 47. In most samples collected in urban and rural areas, mass portions of PCBs were characteristic for global environmental pollution (<10 μg kg^{-1} of dry sample). Higher values were determined in soil in the immediate vicinity of transformation stations, in particular those destroyed during the Homeland War, near airports and in industrial areas.

These values present the highest levels of soil contamination with PCBs of all the examined areas damaged during the war in the karst region of Croatia. Risk values caused by dispersion of capacitor oil were also observed on several sites near the electric substation in Zadar.

Table 47. Mass portions (μg kg^{-1} of dry sample) PCBs in soil

Site	Sampling period	Range (N)
Airports	1994/96	3 – 41 327 (18)
Near industrial installations	1997	21 – 1 207 (7)
Near substations destroyed in the war		
– Konjsko (Split)	1993	7 – 166 (17)
– Komolac (Dubrovnik)	1996	1 640 (2)
– Zadar	1996	173 – 204 823 (6)
– Šibenik	1996	470320 – 2 094 151 (3)
– Delnice	1996	21 (1)
Urban and rural areas	1994/97	2 – 39 (18)

N = number of samples

The highest mass portions of PCBs in soil within airports were observed in samples collected immediately by runways and by take off and landing fields which could be caused by previous uncontrolled release of these compounds into the environment from airplane electric and hydraulic systems. The fact that levels of PCBs near airports were regularly at the level of global pollution indicate the presence of local pollution sources within airports.

The only data on PCDD and PCDF levels in soil published to date were obtained by analysis of soil collected within airport in which mass portion of PCB exceeded 5000 μg kg^{-1} and analysis of soils collected close to previous chloro-alcali electrolysis installation. The level of total PCDDs and PCDFs in the soil collected within an airport amounted to 843.4 ng kg^{-1} of dry sample) with I-TEQ value of 9.7 ng I-TEQ kg^{-1} of dry sample was within the framework of values typical for urban and rural areas (<10 ng I-TEQ kg^{-1} of dry sample). In the soil collected close to previous chloro-alcali electrolysis installation (Kaštel Sučurac in Split) observed I-TEQ values were 50 times higher: 493 and 549 ng I-TEQ kg^{-1} of dry sample in the course of which mass portions of total PCDD and PCDF exceeded 17 000 ng kg^{-1} of dry sample. However, even in these soils, the calculated values of I-TEQ were far below the value of 10 000 ng I-TEQ kg^{-1} of dry sample, the limit value prescribed by law in Germany above which reclamation of contaminated areas must be performed.

4.7.2.5. OC pesticides and PCB in surface, underground and drinking waters

The collection of data on OC pesticides in surface and underground waters began in the late 1970s. From 1980 to 1983, levels of OC pesticides were examined in surface waters as potential drinking water sources at several sites in eastern Slavonia, including the area of Osijek. The most frequently detected compounds, also with the highest concentrations were the following: γ-HCH (to 28 ng L^{-1}), DDT and its metabolites (to 25 ng L^{-1}) and HCB (to 3 ng L^{-1}). According to the data from the annual report of the Public Health Institute of Istria County, in the period from 1980 to 1984, DDT type compounds reached the highest concentrations in the rivers of the Istria region (Boljunčica, Mirna, Raša, Pazinčica), with values ranging from 500 to even 8800 ng L^{-1}. In subsequent years (1986-1994), they decreased considerably (<100 or <50 ng L^{-1}), in line with the restrictions concerning the application of 4,4'-DDT. During the same period, a drop in concentrations of γ-HCH was also observed in the Istria region. In the period from 1980–1984, the highest concentrations of γ-HCH determined in water from Boljunčica and Raša amounted to 50, Mirna around 30 and

Pazinčica around 200 ng L^{-1}, in the period 1991–1994 the highest concentrations in the first three rivers were below 10, and in Pazinčica around 100 ng L^{-1}.

According to data from annual reports of the Public Health Institute of Split-Dalmatia County, the highest concentrations of DDT type compounds in Dalmatian rivers measured from 1988 to 1993 ranged from 20 ng L^{-1} (Jadro River in 1993) to 195 ng L^{-1} (Krka River in 1988/89). The highest γ-HCH concentration of 56 ng L^{-1} was measured in the Čikola River in 1988/89. However, in samples from the Jadro, Cetina, Žrnovnica and Pantana Rivers collected during 1993 and 1994, HCB, α- and γ-HCH, and DDT type compounds were found in very low concentrations: from <0.5 to a maximum of 2 ng L^{-1}. The highest concentrations of DDT type compounds were determined in several rivers in continental Croatia (Sava, Drava, Korana, Dobra and Kupa) in the period from 1979 to 1989, though these were always below 1 ng L^{-1}. However, data were also published stating that 4,4'-DDT and its metabolites were detected in several samples of water from the Kupa River near or in the Sisak area in concentrations up to 6 ng dm^{-3} during the period 1988/89.

Within the framework of these examinations, the highest concentrations for γ-HCH (1 do 20 ng L^{-1}) were detected in the water from the Kupa River near Sisak, though this compound was also detected in all samples. The second most frequently detected OC pesticide in the Kupa River was HCB, in concentrations up to 3 ng L^{-1}. The examination of OC pesticide levels in the Sava River, brooks, lakes and underground waters in the area of Zagreb in the period 1992–1995 confirmed frequent presence of traces of γ-HCH and the occasional occurrence of very low concentrations of all other compounds.

OC pesticides were also detected in drinking water. The frequency of their occurrence in the water supply system water in Sisak during 1988/89 was similar to that of the Kupa River, which was treated for the purpose of preparing drinking water. Concentrations of γ-HCH ranged from 1–59 ng L^{-1}. Simultaneous examination of OC pesticide levels in drinking water in Zagreb and Labin also established the regular presence of γ-HCH traces, while other compounds were detected occasionally. Thus, during the period from 1981 to 1990, the concentrations of total OC pesticides in the freshwater karst springs, from which drinking water for the area of Labin is prepared, amounted to 7–574 ng L^{-1}, in the Buzet area 11–260 ng L^{-1} and the Pula area 1–180 ng L^{-1}.

There are very few data on levels of OC pesticides in river sediments in Croatia, even though higher levels may be expected in these media than in water due to their sorption and bioconcentration preferences. In sediments from the central Dalmatian rivers (Jadro, Cetina, Pantana, Žrnovnica), traces of HCB-a, α- and γ-HCH and DDT and its metabolites were detected, which may be assigned to global environmental pollution.

Direct releases of non-treated waste waters and uncontrolled waste disposal, in particular waste oil disposal are common sources of the contamination of the aquatic environment by PCBs. Table 48 compares the levels of these compounds established in the previous ten years in specific river and drinking waters and in river sediments.

Table 48. PCBs in river and drinking waters (ng L^{-1}) and in river sediments (μg kg^{-1} of dry sample)

Sample (N)	Sampling period	Range of concentrations/mass portions

River water		
Sava (7)	1992/95	<1 – 25
Kupa (22)	1985	<1 – 52
Kupa (6)	1985/86	2 – 16
Kupa (24)	1988/89	<1 – 8
Drava (8)	1981/82	<1 – 7
Cetina (7)	1993/94	2 – 8
Jadro (7)	1993/94	3 – 13
River sediment		
Kupa (6)	1985/86	1 – 39
Jadro (8)	1993/94	2 – 507
Cetina (18)	1993/94	<1 – 7
Fresh water (karst sources prior to treatment)		
Labin	1980/90	2 – 48
Pula	1980/90	4 – 176
Buzet	1980/90	4 – 50
Drinking water (after treatment)		
Zagreb (10)	1988	<1 – 5
Sisak (16)	1988/89	<1 – 5
Labin (10)	1989	<1 – 3

N = number of analysed samples

Results of determining the level of OC pesticides and PCBs in the period 2000–2002 are shown in Table 49.

There are almost no published data on levels of organochlorine pesticides and polychlorinated biphenyls in waste waters, even though it is common knowledge that measurements were performed, primarily on water effluents from industrial installations.

Table 49. Levels of organochlorine pesticides and polychlorinated biphenyls in river water samples (ng L^{-1}) collected in the period from 1 January 2000 to 31 December 2002.

Site and year of sampling	PCB	Total OC pesticides	Lindane	DDT
Rivers and accumulations in Istria *				
2000	0-13.3	0-30.9	0-5.5	0-7.7
2001	0-50	0-18.9	0-1.3	0-10.8
2002	0-7.5	0-32.6	0-4.4	0-9.5
Drava (Nemetin, Donji Miholjac, Botovo, Varaždin, Terezino field): 2000	NR	NR	1-100	1-100
2001	NR	NR	0-9	0-50

Site and year of sampling	PCB	Total OC pesticides	Lindane	DDT
2002	NR	NR	0-34	0-5
Dunav (Borovo, Batina):				
	NR	NR	1-30	1-50
2000				
2001	NR	NR	0■	0■
2000	NR	NR	0■	0■
Mura (Goričan):				
	NR	NR	100■	2-3200
2000				
2002	NR	NR	100■	5■

* Measurement stations: Mirna, Raša – Bridge Potpićan middle, accumulation Butoniga – surface, Sveti Anton, Mutvica, Balobani, Rakonek, Kokoti, Blaž, Tivoli, Gradole, Sveti Ivan, Bulaž, Mlini, Pazinčica – Dubravica middle, Pazinčica – middle of the sinkhole, Boljunčica – middle of estuary;

■ same level in all samples; NR = not referred

4.7.2.6. OC pesticides and PCBs in sea water and sea sediments

Most data on levels of persistent OC insecticides and PCBs in the Croatian sea have been collected in several multi-year studies of the origin and fate of 4,4'-DDT and its metabolites 4,4'-DDE and 4,4'-DDD, dieldrin and PCBs in the Bay of Rijeka. A share of these pollutants enter the sea around Rijeka as precipitation from the atmosphere as a consequence of global environmental pollution. The concentrations of OC compounds in waste waters of the City of Rijeka were observed from 1979 to 1981. In 1986, they ranged from <0.2 to 256.3 ng L^{-1} for 4,4'-DDT, from <1 to 397.9 ng L^{-1} for 4,4'-DDE, from<1 to 229.2 ng L^{-1} for 4,4'-DDD and from <0.5 to 9115.5 ng L^{-1} for total PCBs. The determination of compounds in aquatic solution and particles suspended in waste water showed that particles contained around 50% of the total amount of DDT and around 80% of PCBs. The comparison of levels observed in waste waters in the period 1979/81 and 1986 showed a considerable decrease of DDT and its metabolites concentrations over time, though the same is not true for PCBs.

The systematic research of OC compounds in samples from surface microlayer and sea water collected at a depth of 1 m at several stations in Rijeka Bay were conducted in the period from 1977 to 1987. The results are presented in Table 50.

Mass portions of total DDT type compounds and total PCBs, determined by the analysis of surface sea sediment collected along the eastern coast of the Adriatic Sea in the period from 1976 to 1990 are also summarized in Table 50. The levels were comparable or lower than levels of the same compounds determined in sediments collected in other parts of the Adriatic and Mediterranean Seas.

Table 50. Organochlorine compounds in water (ng L^{-1}) and surface sediment layer (μg kg^{-1} of dry sample) in the eastern Adriatic

Site	Sample	DDT + metabolites	PCB

(Period)		Range	Median (N)	Range	Median (N)
Rijeka Bay (1977–1987)	coastal sea				
	– water	0.07 – 104.9	0.98 (24)	0.2-17.0	3.6 (23)
	– surface microlayer	3 – 25.3	4.8 (7)	28-597	112 (7)
	open sea				
	– water	<0.06 – 0.99	0.21 (10)	<0.2-1.7	0.6 (10)
	– surface microlayer	0.75 – 4.2	1.3 (10)	1-52	6 (10)
Umag – Dubrovnik* (1976–1990)	coastal sea sediment (0-3 cm)	<0.1 – 93.9	1.6 (142)	<0.5 – 294	5.5 (141)

N = number of samples; *Umag, Poreč, Rovinj, Pula, Rijeka, Šibenik, Dubrovnik

Levels of PCBs were examined in sediments from the coastal area of Zadar, Vransko Lake near Biograd, Bilice near Šibenik and Komolac near Dubrovnik in relation to land contamination near electric substations destroyed during the Homeland War in those areas. A narrow coastal belt at Selce near Crikvenica was taken as the reference area. Besides PCBs, DDT was also determined. A total of 35 sediment samples were analysed. Samples were collected (except for the area of Šibenik and Vransko Lake) in a very narrow coastal zone, just a few meters from the coastal line, therefore in zones of potential intensive local contamination. Mass portions of PCBs in analysed sediments ranged from 5.7–2203 μg kg^{-1} of dry weight (median 45 μg kg^{-1}), and DDT 0.2–35 μg kg^{-1} dry weight (median 1.5 μg kg^{-1}). The highest levels of PCBs were detected in sediments from the coastal area of Zadar. Results of the analyses indicate that Vransko Lake belongs to the group of practically clean aquatic systems. In the Šibenik area, levels that would indicate potential PCB invasion from the substation Bilice were not established. In the Dubrovnik area, increased levels of examined compounds were not detected at the site Petka near the entry position for waste waters of Dubrovnik and Mokošica (where solid waste from that area was also temporarily disposed during the Homeland War) and at stations at Ombla. However, relatively high levels of PCBs were measured in sediments collected in the area of the marina located at Rijeka Dubrovačka.

