REPUBLIC OF CROATIA
Ministry of Economy
and Sustainable
Development

THIRD NATIONAL IMPLEMENTATION PLAN FOR THE STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS IN THE REPUBLIC OF CROATIA

July 2021

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Abbreviations

ALA	Agricultural Land Agency	
BaP	Benzo(a)pyrene	
GDP	Gross domestic product	
BC		Black carbon
CAS	CAS registry number	Chemical Abstracts Service number
CBD	Convention on Biological Diversity	
COP	Conference of the Parties to the Stockholm Convention	
MHS	Meteorological and Hydrological Service	
CBS	Croatian Bureau of Statistics	
ECHA	European Chemicals Agency	
EFFIS	European Forest Fire Information System	
EEA	European Environment Agency	
EMEP	Co-operative programme for monitoring and evaluation of the long range transmission of air pollutants in Europe	(European Monitoring and Evaluation Programme)
E-PRTR	European Pollutant Release and Transfer Register	
EPS/XPS	Expanded polystyrene / Extruded polystyrene	
EU	European Union	
EUMEPS	Association for European Manufacturers of Expanded Polystyrene	
EUROSTAT	European Statistical Office	
FSC	Forest Stewardship Council	
GEF	Global Environment Facility	
CAEN	Croatian Agency for Environment and Nature	
CCAFRA	Croatian Centre for Agriculture, Food and Rural Affairs	
CAAF	Croatian Agency for Agriculture and Food	
CW	Croatian Waters (Hrvatske vode)	
CIPH	Croatian Institute for Public Health	
IED	Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions	(Industrial Emissions Directive)
IUCN	International Union for Conservation of Nature	
LRSGUs	Local and regional self-government units	
LRTAP	Long-Range Transboundary Air Pollution	
MRL	Maximum residue level	
MAC	Maximum annual concentration	
MESD	Ministry of Economy and Sustainable Development	
MH	Ministry of Health	
MA	Ministry of Agriculture	
MI	Ministry of the Interior	
MSE	Ministry of Science and Education	
MEPE	Ministry of Environmental Protection and Energy	
NIP	National Implementation Plan for the Stockholm Convention	
NMVOCs	Non-methane volatile organic compounds	
NPK	Nitrogen – phosphorus – potassium	
BAT	Best Available Technique	
PAH	Polycyclic aromatic hydrocarbons	
AAC	Average annual concentration	
POPs	Persistent organic pollutants	
BREF	Best Available Technique Reference Document	

REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals	
EPR	Environmental Pollution Register (Croatian E-PRTR)	
REDS/RRMA	Register of Establishments in which Dangerous Substances are Present and the Register of Reported Major Accidents	
SCIP		Substances of Concern In Products
AEQS	Aquatic environmental quality standard	
TEQ	Toxic Equivalents	
UNEP	United Nations Environment Programme	
UPOPs	Unintentionally produced POPs	
IENP	Institute for Environmental and Nature Protection	

1 INTRODUCTION

Persistent organic pollutants (hereinafter: POPs) include a large number of toxic organic compounds that, to a varying degree, resist photolytic, biological and chemical degradation, and have the following properties: toxicity, persistence (resistance to chemical, photochemical and biological degradation), accumulation in living organisms (bioaccumulation, mostly in fat tissue), tendency for long-range transport (due to the property of partial volatility, they are in the vapour phase or are absorbed by particles in the atmosphere) and adverse effects on the environment and human health.

POPs released into the atmosphere are transported over long distances, can be deposited anywhere in the world, cannot be removed, intensively accumulate in the food chain and, as such, have an adverse effect on all environmental components.

Based on numerous studies of the consequences of using persistent organic pollutants in agriculture, veterinary medicine, forestry and industry and of releasing those substances into the atmosphere, water and soil, it has been scientifically established that their use is harmful to human health, particularly in developing countries and especially to women and, through them, to future generations.

The Stockholm Convention is one of the international treaties whose provisions originally referred to a group of 12 persistent organic pollutants, sometimes called the "Dirty Dozen", that are, based on their adverse effect on the environment, classified into three main groups: pesticides, industrial chemicals and unintentionally produced POPs (intermediates). However, with the adoption of Decisions on Amendments to Annexes A, B and C to the Stockholm Convention at the fourth, fifth and sixth Conference of the Parties, the Stockholm Convention was supplemented with 11 new POPs, and at the seventh and eight Conference of the Parties, with five more.

The Stockholm Convention aims to reduce and, where appropriate, prevent the release of persistent organic pollutants into the environment, and today the list includes 28 substances or groups of substances with requirements that each Party to the Convention must comply with in order to achieve elimination of the production, use, import and export of persistent organic pollutants at a global level. This would result in significant reduction or complete elimination of the release of those substances into the environment.

The Republic of Croatia signed the Convention in 2001, and the Croatian Parliament adopted the decision on promulgating the Act on the Ratification of the Stockholm Convention on Persistent Organic Pollutants (Official Gazette – International treaties (hereinafter: OG-IT) 11/06) at its session held on 30 November 2006). The Convention entered into force with respect to the Republic of Croatia on 30 April 2007 (OG-IT 2/07).

Subject to the obligations referred to in Article 7 of the Stockholm Convention, the Republic of Croatia prepared the first National Implementation Plan for the Stockholm Convention (hereinafter: NIP) that was adopted by the Government of the Republic of Croatia the Decision on the adoption of the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (Official Gazette (hereinafter: OG) 145/08). As a Party to the

Stockholm Convention, the Republic of Croatia delivered the First NIP to the Stockholm Convention Secretariat in April 2009.

With the adoption of Decisions on Amendments to Annexes A, B and C to the Stockholm Convention in 2009, 2011 and 2013 at the fourth, fifth and sixth Conference of the Parties, the Stockholm Convention was supplemented with 11 new POPs. The Amendments to Annexes A, B and C entered into force in August 2010 for nine POPs (alpha and beta hexachlorocyclohexane (alpha- and beta-HCH) , chlordecone, hexabromobiphenyl, lindane, pentachlorobenzene, perfluorooctane sulfonic acid (PFOS) and its salts and perfluorooctane sulfonyl fluoride (PFOSF), tetrabromodiphenyl ether and pentabromodiphenyl ether). Additional Amendments to Annex A, along with inclusion of technical endosulfan, entered into force in October 2012 in line with Article 22, paragraph 3(c) of the Stockholm Convention. Amendments to Annex A of 2013, along with inclusion of hexachlorocyclohexane, entered into force in November 2014 for majority of the Parties. In accordance with the indicated adopted Decisions, Parties to the Stockholm Convention are required to develop a new revised NIP that includes all the aforementioned amendments.

The Global Environment Facility (GEF) approved the project for financing the activities required for the preparation of the revised NIP in June 2013. The Committee for monitoring the implementation of the project "*Revision of the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants*" was established in July 2014, and the former Ministry of Environmental and Nature Protection, currently the Ministry of Economy and Sustainable Development[1] (hereinafter: MESD), as the beneficiary and main project holder, developed the Second NIP in cooperation with the United Nations Environment Programme (UNEP), as the implementing agency, and other competent state administration bodies. In June 2016, the Government of the Republic of Croatia adopted the Decision on the adoption of the Second National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (OG 62/16) which, *inter alia*, proposed and defined improvement measures related to reporting obligations under the Convention. The Second NIP was delivered to the Stockholm Convention Secretariat on 28 November 2016. The Second NIP covered the Decisions adopted at the fourth, fifth and sixth Conference of the Parties.

Amendments to Annexes A and C to the Convention of 2015 on the listing of hexachlorobutadiene (HCBD) in Annex A, pentachlorophenol and its salts and esters (PCP) in Annex A, and polychlorinated naphtalenes (PCN) in Annexes A and C entered into force for

[1] In October 2016, pursuant to the Act on the Organisation and Scope of Ministries and Other Central State Administration Bodies (OG 93/16 and 104/16), the Ministry of Environmental and Nature Protection changed its name into the Ministry of Environmental Protection and Energy. On 24 June 2015, the Government of the Republic of Croatia adopted the Regulation on the establishment of the Croatian Agency for Environment and Nature (OG 72/15). The legal predecessors of the Croatian Agency for Environment and Nature are the Croatian Environment Agency and the State Institute for Nature Protection, and it was registered with the court register of the Commercial Court in Zagreb and started its operations on 16 September 2015.
Pursuant to Article 73, paragraph 3 of the Act on Amendments to the Environmental Protection Act (OG 118/18 of 27 December 2018) and the deletion of the Croatian Agency for Environment and Nature (CAEN) from the court register (17 January 2019), the Ministry of Environmental Protection and Energy, Radnička cesta 80, 10000 Zagreb, PIN (OIB): 19370100881, took over the CAEN employees, activities, rights and obligations, as well as its assets, equipment, archive and other documentation. In line with the above, all activities and obligations hereinafter referred to the Croatian Agency for Environment and Nature are assumed by the Ministry as of 1 January 2019.
In July 2020, pursuant to the Act on the Organisation and Scope of State Administration Bodies (OG 85/20), the Ministry of Environmental Protection and Energy changed its name into the Ministry of Economy and Sustainable Development.

majority of the Parties, including the Republic of Croatia, in December 2016. The indicated Decisions are contained in:

- the Regulation on the publication of Annex G of 6 May 2005, Amendments to Annexes A, B and C of May 2009, Amendment to Annex A of April 2011 and Amendments to Annex A of May 2013 of the Stockholm Convention on persistent organic pollutants (OG-IT 8/15) and
- the Regulation on the publication of Amendments to Annexes A and C of May 2015 of the Stockholm Convention on persistent organic pollutants (OG-IT 5/16).

Amendments to Annexes A and C to the Convention of 2017 entered into force for majority of the Parties, including the Republic of Croatia, in December 2018, and they are contained in:

- the Regulation on the publication of Amendments to Annexes A and C of May 2017 of the Stockholm Convention on persistent organic pollutants (OG-IT 1/19).

In accordance with the indicated adopted Decisions, Parties to the Stockholm Convention are required to develop a new revised NIP that includes all the aforementioned amendments.

Amendments to Annexes A and B to the Convention of 2019 entered into force for majority of the Parties, including the Republic of Croatia, in December 2020, and they are contained in:

- the Regulation on the publication of Amendments to Annexes A and B of May 2019 of the Stockholm Convention on persistent organic pollutants (OG-IT 5/20), and will be taken into account when developing the Fourth NIP.

Table 2.1-1. POPs listed in annexes to the Stockholm Convention

ANNEX	SUBSTANCE	PESTICIDE	INDUSTRIAL CHEMICAL	UNINTENTIONAL PRODUCTION	NOTE
Annex A: Elimination	Aldrin	x			
	Chlordane	x			
	Dieldrin	x			
	Endrin	x			
	Heptachlor	x			
	Hexachlorbenzene (HCB)	x	x		
	Mirex	x			
	Polychlorinated biphenyls (PCB)		x		
	Toxaphene	x			
	Chlordecone	x			
	Hexabromobiphenyl (HBB)		x		
	Hexabromodiphenyl ether and heptabromodiphenyl ether		x		
	Alpha hexachlorocyclohexane	x			
	Beta hexachlorocyclohexane	x			
	Lindane	x			
	Pentachlorobenzene	x	x		
	Tetrabromodiphenyl ether and pentabromodiphenyl ether		x		
	Technical endosulfan and its isomers	x			
	Hexabromocyclododecane (HBCD)		x		
	Hexachlorobutadiene (HCBD)		x		**COP-7** Listing of hexachlorobutadiene (HCBD) in Annex A to the Convention without specific exemptions
	Polychlorinated naphthalenes (PCN)		x		**COP-7** Listing of polychlorinated naphthalenes (PCN) in Annexes A and C to the Convention with specific exemptions
	Pentachlorophenol and its salts and esters (PCP)	x			**COP-7** Listing of pentachlorophenol (PCP) in Annex A to the Convention with specific exemptions
	Decabromodiphenyl ether (commercial mixture, c-decaBDE)		x		**COP-8** Listing of decabromodiphenyl ether (BDE-209) present in commercial decabromodiphenyl ether (c-decaBDE)) in Annex A to the Convention with specific exemptions
	Short-chain chlorinated paraffins (SCCP)		x		**COP-8** Listing of short-chain chlorinated paraffins (SCCP) in Annex A to the Convention
	Dicofol	x			**COP-9** Listing of difocol in Annex A to the Convention without specific exemptions
	Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds		x		**COP-9** Listing of perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds in Annex A to the Convention with specific exemptions
Annex B: Restrictions	Dichlorodiphenyltrichloroethane (DDT)	x			
	Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F)		x		
Annex C: Unintentional production	Polychlorinated dibenzo-p-dioxin (PCDD) / polychlorinated dibenzofurans (PCDF)			x	
	Hexachlorbenzene (HCB)			x	
	Polychlorinated biphenyls (PCB)			x	
	Pentachlorobenzene (PeCB)			x	
	Polychlorinated naphthalenes (PCN)			x	**COP-7** Listing of polychlorinated naphthalenes (PCN) in Annexes A and C to the Convention with specific exemptions
	Hexachlorobutadiene (HCBD)			x	**COP-8** Listing of hexachlorobutadiene (HCBD) in Annex C to the Convention

Key:

COP-4 (2009)
COP-5 (2011)
COP-6 (2013)
COP-7 (2015)
COP-8 (2017)
COP-9 (2019)

2 GENERAL INFORMATION ON THE STATE

2.1 STATE PROFILE

2.1.1 GEOGRAPHY AND POPULATION

The Republic of Croatia is an Adriatic and Central European country. The continental area covers 56,594 km^2 and the territorial sea covers 31,479 km^2 (Source: Statistical Yearbook of the Republic of Croatia 2018, CBS). Numerous internationally significant routes pass through the Republic of Croatia. The importance of its geographical position is increased by the Adriatic Sea as a part of the Mediterranean Sea, which penetrates the deepest and furthest to the north of the central part of the European continent. The most important traffic routes run along the river Sava valley and the Adriatic, as well as the river Drava valley, and there are several transversal routes extending from Austrian and Hungarian borders to the Adriatic (Rijeka and Split).

The territory of the Republic of Croatia is divided into three major natural and geographic regions:

- Panonian and Peri-panonian area covers the lowlands and rolling hills of the eastern and north-western Croatia. Most of the area is used for agriculture and livestock production. Slavonia and Baranja in the east are the most suitable for cereal growing, moist lowlands and mountain regions are rich in woods, while the north-western part, which distinctly gravitates towards the City of Zagreb, is the most industrially developed part;
- Mountain region, which mainly separates the Pannonian Croatia from its coastal area, is a less developed region. Its future development is based on important traffic routes, further development of wood industry, still insufficiently exploited possibilities for the production of healthy food and development of winter and rural tourism;
- Adriatic region covers the narrow coastal zone, separated from the hinterland by high mountains. This is (mostly) a karst region with exceedingly dry summers. Few water streams run through narrow gorges towards the sea. Croatian coastline is divided into northern (Istria and Kvarner) and southern (Dalmatia) regions, with a distinctive longitudinal division to island zone, coastline zone and hinterland. Croatian Adriatic coast is one of the most indented coasts in Europe; it has 1,185 islands, cliffs and reefs. 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) and Korčula (276 km^2). The largest peninsulas are Istria and Pelješac, and the largest bay is the Kvarner aquatorium.

According to the last population census from 2011, the Republic of Croatia has 4,284,889 inhabitants. Zagreb is the largest city and the capital of the Republic of Croatia, with 790,017 inhabitants. More than 400,000 inhabitants live in three more cities: Split, Rijeka and Osijek (Source: Population Census 2011, CBS).

2.1.2 SOCIO-POLITICAL STRUCTURE

The Republic of Croatia became an independent state on 25 June 1991. Under the Constitution of the Republic of Croatia (OG 56/90, 135/97, 8/98,113/00, 124/00, 28/01, 41/01, 55/01, 76/10, 85/10 and 5/14), the Republic of Croatia is a unitary and indivisible democratic welfare state.

The Republic of Croatia became a member of the United Nations on 22 May 1992.

On 1 July 2013, the Republic of Croatia became a full member of the European Union with all the rights and obligations arising from this membership, and certain powers have been transferred to the European Union institutions in line with the provisions of the Treaty on the European Union and Treaty on the Functioning of the European Union, as well as the provision of the Constitution of the Republic of Croatia under Chapter VIII.

In the Republic of Croatia, the state authority is organised on the principle of the division of power into legislative (Croatian Parliament), executive (the Government and the President) and judicial branches. The principle of the division of power includes mutual cooperation and reciprocal control of authority carrier prescribed by the Constitution and laws. In the Republic of Croatia, laws have to comply with the Constitution, and other regulations have to comply with the Constitution and laws. Everyone must abide by the Constitution and laws and respect the legal order of the Republic of Croatia.

The Croatian Parliament is the representative body of the people and is vested with legislative power in the Republic of Croatia. The President of the Republic of Croatia represents and acts on behalf of the Republic of Croatia at home and abroad, and ensures regular and balanced functioning and stability of government.