4.7.2.7. Organochlorine pesticides, PCBs, PCDDs/PCDFs in various test subjects

Concentrations in blood and breast milk

The first testing of the presence of POPs compounds in humans began in 1969 and was done on human fat tissue. More extensive research on the distribution of organochlorine compounds in humans in Croatia began in 1975, with the analysis of human serum and breast milk. The results of several years of monitoring the levels in human blood and breast milk are summarised in Tables 51 and 52. Initially, analysis was limited to organochlorine pesticides while later on, total PCBs were also analysed.

Table 51. Mass concentration (μg L^{-1} serum) of pesticides (range of medians of individual compounds: DDT, DDD, DDE, α-HCH, γ-HCH) and PCBs (according to Aroclor 1260) in the serum of the generally exposed population and occupationally exposed population. N represents the number of samples taken.

Place and year of sampling	N	Pesticides	PCBs
Zagreb, 1975	147	0-31	NA
Zagreb, 1976	18	0.5-8.7	NA
Bjelovar and Zabok, 1976	27	5.5-34.4	NA
Zagreb, 1976–77	11	0-33	NA
Krk, 1977	44	0-18	NA
Klakar, 1979	41	0-7	NA
Zagreb, 1977–79	35	0-18	NA
Zagreb, 1978–81	31	0.3-11.2	NA
Pula, 1978–81	31	0-11.2	NA
Zagreb, 1985	15	0-7	4
Zagreb, 1987–88	24	0-4	3
Zagreb, 1989–90	26	0-8	8
Labin, 1989	10	0-18	7
Zagreb, 1990	32	0-2	8
Zagreb, 1994–95	14	0-3.4	2.4•
Zagreb, 1976*	50	0-59	NA
Zagreb, 1989□	26	NA	8(25■)
Zagreb, 1994□	15	0-4.9	9(6.6•)

* workers occupationally exposed to organochlorine pesticides

□workers occupationally exposed to PCBs

0=below detection levels; NA=not analysed

• sum of six PCB congeners

■ according to Aroclor 1260 and Aroclor 1016 mixture (1:1)

Table 52. Mass content (μg kg^{-1} milk fat) of pesticides (range of medians of mass contents of individual compounds: DDT, DDD, DDE, α-HCH, β-HCH, γ-HCH) and PCB (according to Aroclor 1260) in human breast milk. N represents the number of samples taken.

Place and year of sampling	N	Pesticides	PCBs
Bjelovar and Zabok, 1976	27	0-1537A*	NA
Zagreb, 1977–79	71	0-63M	NA
Osijek, 1978–79	20	0-176A	0
Zagreb, 1981–82	50	180-1900	620
Zagreb, 1985	18	0-1060	440
Sisak, 1985	20	NA	300-2700□
Island of Krk, 1986–87	33	0-108	500
Labin, 1989	20	0-550	270

NA= not analysed;

0 = below detection level

*aldrin, dieldrin, endrin, heptachlor, heptachlorepoxid and δ-HCH also analysed but not detected

A range of arithmetic means of individual compound mass contents

M range of medians of individual compound mass contents expressed as μg kg^{-1} of breast milk, while

Sisak, 1987	9	0-633	431
Karlovac, 1988	9	0-600	300
Zagreb, 1986–87	41	0-1480	450
Zagreb, 1987–90	40	0-491	243
Zagreb, 1990–91	30	0-450	230
Zagreb, 1991–93	54	0-282	213
Krk, 1992	27	0-325	412
Jastrebarsko, 1992	18	0-285	180
Zagreb, 1994–95	45	0-247	212
Osijek, 1994	18	0-385	215
Zagreb, 1995	14	0-250	219
Rijeka, 1995–96	31	0-21.8[$]	778
Osijek, 1997	20	0-629	126

β-HCH was not analysed

[$] aldrin, dieldrin, endrin and heptachlorepoxid were also analysed (range of median 0-0.7μg kg^{-1} of milk fat)

 range of mass contents of total PCBs in individual samples

For the purpose of evaluating the levels of individual congeners of PCBs in the Croatian population, an analysis was carried out on 30 serum samples from the general population (25 male and 5 female, age 14–83) and 15 serum samples taken from workers (14 male and 1 female, age 31–58) occupationally exposed to PCBs. Six indicator PCBs were measured while in the serum samples of the exposed worker group total PCBs were also measured according to Aroclor 1260. All samples contained PCB-138 and PCB-153, while the frequency of appearance of other congeners ranged between 80 and 98%. Results are presented in Table 53.

Table 53. Mass concentrations (median; range in parenthesis; μg L^{-1}) of congeners of PCBs and total PCBs in blood serum of the general population and exposed workers

PCB congener	General population		Exposed workers
	1995 (N = 14)	1997 (N = 16)	1994 (N = 15)
PCB-28	0.1 (0 – 0.3)	0.2 (0 – 0.5)	0.4 (0 – 3.8)
PCB-52	0.7 (0.3 – 1.5)	2.5 (0.5 -9.1)	1.6 (0 – 4.6)
PCB-101	0.4 (0 – 3.4)	0.5 (0 – 2.4)	0.6 (0 – 0.7)
PCB-138	0.5 (0.2 – 1.2)	0.5 (0.2 – 4.6)	0.9 (0.3 – 4.6)
PCB-153	0.5 (0.3 – 1.6)	0.5 (0.1 – 2.4)	1.3 (0.3 – 5.2)
PCB-180	0.3 (0.2 – 2.7)	0.3 (0 – 0.9)	0.9 (0 – 2.8)
Sum of 6 PCBs	2.4 (1.5 – 6.4)	4.4 (1.9 – 11.4)	6.6 (1.1 – 20.5)
Total PCBs•	-	-	9 (3 – 29)

• according to Aroclor 1260

In the above mentioned groups of workers occupationally exposed to organochlorine pesticides, i.e. PCBs, the concentrations found in the serum were higher than the average levels found in the tested general population, but were not at levels at which acute symptoms of poisoning appear due to high absorption. The levels of 4,4'-DDE in human serum (Figure 4) and human breast milk (Figure 5) have been reduced significantly over the past twenty years

as the result of the prohibition, i.e. restriction of the use of DDT which lead to reduced intake of this substance through food, skin and air.

Figure 4. DDE in human serum of test subjects in Zagreb (μg L^{-1} of serum)

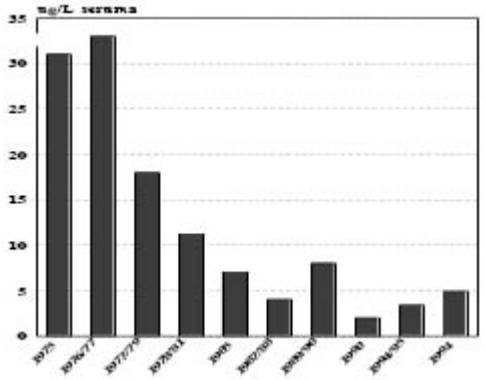
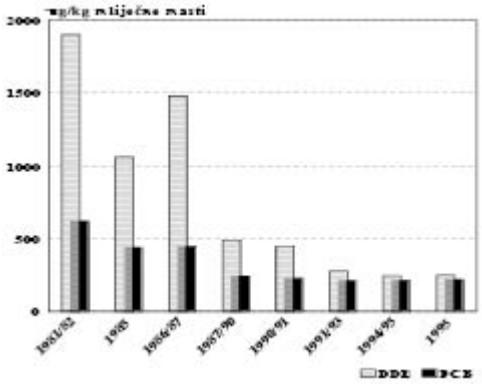


Figure 5. DDE and total PCB in human breast milk of women from Zagreb (μg kg^{-1} of milk fat)



Due to lack of adequate equipment, analyses of PCDD and PCDF have not been carried out in Croatia to date. In co-operation with the US Environmental Protection Agency (US EPA) and as part of co-operation with the World Health Organisation, several pooled samples of human breast milk were also analysed for the presence of PCDD and PCDF.

Samples of human breast milk were collected in the period from 1981 to 1997 in Zagreb, Jastrebarsko, Osijek, Labin and the Island of Krk. The results are summarised in Table 54. Dioxin levels ranged from 8.4 to 26.7 ng I-TEQ kg^{-1} of milk fat. In a comparative study carried out by the WHO over a five-year period (1987–1992), a drop in concentration levels amounting to approximately 1.8% annually was observed in the samples collected in Zagreb and on the Island of Krk, while in other European countries and in Canada, an average drop of 7.2% was detected.

The study was continued in the year 2000 and once again the results showed a drop in concentration levels. However, it must be pointed out that comparisons of the dioxin levels in human breast milk collected in Croatia and some European countries, Pakistan and Canada show that the levels in the Croatian samples are already in the lower half of the range found in other countries, so that a more significant decrease of levels cannot be expected.

Table 54. PCDD and PCDF levels in human breast milk calculated by application of I-TEF. The number of breast milk samples in the pooled sample is in parenthesis.

Place and year of sampling	pg I-TEQ g^{-1} of fat
Zagreb: 1981–82 (50)	24.2
1985 (17)	20.7
1987–89 (10)	26.7
1987 (41)	11.8
1990–92 (13)	13.5
1993–95 (61)	13.2
2000 (12)	5.9
Island of Krk: 1986–87 (14)	12.0
1992 (10)	8.4
2000 (10)	5.2
Labin: 1988–89 (10)	19.4
Jastrebarsko: 1992 (18)	8.4
Osijek: 1994 (18)	11.8
1997 (20)	15.8

4.7.3. Identification of the part of the population in which the negative effects of POP compounds were detected

This section provides a brief overview of the potential risk groups in which the negative effects of POP compounds might appear.

4.7.3.1. Possible risk groups

Analysis of the existing research results in Croatia do not reveal any clear indicators that high risk groups exist among the group of individuals occupationally exposed to organochlorine pollutants. Since organochlorine pesticides from the “dirty dozen” group are no longer used in Croatia, it can be expected that there are no individuals occupationally exposed to organochlorine pesticides.

Due to their occupation, workers in electrical transformer workshops working with and repairing power transformers and condensers containing PCBs are exposed to this substance. It is to be expected that in the case of accidents involving transformers and condensers containing PCBs, local contamination will occur and the extent of that contamination cannot be predicted. When such accidents occur, usually a certain part of the population is accidently exposed, while the risk group definitely involves those individuals handling such equipment, as well as fire-fighters (exposure to PCDD/PCDF) and persons performing the subsequent decontamination of the area. Fire-fighters constitute a risk group due to exposure to PCDD/PCDF. It is well known that PCDD and PCDF are created in fires of any kind and due to their occupation, fire-fighters are the individuals most exposed to smoke after the fire. In Croatia, there is no available information on the PCDD and PCDF levels in the blood of fire-fighters and such data is also lacking in the rest of the world.

Research carried out on the general population shows that the intake of persistent compounds is highest in infants, which are therefore considered to be the risk group. Daily intake from breast milk in infants is steadily decreasing and now rarely exceeds the acceptable daily intake proposed by international organisations. However, this intake is not considered to be dangerous even if it exceeds the acceptable daily amounts, as the breast feeding period is short in comparison to the human lifespan. Therefore, breast feeding is still strongly encouraged.