The Government of the Republic of Croatia exercises executive power pursuant to the Constitution and the respective laws.

Judicial power is exercised by the courts. Courts administer justice according to the Constitution and laws. The Supreme Court of the Republic of Croatia, as the highest court of law, ensures uniform application of laws and equality of all before the law.

Local self-government units in the Republic of Croatia are municipalities and cities, which perform tasks of local significance that are not assigned to state administration bodies. Regional self-government units, which perform tasks of regional significance, are Counties (20 of them) and the City of Zagreb (also having the status of a county) which, within its self-governing scope, performs tasks within the scope of a city and the scope of a county, as well as other tasks in accordance with the law.

2.1.3 ECONOMIC INDICATORS

2.1.3.1 CHARACTERISTICS OF ECONOMIC SECTORS

Agriculture, fishery, forestry and food industry

The Republic of Croatia is divided into three geographic and climate zones: the lowland zone in the north of the country, which has a continental climate, the Mediterranean coastal zone in the south, and the mountainous zone stretching across the central part of the country. Various types of climate, landforms and soils are favourable for the production of a wide range of agricultural products, from field and industrial crops to vineyards, continental and Mediterranean fruits and vegetables. Livestock breeding has always been important in these parts, while fishing and fish processing have traditionally been the most important activities

along the coastal part of the Republic of Croatia and on the islands. Forests and forest lands cover almost half of the land area of the Republic of Croatia. They are characterised by naturalness and rich biodiversity thanks to a centuries-old tradition and sustainable forest management that enables the survival and development of rural areas and the Croatian economy.

Industry, energy and construction

Industrial production in the Republic of Croatia has occupied a significant place in total production until the recession. The most significant were processing and petrochemical industry and shipbuilding. Certain companies were shut down in the process of transition or destroyed during the war. These were mostly textile, leather, metal and wood industry factories.

The production was significant in construction and energy sectors as well. Certain industries are still achieving positive results and participate in foreign trade. According to total income, the leading industries are production of food, beverages and tobacco, followed by chemical, oil and mineral industries. Liquid fuels and natural gas have the highest shares in total energy consumption in the Republic of Croatia. Electricity consumption has been around the same level in recent years, but its share in total consumption is slightly growing. The share of renewable energy in total consumption is increasing as well. The exploitation of oil and gas occurs on 54 exploitation fields, whereas the domestic production covers around 20 % of the needs for oil and around 40 % of the needs for natural gas. More than half of electricity is, on average, produced in hydro power plants, so electricity production in the Republic of Croatia varies significantly depending on hydrological conditions. The domestic needs are not met by own production and electricity imports account for about 30 % of total consumption (Source: Energy Development Strategy of the Republic of Croatia until 2030 with an outlook to 2050, https://narodne-novine.nn.hr/clanci/sluzbeni/2020_03_25_602.html).

Tourism

As one of the most significant tourist destinations in the Mediterranean, the Republic of Croatia has a long tradition in tourism and favourable developmental opportunities. Revenues from tourism amounted to EUR 12 billion in 2018, of which EUR 10 billion from foreign guests (Source: Croatian National Bank). The advantages of Croatian tourist offer are primarily well-preserved natural resources and environment, cultural and historical heritage, a mild Mediterranean climate, its vicinity to European markets and an opportunity for active holidays in protected areas.

Transport

The Republic of Croatia's advantageous geographical position in terms of transport enables the development of transport infrastructure and transport activities as one of the most important factors of its overall economic and social development. The share of combined transport in the total cargo transport is insufficient. This type of transport, as one of the most modern and environmentally friendly, needs to be developed as soon as possible in order to enable integration into the already developed European routes of combined transport. Road and

railway infrastructures are not equally developed in all parts of the Republic of Croatia. Even though over the last two decades great efforts have been put into the construction of new roads, substantial investments are still necessary both in terms of the existing as well as new infrastructure (especially regarding the development of railway transport and its greater share).

2.1.3.2 STATE OF THE ENVIRONMENT

Air protection

Air is part of the environment of common good that has special importance in the Republic of Croatia, which is reflected through the established good legislative framework at the national level and the established infrastructure consisting of the national and local networks and the network of special monitoring stations, whether for monitoring air quality (imissions) or for monitoring pollutant emissions into the air from stationary and diffuse sources of pollution (emissions).

Data on emissions of pollutants into the air and air quality data are an integral part of the Air Protection Information System managed by the Institute for Environmental and Nature Protection as an organisational unit of the MESD.

The MESD is competent for collecting data on emissions of pollutants into the air in the Republic of Croatia and for preparing emission inventories reports in accordance with the obligations under Croatian legislation and international treaties, primarily under the Convention on Long-range Transboundary Air Pollution (LRTAP Convention) and the Regulation on the national obligations to reduce emissions of certain pollutants into the air in the Republic of Croatia (OG 76/18) (hereinafter: NEC Regulation).

The air quality in the Republic of Croatia is monitored within the national network for continuous air quality monitoring and local networks for air quality monitoring in counties and cities that include special-purpose monitoring stations. Under the Air Protection Act, since 2010 the state administration body competent for managing the national network is the Meteorological and Hydrological Service (hereinafter: MHS). The number of monitoring stations, as well as the monitoring programme applied in them, is occasionally modified and continuously improved. The number of automatic stations has increased in recent years, primarily due to the development of the national network for continuous air quality monitoring and monitoring stations established according to decisions on the environmental acceptability of the project or decisions on integrated environmental requirements, i.e. environmental permits, which are financed by polluters.

The aim of preventive measures and air quality preservation instruments, such as well thought out project planning, foreseeing potential impacts on air quality, prescription of adequate air protection requirements, monitoring and reporting on air quality, compliance and improvement of regulations, and development and strengthening of institutional, organisational and expert/scientific capacities, is to prevent pollution and improve air quality. Preventive measures include existing intersectoral environmental protection measures and instruments, as well as

additional measures aimed at improving the integrated air quality management system in the Republic of Croatia.

In the field of air quality protection and improvement in the Republic of Croatia, significant positive steps were taken in the period from 1990 until today. For example, as compared to 1990, in 2018 emissions were lower by 53.3 % for nitrogen oxides (NO_x), 93.9 % for sulphur oxides (SO_2), 33.7 % for ammonia (NH_3), 57 % for non-methane volatile organic compounds (NMVOC), 57.8 % for carbon monoxide (CO), 25.6 % for PM_{10}. The reduction of pollutant emissions into the air is partially a consequence of the war for Croatian independence (1991–1995) and the economic crisis after 2007, but largely also a result of implementing measures and techniques to reduce emissions into the air, followed by stricter regulations on air pollutant concentrations and emission limit values, as well as the use of better-quality fuel with lower sulphur content, gasification and connection to the heating network, the use of low-sulphur coal, and to a lesser extent the development of public transport and bicycle paths. By ratifying the Protocols to the LRTAP Convention, the Republic of Croatia also accepted the obligations defined in them. The obligations to reduce emissions have been successfully implemented so far, and the fulfilment of the obligations by 2020 should be achieved through the implementation of the Programme for gradual reduction of emissions of certain pollutants in the Republic of Croatia until 2010 with emission projections for the period from 2010 to 2020 (OG 152/09) or, if required, the revision thereof.

At its session held on 19 September 2019, the Government of the Republic of Croatia adopted the National Air Pollution Control Programme 2020–2029 (hereinafter: the Programme), pursuant to Article 20 of the NEC Regulation and Guidance for the development of National Air Pollution Control Programmes issued by the European Commission. The legal basis for developing the Programme is the Environmental Protection Act (OG 80/13, 153/13, 78/15, 12/18 and 118/18) and the then valid Air Protection Act (OG 130/11, 47/14, 61/17, 118/18) and the NEC Regulation. The Programme for gradual reduction of emissions of certain pollutants in the Republic of Croatia until 2010 with emission projections for the period from 2010 to 2020 (OG 152/09) was used as the available data source for developing the Programme. In the period since 2009, numerous improvements of the European Union legislation occurred, such as the 2012 revision of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to the 1979 Convention on Long-range Transboundary Air Pollution. In 2013, the Republic of Croatia became a full member of the European Union, thus also assuming new international obligations. Consequently, it was required to upgrade the Programme for gradual reduction of emissions of certain pollutants in the Republic of Croatia until 2010 with emission projections for the period from 2010 to 2020 (OG 152/09), which partially replaces the abovementioned Programme.

Although significant efforts have already been made in the field of air protection and the air pollution reduction and limitation in the Republic of Croatia, new obligations and requirements of the European Union represent an additional challenge for their realisation. This is particularly true for fuel combustion in small furnaces in the household sector where, on the one hand, because of climate change, the aim is to increase the biomass consumption for heating due to "zero emission" of CO_2 while, on the other hand, that contributes to deteriorating air quality in

terms of particulate matter ($PM_{2,5}$, PM_{10}, BC), NMVOC and to a lesser extent ammonia. Further challenges include road transport emissions (especially NOx emissions) and their limitation, as well as ammonia emissions from the agricultural sector. Additionally, operators of different installations/polluters which, in terms of emissions, must comply with the legislation by applying the BAT are also presented with a challenge, while the environmental permit is one of the key instruments for limiting significant discharges.

Despite a significant reduction of pollutant emissions into the air and the implementation of air protection measures in the state territory, there are still areas where air is not of the first category, i.e. urban and industrial areas where air quality limit or target values are exceeded.

Due to its geographical position, the Republic of Croatia is exposed to long-range transboundary air pollution, which is especially important when it comes to air pollution by particulate matter and ground-level ozone, whereas the transfer and deposition of POPs, heavy metals and nitrogen cannot be ignored.

2.1.3.3 SOIL PROTECTION

The Strategy for Sustainable Development of the Republic of Croatia and the National Environmental Action Plan emphasise the need to establish a comprehensive soil and land protection policy. Since the basic legal act on soil and land protection has not been adopted, the protection of individual soil functions and sustainable soil and land management in the Republic of Croatia are indirectly covered by the legislation aimed at protecting other environmental components (water and sea, air and nature) and eliminating environmental burdens (industry and waste). However, the soil protection measures implemented under those laws are not sufficient to slow down degradation processes and eliminate soil and land burdens as the soil protection are not the primary focus of the said legislation. The legal framework for land protection is established under special regulations of the competent ministries. The maintenance and protection of agricultural land is governed by the Agricultural Land Act (OG 20/18, 115/18 and 98/19) and subordinate legislation under the competence of the Ministry of Agriculture.

The protection of soil and land from degradation processes does not have any special legislative support in the Republic of Croatia, nor in the European Union, where the European Council failed to complete the process of adoption of the Soil Framework Directive since 2007. However, in the same year, the European Parliament adopted the Thematic Strategy for Soil Protection in order to define a common and comprehensive approach aimed at preserving the main soil functions, preventing further soil degradation and restoring degraded soils to a qualitative level consistent with the target land use category.

The basic precondition for soil and land protection is monitoring the soil status, i.e. soil parameters in order to collect information on changes in the soil status and characteristics, as well as to identify forms and intensity of degradation processes in the soil. Without establishing a permanent system for periodical collection of information on negative changes in the soil, there can be no timely response to prevent or mitigate such changes.

The Croatian Soil Monitoring Programme was developed in 2009 through the pilot project "Development of the Croatian Soil Monitoring Programme". In addition, the first Ordinance on the methodology for monitoring of the status of agricultural land (OG 60/10) was adopted in 2010, and it contained recommendations from the Agricultural Soil Monitoring Programme. The 2019 Ordinance on the methodology for monitoring of the status of agricultural land (OG 47/19) created the preconditions for establishing the soil protection information system.

The Ordinance on the protection of agricultural land against pollution (OG 71/19) defines the pollutants, sources of pollution and the maximum permitted quantities of pollutants in the soil; however, it fails to prescribe them for lands used for other purposes (forest land, settlements, industrial zones, etc.), but that is not an obstacle to applying the Ordinance for other land, which is applied in practice. However, it makes systematic monitoring of polluted and potentially polluted sites and possible changes in the soil status more difficult. According to the 2009 Croatian Soil Monitoring Programme developed by implementing the pilot project "Development of the Croatian Soil Monitoring Programme" (Environmental Protection Agency), it is required to establish a clear legislative framework aimed at comprehensive soil and land protection as environmental components, which is the task of the MESD-IENP.

The maintenance and protection of agricultural land and the related fee is governed by the Agricultural Land Act (OG 20/18, 115/18 and 98/19) and subordinate legislation that, *inter alia*, prescribe: agricultural-engineering measures under which owners and holders of agricultural land are obliged to cultivate agricultural land in the manner that does not diminish its prudential value; define the substances considered as pollutants of agricultural land and their maximum permitted quantities, measures and controls against pollution and degradation in order to maintain them in the status that makes them a favourable habitat for the production of healthy food; prescribe the methodology for monitoring the status of agricultural land and the development of the information system that will be used for reporting on the status of agricultural land in the Republic of Croatia as one of the environmental components.

2.1.3.4 INLAND WATERS

During the process of accession to the European Union, the EU *acquis* relating to the field of water management was transposed into the legal order of the Republic of Croatia. The key regulations in the field of water management are the Water Act (OG 66/19), Water Services Act (OG 66/19), Water Management Financing Act (OG 153/09, 90/11, 56/13, 154/14, 119/15, 120/16, 127/17 and 66/19) and implementing regulations adopted pursuant to those laws.

The MESD performs administrative and expert tasks relating to the general and sectoral water protection policy, while Croatian Waters (Hrvatske vode) are the legal person with public authorities for water management.

Water management principles are stipulated by the Water Act, prescribing that water is not a commercial product, but a heritage that has to be guarded, protected and used sparingly and rationally, that water shall be managed in accordance with the principle of integrity of the water system and the principle of sustainable development which meets the needs of the present

generation without threatening the right and possibilities of future generations to meet their needs, and that water management shall adapt to global climate changes.

Regulations in the field of water management also define water management objectives and water protection objectives. The elaboration of the water management objectives and water protection objectives defined in regulations, i.e. determination of specific objectives and the method of achieving the objectives is performed in water management planning documents. Specific objectives are set depending on the water status, commitments undertaken in accession to the European Union, obligations arising from valid regulations during preparation of planning documents and/or communication with the European Commission. Water management planning documents are: (1) Water Management Strategy, (2) River Basin Districts Management Plan, (3) Multiannual Programmes of Construction, (4) Financial Plan of Croatian Waters, (5) Water Management Plan and (6) detailed plans regulated by the Water Act.

The Water Management Strategy (OG 91/08) is a long-term planning document that defines the vision, mission, objectives and tasks of the state policy in the field of water management until 2038. It provides strategic directions and guidelines for development of water management, starting from the current situation in the water sector, development needs, economic potentials, international obligations and needs for preservation and improvement of the water status, as well as of aquatic and water-dependent ecosystems. The Water Management Strategy is a document on the basis of which reforms of the water sector are carried out, so that the European standards in water management could be achieved, and is also the framework for preparation of strategies and plans in the fields of physical planning, environmental protection, nature protection and development of other sectors which depend on water or have impact on the water status (agriculture, forestry, fishery, industry, energy, transport, tourism, public health, etc.). The Strategy is periodically adjusted in compliance with the changes in the water system, as well as economic and social development, and is adopted by the Croatian Parliament. The National Water Council is responsible for considering the need for its changes within the relevant period.

The River Basin Management Plan is a basic instrument for the management of water status and flood risks adopted by the Government of the Republic of Croatia for the period of six years, after which it is amended and supplemented for the period of next six years in order to maintain/achieve good chemical and ecological water status. The Second River Basin Management Plan 2016–2021 (OG 66/16) consists of two components: water status management and flood risk management. It, *inter alia*, provides an overview of water status data and analysis of implementation of the River Basin Management Plan 2013–2015, evaluation of progress in achieving the water protection objectives, and also the risk assessment stating that the water protection objectives will not be achieved. Croatian Waters (Hrvatske vode) can adopt more detailed management plans for a sub-basin, small basin and sector, i.e. plans related to other issues of interest for water management, and local and regional self-government units are obliged to obtain from Croatian Waters requirements for preparing spatial plans and an opinion on the compliance of those requirements with regard to the compliance of those spatial plans with water management planning documents.

Based on the above, as well as other inputs, in order to achieve the aquatic environmental objectives, a Programme of surface and groundwater protection measures for the planning period from 2016 to 2021 is developed for each river basin district, comprising an integral part of the River Basin Management Plan and includes basic, additional and supplementary measures. Basic measures include: measures to recover the costs of water services and foster efficient use of water, measures to protect water intended for human consumption, measures to control water abstraction, measures to control groundwater recharge, measures to control point sources of pollution, measures to control diffuse sources of pollution, measures to control and reduce hydro-morphological pressures to water, measures to control other significant impacts on water status, in particular on hydro-morphological status, measures to ban direct discharge of pollution to groundwater, measures to eliminate and reduce pollution with priority substances, and measures to prevent accidental pollution. Additional measures include: (1) waters intended for human consumption or reserved for such purposes in the future, (2) waters suitable for freshwater fish life and waters suitable for shellfish, (3) water areas for bathing and recreation, (4) sensitive areas, basins of sensitive areas, (5) areas subject to pollution caused by nitrates from agricultural sources, vulnerable areas, (6) areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection, and (7) proposed update of the Register of Protected Areas. The 2016–2021 Programme of Measures plans the implementation of 144 basic measures and 116 additional measures, and recommends the implementation of nine supplementary measures.