In the case of the contamination of the Kupa River which occurred over two decades ago, it has been revealed that persons who predominantly ate fish from the Kupa River (fishermen and their families) were significantly exposed to PCBs, as their daily intake of PCBs through food significantly exceeded the acceptable daily amounts.

4.8. Overview of technical infrastructure in Croatia pertaining to measurement, analysis and research development in the field of POPs compounds

4.8.1. National capacities for monitoring the release of POPs compounds into the environment

There are many laboratories in Croatia equipped for determining organochlorine pesticides and polychlorinated biphenyls, though none are equipped for monitoring PCDD/PCDF emission levels. The Institute of Public Health of the City of Zagreb has the appropriate equipment for measuring PCDD/PCDF emission levels. In co-operation with internationally approved foreign institutions, such measurements are possible. The equipment and know-how for determining the levels of other POPs compounds are also found in the Croatian National Institute of Public Health, Croatian Veterinary Institute, Institute of Public Health of the City of Zagreb and in part, in some other regional public health institutes. It must be mentioned that the public scientific research institutes, Ruđer Bošković Institute and Institute for Medical Research and Occupational Health, are also adequately equipped and have highly-qualified staff in the field and are capable of performing such measurements, as proven by numerous research results obtained to date.

4.8.2. National capacities for monitoring impact on human health

Measurements of organochlorine pesticide and polychlorinated biphenyl levels in human blood and breast milk are performed in Croatia, while analysis of PCDD/PCDF levels is possible and can be organised in co-operation with foreign institutions. Croatia has sufficiently capable doctors, especially occupational health specialists, who are able to recognise changes in the health condition of their patients resulting from organochlorine compound exposure. In the health care system, there is no organised network for collecting data on exposure to and health problems caused by POPs compounds. The only data collected pertains to suicides, though during the past ten years no suicides carried out with those compounds have been recorded. However, suicides carried out with endosulfan, which is also an organochlorine pesticide, have been recorded.

4.8.3. Proposal for improvement of existing practices

Even though data on these compounds in humans exist, research has not encompassed all regions in Croatia. In order to assess the burden levels in our population, research should be extended to more regions, taking into account lifestyles, i.e. eating habits. It would be advisable to monitor the inhabitants residing in areas close to demolished industrial plants

where PCB contamination occurred. Population in the vicinity of sources of pollution, especially PCDD/PCDF pollution, should also be monitored, such as in the areas surrounding industrial plants (metallurgical and metal-processing installations, cement factories, heating plants, waste landfills) and the occupationally exposed population (fire-fighters, workers in electrical transformer workshops).

Among the compounds included in this project, the fewest results have been collected for PCDDs/PCDFs in any medium. Therefore, future measurements should primarily be oriented towards the evaluation of these compounds in samples taken from the environment and from human beings, taking regional distribution into account.

5. PROVISION OF INFORMATION, RAISING AWARENESS AND EDUCATION OF THE PUBLIC

The general public in Croatia does not have enough information on POPs compounds and their negative effect on human beings and the environment. It has been established that even representatives of the industrial sector in which POPs chemicals (PCB compounds) are used are not aware of their environmental effects. In many cases, they were not even aware that some commercial products contain PCBs (such as ASKAREL). These findings clearly point to the fact that present information and education programmes are insufficient and that additional programmes aimed at target groups are needed. The issue of POPs compounds is insufficiently discussed in Croatian primary and secondary schools. A sufficient level of information is present only in scientific and professional circles whose activities involve POPs compounds and in university programmes where POPs compounds are discussed as part of existing curricula and subjects and not as a separate subject. Lack of knowledge on the connection between human activity and environmental impacts is the result of inaccurate and insufficient provision of information to the public. The problem is not only present in Croatia but also in other developed countries in Europe and worldwide. In general, environmental information has been hard to come by, while environmental protection procedures have been carried out from the top down and have been adapted to the needs of specific parts of the society.

5.1. Overview of present public information policy/environmental practices

One of the fundamental principles of the new Environmental Protection Act (OG 110/07) is the principle of information access and public participation. In addition to the fact that “The public has the right of access to environmental information held by public authorities, persons supervised by public authorities and persons holding information for public authorities…”, the public authority must enable access to environmental information, which it holds and/or supervises, in accordance with this Act and by appropriate application of special regulations governing the public’s right of access to information. In 1998, the United Nations Economic Commission for Europe adopted the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, i.e. the Aarhus Convention. The Republic of Croatia actively participated in the preparation of this Convention and signed it in 1998. It was ratified on 13 December (OG 01/07).

Although the new Act has raised the level of the public’s right to information, full rights to information is reserved for the public which is considered as the “public concerned” without defining the precise criteria for assessing who actually belongs to the “public concerned” and which part of the public “is not concerned” and therefore does not have the right to access

environmental information. The vagueness in the definition of terms and the distinction between the “public” and the “public concerned” leaves room for discrimination and potential withholding of relevant information from the public.

5.2. Public information tools and mechanisms

The Croatian Environment Agency is currently implementing the “Public Cooperation” project in accordance with the Environmental Protection Act and the Aarhus Convention. “Public Cooperation” is an ongoing project of the CEA. In addition to providing fast, verified and reliable information on the state of the environment in Croatia to the legislative bodies of the Republic of Croatia, the state administration or to governmental organisations, the Agency works on familiarising other parts of the society such as the economic sector, the scientific community, NGOs, ecological associations and especially the media with environmental information and current events in the field of environmental protection.

5.3. Public opinion on environmental protection as a priority area

The public recognizes environmental issues as being priority issues and shows concern about the adverse environmental effects of waste and waste management issues.

The current level of information exchange is inadequate. An action plan for this field has been drawn up.

5.4. Mechanisms for the exchange of information among parties to the Convention

At the present, Croatia does not have a developed system which could serve as the basis for the exchange of information among parties to the Convention. The action plan for information exchange proposes the organisation and operation of a national “focal point” which would serve as the body competent for information exchange.

5.5. Activities in the non-governmental sector

At the present, there are over two hundred registered non-governmental organisations and associations active in the field of environmental protection in Croatia. A large number of those organisations and associations are active at the local level and deal with environmental issues in the local community. Co-ordination among the non-governmental sector is not developed, meaning there is no cohesion among the actions and activities they carry out. Also, an additional problem in the work of non-governmental organisations and associations in Croatia is insufficient funding on the part of the state, meaning that the main precondition for their continuous and systematic work is not met.

In relation to POPs compounds, at present there are several associations in Croatia which indirectly also deal with the issue of POPs as part of protection of air, water and waste. However, those activities are not sufficient and systematic and must be improved in the future through better cooperation with the non-governmental sector which should participate in educating the general public and should be consulted in the decision-making process.

This would prevent situations in which the non-governmental sector is active in the field of environmental protection only following the occurrence of incidents related to contamination

of the environment or related to waste handling issues. A list of NGOs can be found on the official website of the MEPPPC (www.mzopu.hr).

6. EXISTING SYSTEM FOR THE EVALUATION OF CHEMICALS UPON THE ISSUING OF VARIOUS PERMITS

There are various regulations pertaining to the registration, import permits, application, production and marketing of substances such as:

– medicinal products for human and veterinary use;

– foodstuffs and general use articles and substances coming into direct contact with food;

– cosmetics;

– narcotics and other addictive substances;

– fodder;

– explosive substances;

– plant protection products;

– mineral fertilizers;

– dangerous chemicals in transport by rail, road, water courses and sea and by air;

– chemicals in transit, under special surveillance;

– products used in the public health sector for pest-control.

Pesticides registered as plant protection products or as products used in public health or veterinary medicine are registered on the basis of research and evaluation carried out by specific commissions with the competent ministry.

The marketing and use of biocidal products and their active substances are regulated under the Act on Biocidal Products (OG 63/07, OG 35/08). Subordinate regulations have been adopted prescribing the active substances permitted in biocidal products and the active substances currently under EU revision. Only biocidal products containing those permitted active substances may be placed on the market (Ordinance on the list of active substances in biocidal products and Ordinance on the list of existing active substances permitted in biocidal products – OG 90/08). The establishment of the commission which will issue expert opinions on the placement of a biocidal product on the market and entry into the register of approved biocidal products is currently underway.

7. IMPLEMENTATION OF THE NATIONAL IMPLEMENTATION PLAN (NIP)

7.1. Policy of the Government of the Republic of Croatia

In order to create the preconditions for fulfilment of obligations stemming from the Stockholm Convention, a focal point has been designated as competent for the implementation of the Stockholm Convention, i.e. for organising and supervising the implementation of measures and activities ensuing from the NIP.

In addition to the obligation of managing POPs compounds with the aim of protecting human health and the environment, as a member of the international community, the Croatian Government also undertakes measures aimed at protecting the environment of neighbouring countries against the effects of long-range transport of POPs compounds.

Provision of information to and active participation by the public, potentially endangered groups and experts in resolving problems related to POPs will be part of the Government's policy aimed at dissemination of knowledge on the dangers of poor and uncontrolled management of POPs or activities in which POPs are created as by-products.

7.2. Application strategy

7.2.1. State of play

The Stockholm Convention entered into force in the Republic of Croatia on 30 April 2007, whereby Croatia's commitment towards undertaking the obligations ensuing from the Convention was confirmed. Since the National Implementation Plan includes diverse measures and activities, it is necessary to coordinate their implementation.

7.2.2 Basic policy and goals of the National Implementation Plan

The fundamental goal of the NIP, like the fundamental goal of the Stockholm Convention itself, is the protection of humans and the environment against the adverse effects of POPs.

The most important objectives to be attained through the implementation of the NIP are:

– phasing out of all potential sources of PCBs in the environment;

– systematic control of the levels of POPs compounds in all environmental components;

– limitation and control of PCDD/PCDF, PCB and HCB emissions from unintentional sources;

– application of technological solutions which have the effect of reducing or eliminating releases of POPs compounds from unintentional sources;

– informing the public on the impacts of POPs on health due to intake into the human body and the measures to be taken for the prevention of their intake.

The Croatian Government has designated the Ministry of Environmental Protection, Physical Planning and Construction as the authority competent for implementation of the NIP. Since POPs represent a multidisciplinary issue, a working group will be formed for supervising the implementation of individual parts of the NIP and will include representatives of other government bodies competent for supervising the use of POPs compounds (Ministry of Regional Development, Forestry and Water Management; Ministry of Health and Social

Welfare; Ministry of the Economy, Labour and Entrepreneurship; Ministry of Agriculture, Fishery and Rural Development, etc.).

7.2.3. Principles of NIP implementation

It must be pointed out that that the NIP is in conformity with the Environmental Protection Strategy and that all envisaged legislative amendments are in conformity with EU standards.

The plan for the progressive reduction of POPs compounds in the environment presupposes active participation by the public and stakeholders who will be included in disseminating information on the effects of POPs compounds and the need to reduce their use and to control their unintentional production. Educating the public is an indispensable part of the activities to be carried out and it will be realised through the mass media, through organisation of seminars, expert discussions, school activities, etc.

The results of monitoring the levels of POPs compounds in the environment will be available to the public through the communication channels of the Croatian Environment Agency (website, publications, reports to the Croatian Government and expert reports to the competent ministries), in accordance with the Regulation on information and participation of the public and the public concerned in environmental matters (OG 64/08) and the Regulation on the Environmental Information System (OG 68/08).

7.2.4. Priorities and conditions for realisation

1. Alignment of national legislation with the *acquis*

2. Additional research programmes for more efficient control and monitoring of POPs compounds in humans and the environment

– during the inventory it was confirmed that the present level of research programmes is insufficient

3. Strengthening capacities for continuing inventorying and monitoring for the purpose of reporting to the Convention Secretariat.

– the need to introduce more efficient inventorying procedures has been recognised, especially in relation to landfills, dumps and possibly contaminated sites

4. Raising public awareness and knowledge

– the level of public awareness about the effects of POPs compounds on humans and the environment is very low, which may result in improper handling of chemicals and waste.

5. It is necessary to find new financial sources and mechanisms for the implementation of the Stockholm Convention

For the NIP implementation to be successful, the following conditions are required:

– securing necessary funds from the Government and international donors based on the assessments and plans outlined in the measures and plans, and

– successful coordination between all the activities set out in the NIP.