The achievement of the objectives, i.e. implementation of the measures from the River Basin Management Plan includes a number of beneficiaries/activities/areas – population, agriculture, climate change, hydropower, energy – other, fisheries and aquaculture, flood protection, forestry, industry, tourism and recreation, transport, etc. A report on the implementation of the River Basin Management Plan is submitted every three years to the Croatian Parliament and the European Commission, and the report is an integral part of the River Basin Management Plan.

Multiannual programmes of construction of municipal waterworks, regulation and protection waterworks and amelioration facilities are adopted by the Government of the Republic of Croatia, and prepared by Croatian Waters in six-year planning cycles. The Multiannual Programme of Construction (OG 117/15) integrates, through investment measures, the obligations from the EU *acquis*, in particular Directive 2000/60/EC of the European Parliament and of the Council of 23 November 2000 establishing a framework for the Community action in the field of water policy (OJ L 327, 22. 12. 2000) (hereinafter: Water Framework Directive) and Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks (OJ L 288, 6.11.2007), with special emphasis on the assessment and management of flood risks, quality of water intended for human consumption and urban waste-water treatment.

For water management at an annual level, Croatian Waters adopts the Water Management Plan that must be aligned with the River Basin Management Plan and the Financial Plan of Croatian Waters.

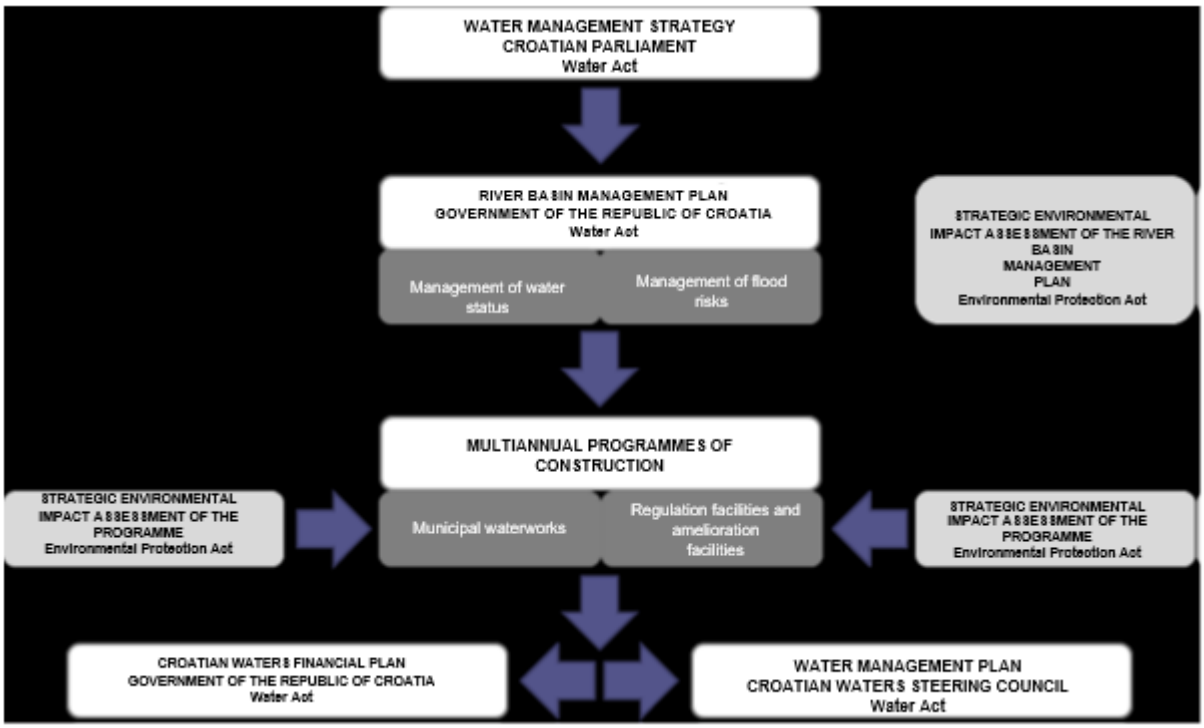


Figure 2.1-1 Relationship of water management planning documents

2.1.3.5 NATURE PROTECTION

Strategic planning aims to direct the available capacities towards activities that will most significantly contribute to nature conservation. The Nature Protection Strategy and Action Plan of the Republic of Croatia are the fundamental nature protection documents that define the long-term biological diversity objectives and guidelines that have been so far adopted in 1999, 2008 and 2017.

The EU *acquis* on nature protection has been transposed into the legal order of Croatia, primarily through the Nature Protection Act (OG 80/13, 15/18, 14/19 and 127/19) and related subordinate legislation. In this way, a new legislative and institutional framework for nature protection was established, which harmonised the legislation with the relevant EU directives, and thus with international conventions and agreements related to nature protection, since the Republic of Croatia is a signatory to 18 international treaties related thereto.

The nature protection tasks are performed by the MESD and administrative bodies of regional self-government units competent for nature protection, public institutions for the management of national parks and nature parks, and public institutions for the management of other protected areas and/or natural areas whose founders are regional self-government units. Within the MESD, the Nature Protection Directorate and the Institute for Environmental and Nature Protection are competent for nature protection.

Pursuant to Article 12 of the Nature Protection Act, the MESD prepares a Report on the state of natural environment in the Republic of Croatia for a period of five years in order to analyse the achievement of the Strategy's objectives and activities. The last Report on the state of natural environment in the Republic of Croatia was prepared for the period from 2013 to 2017,

providing an overview of the state of all components of natural environment (biodiversity, landscape diversity and geodiversity), pressures on them, as well as the implementation of protection mechanisms and measures that should contribute to achieving and maintaining the good status of all components. Under the Nature Protection Act, the use of natural resources is carried out according to the natural resource management plans, taking into account the preservation of biodiversity, landscape diversity and geodiversity. In the process of developing spatial plans and natural resource management plans under the Nature Protection Act, the presence of endangered and rare habitat types and their conservation status are determined, and requirements and measures, i.e. guidelines for their conservation are included in those documents. Habitats are directly protected within protected areas and ecological network areas. Other than the mechanism for assessment of the impact of a project on the ecological network prescribed by the Nature Protection Act in relation to the ecological network of the Republic of Croatia, habitat protection is also taken into account in other areas by implementing the procedures of strategic environmental assessment and environmental impact assessment.

The exceptional abundance of biodiversity in the Republic of Croatia is manifested through almost 40,000 known species and subspecies, assuming that the total number is significantly higher. This is partially a result of intensified research connected with the process of accession to the European Union, particularly the preparation of the proposal for the establishment of the ecological network NATURA 2000. Despite the abundant biodiversity and the implementation of specific conservation measures, many wild species are still endangered. Such a trend has also been recorded worldwide.

Based on the IUCN criteria, the endangered status is estimated for over 3,000 species, or about 8 % of the registered species in the Republic of Croatia. The review of the endangered status performed for individual groups and species shows certain changes, such as the deterioration of the endangered status for individual species. However, this is primarily a result of new findings and more precise application of the IUCN criteria. Under the Nature Protection Act, species are protected through two main mechanisms – protection of areas and targeted protection of species by implementing "horizontal" measures. Horizontal measures include strict protection of species, regulation of the use of species and targeted implementation of conservation measures at the national level, within the activities of the nature protection sector and other sectors.

2.1.3.6 MARINE ENVIRONMENT AND COASTAL AREA PROTECTION

The Environmental Protection Act and the Regulation on the development and implementation of documents under the Marine Environment and Coastal Area Management Strategy (OG 112/14, 39/17 and 112/18) established a legal framework for taking actions towards achieving and/or maintaining good environmental status of the marine environment until 2020, which is also a common objective of the EU Member States with access to the sea. At the same time, the Marine Strategy Framework Directive is also an environmental pillar in all the European Union policies that address and/or include the management and exploitation of natural resources of the marine environment. This legislation also covered the Protocol to the Barcelona Convention

on Integrated Coastal Area Management in the Mediterranean, which the Republic of Croatia ratified by the Act on the Ratification of the Protocol on Integrated Coastal Area Management in the Mediterranean (OG-IT 8/12). In this manner, the protection of marine environment and the integrated coastal area management are connected, which implies a dynamic process of sustainable coastal management and use, while taking into account the fragility of coastal ecosystems and landscapes, diversity of activities and uses, their interactions, maritime orientation of certain activities and uses. and their impact on marine and terrestrial parts.

The holder of the marine environment protection and sustainable coastal area management policy is the MESD, which is responsible for the development and implementation of the Marine Environment and Coastal Area Management Strategy (the Strategy), a key document that defines and directs the long-term marine environment and coastal area management objectives based on the principles of sustainable development and integrated coastal area management, applying an ecosystem approach in compliance with the overall economic, social and cultural development in the territory of the Republic of Croatia. The development of the Marine Environment and Coastal Area Management Strategy is preceded by preparatory procedures, i.e. preparatory documents are drafted, and they serve as expert bases for the preparation of action plans. In the period from 2012 to 2015, all prescribed preparatory documents were adopted, as well as all programmes of action by 2017. The Initial assessment of the state of marine environment in the Croatian part of the Adriatic Sea, whose integral parts are the Economic-social analysis of the use and cost of degradation of the marine environment and coastal area, the Set of features of good environmental status of marine waters under the sovereignty of the Republic of Croatia and the Set of targets to protect the marine environment with related indicators, was the basis for preparing two programmes of action: Monitoring and observation system for ongoing assessment of the Adriatic Sea (OG 153/14); and the Programme of measures for the protection and management of the marine environment and coastal area of the Republic of Croatia (OG 97/17). As all the Strategy documents are subject to revision in six-year implementation cycles, within the second implementation cycle of the Marine Strategy Framework Directive, the preparatory documents of the Strategy were updated by adopting the document *"Updating documents of the Marine Environment and Coastal Area Management Strategy under the obligations from Articles 8, 9 and 10 of the Marine Strategy Framework Directive 2008/56/EC".* The adoption of the updated *"Monitoring and observation system for ongoing assessment of the Adriatic Sea"* is expected at the end of 2020, while the deadline for updating the existing *"Programme of Measures"* is 2022. Taking into account the regional/sub-regional approach in the development of national "marine" strategies prescribed by the Marine Strategy Framework Directive, the Strategy documents are aligned with activities related to implementing the ecosystem approach to managing human activities that may affect the Mediterranean marine and coastal environment, which are implemented within the Mediterranean Action Plan of the United Nations Environment Programme (UNEP/MAP) and the associated Barcelona Convention with accompanying protocols.

Within the implementation of the existing Monitoring and observation system for ongoing assessment of the Adriatic Sea, the data for monitoring hazardous and harmful substances prescribed for the good environmental status descriptors 8 (contaminants in the marine environment) and 9 (contaminants in seafood) are taken over from the Monitoring programme

for testing transitional and coastal water quality implemented by Croatian Waters (Hrvatske vode) based on the obligations under the Water Framework Directive and the Plan for monitoring sea and shellfish quality in production areas and areas of reintroduction of live shellfish implemented under Commission Regulation (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs (OJ L 364, 20.12.2006).

For the purpose of coordinating expert bodies with the aim of developing and implementing the Strategy, the Government of the Republic of Croatia established the Expert National Committee for the execution of tasks regulated by the Regulation on the development and implementation of documents under the Marine Environment and Coastal Area Management Strategy and for the development and implementation of the Strategy (OG 117/12, 31/17 and 42/18), which is managed by the MESD and comprises representatives of all relevant bodies competent for the implementation of the above Regulation.

2.1.3.7 WASTE MANAGEMENT

The waste generation intensity indicator may indicate the separation of the link between economic growth and waste generation, which is the aim set by the Strategy for Sustainable Development of the Republic of Croatia.

At the EU level, the waste generation intensity in processing and service sectors is decreasing, as well as the municipal waste generation intensity with regard to household consumption. In 2019, a total of 1,811,617 tonnes of municipal waste were generated in the Republic of Croatia, which is a 2 % increase compared to the total quantity in 2018. The annual quantity of municipal waste per capita amounted to 444 kg. The increase in total quantities of municipal waste works against the achievement of Objective 1.1 from the Waste Management Plan of the Republic of Croatia 2017–2022 related to the reduction of municipal waste generation. In 2019, municipal waste was disposed of on 108 landfills. Also in 2019, the coverage of population with organised collection of municipal waste was 99 %, and all municipalities and cities had organised municipal waste collection and disposal (Source: Municipal Waste Report 2019, MESD).

Waste statistics are prepared in accordance with EUROSTAT's prescribed methodological recommendations, and submitted every two years to EUROSTAT's Waste Data Centre.

A total of 1,653,918 tonnes of municipal waste were generated in 2015, 1,679,765 tonnes in 2016, 1,716,441 tonnes in 2017, 1,768,411 tonnes in 2018, and 1,811,617 tonnes in 2019.

Operators or organisational units engaged in activities resulting in the generation of waste and/or waste management activities are obliged to report their waste data to the Environmental Pollution Register (EPR). By entry into force of the Ordinance on the environmental pollution register (OG 87/15) in 2015, the thresholds for reporting waste generation for waste producers were raised and the obligation to report data for waste carriers was cancelled. The threshold for mandatory reporting of hazardous waste generation and/or transfer outside the hazardous waste generation site was raised from 50 kg to 500 kg, and for non-hazardous waste from 2 tonnes to 20 tonnes. The same threshold does not apply to operators involved in waste management, i.e.

waste collectors, providers of public services of collecting mixed municipal waste and biodegradable municipal waste, recycling yards, etc.

Producers reported a total of 1,939,376 tonnes of production waste in 2015, 2,107,017 tonnes in 2016, 1,869,789 tonnes in 2017, 1,805,773 tonnes in 2018, and 2,072,329 tonnes in 2019.

Exports of waste subject to the notification procedure has slightly increased from 2004 to 2014 (23,540 tonnes), with minor deviation in quantities. Larger quantities of exported waste were recorded in 2015 (44,071 tonnes) and 2016 (77,826 tonnes), which is a result of the increased production of combustible waste (refuse-derived fuel, RDF) and the need for its disposal. This includes waste-derived fuel and other waste (including mixtures of materials) from mechanical treatment of waste that was not present in large quantities in previous years. In 2018, exports increased by 19 % (96,028 tonnes) compared to 2017 (80,985 tonnes), mostly related to sludge from municipal wastewater treatment plants, combustible waste (RDF) and other mixed waste containing hazardous substances.

The implementation and establishment of an integrated waste management system in the Republic of Croatia is ensured through applying and meeting the objectives defined by the Waste Management Strategy of the Republic of Croatia (OG 130/05), Waste Management Plan of the Republic of Croatia 2017–2022 (OG 3/17), Act on Sustainable Waste Management (OG 94/13, 73/17, 14/19 and 98/19) and other regulations governing waste management.

The strategic priority at the national and EU level is to achieve efficient use of resources, which is sought to be achieved by applying the concept of circular economy. Although the progress towards more efficient use of resources at the European level is undeniable in terms of production (but certainly connected with the relocation of industrial plants to other continents), the trend is less positive when looking at consumption. The material productivity indicator is used as the resource use efficiency indicator, and is calculated as the ratio between GDP and domestic material consumption (DMC).

2.2 INSTITUTIONAL, POLITICAL AND REGULATORY FRAMEWORK

2.2.1 INTERNATIONAL TREATIES

The Republic of Croatia is a party to a number of international environmental agreements.

The list of international treaties to which the Republic of Croatia is a party, and which are related to the POPs management is shown below:

- Stockholm Convention on Persistent Organic Pollutants (OG-IT 11/06) entered into force with respect to the Republic of Croatia on 30 April 2007 (OG-IT 2/07)
- Convention on Long-range Transboundary Air Pollution; pursuant to the notification on succession, the Republic of Croatia became a party to the Convention on 8 October 1991 (OG-IT 12/93)
- Protocol on Persistent Organic Pollutants to the 1979 Convention on Long-range Transboundary Air Pollution (OG-IT 5/07) entered into force with respect to the Republic of Croatia on 5 December 2007 (OG-IT 9/07)

- Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (OG-IT 3/94 and 7/19) entered into force with respect to the Republic of Croatia on 7 August 1994, the Basel Convention
- Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (OG-IT 4/07), entered into force with respect to the Republic of Croatia on 14 February 2008 (OG-IT 1/08)
- Convention on the Transboundary Effects of Industrial Accidents (OG-IT 7/99) entered into force with respect to the Republic of Croatia on 19 April 2000 (OG-IT 10/01)
- Convention for the Protection of the Mediterranean Sea against Pollution; pursuant to the notification on succession, the Republic of Croatia became a party to the Convention on 8 October 1991 (OG-IT 12/93)
- Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources (Athens, 17 May 1980), (LBS Protocol), (Official Gazette of SFRY, International Treaties 1/90)
- Decision on promulgating the Act on the Ratification of Amendments to the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources (OG-IT 3/06) (new name of the Protocol: Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources and Activities)
- Convention on Co-operation for the Protection and Sustainable Use of the River Danube (OG-IT 2/96), Sofia Convention, Sofia 1994
- Framework Agreement on the Sava River Basin (OG-IT 14/03)
- Agreement on water management relations between the Government of the Republic of Croatia and the Government of the Republic of Hungary (OG-IT 10/94)
- Treaty between the Government of the Republic of Croatia and the Government of Bosnia and Herzegovina on the regulation of water management relations (OG-IT 12/ 96)
- Treaty between the Government of the Republic of Croatia and the Government of the Republic of Slovenia on the regulation of water management relations (OG-IT 10/ 97)
- Treaty between the Government of the Republic of Croatia and the Government of the Republic of Montenegro on mutual relations in the field of water management (OG-IT 1/08)
- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (hereinafter: Aarhus Convention) (OG-IT 1/07) entered into force with respect to the Republic of Croatia on 25 June 2007 (OG-IT 7/08)
- Protocol on Pollutant Release and Transfer Registers to the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (OG-IT 4/08) entered into force with respect to the Republic of Croatia on 8 October 2009 (OG-IT 13/11).

2.2.2 LEGISLATION RELATED TO POPs MANAGEMENT AT THE EUROPEAN UNION LEVEL

2.2.2.1 POPs AND REACH REGULATIONS

At the EU level, the key implementing regulation for the POPs Convention and Protocol was the 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC (OJ L 158, 30. 4. 2004), which is directly enforceable in all EU Member States. The listed Regulation was in force until July 2019.

The direct implementation of Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC (OJ L 158, 30. 4. 2004) and amendments to the Regulation[2] was enabled in the Republic of Croatia by the adoption of the Act on the Implementation of Regulation (EC) No 850/2004 on persistent organic pollutants (OG 148/13 and 52/19).

Regulation (EU) 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants (OJ L 169, 25. 6. 2019) (hereinafter: POPs Regulation) is in force since July 2019. The direct implementation of the POPs Regulation was enabled in the Republic of Croatia by the adoption of the Act on the Implementation of Regulation (EU) 2019/1021 on persistent organic pollutants (OG 54/20) (hereinafter: Act on the Implementation of the POPs Regulation).

The recast of the Regulation introduced only technical changes in order to remove the existing ambiguities and improve the implementation of operational provisions. Namely, definitions of "placing on the market", "article", "substance", "waste", "disposal" and "recovery" were changed. The term "preparation" was replaced by the term "mixture" in line with the terminology of the general legislation related to chemicals, and new definitions of "manufacturing", "use" and "closed-system site-limited intermediate" were added.

The European Chemicals Agency (ECHA) was directly involved in the implementation of the POPs Regulation, and some tasks of the European Commission were transferred to the ECHA due to its expertise and experience in implementing the general legislation on chemicals and international agreements on chemicals. The role of the Forum for Exchange of Information on Enforcement, established by Regulation (EC) No 1907/2006 of the European Parliament and of the Council / REACH Regulation and Regulation (EU) 649/2012, was introduced. The recast of the Regulation updated the powers of the European Commission and adjusted the reporting and monitoring provisions.

Furthermore, the POPs Regulation contains provisions that require the performance of calculations of emissions/inventories for unintentionally produced POPs and the development of national and EU plans and mechanisms for the implementation of plans, as well as monitoring and exchange of information on POPs. To a certain extent, the POPs Regulation goes a step further than the international agreement in terms of ambition.

[2] Regulations No 757/2010, 519/2012, 1342/2014, 2015/2030, 2016/293 and 2016/460, 1195/2006, 172/2007, 323/2007, 219/2009, 304/2009 and 756/2010.

By evaluating the legal framework for the field of chemicals at the EU level, a number of issues related to implementation of the EU legislation were identified, which resulted in differences in laws and other regulations of Member States that directly affect the functioning of the internal market, and which led to recognising the need to take additional efforts with the aim of:

- protection of human health and the environment
- ensuring all preconditions for achieving complete and effective chemical safety at the EU level
- free movement of substances on their own, in mixtures and articles
- enhancing competitiveness and innovation; and
- promoting the development of alternative methods for the hazard assessment of substances.

Based on the above, the EU legislation is continuously supplemented and updated in accordance with new knowledge and current needs, while the POPs Regulation is regularly aligned with other EU legislation, primarily Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (OJ L 396, 30.12.2006) (hereinafter: REACH Regulation), which was transposed into national legislation by the Act on the Implementation of Regulation (EC) No 1907/2006 of the European Parliament and of the Council of concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (OG 53/08, 18/13 and 115/18).

The POPs Regulation includes seven annexes:

- Annex I – List of substances subject to prohibition – a list of chemicals/POPs included in Annexes to the Stockholm Convention and the Protocol on POPs to the LRTAP Convention, the provisions relating to the prohibition of production and placing on the market (Part A – Substances listed in the Convention and the Protocol, as well as substances listed only in the Convention, and Part B – Substances listed only in the Protocol)
- Annex II – List of substances subject to restrictions
- Annex III – List of substances subject to release reduction provisions (unintentional production)
- Annex IV – Waste management – prescribed concentration limits in waste
- Annex V – Waste management – disposal and recovery under Article 7(2) (Part 1) and Wastes and operations to which Article 7(4)(b) applies (Part 2)
- Annex VI – Repealed Regulation with list of the successive amendments thereto
- Annex VII – Correlation table.

The Act on the Implementation of the POPs Regulation enables direct implementation of the POPs Regulation, which prohibits/limits the manufacturing, use and placing on the market of the POPs listed in the Annexes to the Convention and the Protocol on POPs, and contains

provisions on stockpiles and waste management. In the Republic of Croatia, state administration bodies competent for health, agriculture, economy, environmental protection, water management, forestry, veterinary medicine and inspection were designated for the implementation of the POPs Regulation.

2.2.2.2 IED DIRECTIVE

Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions ((integrated pollution prevention and control) (recast) (OJ L 334, 17. 12. 2010), (hereinafter: IED) provides a high level of environmental protection through the integration of measures into the industrial processes themselves. The IED was transposed into national legislation and the implementation of its provisions was ensured by a number of regulations, such as the Environmental Protection Act (OG 80/13, 153/13, 78/15, 12/18, 118/18), Air Protection Act (OG 127/19) and the Act on Sustainable Waste Management (OG 94/13, 73/17, 14/19 and 98/19) together with a number of implementing regulations adopted under these laws, in particular the Regulation on limit values for pollutant emissions from stationary sources into the air (OG 42/21), Regulation on environmental permit (OG 8/14, 5/18), Water Act (OG 66/ 19) and the Ordinance on wastewater emission limit values (OG 26/20).

Industrial installations in which activities covered by Annex I of the IED are carried out are required to obtain an environmental permit. Emissions of all relevant pollutants (including POPs), which are likely to be emitted in greater/significant quantities, have to be regulated by the environmental permit. The requirements set out in the environmental permit, in particular emission limits, have to be based on the application/implementation of the Best Available Technique (BAT). The issued environmental permit contains links to regulations in the fields of air, water/sea and soil protection and monitoring of waste movements for the purpose of monitoring regulations and implementing monitoring for the specified site.

The European Commission enabled the exchange of information on BATs for different industrial sectors, using the so-called BREFs, which are available at the web site http://eippcb.jrc.ec.europa.eu/reference/.

Special emission limit values associated with the BAT have been elaborated for POPs. The BAT conclusions are binding documents, i.e. the defined emission limit values for certain pollutants, and are applied when issuing requirements and limit values for individual emissions in environmental permits.

2.2.2.3 NEW LEGISLATIVE ACTIVITIES

The European Green Deal is a core strategy of the European Commission from 2019 that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use. Through the EGD, climate and environmental objectives are, for the first time, placed at the centre of the European Commission's efforts, aiming to protect, conserve and enhance the EU's natural capital, and protect the health and

well-being of citizens from environment-related risks and impacts. Furthermore, it strives for a just and inclusive transition that places EU citizens and their well-being at the centre.

In this sense, the priorities are to address issues related to pollution from micro plastics and chemicals, including pharmaceuticals. The objective of zero-pollution ambition for a toxic free environment was set, and the development of the Chemicals Strategy for Sustainability was initiated in 2020.

The strategy strives for a toxic-free environment, where chemicals are produced and used in a way that maximises their contribution to society, including achieving the green and digital transition, while avoiding harm to the planet and to current and future generations. The strategy envisages the EU industry as a globally competitive player in the production and use of safe and sustainable chemicals. The strategy proposes a clear roadmap and timeline for the transformation of industry with the aim of attracting investment into safe and sustainable products and production methods.

The objectives are:

1. Innovating for safe and sustainable EU chemicals
2. Stronger EU legal framework to address pressing environmental and health concerns
3. Simplifying and consolidating the legal framework
4. A comprehensive knowledge base on chemicals
5. Setting the example for a global sound management of chemicals.

In 2021, the Zero pollution action plan for water, air and soil and the Revision of measures to address pollution from large industrial installations will be elaborated.

A significant contribution to the achievement of this objective is also expected from the new Circular Economy Action Plan, which includes the initiatives for sustainable products and focuses in particular on resource-intensive sectors such as textiles, construction, electronics and plastics. The circularity principles are introduced when designing products in order to ensure safe management of chemicals and waste.

A major contribution to the safe management of chemicals and waste will be also be made by the SCIP database (https://echa.europa.eu/hr/scip) for information on substances of concern in articles as such or in complex objects (products) established under Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (OJ L 150, 14.06.2018), which will be transposed into national legislation through the Act on Sustainable Waste Management, the preparation of which is underway. The SCIP database ensures that the information on articles containing candidate list substances is available throughout the whole lifecycle of products and materials, including at the waste stage. It also aims to reduce hazardous substances in waste, encourages substitution of those substances with safer alternatives, and contributes to a better circular economy, helping waste management operators to ensure that such substances are not present in recycled materials.

Under the Directive (EU) 2018/851, the obligation of submitting SCIP notifications applies from 5 January 2021.

2.2.3 LEGISLATION IN THE REPUBLIC OF CROATIA

The list of regulations and documents governing the management and monitoring of POPs is presented below.

PLANT PROTECTION PRODUCTS AND PESTICIDE RESIDUES
Act on the Implementation of Regulation (EC) No 1107/2009 concerning the placing of plant protection products on the market (OG 80/13 and 32/19)
Act on Sustainable Use of Pesticides (OG 14/14, 115/18 and 32/20)
Ordinance on establishing a framework for action to achieve sustainable use of pesticides (OG 142/12)
Act on the Implementation of Regulation (EC) No 396/2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin (OG 80/13 and 115/18)
Ordinance on methods of sampling for the official control of pesticide residues in and on products of plant and animal origin (OG 77/08)
CHEMICALS
Act on the Ratification of the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (OG- IT 4/07)
Chemicals Act (OG 18/13, 115/18 and 37/20)
Act on the Implementation of Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of chemical substances and mixtures, amending and abolishing Directive 67/548/EEC and Directive 1999/45/EC and amending Regulation (EC) No. 1907/2006 (OG 50/12, 18/13, 115/18 and 127/19)
Act on the Implementation of Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (OG 53/08, 18/13 and 115/18)
National Chemical Safety Strategy (OG 143/08)
Act on the Implementation of Regulation (EU) No 528/2012 of the European Parliament and of the Council concerning the making available on the market and use of biocidal products (OG 39/13, 47/14, 115/18 and 62/20)
Ordinance on the manner of keeping the register of chemicals and the manner and deadlines for submission of data from the register (OG 99/13 and 157/13)
Ordinance on the storage of hazardous chemicals that act as gas (OG 91/13)
Ordinance on the requirements for carrying out activities of production, placing on the market and use of hazardous chemicals (OG 99/13, 157/13 and 122/14)
Ordinance on good laboratory practice (OG 73/12)
Act on the Implementation of Regulation (EU) No 649/2012 concerning the export and import of hazardous chemicals (OG 41/14 and 115/18)
Ordinance on the requirements and the manner of acquiring and testing knowledge related to protection from hazardous chemicals (OG 99/13)
Occupational Health and Safety Act (OG 71/14, 118/14, 94/18 and 96/18)

Ordinance on authorisations for occupational health and safety tasks (OG 50/19)
Ordinance on testing the work environment (OG 16/16)
Ordinance on the protection of workers from exposure to hazardous chemicals at work, occupational exposure limit values and biological exposure limit values (OG 91/18 and 1/21)
WATER
Water Act (OG 66/19)
Ordinance on wastewater emission limit values (OG 26/20)
Regulation on water quality standards (OG 96/19)
Ordinance on special requirements for performing activities of sampling and testing of water (OG 3/20)
SEA
Decision on the adoption of the Programme of Action of the Marine Environment and Coastal Area Management Strategy: Monitoring and observation system for ongoing assessment of the Adriatic Sea (OG 153/14)
VETERINARY MEDICINE
Act on Veterinary Medicinal Products (OG 84/08, 56/13, 94/13, 15/15 and 32/19)
Veterinary Act (OG 82/13, 148/13 and 115/18)
Ordinance on medicated animal feed (OG 120/11)
Ordinance on the monitoring of certain substances and residues thereof in live animals and animal products (OG 79/08 and 51/13)
Ordinance on the safety of animal feed (OG 102/16)
Act on the Implementation of Regulation (EC) No Act on the Implementation of Regulation (EC) No 396/2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin (OG 80/13, 115/18 and 32/20)
Act on Contaminants (OG 39/13 and 114/18)
Act on Official Controls Performed in Accordance with Regulations on Food, Animal Feed, Health and Welfare of Animals (OG 81/13, 14/14 and 56/15)
Food Act (OG 81/13, 14/14 and 115/18)
ENVIRONMENT
Environmental Protection Act (OG 80/13, 153/13, 78/15, 12/18 and 118/18)
Act on the Ratification of the Protocol on Persistent Organic Pollutants to the 1979 Convention on Long-range Transboundary Air Pollution (OG-IT 5/07)
Regulation on environmental impact assessment (OG 61/14 and 3/17)
Regulation on environmental permit (OG 8/14 and 5/18)
Act on the Implementation of Regulation (EU) 2019/1021 on persistent organic pollutants (OG 54/20)
Regulation on the development and implementation of the documents under the Marine Environment and Coastal Area Management Strategy (OG 112/14)
Regulation on the prevention of major accidents involving dangerous substances (OG 44/14, 31/17 and 45/17 – correction)
Ordinance on the Register of establishments in which dangerous substances are present and the Register of reported major accidents (OG 139/14)
Ordinance on the environmental pollution register (OG 87/15)
Ordinance on the EU Ecolabel (OG 116/16)
STRATEGIC PLANNING DOCUMENTS
National Environmental Action Plan (OG 46/02)
Waste Management Strategy of the Republic of Croatia (OG 130/05)

Waste Management Plan of the Republic of Croatia 2007–2015 (OG 85/07, 126/10, 31/11 and 46/15)
Waste Management Plan of the Republic of Croatia 2017 –2022 (OG 3/17)
Environmental Protection Emergency Plan (OG 82/99, 86/99 and 12/01)
Decision on the adoption of the Plan for the protection of air, ozone layer and climate change mitigation in the Republic of Croatia 2013–2017 (OG 139/13)
Contingency Plan for Accidental Marine Pollution (OG 92/08)
Strategy for Sustainable Development of the Republic of Croatia (OG 30/09)
SUSTAINABLE WASTE MANAGEMENT
Act on the Ratification of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (OG-IT 3/94)
Act on the Ratification of Amendments to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (OG-IT 7/19)
Act on Sustainable Waste Management (OG 94/13,73/17, 14/19 and 98/19)
Ordinance on waste management (OG 81/20)
Ordinance on the management of polychlorinated biphenyls and polychlorinated terphenyls (OG 103/14)
Ordinance on the management of waste electrical and electronic equipment (OG 42/14, 48/14, 107/14, 139/14, 11/19 and 7/20)
Ordinance on the management of end-of-life vehicles (OG 125/15, 90/16, 60/18, 72/18 and 81/20)
Decision on the adoption of the Waste Management Plan of the Republic of Croatia 2017 – 2022 (OG 3/17)
Decision on the implementation of the Waste Management Plan of the Republic of Croatia 2017–2022 of 25 May 2017
AIR QUALITY
Air Protection Act (OG 127/19)
Ordinance on air quality monitoring (OG 72/20)
Regulation on levels of pollutants in ambient air (OG 77/20)
Ordinance on monitoring pollutant emissions from stationary sources into the air (OG 47/21)
Regulation on the quality of liquid petroleum fuels and the method of monitoring and reporting and methodology for calculation of greenhouse gas emissions in the life cycle of delivered fuels and energy (OG 57/17)
Regulation on limit values for pollutant emissions from stationary sources into the air (OG 42/21)
PROTECTION OF AGRICULTURAL LAND
Agricultural Land Act (OG 20/18, 115/18 and 98/19)
Ordinance on the protection of agricultural land against pollution (OG 71/19)
Ordinance on the methodology for monitoring of the status of agricultural land (OG 47/19)
Ordinance on agrotechnical measures (OG 22/19)
Ordinance on the criteria for determining particularly valuable arable (P1) and valuable cultivable (P2) agricultural land (OG 23/19)
Ordinance on the procedure of registration of plant protection products (OG 57/07, 119/09, 142/12 and 80/13)
PROTECTION OF FOREST ECOSYSTEMS

Forest Act (OG 68/18, 115/18, 98/19, 32/20 and 145/20)
Ordinance on the protection of forests against fires (OG 33/14)
Ordinance on the method of data collection, keeping the register and requirements for the use of data on forest fires (OG 82/19)
Ordinance on the methods for monitoring the damage to forest ecosystems (OG 54/19)

2.2.4 MECHANISM FOR MANAGEMENT OF POPs IN THE REPUBLIC OF CROATIA (DIVISION OF COMPETENCES AND MONITORING)

2.2.4.1 COMPETENCES

The MESD is the national contact point of the Stockholm Convention on Persistent Organic Pollutants in the Republic of Croatia, i.e. the state administration body competent for the coordination of all activities related to POPs under this Convention.