7.2.5. Key events in the co-ordination of NIP implementation

As part of the process of preparation for accession to the EU, alignment of the Croatian legislation with the *acquis* is currently underway.

The final deadline for phasing out PCBs from use is the year 2010 pursuant to the Ordinance on management of polychlorinated biphenyls and polychlorinated terphenyls (OG 105/08).

7.2.6. Institutional relations and designation of competence

Pursuant to Article 7 of the Convention, after submission the NIP must be periodically reviewed and updated when necessary. Pursuant to Article 15, the parties must periodically report on the fulfilment of obligations from the Convention and the NIP. Therefore, a body consisting of representatives of the authorities responsible for implementation in the Republic of Croatia will be established.

7.2.7. Approach to NIP implementation

The basic approach which will be used in the implementation of the NIP is joint and coordinated implementation of all measures and activities, with the aim of ensuring adequate implementation and avoiding duplication and inconsistency among implementation activities.

7.2.8. Implementation control mechanisms

During NIP implementation, each institution/body will periodically report on progress achieved in the implementation of the NIP in their respective field.

All activities will be presented to the Commission for the purpose of reviewing and approving the process of NIP implementation.

7.3. Measures, programmes and activities

7.3.1. Measure: alignment of the institutional and legislative framework for handling POPs compounds

Goals and priorities

As part of the process of inventorying POPs compounds, institutional responsibilities and the legal framework were determined for each segment relating to the handling and managing of POPs compounds (production, use, import, export, monitoring, control, supervision, etc.).

In this section, only those areas requiring alignment will be listed. The following measures include concrete activities along with a timetable which will ensure implementation of the necessary changes in the Croatian legislative and institutional framework in the area of POPs.

Areas requiring alignment

ANNEX A – Part I, ANNEX B

Stocks containing or contaminated by the substances listed in ANNEX A and B

Sites contaminated by the substances listed in ANNEX A and B

Products and articles in use and waste composed of or containing substances listed in ANNEX A and B

Systematic monitoring of POPs pesticides in humans and the environment

ANNEX A – Part II

Inventory of PCBs in opened and closed systems

Sites contaminated by substances listed in ANNEX A – Part II

Systematic monitoring of PCBs in the environment

ANNEX C

Monitoring the levels of POPs compounds– ANNEX C

Removal of substances and products contaminated by POPs or from which POPs compounds may be created

Introduction of BAT and BEP principles into the economic sector

7.3.2. Measure: reduction or elimination of POPs emission from production and use

Goals and priorities

During the inventory process of POPs compounds, it was been determined that none of the chemicals listed in ANNEXES A and B to the Convention are produced, used, imported or exported in the Republic of Croatia.

However, it was established that PCBs and equipment containing PCBs is still being used and imported. With the adoption of the Ordinance on management of polychlorinated biphenyls and polychlorinated terphenyls (OG 105/08), the legal basis for managing PCBs and PCTs has been established, including the obligations of PCB holders and their recovery, disposal and decontamination.

The use of PCBs in open systems was not indentified during the inventorying process. It is necessary to stress that the regulations prohibit their use.

Summary of current measures for reducing and eliminating POPs emissions from production and use

Regulations in the field of POPs pesticides prohibit their production and use, which is accordance with the Convention.

Implementation

Since all the necessary measures for successful elimination and reduction of releases of POPs chemicals relate exclusively to PCB compounds, Section 3.3.4 covers the implementation of these measures.

7.3.2.1. Planned activities from the areas of production, import and export, use, stockpiles and waste from POPs pesticides (ANNEX A, Part I)

Since it was established during the inventorying of POPs pesticides in Croatia that there is no POPs pesticide production, use, import and export, use, stockpiles and waste, it can be concluded that there is no need for improvement of current practices and the legal basis for pesticide management and handling.

The only area which needs to be better organised and carried out is the systematic monitoring of POPs pesticides in the environment in order to determine the levels of these compounds, thereby confirming the conclusion reached during the inventorying process that from the aspect of impact on the environment and the human health POPs pesticides do not represent a real problem in Croatia. The Monitoring Action Plan provides an overview of the activities and measures that are necessary to introduce systematic monitoring of POPs compounds in the environment and in humans. It also provides an implementation schedule and an estimate of necessary funds.

Table 55 outlines the obligations prescribed by the articles of the Convention which relate to pesticides, showing that all requirements pertaining to their production, import and export have already been met.

The part which jointly pertains to all POPs compounds and which relates to identifying contaminated sites, stockpiles and articles in use containing those pesticides, has been included in action plans and strategies pertaining to those areas.

Table 55. Summary overview of obligations prescribed by the provisions of Articles 3 and 6 of the Stockholm Convention, with an overview of the current situation in Croatia

Obligation	Current situation
Article 3.1	
a) i	No production or use of POPs pesticides from ANNEX A
a) ii	No import or export of POPs pesticides from ANNEX A
b)	Prohibited production or use of POPs pesticides from ANNEX B
Article 3.2	
a) i	Prohibited import for the purpose of disposal pursuant to paragraph 1 (d) Article 6
a) ii	No import because POPs pesticides from ANNEXES A and B are not used
b) i	If remaining stockpiles are found they will be exported for environmentally sound disposal
b) ii	No quantities for use, and therefore, no export
b) iii	No quantities for use, and therefore, no export
c)	If remaining stockpiles are found they will be exported for environmentally sound disposal
3.3. and 3.4	Upon registration, care is taken that the plant protection product is not persistent and that it does not exceed the values stated in ANNEX D
3.5	Provisions on use of chemicals for laboratory purposes exist
3.6	No specific exemptions for POPs pesticides
Article 4	No specific exemptions for POPs pesticides
Article 6	
1.a) i	It is necessary to develop a strategy for identifying stockpiles consisting of or

Obligation	Current situation
	containing POPs pesticides listed in ANNEXES A and B
1 a) ii	No POPs pesticides as products or articles in use and no waste containing POPs identified so far
b)	In the inventorying process, no stockpiles of POPs pesticides have been found, and thus monitoring in which it would be possible to detect larger quantities of POPs pesticides listed in ANNEXES A and B is proposed
c)	POPs pesticide stocks have not been detected to date, while hazardous waste in general is exported in accordance with Article 3.2.
d)	Lacking facilities for environmentally sound disposal of POPs pesticides as hazardous waste
d) i	In the case of existence of POPs pesticides stockpiles as hazardous waste, provisions exist as to who may collect and handle, transport and store hazardous waste
d) ii	Lacking facilities for the management of POPs pesticides as hazardous waste
d) iii	In Croatia, recovery of hazardous waste containing POPs pesticides is neither possible nor permitted
d) iv	Provisions in accordance with the Basel Convention and regulations on transport of hazardous substances
e)	No remediation to date

7.3.2.2. Planned activities from the area of production, use, identification, labelling, elimination, storage and disposal of PCBs and equipment containing PCBs

Goals and priorities

During the inventorying of PCBs, it was established that there is no PCB production in Croatia, however, equipment containing PCBs is used. It has also been established that the import of liquid PCB and equipment containing PCBs will be prohibited as of 31 December 2010.

The PCB activities are aimed at describing and defining the obligations and specific actions which Croatia must undertake in the area of handling PCBs, in accordance with the requirements under the Stockholm Convention. The final goal is PCB reduction and phase out from use, prevention of release of PCBs into the environment and ensuring conditions for disposal of PCBs in an environmentally sound manner.

The highest priority lies with education of and provision of information to the public.

Planned measures for PCB management in Croatia

This section lists the legislative and technical measures necessary for fulfilling the requirements from the Stockholm Convention and achieving proper handling of PCBs and of equipment containing PCBs.

Legislation:

The Republic of Croatia does not have the following PCB related legislation:

– (the Customs Tariff does list transformers and condensers containing PCBs but only “waste oils containing PCBs, PCTs and PBBs” –tariff no. 27109100 and “other cyclic carbohydrates-biphenyls, terphenyls”– tariff no. 29029030);

To enable fulfilment of the requirements from the Stockholm Convention, amendments to the existing legislation and adoption of new legislation in the area of PCBs is proposed:

– amendments to the Regulation on the Customs Tariff so that equipment containing PCBs (transformers and condensers and liquids containing PCBs) are given a separate number for the purpose of controlling and supervising the entry of equipment and devices which might contain PCBs into the country (the Customs Tariff presently in force does list transformers and condensers containing PCBs but only “waste oils containing PCBs, PCTs and PBBs” – tariff no. 27109100);

– adoption of a new or amendments to the existing Ordinance on occupational health and safety when working with substances containing polychlorinated biphenyls, polychlorinated naphthalenes and polychlorinated terphenyls (OG 7/89)

– introduction of the obligation to report the possession of PCB equipment to the competent authorities – the occupational health and safety inspection service of the State Inspectorate (the obligation of applying for a permit for operating devices containing PCBs from the Republic Occupational inspectorate (body dating from the time of SFRY) is prescribed in the Ordinance, but according to the information received from the State Inspectorate, no applications for such a permit have been made to date);

– introduction of the obligation to report accidents involving equipment containing PCBs in which spilling of PCBs into the environment has occurred to the competent authorities – the environmental protection service;

– amendment to Article 5 of the Ordinance since it defines waste PCBs as poisons, while in the meantime they have been removed from the list of poisons and have been redefined as hazardous substances, meaning that waste PCBs do not have to be labelled in accordance with the Ordinance on labelling poisons placed on the domestic market (Official Journal of the SFRY 32/86);

System of permits for activities of handling, transport, storage and disposal of PCBs and equipment containing PCBs – proposal for a more efficient system

At present, in the area of supervision of PCBs, the following forms of PCB monitoring and control exist:

– the permit for putting equipment into operation is issued by the occupational health and safety inspection service (according to the information received from the State Inspectorate no applications for such a permit have been made to date);

– during the operation of equipment containing PCBs, control and supervision of activities is carried out by the occupational health and safety inspectors;

– upon termination of operation of equipment containing PCBs, control and supervision of the waste containing PCBs is carried out by the environmental protection inspectors;

– (the producer of waste containing PCBs must report the generation of such waste to the administrative body in the county or the City of Zagreb competent for environmental protection activities, in accordance with the Waste Act OG 178/04, 111/06, 60/08)

– final disposal is carried out by companies and institutions authorised by the competent state administration bodies (MEPPPC).

In order to enable the fulfilment of the requirements prescribed by the Stockholm Convention pertaining to control and supervision of equipment and waste containing PCBs, the following is proposed:

– to strengthen inspectional supervision over the obligation to report possession of equipment containing PCBs to the occupational health and safety inspection service;

– to strengthen inspectional supervision over the obligation to report waste containing PCBs to the state administration office in the local (regional) self-government unit competent for environmental protection activities.

The current situation in companies and the industrial sector which are phasing out PCB equipment from use and the proposal of a statement to be given by the ten largest owners declaring that they will phase out PCB equipment from use in accordance with the Stockholm Convention

Information on the situation in companies and in the industrial sector which are phasing out PCB equipment is not available since this process is not systematically monitoring. The obligation to apply for a permit for operating devices containing PCBs from the Republic occupational inspectorate (body dating from the time of SFRY) is prescribed in the Ordinance on occupational health and safety when working with substances containing polychlorinated biphenyls, polychlorinated naphthalenes and polychlorinated terphenyls (OG 7/89). However, according to the information received from the State Inspectorate, no applications for such a permit have been made to date.

In cooperation with the Ministry of the Economy, Labour and Entrepreneurship, inspection records on the supervision of equipment containing PCBs drawn up by occupational health and safety inspectors in the period between 1993 and 1997 have been processed and analysed, and a poll carried out for the purpose of setting up a database on owners of equipment containing PCBs (transformers and condensers), liquids containing PCBs and waste contaminated by PCBs. In 2003, the database was supplemented and updated for the purpose of developing a PCB inventory.

In order to fulfil the requirements prescribed by the Stockholm Convention pertaining to monitoring the process of phasing out PCB equipment, in accordance with the Ordinance on PCBs and PCTs (OG 105/08), the Croatian Environment Agency will maintain and update the database on owners of PCB equipment (based on the reporting of equipment to the occupational health and safety inspection service and the proposed reporting of PCB waste to the environmental protection service). This will be aimed at obtaining a realistic picture on the process of phasing out PCB equipment from use.