By adopting the Act on the Ratification of the Stockholm Convention on Persistent Organic Pollutants (OG-IT 11/2006), the Republic of Croatia ratified the Stockholm Convention in November 2006, and became a party to the Stockholm Convention on 30 April 2007 (OG-IT 2/2007).

The Act on the Implementation of the POPs Regulation designated the state administration bodies competent for the implementation of the POPs Regulation and their tasks.

The competence of state administration bodies for the implementation of the Stockholm Convention in the Republic of Croatia is divided between the following bodies:

- **Ministry competent for environmental protection and economy**
  - competent for the issues of air and water pollution, emissions of pollutants into the air, soil and water, and waste management
  - restriction of the use of certain hazardous substances in electrical and electronic equipment
- **Ministry competent for health**
  - competent for the handling of chemicals
- **Ministry competent for agriculture**
  - competent for plant protection / sustainable management of pesticides, agricultural land, forests and veterinary medicine
- **State inspectorate in the field of occupational health and safety**
  - supervising the handling of equipment containing polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT), labelling and occupational health and safety when handling such equipment

3 EVALUATION OF THE CURRENT STATE RELATED TO POPS IN THE REPUBLIC OF CROATIA

This Chapter aims to integrate all available information on substances with POPs characteristics in the territory of the Republic of Croatia. Since the text of the Stockholm Convention is a "living" document, which is amended, supplemented and updated on the basis of new scientific knowledge, in order to view the historical and current situation and to present the information on substances with POPs characteristics in the territory of the Republic of Croatia, the information is presented in chronological order in this Chapter, namely:

- preliminary inventories of substances with POPs characteristics from the First NIP are covered and integrated in Chapter 3.1
- preliminary inventories of substances with POPs characteristics from the Second NIP, adopted by COP-4/5/6, are covered and integrated in Chapter 3.2
- preliminary inventories of substances with POPs characteristics adopted by COP-7/8 are covered and integrated in Chapter 3.3.

Furthermore, the evaluation of the current state related to pesticides and industrial chemicals with POPs characteristics (substances listed in Annexes A and B to the Stockholm Convention) in the Republic of Croatia is a synthesis of the information collected in preliminary and updated POPs inventories included in the First and Second NIO and the preliminary POPs inventory adopted by COP-7 and COP-8. For the purpose of easier overview of available information, the updates of the inventory of pesticides and industrial chemicals with POPs characteristics included in the First and Second NIP are integrated in Chapter 3.7 *Existing programmes for monitoring POPs releases and their impact on human health and the environment* hereof.

The evaluation of the current state related to unintentionally produced substances with POPs characteristics (substances listed in Annex C to the Stockholm Convention) in the Republic of Croatia is a synthesis of the inventory of unintentional production and release of chemicals from the First and Second NIP. The evaluation is covered in Chapter 3.4 *Estimate and inventory of unintentional production and release of chemicals* hereof.

3.1 "OLD" POPS

3.1.1 POPS PESTICIDES, INDUSTRIAL CHEMICALS AND UPOPS

The term "old POPs" refers to substances listed in the Stockholm Convention that were adopted before COP-4 and regulated by the POPs Regulation. The term "old POPs" covers pesticides, industrial chemicals and unintentionally produced POPs (hereinafter: UPOPs) and includes the following substances:

- pesticides listed in Annex A to the Stockholm Convention: Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Hexachlorbenzene (HCB), Mirex and Toxaphene

- pesticides listed in Annex B to the Stockholm Convention: **Dichlorodiphenyltrichloroethane (DDT)**
- industrial chemicals listed in Annex A to the Stockholm Convention: **Hexachlorbenzene (HCB) and Polychlorinated biphenyls (PCB)**; and
- substances listed in Annex C to the Stockholm Convention: Polychlorinated dibenzo-p-dioxin (PCDD) / Polychlorinated dibenzofurans (PCDF),Hexachlorbenzene (HCB) and Polychlorinated biphenyls (PCB)[3].

The so called "old" POPs are not produced, imported or used in the territory of the Republic of Croatia.

3.1.1.1 PESTICIDES WITH POPS CHARACTERISTICS

For the group of pesticides with POPs characteristics listed in Annex A (Part 1) to the Stockholm Convention, there are basic institutional and legal frameworks required for the implementation and application of the Stockholm Convention. The production and use of these chemicals is prohibited in the Republic of Croatia.

In the period when the use of POPs pesticides was permitted, there were several producers who placed different formulations of pesticides on the market. It should be noted that the quantities produced in Croatia when it was part of ex-Yugoslavia were intended for use in the entire former state From 1969 to 1972, INA Kutina produced NPK fertiliser (12:12:12) with 1 % aldrin, which was soon prohibited, and from 1975 to 2005 produced Volaton fertiliser (Florina 3). Although endrin, when first applied in 1959, was used in the same way as dieldrin (first application in 1958), due to a high risk to appliers and the environment it was used in small quantities only as a rodenticide in the form of a concentrated emulsion. Endrin has not been listed in detailed reports on the application of insecticides in sugar beet since 1959, i.e. has not been used since then.

POPs pesticides are not produced nor are active substances for the production of ready formulations of POPs pesticides imported in the Republic of Croatia. Today, there are numerous preparations registered in the Republic of Croatia that have gradually replaced the toxicologically unfavourable pesticides, including POPs.

The pesticide dichlorodiphenyltrichloroethane (DDT) with POPs characteristics listed in Annex B to the Stockholm Convention was banned for agricultural use in the Republic of Croatia in 1972.

3 The inventory of "old" UPOPs using the UNEP, i.e. LRTAP methodology is covered in Chapter "Estimate and inventory of unintentional production and release of chemicals" hereof.

Table 3.1-1 List of active substances from the group of pesticides classified as POPs and the year of their prohibition

ACTIVE SUBSTANCE	PERMITTED SINCE	PROHIBITED SINCE
ALDRIN	1958	1972
CHLORDANE	Data before 1955 not available	1971
DIELDRIN	1958	1972
ELDRIN	1958	1972
HEPTACHLOR	1957 (only as a rodenticide since 1971)	1989
HCB	1962	1980
MIREX	Not permitted for plant protection	
TOXAPHENE	1957	1982
DDT	1944	1972

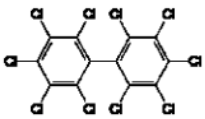
3.1.1.1.1 Information on stockpiles, contaminated sites and waste

Until their ban, POPs pesticides were used in line with application authorisations. The bans that followed did not cause major problems concerning the use of pesticides because pesticides with lower toxicity and risk, as well as improved environmental acceptability, were placed on the market. Prior to their ban, POPs pesticides were used to control many types of pests. Given their widespread use against pests and the crops they were applied on, significant quantities were used.

Products, including pesticides, which are in use today, do not contain POPs and there is no possibility to generate waste containing them. Special landfills at which pesticides containing POPs would be located do not exist. It can be assumed that certain amounts of waste with pesticides containing POPs were deposited at some the municipal waste landfills and covered with layers of waste during the last thirty or more years, but they are hard to find at such sites. Empty packaging of old pesticides could be an exception. According to available data, which is often insufficient and unevenly displayed, so far no contaminated sites have been found.

3.1.1.2 POLYCHLORINATED BIPHENYLS (PCBS), ANNEX A, PART II OF THE STOCKHOLM CONVENTION

PCB



Polychlorinated biphenyls (PCBs) are a group of synthetic organic chemicals, composed of carbon, hydrogen and chlorine. There are 209 different PCB compounds. The number and arrangement of chlorine atoms in the PCB molecule determines their physical and chemical properties.

These are liquid oils or waxes, colourless or slightly yellow, with no smell and taste. Due to their non-flammability, chemical stability, high boiling point, and electrical insulating

properties, they were widely used in commercial applications including electrical and heat transfer, and hydraulic equipment; as plasticisers in paints, plastics, and rubber products; in pigments, dyes, and other industrial applications. They were widely used in mid-20th century. However, due to their high toxicity, persistence in the environment (they are very stable compounds), capability of bioaccumulation and biomagnification, they were recognised as POPs and banned by the United States Congress in 1979, and by the Stockholm Convention on Persistent Organic Pollutants in 2001.

There are various products that may contain PCBs: insulating materials (in transformers and capacitors), electronic equipment (voltage regulators, switches, electromagnets and insulators), motor oils and oils used in hydraulic systems, cable insulation, different thermal insulation materials (foam, fibreglass, felt, and cork), adhesives and tapes, oil-based paint, plastics, gaskets, and floor finish.

PCBs may also be released into the environment from poorly maintained landfills, including improper disposal of waste containing PCBs, leaks from electrical transformers, disposal of waste containing PCBs on city and other landfills not intended for treatment of hazardous waste, and burning of waste containing PCBs.

With some exceptions, the PCBs used in these products are commercial mixtures of individual PCBs, known under different commercial names, of which the most well-known are Aroclors. There are various types of Aroclor that vary according to the level of chlorination. Aroclor mixtures are designated by four digit numbers, of which the first two numbers specify the number of carbon atoms in a phenyl ring (number 12 for PCBs), and the last two numbers specify the percentage of chlorine in the mixture (e.g. Aroclor 1254 is a mixture containing 54% chlorine).

PCBs can cause various adverse health effects, can cause cancer (in higher concentrations), and can affect the immune system, reproductive organs, nervous system, endocrine system, and other organs. They can enter the body by consuming contaminated food (meat, fish, milk and dairy products), through polluted air and through contact with the skin. They are easily absorbed into the body, and are stored and accumulated in fatty tissues. However, adverse health effects are not immediate, but can appear subsequently due to their accumulation in the body, depending on the amount of PCBs absorbed into the body, sensitivity of the body, and the exposure time period.

3.1.1.2.1 Present, current and future production, use, stockpiles and disposal of PCBs

Under Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT) (OJ L 243, 24.9.1996) and the Ordinance on the management of polychlorinated biphenyls and polychlorinated terphenyls (OG 103/14), equipment with PCB volumes of more than 5 dm^3 had to be decontaminated by 31 December 2010. Other equipment, after the devices they were part of are taken out of use, should be collected separately and turned over to an authorised person for decontaminated and/or disposal of as soon as possible in accordance with the provisions of the Ordinance and the Act on Sustainable Waste Management (OG 94/13, 73/17, 14/19 and 98/19). The POPs Regulation

requires from Member States to identify and remove from use equipment (e.g. transformers, capacitors or other receptacles containing liquid stocks) containing more than 0.005 % PCBs and volumes greater than 0.05 dm^3, as soon as possible but no later than 31 December 2025.

PCBs were never produced in the territory of the Republic of Croatia, but there was production of equipment in which liquids (oils) containing PCBs were used and which were imported for these purposes.

Equipment containing PCBs and liquids with PCBs are incinerated solely in incinerators for hazardous waste. Since there are no adequate incineration plants for this type of waste in the Republic of Croatia, all such waste has to be transported for disposal outside Croatia. The provisions of Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste (OJ L 190, 12. 7. 2006) (hereinafter: Regulation (EC) No 1013/2006) are applied to the transboundary movement of waste. Since this is hazardous waste, transboundary movement is conducted using the procedure of prior written notification and consent, the so-called notification procedure. Consents for the transboundary movement of waste are issued by the MESD.

The MESD prepared the latest available data by using several data sources: the Annual report on decontaminated/disposed PCBs, Environmental Pollution Register (EPR), Report on transboundary movement of waste, and data collected/submitted by registered holders of PCB equipment. Based on the listed sources, the MESD updated the information on holders and PCB equipment (transformers and capacitors) that is not disposed of, and PCB equipment that was submitted for disposal (waste containing PCBs under KB 16 02 09*) and the information on other disposed waste articles, materials or liquids that contain or are contaminated with PCBs (other waste containing PCBs under KB 13 01 01*, KB 13 03 01*, KB 16 01 09*, KB 16 02 10* and 17 09 02*).

Fulfilment of obligations from January 2008 to December 2019:

- out of a total of 714 tonnes of registered equipment containing PCBs, 538 tonnes (75 %) were disposed of and 176 tonnes (25 %) remained for disposal in December 2018, while 550 tonnes (77 %) were disposed of and 164 tonnes (23 %) remained for disposal in December 2019, including equipment containing PCBs (63 transformers and 1,623 capacitors) – Figure 3.1-1.

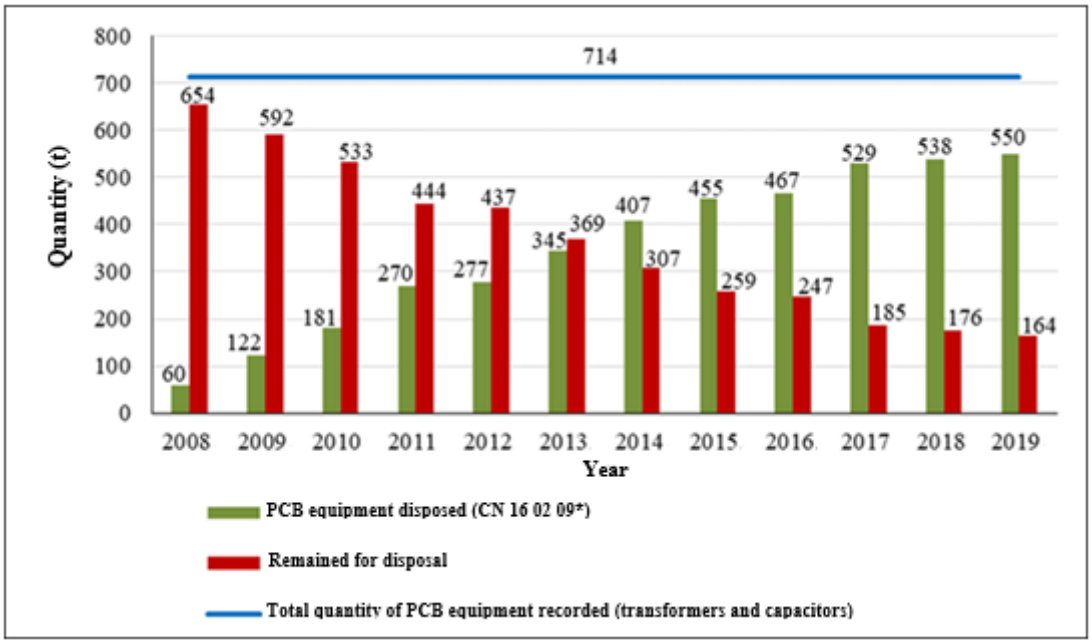


Figure 3.1-1 Amount of equipment containing PCBs – registered / disposed / remaining for disposal, by year, from 2008 to 2019 (Source: MESD 2020)

- from January 2008 to December 2018, a total of 73.90 tonnes were disposed of, and by December 2019 74.10 tonnes of other waste containing PCBs (KB 13 01 01*, KB 13 03 01*, KB 16 01 09*, KB 16 02 10* and KB 17 09 02*).

Out of a total of 164 tonnes of equipment containing PCBs remaining for disposal:

- 97 tonnes (59 %) of equipment is held by four companies, each with an individual share above 10 tonnes (49 t by Dalit CORP d.d. – in bankruptcy; 23 t by Industrogradnja-Izoind d.o.o. in bankruptcy – deleted from the commercial register; 14 t by Impol-TLM d.o.o. and 11 t by Sojara d.o.o.)
- 67 tonnes (41 %) of equipment is held by 29 holders, each with an individual share below 10 tonnes.

In 2018, holders submitted for disposal a total of 4.91 tonnes of waste containing PCBs, of which 4.58 tonnes of equipment containing PCBs – transformers and capacitors (KB 16 02 09*) and 0.33 tonnes of other waste containing PCBs (KB 13 03 01*). According to annual reports on decontaminated/disposed PCBs submitted to the MESD, a total of 4.91 tonnes of waste containing PCBs were taken over from holders in the Republic of Croatia in 2018 for the purpose of disposal. According to the Report on transboundary movement of waste 2018, a total of 13.00 tonnes of waste containing PCBs were exported. The reason for more PCB waste being exported than it was taken over from holders is that exports in 2018 also included PCB waste collected in previous years.

In 2019, holders submitted for disposal a total of 12.09 tonnes of waste containing PCBs, of which 11.89 tonnes of equipment containing PCBs – transformers and capacitors (KB 16 02 09*) and 0.20 tonnes of other waste containing PCBs (KB 13 03 01*). According to annual reports on decontaminated/disposed PCBs submitted to the MESD, a total of 12.09 tonnes of waste containing PCBs were taken over from holders in the Republic of Croatia in 2019 for the purpose of disposal. There was no transboundary movement of waste in 2019.

Equipment containing PCBs and liquids with PCBs are incinerated solely in incinerators for hazardous waste. Since there are no adequate incineration plants for this type of waste in the Republic of Croatia, all such waste has to be transported for disposal abroad. Companies export the collected waste after obtaining consent from the MESD in accordance with the provisions of Regulation (EC) No 1013/2006 and the provisions of Chapter VII of the Act on Sustainable Waste Management (OG 94/13, 73/17, 14/19 and 98/19).

In the following period, the fulfilment of obligations of a part of holders may be aggravated as it is recorded that 53 tonnes or 32 % of PCB equipment remaining for disposal is held by companies under bankruptcy, and 45 tonnes or 28% is held by companies whose status of a business entity has been deleted.

Given that a certain number of new PCB equipment holders is registered each year, it is likely there is a certain number of companies that did recognise their own responsibilities and obligations under the Ordinance, and are still not on the list of holders.

The data on the fulfilment of obligations in accordance with the Ordinance, which are prepared by the MESD, can be viewed on its web site: http://www.haop.hr/hr/tematska-podrucja/otpad-registri-oneciscavanja-i-ostali-sektorski-pritisci/gospodarenje-otpadom-0

3.1.1.2.2 Facilities for storage and decontamination of PCBs

The Republic of Croatia has in place the legal basis which sets the requirements for equipping locations used for storage and decontamination or treatment of hazardous waste, and thus also for waste containing PCBs.

The temporary storage of PCBs, waste PCBs or equipment containing PCBs for a period longer than 12 months prior to decontamination or disposal is prohibited. Places where waste is temporarily stored are the areas within plants throughout the Republic of Croatia, or warehouses of companies with a licence for managing waste containing PCBs.

3.1.1.2.3 Sites contaminated with PBCs

A more detailed overview of the sites contaminated with PCBs identified to date, as well as the experiences of remediation of PCBs-contaminated facilities, are presented in the First NIP.

In order to acquire a full picture of the state of soil contamination in the Republic of Croatia, a systematic analysis should be carried out for all areas suspected to be contaminated with PCBs.

Based on the research conducted so far, significant contamination with PCBs is suspected at two karst sites (Bilice and Zadar) (Source: First NIP). In the Second NIP, as well as in this document, it is proposed to carry out research of the actual risk to water sources and recipients, sorptive properties of land and possibilities for removal of PCBs from land and water.

3.1.2 SUMMARY OF FUTURE PRODUCTION, USE AND RELEASE OF "OLD" POPS

Since the production of "old" POPs is prohibited in the Republic of Croatia, future production is neither anticipated nor possible.

Table 3.1-2. Current and projected production, use and release of "old" POPs

SUBSTANCES		PRODUCTION (TONNES)			USE (TONNES)			STOCKPILES (TONNES)		
		2005	2019	2030	2005	2019	2030	2005	2019	2030
PESTICIDES LISTED IN ANNEX A TO THE STOCKHOLM CONVENTION		0	0	0	0	0	0	0	0	0
PESTICIDES LISTED IN ANNEX B TO THE STOCKHOLM CONVENTION		0	0	0	0	0	0	0	0	0
INDUSTRIAL CHEMICALS LISTED IN ANNEX A TO THE STOCKHOLM CONVENTION	HCB	0	0	0	0	0	0	0	0	0
	PCB	0	0	0	0	0	0	662.47	164	0[4]

3.1.3 "OLD" UPOPS

The inventory of the UPOPs PCDD, PCDF, HCB, PCB is covered in Chapter "Estimate and inventory of unintentional production and release of chemicals" hereof.

3.2 "NEW" POPS ADOPTED BY COP-4, COP-5 AND COP-6

The term "new POPs" refers to substances listed in the Stockholm Convention and regulated by the POPs Regulation. The term "new POPs" covers pesticides, industrial chemicals and UPOPs and includes the following substances:

- pesticides listed in Annex A to the Stockholm Convention: **chlordecone, alpha/beta/gamma hexachlorocyclohexane, pentachlorobenzene** and technical **endosulfan** and its isomers;
- industrial chemicals listed in Annex A to the Stockholm Convention: hexabromobiphenyl (HBB), hexabromodiphenyl ether (hexaBDE) and heptabromodiphenyl ether (heptaBDE), pentachlorobenzene, tetrabromodiphenyl ether and pentabromodiphenyl ether and hexabromocyclododecane (HBCD);
- industrial chemicals listed in Annex B to the Stockholm Convention: perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF);
- the substance listed in Annex C to the Stockholm Convention: **pentachlorobenzene (PeCB)**.

[4] According to the Stockholm Convention, the use of PCBs in equipment (e.g. transformers and capacitors) is allowed until 2025 at the latest.

3.2.1 PESTICIDES WITH POPS CHARACTERISTICS

Table 3.2-1 List of active substances from the group of pesticides classified as POPs and the year of their prohibition

ACTIVE SUBSTANCE	PERMITTED SINCE	PROHIBITED SINCE
CHLORDECONE	1951	1993
ALPHA, BETA AND GAMMA HEXACHLOROCYCLOHEXANE	1944	1972*/2001
PENTACHLOROBENZENE	/	/
ENDOSULFAN	1950	1.7.2007**

***** In the list from 1972, lindane was prohibited only in certain plant protection products.

** Application and sale of registered stockpiles was permitted until January 2008. The sale to end users and application by end users was permitted until January 2009.

3.2.1.1 CHLORDECONE

Chlordecone is a synthetic chlorinated organic compound, which has mainly been used as a pesticide. Chlordecone is highly persistent in the environment. has a very high potential for bioaccumulation and biomagnification and, based on physical and chemical properties and modelling data, is subject to long-range transport. It is classified as a possible human carcinogen and very toxic to aquatic organisms.

It was first produced in 1951 (patented in 1951), and introduced commercially in the USA under the trade name Kepone in 1958. *Kepone* typically contained 94.5% chlordecone. Additionally, chlordecone was also found in mirex ("old" POPs) at concentrations up to 2.58 mg/kg, and in mirex baits at concentrations up to 0.25 mg/kg.

Between 1951 and 1975, approximately 1,600 tonnes of chlordecone were produced in the USA. Chlordecone production was discontinued in 1976. By 1976, technical chlordecone (94.5 % active ingredient) was not exported from the USA. Diluted chlordecone (80% active ingredient) was exported to Europe, particularly Germany, from 1951 to 1975 for the purpose of production of the so called *Kelevan*. *Kelevan* is a derivative of chlordecone and used for the same purposes. In the environment, it oxidises to chlordecone. Additionally, chlordecone was marketed in France as *Curlone* from 1981 to 1993, and was used in Martinique and Guadeloupe following hurricane Allen in 1979 and David in 1980.

Although the production and use of chlordecone has ceased over the last decades in developed countries, it is assumed that it can still be sporadically used as an agricultural pesticide in some developing countries. Considering the long-standing ban in the Republic of Croatia, i.e. the status at the national level, chlordecone does not represent a potential issue for human health and the environment.

3.2.1.2 ALPHA, BETA AND GAMMA HEXACHLOROCYCLOHEXANE

The technical mixture of hexachlorocyclohexane (HCH) contains mainly five forms of isomers, namely alpha-, beta-, gamma-, delta- and epsilon-HCH. Lindane is the common name for the gamma isomer of HCH.

Alpha- and beta-HCH are highly persistent in water in colder regions and may bioaccumulate and biomagnify in biota and arctic food webs. They are subject to long-range transport, are classified as potentially carcinogenic to humans and adversely affect wildlife and human health in contaminated regions. Lindane is persistent, bioaccumulates easily in the food chain and bioconcentrates rapidly. There is evidence for long-range transport and toxic effects (immunotoxic, reproductive and developmental effects) in laboratory animals and aquatic organisms.

Lindane belongs to a group of dangerous insecticides and has contact, gastrointestinal and fumigation effects. It was used to control biting pests and pests in the soil. Products that contained lindane were not permitted to be used on vegetables, tobacco, fodder crops, medicinal plants and grapevines. The use on oilseed rape was allowed only before flowering. Its use was not permitted in greenhouses, cultivation under plastic covering and warehouses. Plant protection products that contained lindane were permitted be used only once a year on the same field, with the exception of forest plantations with two applications permitted per year. Powder formulas were not permitted to be used from aircraft.

The technical HCH (mostly composed of α and β isomers) was used as a pesticide within the European Union as an alternative to DDT from the 1940s onwards. The technical HCH was gradually replace with lindane (containing 99 % γ – HCH isomer). However, in 2006 the IPHA indicated the inefficiency in the production process of lindane. i.e. for each tonne of lindane produced, up to tonnes of hazardous waste containing α and β isomers were generated. The European Union countries where lindane was produced are as follows: Austria, Czech Republic, France, Germany, Hungary, Poland, Romania, Slovakia, Spain, the Netherlands and the United Kingdom.

There was no lindane production in the Republic of Croatia. Lindane was for many years used as a plant protection product for controlling a variety of pests on barley, oats, corn, sugar beet, oilseed rape, as well as for controlling corn and sugar beet soil pests.

In the period from 1957 to 2001 when the active substance lindane was used, authorisations for use were given to different formulations of plant protection products from various producers. Two products containing the active substance lindane that were in use were *Gamacid T50*, a preparation produced by Pliva d.d., and *Dendroline*, produced by Herbos d.o.o. The authorisation for trade and use of *Dendroline* expired in 1998, and it was replaced with *Deltacid*, a preparation containing the active substance deltametrine. Afterwards, only *Gamacid T50* was used. The last use of *Gamacid T50* in the amount of 163 litres was registered in 2004 (Source: Register of records from the Croatian Institute for Public Health – Toxicology Department).

Gamacid T50 was also on the List of Finished Veterinary Medicines, Medicinal Supplements and Veterinary Medicinal Products Approved for Use (OG 75/99, 118/99, 21/00, 73/00 and 114/07). Its registration was valid until 17 August 2005.

According to data from the Second NIP, the greatest quantities applied and the largest area of application of the active substance lindane for pest control on agricultural crops were in Brod-Posavina, Osijek-Baranja and Vukovar-Srijem County. The applied quantities depended on the type of the controlled organism and, accordingly, the lowest application per hectare was in Koprivnica-Križevci County, and the highest in Istria County.

3.2.1.3 PENTACHLOROBENZENE (PeCB)

PeCB belongs to a group of chlorobenzenes that are characterised by a benzene ring in which the hydrogen atoms are substituted by one or more chlorine atoms.

PeCB is persistent in the environment, highly bioaccumulative and has a potential for long-range environmental transport. It is moderately toxic to humans and very toxic to aquatic organisms.

Previously, PeCB was used in PCB products, in dyestuff carriers, as a fungicide and a flame retardant. It might still be used as a chemical intermediate (e.g. for the production of quintozene). It is also produced unintentionally during combustion, thermal and industrial processes, and present in the form of impurities, in products such as solvents or pesticides.

The production, use, export, import and stockpiles of PeCV were not registered in the European Union or in the Republic of Croatia.

3.2.1.4 ENDOSULFAN

Endosulfan belongs to a group of plant protection products (insecticides) with contact and gastrointestinal effects that has been used since the 1950s. The period of application for endoslufan was shorter than for lindane, and its application was not through direct contact with the soil, i.e. it was not used for controlling soil pests.

The trade in insecticides containing the active substance endosulfan was banned by the Decision of the Ministry of Agriculture, Forestry and Water Management, CLASS: UP/I-320-20/07-01/34, REG.NO: 525-02-07-1 of 28 May 2007. Producers and distributors of plant protection products were required to register remaining stockpiles until the end of June 2007.

The application and sale of registered stockpiles were permitted until January 2006. The sale to end users and application were permitted until January 2009.

Stockpiles of insecticides containing the active substance endosulfan amounted to 0 litres in 2008.

Future production is not planned, and there is no new knowledge on potential stockpiles, so the status remains unchanged in relation to the inventory from the Second NIP.

3.2.2 INDUSTRIAL CHEMICALS

3.2.2.1 HEXABROMOBIPHENYL (HBB)

Hexabromobiphenyl is highly persistent in the environment, highly bioaccumulative and has a strong potential for long-range environmental transport. It is classified as a possible human carcinogen and has other chronic toxic effects.

HBB is an industrial chemical that has been mainly used as a flame retardant. The production of HBB started in the 1970s in the USA.

According to available information, hexabromobiphenyl is no longer produced or used in most countries due to restrictions under national and international regulations, and this also applies to the Republic of Croatia.

3.2.2.2 POLYBROMINATED DIPHENYL ETHERS (PBDE[5])

The acronym PBDE is used as the generic term that covers all congeners of the family of brominated diphenyl ethers. It is sometimes abbreviated to BDE.

Polybrominated diphenyl ethers, including tetra-, penta-, hexa-, and heptaBDEs, inhibit or suppress combustion in organic materials and therefore are used as additive flame retardants. The production of tetra- and pentaBDEs has ceased in certain regions of the world, while no production of hexa- and heptaBDEs is reported.

Tetrabromodiphenyl ether and pentabromodiphenyl ether are the main components of commercial pentabromodiphenyl ether. Commercial pentabromodiphenyl ether (c-pentaBDE) refers to mixtures of bromodiphenyl ether congeners in which the main components are tetrabromodiphenyl ether (CAS No. 40088-47-9) and pentabromodiphenyl ether (CAS No. 32534-81-9).

The production of c-pentaBDE at the EU level, mostly used in the production of flexible polyurethane foam (95% active ingredient), was banned in 1994; however, its use and placing on the market were banned ten years later. With a lifetime of ten years, it is assumed that the total quantity of c-pentaBDE at the EU level is present exclusively in waste streams.

Hexabromodiphenyl ether and heptabromodiphenyl ether are the main components of commercial octabromodiphenyl ether. It is assumed that the commercial mixture of c-octaBDE is not produced since 2004, i.e. when the largest producer ended its production. Since 2001, commercial c-octaBDE imported to the European Union consisted of ≤0.5 % pentabromodiphenyl ether isomers, ≤12 % hexabromodiphenyl ether isomers, ≤45 % heptabromodiphenyl ether isomers, ≤33 % octaBDE isomers, ≤10 % nonabromodiphenyl ether isomers and ≤0.7 % decabromodiphenyl ether.

[5] The group of congeners of the family of brominated diphenyl ethers also includes decabromodiphenyl ether (BDE-209) present in commercial decabromodiphenyl ether (c-decaBDE) and listed in Annex A to the Convention with specific exemptions adopted by COP-8.

The primary use of c-octaBDE was as a flame retardant in acrylonitrile-butadiene-styrene (ABS) polymers (10–18 % weight % the of active substance). ABS was mainly used for housings/casings of electrical and electronic equipment. In the 1990s, c-octaBDE in ABS was replaced with alternative flame retardants. Today, ABS is produced by the polymerisation of styrene and acrylonitrile in the presence of polybutadiene. The proportions can vary from 15 % to 35 % acrylonitrile, 5 % to 30 % butadiene and 40% to 60% styrene, which are easily recyclable mixtures, meaning that another common method of producing ABS plastics is to recycle waste ABS plastics.

As with the use of c-pentaBDE, the use of c-octaBDE was banned at the EU level in 2004, and it is assumed that the total quantity of c-octaBDE from electrical and electronic equipment at the EU level has been disposed of by 2012.

The preliminary inventory from the Second NIP, prepared by using the draft Guidance for the inventory of polybrominated diphenyl ethers (PBDE) included in the Stockholm Convention in 2014, identified around 23 tonnes of PBDE in the territory of the Republic of Croatia. Considering the statistical methodology of data processing used by individual institutions, the listed quantities may vary significantly.

No new knowledge on potential stockpiles is available, so the status remains unchanged in relation to the inventory from the Second NIP.

3.2.2.3 PENTACHLOROBENZENE (PECB)

Described in Chapter 3.2.1.3 and Chapter "Estimate and inventory of unintentional production and release of chemicals" hereof (Chapter 3.4).