Plans for the final treatment and disposal of waste containing PCBs including determination of required spatial capacities

At present, waste is temporarily stored in facilities inside the factory area, throughout the territory of Croatia, where decommissioned PCB equipment is temporarily stored, or in storage facilities of companies managing waste containing PCBs.

In accordance with the Ordinance on management of PCBs and PCTs (Article 7), the period for which PCBs, waste PCBs or equipment containing PCBs may be temporarily stored is limited to 2 years, after which time, decontamination, recovery and/or disposal must be carried out.

Waste containing PCBs is most often exported for disposal abroad, in accordance with the Basel Convention.

Existing programmes or plans for development and dissemination of information on alternative substances and equipment, and their production and use

There are no programmes for development and dissemination of information on alternative substances and equipment, their production and use in the Republic of Croatia at this time.

In order to fulfil the requirements prescribed by the Stockholm Convention pertaining to development and dissemination of information on alternative substances and equipment, and their production and use, the following is proposed:

– to publish an educational material/leaflet containing guidelines for the use of alternative substances instead of PCBs (it may include a list of alternative products, their physical and chemical properties and a list of producers of alternative products);

– to make the educational material/leaflet available to all owners of PCB equipment, e.g. by publication on the MEPPPC website

Implementation of planned measures

Implementation is planned to be carried out through three areas:

– co-ordination of implementation;

– updating legislation, developing guidelines and strategies;

– gradual phase-out of PCBs.

It is necessary to:

– determine the quantities and types of equipment containing PCBs;

– monitor and supervise implementation of measures through:

– monitoring and regular updating of the database on owners of PCB equipment,

– monitoring the condition of PCB equipment,

– monitoring the disposal of PCB equipment

– monitoring the application of alternatives to PCBs;

– report to the Secretariat of the Stockholm Convention on progress in the elimination of PCBs by Croatian competent authorities;

– draw up a work plan and determine the necessary funds, and identify and train the economic entities and competent state administration bodies on the obligations stemming from the Stockholm Convention;

– transport decommissioned equipment to temporary storage;

– export PCB equipment for final disposal – the final deadline for disposal of all equipment containing PCBs is the year 2010;

– ensure proper implementation of legislative provisions;

– prepare guidelines for the identification, decontamination, use, transport, storage and disposal of PCB equipment and PCB waste, organise training on the above guidelines for owners, and make the guidelines available to the public;

It is also proposed that measures will be reassessed and amended accordingly, as required.

The implementation schedule, the parties obligated to implement the measures/activities and the deadlines are presented in Table 56 below.

Table 56. Implementation of planned activities

Activity/measure	Competent authority	Period of application
Monitoring and regular updating of the database on owners of PCB equipment; – monitoring the condition of PCB equipment; – monitoring the disposal of PCB equipment; – monitoring the application of alternatives to PCBs;	MEPPPC/CEA	2009–2010
Prepare guidelines for the identification, decontamination, use, transport, storage and disposal of PCB equipment and PCB waste, organise training on the above guidelines for owners, make guidelines available to the public;	MEPPPC	2010
Phase PCB equipment out of use	Equipment owners	2009–2010

7.3.3. Activities related to DDT production, import and export, use, stockpiles and waste (ANNEX B)

No additional activities have been planned.

7.3.4. Measure: register of exemptions and ongoing need for exemptions

Croatia has not met the requirement for exemption relating to the chemicals referred to in ANNEXES A and B. It has been decided that Croatia will not make such a request in the future and therefore, there is no need to carry out activities related to the obligations referred to in Article 4 of the Convention. In the event that an exemption is requested, this section will be compiled subsequently.

7.3.4.1. Planned activities for the reduction and elimination of PCDD/PCDF, HCB and PCB emissions as by-products

Goals and priorities

Annex C to the Stockholm Convention refers to products formed and released unintentionally from anthropogenic sources: polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofurans (PCDF), hexachlorobenzene (HCB) and polychlorinated biphenyls (PCB).

The activities define and describe the steps Croatia needs to take for the efficient application of the Convention. The priority areas are as follows:

– setting up comprehensive monitoring,

– raising awareness of stakeholders and the public and their inclusion in the decision making process and implementation of measures.

Activities include short-term and long-term measures, obligations and procedures which Croatia needs to undertake towards the reduction/elimination of emissions into the environment.

They pertain to the Stockholm Convention obligations which include:

– assessment of existing and anticipated emissions into the environment,

– assessment of the efficiency of laws/regulations,

– development of a strategy for reducing emissions into the environment,

– education and training,

– review of the strategy for environmental emission reduction every five years,

– planning the implementation of planned activities,

– promotion of accessible, cost-effective and practical measures for achieving a realistic and significant emission reduction or source elimination (promotion of the BAT principle),

– support to substitution/modification of raw materials, products, processes,

– adoption of technical guidelines for reduction/elimination of production and use of substances and products containing POPs,

– gradual elimination of substances and products contaminated by POPs or from which POPs may be produced, handling and final disposal of waste contaminated by POPs, remediation of sites polluted by POPs,

– phase-out of the use of PCB in existing equipment by the year 2010,

– voluntary arrangements with companies or industrial groups which may influence POPs emissions during the production process,

– reporting and public information activities, and

– handling and final disposal of waste and remediation of sites polluted by the compounds listed in ANNEX C.

The proposed activities are in line with the requirements stemming from the Stockholm Convention and in conformity with the fundamental principles of the environmental protection policy. According to these, the setting of goals and their realisation for the reduction/elimination of environmental emissions are possible only through mutual partnership among all participants in the process (state administration, economic sector, public), accompanied by changes in production and consumption and the use of a greater number of instruments for the implementation of activities (administrative limitations, incentives based on voluntary schemes).

Planned activities and measures

The Republic of Croatia has the obligation to prepare an inventory of emissions of POPs compounds into the air (including PCDD/PCDF and HCB) according to the EMEP/CORINAIR international methodology, officially accepted by the Executive Body of the Convention on Long-Range Transboundary Air Pollution (CLRTAP).

The UNEP Toolkit is in the process of introduction (Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases, UNEP 2001). The UNEP Toolkit develops a methodology for calculating emission and/or transfers of PCDD/PCDF into the environment through five media: air, water, soil, products and residues/waste.

Development of a detailed Inventory of POPs compounds listed in ANNEX C to the Stockholm Convention

Following the instructions and procedures for developing an inventory of POPs compounds listed in ANNEX C to the Stockholm Convention, it is necessary to carry out a detailed review and to supplement the Inventory of PCDD/PCDF emissions into the environment and develop a detailed inventory of emissions of HCB and PCB into the environment as by-products.

In the development of the inventory, it is necessary to also ensure and enable better insight into data on activities according to each category and sub-category and into data on specific technological processes. It is also necessary to analyse the condition of emission reduction equipment and the capacities of filters installed on plants. In the calculation of releases of by-products into the environment, emission factors determined on the basis of concrete

measurements of environmental emissions of by-products must be used, along with measurements of levels of point and fugitive emission sources and contaminated sites.

The inventory must also include identification of those specific substances and products which are contaminated by or represent a potential source of the POPs compounds listed in ANNEX C. It is also necessary to identify all sites contaminated by the POPs compounds listed in ANNEX C to the Stockholm Convention.

Development of a Programme for gradual elimination of substances and products contaminated by or which may produce POPs compounds, handling and final disposal of waste contaminated by the POPs compounds listed in ANNEX C and the remediation of sites contaminated by the POPs compounds listed in ANNEX C

The Programme must be in conformity with the requirements of the Stockholm Convention, the requirements of other international conventions and undertaken commitments, requirements stemming from the EU accession process and requirements prescribed by national strategies and plans.

The Programme must be in conformity with the measures and plans from the National Waste Management Strategy, including modern and environmentally friendly methods and technologies for waste disposal and remediation of sites contaminated by the POPs compounds listed in ANNEX C to the Stockholm Convention.

It is necessary to include all interested parties in the process of developing the Programme, determine the short-term and long-term priorities and enable all those who are interested to participate in monitoring, reviewing and supplementing the proposed goals and measures.

The Programme must promote the principles of partnership and shared responsibility, with the aim of achieving the final goal of reducing and eliminating emissions into the environment.

Review of existing and adoption of new legislation pertaining to limit values for POPs compounds from ANNEX C in food and the environment

It is necessary to align national legislation with the *acquis* relating to limit values for the POPs compounds from ANNEX C in food and the environment.

A short overview of legislation currently in force in Croatia regulating POPs compounds from ANNEX C to the Stockholm Convention is provided below, along with examples from individual European countries (limitations and recommendations) for maximum permitted concentrations of PCDD/PCDF in food and in individual environmental components.

Food

In the Republic of Croatia, the maximum permitted levels of HCB, PCB and PCDD/PCDF in food are prescribed by law (Ordinance on toxins, metals, metalloids and other harmful substances which might be found in foods, OG 16/05).

Certain countries have developed regulations and recommendations related to the PCDD/PCDF concentrations in milk and products (Table 57).

Table 57. PCDD/PCDF in milk and products (concentration in pg I-TEQ kg^{-1} of milk fat) – maximum values and recommended activities

Country	Concentration (pg I-TEQ kg^{-1} of milk fat)	Comment/Recommendation
Germany	< 0.9	– target concentration
	>3.0	– recommendation: not to be placed on the market
	5.0	– maximum concentration
Ireland	5.0	– maximum concentration
The Netherlands	6.0	– maximum concentration
Great Britain	0.7	– milk and products with less than 2% milk fat
	16.6	– maximum concentration

Water

In the Republic of Croatia maximum permitted concentrations of HCB, PCB and PCDD/PCDF in water are prescribed in the following legislation:

• Regulation on water classification (OG 77/98),

• Regulation on dangerous substances in waters (OG 78/98),

• Ordinance on sanitary quality of drinking water (OG 47/08).

It is necessary to:

• align the limit values of mass concentrations (μg L^{-1}) of PCBs in certain types of waters (Regulation on water classification, OG 77/98) with the limit values defined in EU regulations and to define the limit values of concentrations (μg L^{-1}) of PCDD/PCDF and HCB in certain types of waters;

• align the Regulation on dangerous substances in waters (OG 78/98) and the Regulation on water classification (OG 77/98) in the part relating to maximum mass concentration of PCB in the category of types II-V of inland waters;

• align maximum permitted mass concentrations (μg L^{-1}) of PCDD/PCDF, PCB and HCB in type IV inland waters and the sea (Regulation on dangerous substances in waters, OG 78/98) with the values defined in EU regulations;

• align indicators of sanitary quality of water used for public water supply (Ordinance on sanitary quality of drinking water, OG 47/08) in the part pertaining to PCDD/PCDF, PCB and HCB with the indicators defined in EU regulations.

Alignment of the national legislation is underway.

Soil

The Croatian legislation defines the maximum permitted values, expressed as mg kg^{-1} of dry matter, for 2,3,7,8–tetrachlordibenzo-p-dioxin, HCB and PCB in soil in the Ordinance on protection of agricultural land against pollution by harmful substances (OG 15/92).

It is necessary to align the values stated in the Ordinance with the values defined in EU regulations.

Germany and The Netherlands have developed detailed recommendations related to PCDD/PCDF concentrations in soil (Table 58):

Table 58. PCDD/PCDF in soil (concentration in ng I-TEQ kg^{-1} dry matter) – maximum values and recommended activities

Country	Concentration (ng I-TEQ kg^{-1} dry content)	Comment/Recommendation
Germany	< 5.0	– target concentration
	5 – 40	– control of production on agricultural land
	>100	– remediation of soil on children's playgrounds
	>1000	– remediation of soil in residential areas
	>10000	– remediation of soil irrespective of location and intended use
The Netherlands	1.0	– agricultural land
	10	– pastures

Air

Limit values for pollutant emissions from stationary sources into the air are prescribed by:

• Regulation on limit values for pollutant emissions from stationary sources into the air (OG 21/07),

• The ELV for dioxins and furans in waste gases from waste incineration plants and in waste gas generated during the technological process of cement production during co-incineration of waste is 0.1 ng m^{-3}. The prescribed limit value is in conformity with the EU Directive

(2000/76/EC) which applies to all types of waste incineration plants and co-incineration plants.

The planned activities for the reduction and elimination of emissions of by-products into the environment must be in accordance with the objectives defined for POPs compounds in the National Environmental Protection Strategy (OG 46/02) and the National Environmental Action Plan (OG 46/02). The mentioned strategic documents outline the general targets for POPs. The Plan for Air Quality Protection and Improvement in the Republic of Croatia for the Period 2008–2011 prescribes measures for reducing POPs emissions into the air:

• adoption of a programme for the implementation of the IPPC Directive and application of best available techniques (BAT) for the reduction of POPs emissions.

In Croatia, it is necessary to systematically introduce the most important instrument for reducing emissions of dioxins and furans from industrial processes, i.e. implementation of the IPPC Directive – the Directive on Integrated Pollution Prevention and Control. Its aim is to reduce the environmental effects of the largest industrial installations by reducing pollution of air, water and soil, reducing waste generation to the greatest possible extent and rational use of natural resources and energy.

The UNEP document Best Available Techniques (BAT) and Best Available Practices (BEP) for reducing and/or eliminating emission of POPs by-products is available and may assist in reducing POPs emissions.

Development and application of a strengthened system of supervision over the implementation of legislation on POPs compounds listed in ANNEX C

Supervision over the implementation of legislation is possible only if accompanied by effective inspection. It is necessary to improve on the system of inspectional supervision for the purpose of more efficient supervision of regulations on POPs compounds listed in ANNEX C.

Voluntary arrangements with companies and industrial groups

One of the basic elements of environmental policy, in accordance with the EU environmental policy and the requirements stemming from the Stockholm Convention, is partnership between economic development and environmental standards. A partnership approach may be realised only through arrangements with companies or industrial groups, aimed at reducing/eliminating pollutant emissions into the environment. It is necessary to promote investments into the environment through special schemes and incentives, by introducing clean sustainable technologies and applying BAT and BEP methodologies.

The authority competent for the implementation of the Stockholm Convention should initiate the set up of special arrangements with companies and industrial groups through the following measures:

– identifying possible candidate companies or industrial groups,

– preparing the form for voluntary schemes,

– initiating negotiations and contracting mutual obligations,

– monitoring the process of contracting and scheme implementation.

Reporting and public information activities

Successful implementation of planned activities depends on the training of, reporting to and informing of stakeholders and the general public. The goal is to enable easy and timely access to information and to stimulate and enable participation in the decision-making process. Mechanisms must be developed for the exchange of information, for the creation of educational programmes and organisation of training.

The programme of activities must include the following:

– development of educational programmes and organisation of training on the implementation of the Action Plan;

– development of instructions and performing assessment of progress in the plan's implementation and reporting in accordance with the Stockholm Convention requirements;

– provision of information on the implementation of the Action Plan to the public and all interested parties.

The Regulation on information and participation by the public and public concerned in environmental matters (OG 64/08) lays down the manner of informing the public and participation of the public and public concerned. The Regulation on the Environmental Information System (OG 68/08) – it is the aim of the information system is to interconnect all existing data and information streams by using modern tools such as the Internet and satellite technology and to ensure that reporting in paper format is replaced by a system in which data is accessible to users at the very data source, in an open and transparent manner.

Gradual elimination of substances and products contaminated by POPs or from which POPs compounds may be produced, handling and final disposal of waste contaminated by POPs compounds listed in ANNEX C and remediation of sites contaminated by POPs compounds listed in ANNEX C

Pursuant to the Stockholm requirements it is necessary to:

– elaborate detailed goals, including implementation procedures from the Strategy for the gradual elimination of substances and products contaminated by POPs or from which POPs compounds listed in ANNEX C may be produced;

– develop implementation procedures for the handling and final disposal of waste contaminated by the POPs compounds listed in ANNEX C of the Stockholm Convention;

– elaborate detailed goals and implementation procedures for the remediation of sites contaminated by the POPs compounds listed in ANNEX C of the Stockholm Convention.

The implementation schedule, parties obligated to implement the measures/activities and deadlines are presented in Table 59.

Table 59. Implementation timetable

Activity/measure	Competent authority	Application period
Develop a detailed inventory of POPs compounds listed in ANNEX C	MEPPPC	2009–2010
Prepare a Programme for gradual elimination of substances and products contaminated by POPs or from which POPs compounds may be produced, handling and final disposal of waste contaminated by POPs compounds listed in ANNEX C and adopt a programme for remediation of sites contaminated by POPs compounds listed in ANNEX C	MEPPPC	2009–2010
Revise existing and adopt new legislation related to limit values for POPs compounds listed in ANNEX C in food and the environment	MHSW	2009
Elaborate implementation procedures from the Programme for gradual elimination of substances and products contaminated by POPs or from which POPs compounds listed in ANNEX C may be produced	MEPPPC	2010–2013
Develop implementation procedures for the remediation of sites contaminated by PCB compounds listed in ANNEX C of the Stockholm Convention	MEPPPC	2010–2013

7.3.5. Measure: reduction of emissions from stockpiles and waste

During the inventorying process, the existence of PCB stockpiles and waste containing PCBs was established. To be more precise, the quantities of PCB equipment in stock, stockpiles of liquid PCBs, PCB equipment out of function/use and liquid and solid PCB waste (see Section 2.3.2.6 for exact data) have been determined. These stockpiles and waste are located in the owners' facilities.

The following section outlines the necessary activities for preventing and eliminating POPs compounds from stockpiles and waste that may be identified in the future.

7.3.5.1. Programme for identifying significant stockpiles, articles in use and waste containing persistent organic pollutants

Programme goals and priorities

During the inventorying process, the following was established:

– there are no significant stockpiles of POPs pesticides, articles in use or waste containing POPs pesticides;

– stockpiles of PCB equipment, smaller quantities of stocks of liquid PCBs and PCB equipment which is no loner in use and represents waste;

– use of PCBs in open sources has not been found;

– products and articles in use or waste contaminated by or containing the compounds listed in ANNEX C was not found.

In implementing the proposed measures, it must be kept in mind that based on the inventory of pesticides it cannot be assumed whether or not stockpiles of articles or waste containing pesticides exist. This conclusion is based on the fact that in Croatia there was never any synthesis of pesticides having the properties of persistent organic pollutants and that at the time of application, the quantity imported was sufficient for one year use.

The use of pesticides was permitted until the existing stockpiles were used up.

The proposed measures for identifying significant stockpiles, articles in use and waste

This section outlines the technical measures for identifying stockpiles, articles in use and waste

Pursuant to the obligations prescribed by the Stockholm Convention, it is necessary to assess the need for developing the Programme based on the existing data on stockpiles of POPs compounds listed in ANNEXES A and B and the quantities of products, articles in use and waste consisting of or containing POPs compounds or is contaminated by chemicals listed in ANNEXES A, B and C of the Convention.

Through the implementation of this Programme, it is necessary to identify stockpiles containing the compounds listed in ANNEXES A and B and ensure that identified stockpiles are managed in a safe, efficient and environmentally sound manner. The existence and management of stockpiles of compounds listed in ANNEXES A and B should be permitted only in the case of export for the purpose of environmentally sound disposal.

Technical measures required for implementation

Technical and implementation measures for Programme implementation:

1) Measures required for identifying stockpiles containing or contaminated by the compounds listed in ANNEXES A and B:

– determining the existence and quantities of stockpiles according to products/chemicals,

– labelling stockpiles,

– developing a more detailed inventory,

– securing the stockpiles against emissions into the environment,

– building a temporary storage facility,

– collecting and transporting stockpiles to a constructed temporary storage facility,

– export of the stockpiles for treatment and final disposal.

2) Measures for proper handling and disposal of waste, articles in use and products containing or contaminated by POPs listed in ANNEXES A, B and C:

– determining the quantities of waste, articles in use and products,

– securing the waste against emissions into the environment,

– developing a more detailed inventory,

– begin replacing the products and articles in use,

– final disposal of articles in use.

Programme implementation

Successful implementation of the Programme may only be accomplished through the co-operation of all stakeholders. The setting up of a body comprised of representatives of all the stakeholders (Commission) is also planned. This body would meet once a year in order to evaluate the progress made in the Programme's implementation. Depending on its success, the Programme would be amended (if necessary) every two years.

The implementation schedule, parties obligated to implement the measures/activities and the deadlines are presented in Table 60.

Table 60. Programme implementation schedule

Activity / measure	Competent authority	Application period
Study on identifying stockpiles, waste and articles in use	MEPPPC	2009
Development of technical procedures and instructions for identification of stockpiles, articles in use and their proper handling	MEPPPC Owners	2010

7.3.6. Measure: handling stockpiles and appropriate measures for handling and disposing of articles in use

All activities necessary for the management of identified stockpiles containing POPs and for proper handling and disposal of articles in use have been presented in the previous section.

7.3.6.1. Programme for identification and remediation of contaminated sites

Goals and priorities

Since during the inventorying process sites contaminated by POPS were not identified with certainty but only a preliminary assessment of possible locations was carried out, this section will list the necessary activities and measures for the possible development of a national programme for the identification of contaminated sites, extent of contamination and possible environmentally sound remediation methods, in addition to technical measures needed for the timely implementation of the programme.

Preliminary identification of contaminated sites

Sites contaminated by pesticides

During the process of inventorying POPs compounds and based on the available data, sites contaminated by pesticides were not found. However, since pesticides were mixed, used, imported and exported in Croatia, it is necessary to carry out further investigations in those areas where pesticides were used in greater quantities. These investigations should be carried out on the territory of the Osijek-Baranja County, Vukovar-Srijem County and Bjelovar-Bilogora County.

Sites contaminated by PCBs

Due to the former and present existence of equipment containing PCBs in Croatia (transformers and condensers) and the war (in the period from 1991 to 1995) in which significant devastation occurred and electrical power installations were shelled and destroyed, a preliminary identification of locations were PCB contamination might have occurred was carried out after the war. At these locations, the presence of PCB compounds was found in the soil and in the air. Based on previous investigations and the inventorying procedures, three locations were identified in the coastal area (Zadar, Rijeka Dubrovačka, Bilice near Šibenik) in which further investigations need to be carried out in order to definitively determine the actual condition of these sites and the possible level of contamination.

Sites contaminated by PCDD/PCDF

It is necessary to carry out further investigations in order to identify sites possibly contaminated by PCDD/PCDF since data on such sites do not exist. In identifying the possibly contaminated sites, locations near potential sources of emissions of these compounds into the environment must be examined, in addition to locations at which the presence of PCB was found in soil during preliminary investigation, as these sites also likely contain certain quantities of PCDFs.

Proposed measures for identifying contaminated sites and their possible remediation

Adoption of new and alignment of existing legislation aimed at identification and possible remediation of sites contaminated by POPs compounds

According to the obligations prescribed by the Stockholm Convention, it is first necessary for the state to adopt a decision on the preparation of a national programme for the identification and remediation of sites contaminated by POPs. In preparing the programme, it is necessary to adopt and align existing acts and subordinate regulations (ordinances, instructions) in which all steps and procedures for successful implementation of the strategy will be defined.

The Environmental Protection Act (OG 110/07) prescribes the obligation of keeping an environmental emission register, i.e. a database on sources, types, quantities and points of release, transport and disposal of pollutants and waste in the environment. Pursuant to the Act, liability in cases of environmental pollution and the polluter pays principle have been established.

As part of the integrated Environmental Information System, a database on sites contaminated by POPs in environmental components is also planned to be set up.

Technical measures required for setting up and keeping the register and for possible remediation of contaminated sites

Once the obligation to keep the register of soil (land) contamination is introduced, it is first necessary to prescribe technical instructions and procedures for preparing and keeping of the register of sites contaminated by POPs.

Furthermore, it is necessary to develop procedures or instructions at the expert level for identifying locations contaminated by POPs compounds and assessment of the level of their contamination (determining priorities for remediation with an implementation timetable). These procedures or instructions must include an assessment of contaminated sites in relation to their impact on humans and the environment and cost estimates for the remediation of individual sites. Furthermore, it is necessary to prescribe the methods to be used for proper handling of locations identified as contaminated but not scheduled to undergo immediate remediation for the purpose of preventing possible adverse environmental effects.

After identifying the priority locations for remediation, it is necessary to develop instructions and procedures for carrying out environmentally acceptable remediation of the contaminated sites.