3.2.2.4 HEXABROMOCYCLODODECANE (HBCD)

HBCD/HBCDD is very persistent in the environment, has a potential for long-range environmental transport and a strong potential for bioaccumulation and biomagnification. It is highly toxic to aquatic organisms. There is little information on the toxicity of HBCD for humans, but vulnerable groups could be at risk, particularly with regard to the observed neuroendocrine and developmental effects.

Each Party that registered the exemption for the production and use of HBCD for expanded polystyrene (EPS) and extruded polystyrene (XPS) in buildings shall take necessary measures to ensure that EPS and XPS containing HBCD can be easily identified throughout their life cycle through labelling or other means.

There are no natural sources of HBCD. HBCD was first introduced in the 1960s and, through the introduction of fire safety regulations for articles, vehicles, and buildings in the 1980s, began to be widely used as a flame retardant additive in polystyrene materials. The four main products in which HBCD is used are EPS, XPS, HIPS and back coating agents for textiles, of which the largest area of application of EPS and XPS is for insulation and packaging.

The European Union has as early as 2008 classified HBCDD as a substance of great concern due to its PBT properties. Because of that, in 2011 HBCDD was included in Annex XIV to the REACH Regulation, pursuant to which production and application in polystyrene foams in the territory of the European Union was permitted until 21 August 2015 only for temporary authorisations that are allowed by the ECHA, and requests submitted until 13 February 2014. In January 2016, in the Official Journal of the European Union a Summary of the European Commission Decision on authorizations for the placing on the market for use and/or for use of substances listed in Annex XIV to the REACH Regulation, concerning the authorised use of formulation of flame-retarded EPS to solid unexpanded pellets using HBCDD as the flame retardant additive (for onward use in building applications) and production of flame-retarded expanded polystyrene (EPS) articles for use in building applications, with the date of the review of 21 August 2017 since socio-economic benefits outweigh the risk to the environment.

In the territory of the European Union, there were no recorded requests for authorisation for the production of XPS, only for EPS. The European Commission, on behalf of the European Union and its Member States, in November 2014 informed the United Nations depositary of being unable to accept the adopted decisions, and requested a temporary so-called "opt-out" until 21 August 2015 due to legal issues and harmonisation of EU legislation. However, since the debate at the level of European institutions extended over the indicated deadline, in August 2015 the European Commission again delivered a notice to the depositary of the United Nations in order to extend the so-called "opt-out" because the conditions for implementation of the relevant Decision at the level of the European Union were still not ensured, but without defining a date on which this was expected. According to information of the Association for European Manufacturers of Expanded Polystyrene (EUMEPS), EPS with HBCDD content is no longer distributed in the European market, although the authorisation in accordance with the REACH Regulation has been issued in 2016 to a consortium of companies for the use of HBCCD in two EPS products. However, by the time of issuing the authorisation, an adequate replacement for HBCD was found in a new flame retardant additive for polymer materials, so the authorisation was withdrawn (EUMEPS, 2016).

Under Commission Regulation (EU) 2016/293 of 1 March 2016 amending Regulation (EC) No 850/2004 of the European Parliament and of the Council on persistent organic pollutants as regards Annex I (OJ L 55, 2.3.2016) and the POPs Regulation, the European Union / the Republic of Croatia banned/restricted the production/use and placing on the market, except for authorisations approved in accordance with the REACH Regulation, i.e. the aforementioned Summary of European Commission Decisions from January 2016.

According to available data, it was identified that HBCD was imported into the Republic of Croatia by the company Dioki d.d., the former largest EPS producer in the Republic of Croatia in the period from 2005 to 2009. The company ceased its production in 2011. According to data submitted in the questionnaire, in 2013 four companies produced/imported EPS and XPS granulate in the total amount of 5,173 tonnes with the HBCD content of 0.7-1 % by weight, or 6,503 tonnes of HBCD. Additionally, data related to the production, import and export of EPS and XPS and granulated polystyrene were analysed. Since not all necessary data were available in order to consider and assess in more detail the historical use of HBCD in the Republic of

Croatia, the estimated total quantity of HBCD on the market in the Republic of Croatia of 6,503 tonnes can be considered a rough estimate. Companies that confirmed the use of HBCD stated that their suppliers were for the most part in the process of replacing HBCD with other, less harmful alternative substances, because they were aware of their existence in the European Union market. As shown in the Second NIP, data were collected by the Croatian Institute for Toxicology and Antidoping and the CBS, and also through a questionnaire on the use of HBCD that was distributed through the Croatian Employers' Association and the Croatian Chamber of Economy to potential producers and users of articles containing HBCD. No new knowledge on potential stockpiles is available, so the status remains unchanged in relation to the inventory from the Second NIP.

3.2.2.5 PERFLUOROOCTANE SULFONIC ACID (PFOS) AND PERFLUOROOCTANE SULFONYL FLUORIDE (PFOSF)

PFOS compounds are extremely stable. Humans can be exposed to it through food and the environment. Unlike other bioaccumulative compounds, they are deposited in the liver and plasma proteins and not in the fatty tissues. They interfere with the metabolism of thyroid hormones, lipids and liver, as well as lung development.

The production and use of PFOS is prohibited for all Parties, except for acceptable purposes and specific exemptions as provided for by Part I of Annex B to the Stockholm Convention.

As PFOS and PFOSF have been listed in Annex B to the Stockholm Convention in 2009 with a large number of specific exemptions and acceptable purposes, the need for these chemicals is, pursuant to the provisions of the Stockholm Convention, examined every four years and, if there is no registration in the Register of specific exemptions, they are removed from the list.

In the European Union, as well as in the Republic of Croatia since 1 July 2013, the list of exemptions, which referred only to acceptable purposes (POPs Regulation) on whose requirements and progress it is required to notify the European Commission every four years, was already reduced.

The specific purposes from the POPs Regulation:

a) surfactants in controlled galvanising systems, until 26 August 2015
b) photoresistive and anti-reflective coatings for photolithographic procedures
c) photographic coatings applied to films, paper or printing plates
d) substances to prevent condensation of non-decorative coatings from hard chromium (VI) in closed systems
e) hydraulic fluids used in aviation.

In the Republic of Croatia, there were no registered applications for the abovementioned purposes.

PFOS and its derivatives are used in numerous manufacturing processes because of their non-reactive properties, low surface tension, chemical stability, resistance to acids and high temperature. They have a specific use as agents in the industry of electronics, semiconductors,

and photography. At the international level, they are used in small quantities in closed systems. The production chain can be rather complicated and downstream users may not know that PFOS has been used in the preceding manufacturing processes. PFOS is also used as drilling fluids in the mining industry, surfactants in the oil and gas industry, and as surfactants or wetting agents in the metal plating industry. The gradual discontinuation of the production of PFOS by the company 3M resulted in a considerable decrease in the consumption of PFOS and derivatives. According to received information, PFOS was being used in metal plating, in hydraulic fluids for the aviation industry, leather industry and the production of photographic equipment.

The production in the territory of the European Union has mostly been stopped in the period from 2000 to 2004.

During the development of the preliminary inventory in the Second NIP, questionnaires on the production and use of PFOS in semi-finished and finished products and/or parts thereof were collected. Companies and organisations that submitted the completed questionnaires indicated that they did not produce, use or place on the market products containing PFOS, nor did they have stockpiles or produced waste containing PFOS. The largest national operator in civil aviation stated that it never used hydraulic oils containing PFOS in its operation.

The Croatian Firefighting Association is the main firefighting organisation that integrates all firefighting organisations and units in the Republic of Croatia. All firefighting units, depending on the size and area they cover, usually perform fire drills two to four times per year. The average amount of foam utilised per drill amounts to 20–50 litres.

Ten to twenty years ago, a very popular foam in the Republic of Croatia was the "Light Water" produced by the company 3M. It was synthetic foam that contained PFOS. There is no data on existing stockpiles or the quantities of that foam used during fire drills. There is a considerable number of small quantities of foam about which little is known. They are often left by ships during repair or similar during their stay in the Republic of Croatia, while some quantities were donated. All foams used today contain only fluorotelomers.

It should be noted that the inventory of firefighting foams is very extensive, involving many stakeholders and requiring thorough planning.

The Second NIP recommends that firefighting organisations carry out detailed assessment/analysis of firefighting foams in use in order to remove doubts regarding the possibility of the presence of stockpiles, and to inform users about the potential risks to health and the environment. The continuous control of stockpiles is still recommended due to potential donations that were received in the meantime.

3.2.3 UPOP ADOPTED BY COP-4, COP-5 AND COP-6

3.2.3.1 PENTACHLOROBENZENE

The most significant source of PeCB is its release during the combustion process in waste incineration plants and thermal processes of combustion of various waste/materials, including

coal. The inventory of the UPOP PeCB is covered in Chapter 3.4 “Estimate and inventory of unintentional production and release of chemicals” hereof.

3.3 “NEW” POPS ADOPTED BY COP-7 AND COP-8

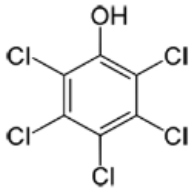
The term “new POPs” refers to, in addition to the substances previously adopted by COP-4/5/6, substances listed in the Stockholm Convention and regulated by the POPs Regulation.

The term “new POPs” covers pesticides, industrial chemicals and UPOPs and also includes the following substances:

- pesticides listed in Annex A to the Stockholm Convention: **pentachlorophenol, its salts and esters (PCP)**
- industrial chemicals listed in Annex A to the Stockholm Convention: hexachlorobutadiene (HCBD), polychlorinated naphthalenes (PCN), decabromodiphenyl ether (commercial mixture, c-decaBDE), short-chain chlorinated paraffins (SCCP); and
- substances listed in Annex C to the Stockholm Convention: polychlorinated naphthalenes (PCN) and hexachlorobutadiene (HCBD)[6].

3.3.1 POPS PESTICIDES

3.3.1.1 PENTACHLOROPHENOL AND ITS SALTS AND ESTERS (PCP)



Pentachlorophenol (PCP) and its salts and esters are listed in Annex A to the Convention with specific exemptions for the production and use of PCP for utility poles and their cross-arms. Each Party that has registered for the exemption pursuant to Article 4 to the Convention for the production and use of PCP for utility poles and cross-arms shall take the necessary measures to ensure that utility poles and cross-arms containing PCP can be easily identified by labelling or other means throughout their life cycles.

Articles treated with pentachlorophenol should not be reused for purposes other than those exempted.

Placing on the market or use of PCP as a substance, as a constituent in other substances or in mixtures in a concentration equal to or greater than 0.1% by weight is restricted pursuant to entry 22 in Annex XVII to the REACH Regulation. In addition, placing on the market and use of PCP as a plant protection product and as a biocidal product is prohibited pursuant to Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009) (hereinafter: Regulation (EC) No 1107/2009) and Regulation (EU) No 528/2012 of the European Parliament and of the

[6] The inventory of “old” UPOPs using the UNEP, i.e. LRTAP methodology is covered in Chapter “Estimate and inventory of unintentional production and release of chemicals“ hereof.

Council of 22 May 2012 concerning the making available on the market and use of biocidal products (OJ L 167, 27.6.2012) (hereinafter: Regulation (EU) No 528/2012), respectively.

By definition, PCP belongs to a group of chlorinated hydrocarbons that were used primarily for wood preservation. PCP is extremely toxic to all living creatures, and in humans it causes severe skin diseases, liver diseases and immune system disorders. The first symptoms are headache, fatigue and insomnia. Back in 1987, the analysis of effects of PCP on humans and the environment was carried out within the World Health Organisation programme, in which authors summarised over 600 studies on its production, use, harmfulness and adverse effects.

PCP was first introduced for use as a wood preservative in the 1930s. Since its introduction, it had a variety of other applications as biocide, insecticide, fungicide, disinfectant, defoliant, and anti-microbial agent in forestry, agriculture, textile industry and oil industry, as well as in the paint industry. It was also used in the production of the ester pentachlorophenyl laurate (PCP-L) that was used in the textile industry for preserving textiles and fabrics, particularly those used in military equipment, which are subject to attack by fungi and bacteria during storage and use. Sodium pentachlorophenate salt (NaPCP) was used for similar purposes as PCP and is easily dissociated to PCP. PCP is produced by reacting chlorine with phenol at high temperatures in the presence of a catalyst. Chlorinated contaminants, including hexachlorobenzene, pentachlorobenzene, dioxins and furans, are produced in the manufacturing process. In addition, dioxins and furans formed during the manufacturing process can be released during the use and disposal of PCP-treated wood. Dioxins and furans are also by-products of the combustion of wood. These compounds are toxic, persistent in the environment, and their presence increases environmental and human health risks associated with the use of PCP.

Alternatives are available and used as replacement for these substances in many countries. These chemical alternatives are chromated copper arsenate (CCA), creosote, copper naphthenate, ammoniacal copper zinc arsenate (ACZA) and alkaline copper quat (ACQ). Chemical alternatives, such as CCA and creosote, are already being mass-produced, while the use of new alternatives, such as copper naphthenate and ACZA, is on the rise. Chemical alternatives on the market have their own strengths and weaknesses, and do not have to be directly replaceable with pentachlorophenol for specific purposes. Additionally, non-chemical alternatives are available.

According to E-PRTR data[7], in the territory of the European Union, the release of 52.3 kg of PCP into water from 14 installations was registered in 2015, 449 kg of PCP into water from 18 installations in 2016, 663 kg of PCP into water from 18 installations in 2017, 761 kg of PCP into water from 24 installations in 2018, and 84 kg of PCP into water from 23 installations in 2019. According to EPR data, there were no registered releases of PCP into air, water and soil in the Republic of Croatia since 2008.

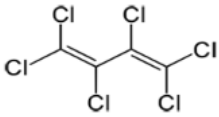
It is assumed that PCP could appear in waste streams, mostly in waste processed wood and leather. The application of PCP as a preservative in impregnation was discontinued in 1979.

[7] https://prtr.eea.europa.eu/#/pollutantreleases

In the Republic of Croatia, PCP is neither used nor it can be found in new products that are imported and placed on the market, but is replaced by appropriate substitutes.

3.3.2 INDUSTRIAL CHEMICALS

3.3.2.1 HEXACHLOROBUTADIENE (HCBD)



Hexachlorobutadiene (HCBD) is listed in Annex A, Part I, without specific exemptions, and in Annex C to the Convention. HCBD is a chlorinated aliphatic hydrocarbon, which is mainly formed as a by-product in the production of chlorinated aliphatic compounds.

The United States Environmental Protection Agency classified HCBD in group C as a substance with a possible carcinogenic effect on humans.

HCBD is most commonly used as a solvent for other chlorine-containing compounds. HCBD is formed as an unintentional by product in industrial processes (particularly in the production of other chlorinated hydrocarbons and the production of magnesium).

HCBD is unintentionally formed during combustion and other thermal and industrial processes. HCBD is released in unknown quantities from former landfills. Urban waste water treatment plants are also a source of HCBD, which accumulates in sewage sludge in waste water treatment processes.

Releases of HCBD from incineration processes can be minimised by alternative production processes, improved process control, emission control measures, or by substitution of the relevant chlorinated chemicals. This would include an obligation to promote the use of best available techniques (BAT) and best environmental practices (BEP) for HCBD sources. Efficient BAT and BEP for reducing the release of unintentionally produced HCBD are available and described in relevant documents.

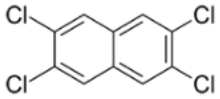
Smaller quantities were used as solvents, e.g. for transformer oils and hydraulic fluids, gyroscope fluids, heat transfer fluids, etc. In the past, HCBD was extensively used as a pesticide, especially to protect vines against Phylloxera (Lecloux, 2004), particularly in the EU countries such as France, Greece, Italy and Spain.

According to E-PRTR data, in the territory of the European Union, the release of 194 kg of HCBD into water from 11 installations was registered in 2015, 322 kg of HCBD into water from 7 installations in 2016, and 1,333 kg of HCBD into water from 11 installations in 2017.

According to EPR data, there were no registered releases of HCBD into air, water and soil in the territory of the Republic of Croatia since 2008.

The production of HCBD for commercial purposes was stopped at the end of the 1970s. There are no available data that would indicate that HCBD was used in the Republic of Croatia, whether for industrial purposes or as a pesticide.

3.3.2.2 POLYCHLORINATED NAPHTHALENES (PCN)



Polychlorinated naphthalenes (PCNs) are listed in Annexes A and C to the Convention with specific exemptions for the production and use of chemicals as intermediates in the production of polyfluorinated naphthalenes, including octafluoronaphthalene.

PCNs are a group of aromatic synthetic organic compounds that contain a naphthalene ring in their structure and are structurally similar to PCBs. In the European Union, PCNs are no longer produced for commercial purposes.

PCNs are mainly used in the electrical industry, representing effective insulating coatings for electrical cables and capacitors. They are also used as an additive to paints and motor oils. They were also used for the impregnation of wood, paper and textiles in order to achieve waterproofing, flame resistance and protection against insects, mould and fungi.

The mass production of a compound similar to dioxin, polychlorinated naphthalene, started during World War I. Commercially, PCN is a mixture of up to 70 different products and by products. Polychlorinated naphthalenes started to be produced for high-volume uses around 1910 in both Europe and the USA. The largest production was carried out by the company Bayer, Germany, for the purpose of producing the so called Nibren waxes.