The dynamics of monitoring remediation of the identified contaminated sites is to be carried out on a case-by-case basis.

Table 61. Programme implementation schedule

Activity / measure	Competent authority	Application period
Identification of sites contaminated by POPs	MEPPPC	2010
Development of guidelines and instructions for identification and assessment of contaminated sites	MEPPPC	2010
Identification and assessment of contaminated sites	MEPPPC	2010
Remediation of contaminated sites	Owners/EPEEF	2015
Maintaining a cadastre/register of information on contaminated sites	CEA	2010

7.3.7. Information exchange programme

7.3.7.1. Aims of information exchange policy

The information exchange programme must be based on:

– international information exchange,

– domestic information exchange.

7.3.7.2. National focal point for information exchange

The Stockholm Convention focal point shall be the ministry competent for environmental issues which will also serve as the information body for all stakeholders. On the one hand, it shall gather information from the competent Croatian institutions and deliver it to the Secretariat, while on the other, it shall distribute all information received from the Secretariat to the competent institutions in Croatia.

Due to the fact that the number of stakeholders is high, the establishment of a working group is planned. This working group will include representatives from competent ministries responsible for the implementation of the Act on the Ratification of the Stockholm Convention on Persistent Organic Pollutants (OG-IA 11/06). Each competent institution will appoint one person in its organisation responsible for communication with the Ministry.

7.3.8. Programme for raising awareness, public information and education

7.3.8.1. Goals and priorities in the area of education, raising awareness and provision of information to the public

The aim of the Programme for raising awareness, public information and education is to describe and define programmes for informing and educating the public on POPs in accordance with the requirements of the Stockholm Convention and in that way, to raise public awareness. All programmes must be oriented towards the chosen target groups in order to train them for proper handling of persistent organic pollutants and thereby raise public awareness on the subject. The final goal is inclusion of the public in the process of making decisions on matters related to the use and gradual elimination of the production and use of POPs, the prevention of environmental emissions and ensuring the disposal of POPs waste in an environmentally sound manner.

The programmes and their target groups are shown in Table 62.

Table 62. Programmes and their intended target groups

	Representatives of competent institutions	Expert circles	Technical management staff	Workers	Women and children	Teachers and students	Media representatives	NGO representatives
Publications	√	√				√	√	√
Instructions and guidelines			√	√				
Posters and leaflets					√	√	√	√
Seminars, expert lectures		√	√		√		√	√
Courses				√				
Quizzes and						√		

competitions										
Information centre	√		√			√	√	√		√
Exhibitions	√		√			√	√	√		√

7.3.8.2. Basic aims of education, information and raising public awareness

The programme for informing and educating the public and raising public awareness is based on the following:

– Enabling access to information

The Stockholm Convention prescribes the obligation of signatory countries to make all data and information relating to persistent organic pollutants available and accessible to all, especially to high-risk groups. All information must be accurate, timely and up-to-date.

– Designating institutions responsible for implementation of the programme for education and raising public awareness

For the successful implementation of the programmes for informing and educating the public and raising public awareness, the decision on who will implement the programmes must first be made. Whether this task is entrusted to the National focal point or the National information exchange centre is entirely up to the signatory state to the Convention to decide. Without this decision, programmes can neither be applied nor implemented.

– Development and implementation of programmes for educating and raising public awareness for all target groups

It is necessary to adopt programmes for educating and raising public awareness specifically for each of the detected target groups.

Possible difficulties and limitations in the application of the strategy for informing and educating the public and raising public awareness may first appear in selecting an appropriate programme for each target group. Lack of technical capacities, securing necessary funds and lack of support from the management staff in economic entities may represent limiting factors in the implementation of the action plan.

Presentation in the media of the harmful effects of compounds covered by the Stockholm Convention may be improved by further supplementing the promotional activities held by the Ministry of Regional Development, Forestry and Water Management as part of the joint project with the FAO aimed at raising awareness on the harmful effects of forest fires (2006).

7.3.9. Measure: evaluation of efficiency and reporting

The Conference of the Parties to the Stockholm Convention has established the mechanisms for periodic assessment of the success of the implementation of the Convention.

With the aim of providing information to the Conference of the Parties on monitoring the presence of chemicals listed in ANNEXES A, B and C to the Convention and on their regional and global distribution, the MEPPPC serves as the national focal point towards the Conference of the Parties, which is in accordance with the proposed strategy for the exchange of information in Section 4.3.12.

The Ministry shall report to the Secretariat of the Convention for the purpose of evaluating the success of fulfilment of the Convention's requirements.

7.3.10. Measure: development, research and monitoring

7.3.10.1. Goals and priorities of planned measures for setting up and implementing systematic monitoring of POPs compounds in the air, soil, water

The goal of setting up systematic monitoring of POPs compounds, serving to determine their level in the environment and, among other things, to confirm the assumptions set out in the action plans on pesticides, contaminated locations, stockpiles and articles in use, stating that pesticides do not present a real problem in Croatia and that more data on the levels of PCDD/PCDF in the environment need to be collected.

Since the Convention prescribes that development and research activities must be performed in accordance with the possibilities in place and available funds, only those areas where additional development and research activities are required are listed.

Priorities are as follows:

– amendment and preparation of implementing regulations for monitoring POPs in the environment;

– proposal of a structure of the institutions competent for setting up and implementing environmental monitoring;

– proposal of the dynamics of introducing and monitoring POPs compounds;

– proposal of the method and scope of reporting and informing the public;

– proposal of the scope and dynamics of funding;

– securing funds.

Continuous monitoring of emissions, landfilling, transit and transport, import and export, production and application/use, level of POPs compounds in the environment, food and humans is not in place.

8. MEASURES FOR IMPROVEMENT OF QUALITY AND INTRODUCTION OF INTEGRATED MONITORING OF LEVELS OF POPs COMPOUNDS

8.1. Legislative framework for creating the conditions necessary for monitoring POPs levels

It has been established that there is no systematic monitoring of POPs residues in all environmental components. The existing laws and subordinate regulations have laid down relatively good tolerance and maximum permitted values of certain compounds in environmental components (in air, soil, drinking water and other water, food) and in part prescribe methods for testing food and water.

All gathered data result from insufficiently co-ordinated expert controls and expert or scientific research and have been published in varies scientific publications or collections of papers presented at expert and scientific conferences.

Monitoring of organochlorine compounds, including PCBs, is regulated by the Ordinance on monitoring residues of certain substances in live animals and products of animal origin (OG 106/99). By amending the Ordinance (to include groups of PCDD/PCDF compounds and define maximum permitted values in food in accordance with EU recommendations, define all compounds covered by the term "organochlorine compounds" and the abbreviation PCB – total PCB, according to mixture or individual PCBs), a unique basis for monitoring in live animals and semi-finished products and products of animal origin would be created.

The purpose of such monitoring would be to create a database organised according to geographic distribution (Geographic Information System – GIS). This would serve as the basis for monitoring changes in levels and enable insight into trends of each instance of pollution in normal conditions and in the case of accidents. The situation for waste is similar. Precise data on equipment containing PCBs is lacking (transformers, condensers and heat exchangers containing PCBs).

8.2. National capacities and resources needed for monitoring

For successful investigation of the presence of most of the compounds from the POPs group (organochlorine pesticides, polychlorinated biphenyls) in samples taken from the environment, it is necessary to secure:

– adequate highly-qualified personnel and technical staff trained for the analysis of traces of the compounds in question in samples taken from the environment;

– adequate facilities and equipment for trace analysis. The basic equipment includes a high resolution gas chromatograph with electron capture detector (HRGC-ECD) or a high resolution gas chromatograph with mass spectrometer (HRGC-MS);

– interconnected and harmonised testing system, in conformity with good laboratory practices and international standards.

In Zagreb, the Institute for Medical Research and Occupational Health, the Ruđer Bošković Institute, Institutes for Public Health, the Veterinary Institute, Faculty of Food Technology and Biotechnology and the Faculty of Agriculture have the necessary equipment for testing and control of compounds from the group of organochlorine pesticides and polychlorinated biphenyls (HRGC-ECD). In other parts of Croatia, such equipment can be found and is used in the ecology services of institutes for public health in Rijeka, Split, Osijek, Sisak, Pula, Zadar, Koprivnica and Karlovac. In addition, existing personnel could receive additional training in trace analysis and would then be qualified and capable of carrying out analysis of samples collected for the purpose of monitoring organochlorine pesticides and

polychlorinated biphenyls from the POPs compounds group. Therefore, the most rational solution would be to co-ordinate and harmonise the use of existing capacities.

For reliable analysis of levels of individual PCDD/PCDF congeners present in non-contaminated samples from the environment and in humans, it is necessary to have a high resolution gas chromatograph connected to a high resolution mass spectrometer (HRGC-HRMS) and adequately trained staff. Such a device and staff still do not exist in Croatia, although steps are being taken towards the procurement of such equipment and training.

However, the Institute of Public Health of the City of Zagreb has the adequate facilities, staff and equipment (Soxtherm extractor for processing solid samples and extract purification system – FMS) for preliminary testing of relatively elevated quantities of all 17 relevant congeners from the PCDD/PCDF group in samples from the environment.

Further, this Institute also meets the special requirements for performing control of emissions of compounds from the PCDD/PCDF group in waste gases from stationary combustion units, which relate to standardised equipment for isokinetic sampling and the minimum requirement for determining elevated PCDD/PCDF levels, which relates to availability of a high resolution gas chromatograph connected to a mass spectrometer for single ion monitoring (HRGC-MS-SIM).

The main water management laboratory of Croatian Waters has both the equipment and staff necessary for water monitoring.

8.3. Development of national, regional and local institutions competent for monitoring (locations, medium, sampling frequency) and dissemination of information on the results of POPs monitoring

The existing programmes for monitoring POPs compounds in waters, coordinated by Croatian Waters and the programme for monitoring compounds in meat and products of animal origin organised by the Ministry of Agriculture, Fisheries and Rural Development should be upgraded to include monitoring of POPs compounds.

The equipment currently available at the existing laboratories in scientific and research institutions and the Institute of Public Health (at the state or county level) is not adequate for identifying low levels of POPs compounds in different media. As such, the main precondition for carrying out high-quality monitoring is the procurement of equipment for identifying low levels of POPs compounds in various media, education of personnel to perform such analyses and improvement of control of laboratory work (accuracy of measurements, interpretation of results, selection of methods…).

Croatian Waters is the competent institution for organising, financing and implementing water monitoring. There is a network of laboratories that conduct sampling and analysis and undergo international intercalibration procedures and, according to the intercalibration results, receive accreditation for testing specific indicators in media from the MRDFWM. If the laboratory is not able to test for a certain indicator, it delivers the samples to an accredited laboratory possessing the necessary equipment. The legislative framework also defines the reference laboratory responsible for control over the operations of accredited laboratories. With the introduction of the HRN EN ISO/IEC 17025 standard, which is currently underway, the quality and uniformity of the system as a whole will be improved.

8.3.1. Organisation and extent of monitoring

8.3.1.1. Monitoring in blood samples

Monitoring of POPs compounds in samples of blood, i.e. serum/plasma. Taking into account the results of research carried out to date, one-time monitoring should be carried out in four broader areas (including the rural and urban population of 50 samples each): eastern part – Slavonia, northwestern and central Croatia (Zagreb, Karlovac, Krapina-Zagorje and Sisak-Moslavina Counties), Istria and Kvarner, and southern Dalmatia. In the continuation, monitoring should be expanded if the results indicate that levels in a certain area are higher than in other regions. In order to follow the trends of changes in levels, the collection of samples and analysis should be repeated in the same area after five years. Blood samples should be taken from the general population, from men and women in equal ratio and from similar age groups in all areas.

8.3.1.2. Monitoring POPs pesticides and PCBs in soil samples

The project "Development of the Croatian soil monitoring programme with pilot project, LIFE05 TCY/CRO/000105" is co-financed by the European Commission (Life Third Countries). Its beneficiary is the Croatian Environment Agency with its implementation partner the Faculty of Agriculture of the University of Zagreb, and the Institute for Soil as a participant in project preparation.

The Manual for Permanent Soil Monitoring in Croatia – first edition/working draft has been prepared. Based on this, pilot projects were carried out in 2006 and 2007 on agricultural, forest and contaminated soils. The final objective of the project initiated in 2006 is to define a Programme for Permanent Monitoring of Soil (agricultural, forest and contaminated) as a tool for collecting georeference data on soil in a harmonised format. One of the basic tasks is to determine the level of contamination and to monitor agricultural soil, which also includes determining the content of persistent organic pollutants (PAH, PCB, triazin herbicides, organochlorine pesticides).

Based on the pilot projects, the Programme for Soil Monitoring in the Republic of Croatia has been drafted and will be presented to the Croatian Government and line ministries at the beginning of 2009. This data is needed for monitoring the condition of soil, both pursuant to obligations on reporting on the state of the environment in the Republic of Croatia and pursuant to international commitments. Permanent monitoring of agricultural soil in Croatia is one of the basic tasks of the Institute for Soil pursuant to the Act on Agricultural Land (OG 66/01, 87/02, 90/05) and the Regulation on the establishment of the Institute for Soil (OG 100/01).

Data obtained through soil monitoring will be incorporated into the Croatian Soil Information System (CROSIS) which forms a part of the Environmental Information system (EIS), the key government instrument for setting up a system of sustainable environmental management, directing and following the implementation of legislation and developing the environmental protection strategy and policy at the national level.

The permanent soil monitoring system must also ensure comparability of data at the national level and at the EU level. This includes harmonised methods and standards for collecting soil

samples, analysis, presentation and dissemination, as well as selection of areas where soil will be monitored.

The new Act on Agricultural Land is in its final phase of preparation while the new Ordinance on protection of agricultural land against pollution by harmful substances (OG 15/92) is in the process of adoption.

The Programme is based on the numerous soil investigations carried out in Croatia to date and on Croatian legislation.

3.3.3.3. Food monitoring

Food monitoring is already being conducted as part of the monitoring carried out by the MAFRD. It should be continued in the same extent and linked to the results of food safety checks carried out by the institutes for public health. Through the National Residue Monitoring Programme, the MAFRD monitors organochlorine pesticide residues in products of animal origin (eggs, honey, milk, muscle, fatty tissue). These analyses are carried out by the Croatian Veterinary Institute. In addition, as part of the Plan for monitoring the quality of the sea and shellfish in areas of cultivation, overfishing and recultivation of shellfish, organochlorine pesticides in shellfish are monitored. Analysis, reporting methods and controls of analysis quality require harmonisation. Monitoring also needs to be expanded to include analysis of PCDD/PCDF.

Monitoring of food must include domestic and imported products and is carried out in two-year cycles. In the first year, 10 different products must be chose for analysis from the 10 largest domestic producers of those products, while the following year 20% of the products are replaced by other products of the same producers and 20% are replaced by products of producers whose products were not tested the first year. Products are taken on a monthly basis, taking care that the production dates of the samples are not the same. Imported food is chosen according to nutritional significance, though it is advisable to include at least one less important product (i.e. coffee, tea, spices). The method of sampling is the same as for domestic products with the difference that among foreign producers, producers from different countries are selected. Apart from the existing control and monitoring of food of animal origin, it is planned that an additional 500 samples not covered by the abovementioned programmes be included.

8.3.1.4. Air monitoring

As part of the state network for permanent monitoring of air quality, which will be set up by the end of 2010 as part of the PHARE 2006 project “Establishment of Air Quality Monitoring and Management System”, POPs concentration levels in air will be monitored at four stations: Bilogora, Neretva Delta, Karojba and Plitvice Lakes. These stations will be set up for measuring air quality at stations for the measurement of background pollution, regional and long-range transboundary transfer and monitoring as part of the state’s international commitments (Bilogora and Karojba), and at stations in areas of national parks, parks, nature parks, protected areas, vulnerable environmental systems and areas of cultural and natural heritage (Plitvice Lakes and Neretva Delta) according to the Programme for air quality measurement in the national network for permanent monitoring of air quality (OG 43/02).

Representatives from the Institute for Medical Research, the Ruđer Bošković Institute and the Meteorological and Hydrological Service of Croatia participated in the project "Determination of trend in the ambient air POPs concentration in the Central and Eastern Region using the polyurethane foam-based passive air samplers (PAS CEECs) – 2nd phase 2007" financed by the Czech government. The project consisted of collecting air and soil samples at five locations in Zagreb within a period of five months. It was oriented towards studying the relation between the level of POPs in the environment and their biological effects. The samples were analysed in the Czech Republic.

8.3.1.5. Water monitoring

Water monitoring is carried out by Croatian Waters but only on some rivers and accumulations. Testing should be expanded to other watercourses where the presence of POPs is expected and analysis of sediment should be introduced. The existing monitoring should be harmonised in terms of methodology and method of reporting on results collected through monitoring. Monitoring carried out by Croatian Waters includes approximately 330 measurement stations on flowing and standing waters. At many stations, organochlorine pesticide and PCB content is monitored. Croatian Waters is not competent for monitoring water in wells used for water supply. Monitoring the quality of these waters is within the competence of the Ministry of Health and Social Welfare. Furthermore, in order to determine the scope of monitoring POPs concentrations, a detailed analysis of the possible presence in waters must be conducted.

8.3.2. Implementation of planned monitoring measures

Implementation depends on the active engagement of the competent state administration bodies and bodies thereby accredited, and is based on the results of the inventorying process, the monitoring plan, public education and the availability of funds.

Priorities should be focused towards: improvement of inspectional supervision, reduction of the number of POPs sources, development of the network of equipped laboratories, organisation of monitoring with financial support and organisation of a database for the purpose of informing the public on processed results and their interpretation. Table 68 presents the order of implementation, parties obligated to implement the measures and the activities and deadlines.

If monitoring should show over the course of one or two years that the compounds are not present in water for example, such tests need not be conducted further, at least not to such an extent and with such frequency.

8.3.3. Capital investment requirements

As regards capital investments, the most important area would be strengthening the capacities of existing laboratories for testing the presence of habitual levels of PCDD/PCDF in samples taken from the environment (soil, air, water, sea) and in human derived material samples. In order to improve the monitoring of POPs pesticides, it is first and foremost necessary to interconnect and co-ordinate the work of the existing equipped laboratories.

8.3.4. Implementation costs

Funds required for implementation of monitoring (for a minimum period of seven years) cover the development of laws and subordinate regulations, the information system, organisation of monitoring with simultaneous quality checks of laboratory operations, collection and processing of monitoring results, reporting on obtained results, and organisation of systematic provision of information to the public. Funds for those activities should be secured from the competent ministries, counties and local self-government units, and from international organisations (e.g. GEF, UNIDO).

Table 63. Implementation schedule

Activity/measure	Competent authority	Application period
Definition of the monitoring system, adoption of implementing regulations	MEPPPC/Croatian Waters/MHSW/ MAFRD / MRDFWM	2009
Implementation of monitoring	MEPPPC/Croatian Waters/MHSW/ MAFRD / MRDFWM	2010–2015
Public information and raising public awareness	MEPPPC/CEA	2010 forth

8.4. Strategy for research and development in the area of POPs compounds

Since the present situation related to research and development project activities connected with POPs compounds is not satisfactory, the following proposed areas require intensification of activities in accordance with the recommendations set out in the Stockholm Convention:

– Development of biological procedures for decomposition of persistent chemical compounds in the environment (biological and microbiological decomposition).

– Research on the levels of harmful pollutants. PCDD, PCDF, PCB and HCB in air and in soil/sediment in urban, rural and industrial areas.

– Assessment of POPs intake through food.

– Research on the distribution and levels of PAH compounds, PBDEs, short-chain chlorinated paraffins and other POPs compounds in environmental components.

– Development of methods for determining the levels of POPs compounds in (diffuse) mobile sources.

– Epidemiological studies on the health risks in various population groups.

– Studies on the transfer and distribution of POPs in the environment (atmospheric processes: gas/soil phase separation; water/particulate matter; water/soil/vegetation changes).

– Inventory of global levels and a model of the global distribution of POPs compounds.

– Study on the appearance, availability and movement of POPs compounds in soil, sediment and groundwater.

– Study on the effect of POPs compounds on humans and animals, including biodegradation and biotransformation mechanisms and toxicity.

– Study on the effects of POPs mixtures on the environment.

– Study on deposition/emission processes, transformation processes and bioavailability of POPs compounds in terrestrial and marine eco-systems.

– Development of analytical methods for identifying new types of POPs compounds, their metabolites, stereoisomer and polar POPs compounds.

The abovelisted areas will be further elaborated in the course of implementation of the National Implementation Plan.

8.4.1. Measure: technical and financial assistance

Since Croatia is a country with a transition economy, obtaining technical and financial assistance is crucial for the successful implementation of the Convention.

It is planned that Croatia shall request available funds from more developed countries on the basis of the arrangement between the Conference of the Parties to the Stockholm Convention.

8.4.2. Areas in which capacity strengthening is required

The most important areas in which present capacities and capabilities must be strengthened in order to achieve the goals set out by the National Implementation Plan are as follows:

– construction of a temporary storage for collecting PCB waste and equipment containing PCB compounds,

– development of a monitoring system for POPs compounds in the environment.

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8.5. NIP implementation schedule

The implementation timetable for the NIP as a whole is based on plans for the implementation of individual measures and activities. The overlapping implementation of the individual measures and activities for which the timetable is provided is based on the following phases:

– organisational phase,

– amendment of existing or preparation of new implementing regulations,

– development of technical instructions, guidelines, procedures ensuring the application of legislative provisions,

– implementation of the measures proposed in action plans and strategies.

The MEPPPC is competent for the implementation of the NIP and will co-ordinate and oversee the implementation of individual measures, activities and programmes.

As the most important short-term goal in the first five-year period, the preparation of new and alignment of existing regulations is singled out, as well as the preparation of technical instructions and the beginning of implementation of specific activities (such as the construction of the temporary storage for PCB equipment, phase-out of equipment from use, education and informing of the public, organisation and beginning of implementation of POPs monitoring). This phase is very important as proper organisation and initiation of individual activities ensures their ongoing implementation in the future.

The logical mid-term goal is the continuing implementation of initiated measures spanning for the period from the fifth to the tenth year.

Table 64 presents the order of implementation, the parties obligated to implement the measures/activities and the deadlines.

Table 64. NIP implementation schedule

In the long-term (from year 10 forth) it is necessary to continue with the activities ensuing from each measure or activity. The duration of those activities depends on the speed of accomplishing the set activities in the mid-term.	Competent authority	Application period
Activity/measure		
Alignment of existing or adoption of new legislation	MEPPPC/MELE/ MHSW MAFRD / MRDFWM	2009–2010
Development of programmes, guidelines, technical instructions, procedures and processes	MEPPPC	2009–2010
Implementation of measures, programmes and activities	MEPPPC	2010 forth

8.6. Funds required for NIP implementation

The financial assessment is based on the estimate of costs set out in each action plan and strategy. However, the action plans and strategies do not contain an assessment of an element which will represent a significant cost and that is the cost of replacing the PCB equipment in the industrial sector, which will arise after equipment is phased-out from use.

Since the manner for calculating additional incremental costs to arise from the implementation of the Convention has not been stipulated by the Convention bodies, that section will be further elaborated following the issuing of adequate instructions.

For the implementation of envisaged activities, the Republic of Croatia plans to, in addition to its own limited financial sources, request expert and financial support from international

organisations and Stockholm Convention bodies. Now that the Republic of Croatia has become a party to the Convention, the obtaining of financial assistance is possible.

9. ANNEX I: ABBREVIATIONS

POPs - persistent organic pollutants

OCP – organochlorine pesticides

HCB – hexachlorobenzene

PCB – polychlorinated biphenyls

HCH – hexachlorocyclohexane

PCDD – polychlorinated dibenzo-p-dioxins

PCDF – polychlorinated dibenzofurans

BAT – best available techniques

BEP – best environmental practices

MEPPPC– Ministry of Environmental Protection, Physical Planning and Construction

MELE – Ministry of the Economy, Labour and Entrepreneurship

MRDFWM – Ministry of Regional Development, Forestry and Water Management

MAFRD – Ministry of Agriculture, Fisheries and Rural Development

CEA – Croatian Environment Agency

MHSW – Ministry of Health and Social Welfare

EPEEF – Environmental Protection and Energy Efficiency Fund

NIP – National Implementation Plan

TEQ – toxic equivalent

EMEP Protocol – Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)