In other European countries, as well as in the USA, it appeared under trade names Seekay (UK), Clonacire (France), Cerifal (Italy) and Woskol (Poland). In the United States, it was known under the name Halowax, produced by Union Carbide.

The first effects on human health, as well as the health of other living creatures, were recorded after more than 20 years of commercial production. Symptoms of the effects on humans can be observed in the form of a severe skin rash and liver problems which, under certain conditions, can even lead to death. Already in 1937, the Harvard School of Public Health warned about the negative effects of PCN as a whole. It is indicative that more than 40 years have passed from the publication of negative effects of PCN to the government reaction, which has certainly had a major negative impact on the population in general. The year 1976 is the turning point the production and use of PCN because that year the Toxic Substances Control Act entered into force in the USA, which has formally forced large producers to stop the production of PCN. The production of CPN has continued until 1983, but only in very small quantities and primarily for research purposes. Until a few years ago, production was continued only by the company DuPont (Ireland), but with very low capacity. Today, the production of PCNs is completely banned, and can be found only in production systems of the company Ukrgeochem in Simferopol.

Information on substitutes and alternatives are extremely limited since PCNs are no longer used. The production of PCNs began to decline with the use of plastics as an insulating material and the use of PCBs for dielectrics in transformers.

PCNs are currently formed mainly unintentionally during various thermal processes, such as the incineration of solid municipal waste, incineration of hospital waste, household combustion or during various metalworking processes, such as the production of secondary copper and

secondary aluminium, production of magnesium, iron sintering processes and electric arc furnaces for iron production. The occurrence of PCNs is possible in cases of fire and incomplete combustion. However, at the time of mass production, the ratio of produced and naturally occurring PCNs was 1:10 000.

Although the production of PCNs has ceased in Europe, they can still be unintentionally produced in certain industrial activities. In such activities, if the IED thresholds are reached, it is mandatory to apply best available techniques to prevent and reduce emissions and environmental impacts as a whole. An industrial installation has to obtain a permit for its operation from the competent state administration body of a Member State. These permits must contain emission limit values for polluting substances listed in Annex II to the IED, and for other substances, which are likely to be emitted in significant quantities, having regard to their nature and their potential to transfer pollution from one medium to another.

Placing on the market or use of PCN as a substance, as a constituent in other substances or in mixtures in a concentration equal to or greater than 0.1% by weight is restricted pursuant to entry 22 in Annex XVII to the REACH Regulation. In addition, placing on the market and use of PCN as a plant protection product and as a biocidal product is prohibited pursuant to Regulation (EC) No 1107/2009 and Regulation (EU) No 528/2012, respectively.

Particular PCN types are susceptible to degradation in sunlight, as well as by applying selective micro-organisms. However, due to their exceptionally widespread use in the past, the presence of PCNs in the environment is not excluded.

There is no information on the past use of PCNs in the Republic of Croatia, but since PCN has the same use as PCB, the possibility of historic imports and use cannot be fully excluded. It is assumed that the discontinuation of possible use of PCNs occurred at the same time when the use of PCBs was discontinued.

3.3.2.3 DECABROMODIPHENYL ETHER

Decabromodiphenyl ether (BDE-209) is present in commercial decabromodiphenyl ether (c-decaBDE) and listed in Annex A to the Convention with specific exemptions. BDE-209 is a brominated hydrocarbon with a ring structure that belongs to the group of polybrominated diphenyl ethers (PBDE), described in Chapter 3.2.2.2 hereof.

The commercial mixture consists primarily of the fully brominated decaBDE congener in a concentration range of 77.4-98 %, and smaller amounts of the congeners of nonaBDE (0.3-21.8 %) and octaBDE (0-0.04 %). C-decaBDE is highly persistent in the environment, has a high potential for bioaccumulation and biomagnification, as well as for long-range environmental transport. Adverse reactions were recorded for soil organisms, birds, fish, frogs, rats, mice, and humans.

C-decaBDE was used as a flame retardant in expanded polymers, mainly in polystyrene, textiles, adhesives, coatings and inks, and in various items and articles. Plastics containing BDE-209 are used in housings of computers and TVs, wires and cables, small electric components, pipes and carpets. The commercially available production of BDE-209 reached its peak at the beginning of the 2000s, but c-decaBDE is still used extensively around the world. Other uses of plastics with the flame retardant c-decaBDE are found in buildings, construction materials, storage and distribution-related products such as plastic pallets, and in the transport sector (cars, aircraft, trains and ships). It is expected that c-decaBDE will be present in plastics and textiles in several waste streams, such as end-of-life vehicles, e-waste, textile and mixed waste.

There are many chemical alternatives that can be used as a substitute for c-decaBDE such as: decabromodiphenyl ethane (DBDPE), bisphenol bis (diphenyl phosphate) (BDP/BAPP), resorcinol bis(diphenylphosphate) (RDP), ethylene bis (tetrabromophthalimide) (EBTBP), magnesium hydroxide (MDH), triphenyl phosphate (TPP), aluminium trihydroxide (ATH), red phosphorous, substituted amine phosphate mixture. Non-chemical alternatives and technical solutions, such as non-flammable materials and the use of fire-resistant barriers, are also available. There are also polymer materials that are inherently flame-retardant and which might be considered as a substitute for c-decaBDE-based polymers such as poly(butylene terephthalate) (PBTE) or polyamide/nylon (PA), halogen-free polyketone and high performance thermoplastics such as polysulphone, polyaryletherketone (PAEK) or polyethersulphone (PES).

C-decaBDE is an intentionally produced chemical composed of the fully brominated decaBDE congener or BDE-209 (≥ 90–97 %) and smaller amounts of nona- and octabromodiphenyl ether. C-decaBDE has been investigated for already more than ten years for its possible effects on health and the environment and, in some countries and regions as well as some companies, it is subject to restrictions and voluntary risk management measures. However, c-decaBDE is still produced in several countries.

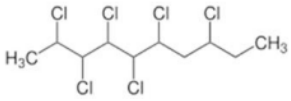
Emissions of C-decaBDE into the environment are released in all phases of its life-cycle, but it is assumed that they are highest during the service life of BDE-containing equipment and as waste. Monitoring data shows that c-decaBDE levels are generally highest near waste water discharges and in areas around electronic waste and recycling plants The average service life for electrical and electronic equipment is about ten years, hence c-decaBDE will continue to be released to the environment through articles in use for years to come. The most efficient control measure to reduce the releases of c-decaBDE and its main constituent BDE-209, would be to list BDE-209 (c-decaBDE) in Annex A to the Convention without specific exemptions.

Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (OJ L 174, 1.7.2011) (hereinafter: RoHS Directive) restricts the use of decabromodiphenyl ether in electrical and electronic equipment. The production, placing on the market or use of decabromodiphenyl ether (decaBDE), on its own and as a constituent of other substances, in mixtures or in articles is restricted under Commission Regulation (EU) 2017/227 of 9 February 2017 amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and

of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards bis(pentabromophenyl)ether (OJ L 35, 10.2.2017) (hereinafter: Commission Regulation (EU) 2017/227). Based on entry 67, the production, placing on the market or use of decabromodiphenyl ether is allowed only for the production of aircraft until 2 March 2027, for spare parts of aircraft produced before the expiry of this period, and for the production of spare parts of motor vehicles, agricultural and forestry vehicles produced before 2 March 2019. In addition, electrical and electronic equipment within the scope of the RoHS Directive and articles placed on the market before 2 March 2019 as defined in Commission Regulation (EU) 2017/227 are exempted.

There are no available data that would indicate that c-decaBDE was used in the Republic of Croatia.

3.3.2.4 SHORT-CHAIN CHLORINATED PARAFFINS (SCCP)



Short-chain chlorinated paraffins (SCCPs) are listed in Annex A to the Convention with specific exemptions. Chlorinated paraffins (CPs) are complex mixtures of certain organic compounds containing polychlorinated n-alkanes, while short-chain chlorinated paraffins have a carbon chain length of 10 to 13 C atoms.

SCCPs are hydrolytically stable and sufficiently persistent in air for long range transport. Many SCCPs can accumulate in biota. It is concluded that SCCPs are likely, as a result of their long range environmental transport, to lead to significant adverse environmental and human health effects.

Chlorinated paraffins are produced by the chlorination of straight-chain paraffin fractions. SCCPs are primarily used in metalworking applications and in polyvinyl chloride (PVC) processing. SCCPs are also used as plasticisers and flame retardants in a variety of applications, including in paints, adhesives, plastics, rubber, leather, textiles and polymer materials. Historically, SCCPs are used as lubricants and coolants in metalworking fluids. In general, lubricants that are chlorinated paraffins or contain additives for chlorinated paraffin are designed for lubricating components exposed to extreme pressures.

In an effort to implement sustainable metalworking systems, significant progress has been made by industry through the development of environmentally adapted lubricants. Such lubricants are highly biodegradable, have low toxicity and their performance is equal to or better than conventional alternatives.

There are numerous classes of lubricants, including vegetable oil-based ingredients (soybeans, pine, oilseed rape, sunflower, coconut) which can be used in traditional water-based formulations instead of conventional fluids. Alternative techniques have been developed, including the use of gas-based system such as supercritical CO_2. Supercritical CO_2 can be combined with soybean oil to obtain improved performance.

Other alternative processes include dry machining, where no cutting fluid is required, and cryogenic machining, where liquefied gases are used.

Furthermore, bio-based formulations have the potential to reduce the waste treatment costs for metalworking system effluents and the occupational health risks associated with petroleum oil-based metalworking systems. Synthetic and semi-synthetic lubricants, which are often diluted with water rather than VOC solvents, may also serve as alternatives. Some of the compounds that can be used as alternatives to SCCPs in metalworking fluids are: alkanol amides isopropyl oleate, medium-chain chlorinated paraffins, long-chain chlorinated paraffins, nitrated compounds (e.g. Doverlube NCEP- nitrogen containing compound), calcium sulfonates, PEP additives, sulphur and phosphorus-based substitutes. Chemical substances that can be used to replace SCCPs in polyvinyl chloride applications include: acrylic polymers, alumina trihydrate, aluminium trihydroxide used in conjunction with antimony trioxide, aluminium trioxide, antimony trioxide, medium-chain chlorinated paraffins, long-chain chlorinated paraffins, organophosphorus flame retardants, phthalates, zinc borate.

SCCPs are persistent, bioaccumulative, and toxic to aquatic organisms at low concentrations. They can remain in the environment for a significant amount of time and can bioaccumulate in animal tissues, increasing the probability and duration of exposure. Even relatively small releases of these chemicals from individual manufacturing, processing, or waste management facilities have the potential to accumulate over time to higher levels and cause significant adverse impacts on the environment.

SCCPs have been measured in a variety of environmental media including air, sediment, surface waters, and waste water. SCCPs have also been measured in a variety of wild taxa, including freshwater aquatic species, marine mammals, and avian and terrestrial wildlife. Furthermore, SCCPs have been detected in samples of human breast milk from Canada and the United Kingdom, as well as in a variety of food items from Japan and various regions of Europe.

Emissions of SCCPs into the environment may occur in all phases of their life-cycle: during production, storage, transport, use and disposal of SCCPs and articles containing them. Although data are limited, the main sources of SCCP releases are probably the formulation and production of articles containing SCCPs such as PVC plastics and the use in metalworking fluids.

SCCPs are listed in the Protocol on Persistent Organic Pollutants to the Convention on Long-range Transboundary Air Pollution, and thus the Parties are required to discontinue their production and use. Under the then valid Commission Regulation (EU) 2015/2030 of 13 November 2015 amending Regulation (EC) No 850/2004 of the European Parliament and of the Council on persistent organic pollutants as regards Annex I (OJ L 298, 14.11.2015), the production, placing on the market and use of SCCPs are prohibited in the Union. However, by way of derogation, the production, placing on the market and use of substances or preparations containing SCCPs in concentrations lower than 1 % by weight or articles containing SCCPs in concentrations lower than 0.15 % by weight are still allowed. In addition, use is allowed in respect of: (a) conveyor belts in the mining industry and dam sealants containing SCCPs already in use before or on 4 December 2015; and (b) articles containing SCCPs other than those

referred to in (a) already in use before or on 10 July 2012. The same is regulated by the valid POPs Regulation.

Looking at the historical trend in the Republic of Croatia, the production and import of alkanes C10-C13, chloro (SCCP) Cas No 85535-84-8 from 2010 to 2012 was recorded as follows: **production** in 2010: 240.00 kg (15 %) 36 kg C10-13, chloro; in 2011: 720.00 kg (15 %) 108 kg C10-13, chloro; and in 2012: 2,160.00 kg (15 %) 324 kg C10-13, chloro; **import** in 2010: 4,275.00 kg C10-13, chloro; in 2011: 4,560.00 kg C10-13, chloro; and in 2012: 9,120.00 kg C10-13, chloro. The production or import to the Republic of Croatia were not registered since 2013 and there is no new knowledge on potential stockpiles.

3.3.3 UPOPs ADOPTED BY COP-7 AND COP-8

HCBD, pentachlorophenol, its esters and salts, PCN, decaBDE and SCCP belong to UPOPs that can be produced as by-products and released as such from anthropogenic sources, which are listed in Annex C to the Stockholm Convention. All these compounds include organic matter containing halides that are mostly formed in thermal processes or as a result of incomplete combustion or chemical reactions.

The negative impact of the listed substances/compounds on human health and the environment has already been defined in this document.

However, what is common to all these substances is that administrative procedures, as well as proper handling thereof, have reduced or completely eliminated the presence of these chemicals in a way that can adversely affect human health and have a negative impact on the environment in general.

None of these substances have been intentionally produced in the Republic of Croatia, while sporadic cases of unintentional production can only be mentioned in the context of incomplete combustion or fire.

3.4 ESTIMATE AND INVENTORY OF UNINTENTIONAL PRODUCTION AND RELEASE OF CHEMICALS

Polychlorinated dibenzo-p-dioxins (PCDD) / polychlorinated dibenzofurans (PCDF), hexachlorobenzene (HCB), polychlorinated biphenyls (PCB), pentachlorobenzene (PeCB), polychlorinated naphthalenes (HCN) and hexachlorobutadiene (HCBD) belong to UPOPs that can be unintentionally produced as by-products and released as such from anthropogenic sources, which are listed in Annex C to the Stockholm Convention. All these compounds include organic matter containing halides that are mostly formed in thermal processes or as a result of incomplete combustion or chemical reactions.

The negative impact of the listed substances on human health and the environment has already been defined in this document. However, what is common to all these substances is that administrative procedures, as well as proper handling thereof, have reduced or completely eliminated the presence of these substances in a way that can adversely affect human health and have a negative impact on the environment in general.

None of these substances have been intentionally produced in the Republic of Croatia, while sporadic cases of unintentional production can only be mentioned in the context of incomplete combustion or fire.

3.4.1 CURRENT AND PLANNED MONITORING OF EMISSIONS OF UNINTENTIONALLY PRODUCED/RELEASED POPs LISTED IN ANNEX C AND PCDD/PCDF INTO THE ENVIRONMENT IN THE REPUBLIC OF CROATIA

3.4.1.1 MONITORING OF POPS EMISSIONS IN ACCORDANCE WITH THE OBLIGATIONS UNDER THE LRTAP CONVENTION AND RELATED PROTOCOLS

The Republic of Croatia ratified the following protocols to the LRTAP Convention: Protocol on Further Reduction of Sulphur Emissions (OG–IT 17/98 and 3/99), Protocol on Heavy Metals (OG-IT 05/07), Protocol on Persistent Organic Pollutants (OG-IT 05/07), Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes (OG-IT 10/07), Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes (OG-IT 10/07), Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (OG-IT 07/08).

The POPs emission inventory in the Republic of Croatia was initiated in 1996 in accordance with international EMEP/CORINAIR methodology, which is officially accepted by the Executive Body of the LRTAP Convention. The calculation shows emissions of the five main air pollutants (SO_2, NO_x, CO, NMVOC, NH_3), particulate matter (TSP, PM_{10} and $PM_{2,5}$), nine heavy metals (Cd, Pb, Hg, As, Cr, Cu, Ni, Se, Zn) and four groups of persistent organic compounds – polycyclic aromatic hydrocarbons (PAH), hexachlorocyclohexane (HCH), hexachlorobenzene (HCB), dioxins and furans. The reporting on emissions of hexachlorocyclohexane (HCH) is excluded from the reporting obligations since 2015.

The MESD prepares annual reports on the inventory of emissions of certain pollutants according to the obligations under the LRTAP Convention and publishes them on its web site.

The POPs Protocol entered into force with respect to the Republic of Croatia on 6 December 2008. Pursuant to Article 3, paragraph 5 of the POPs Protocol, the Republic of Croatia is obliged to maintain POPs emission levels below those in the base year (1990).

Accordingly, table *3.4-1* provides an overview of quotas for certain POPs.

Table 3.4-1 Emission levels of certain POPs according to the POPs Protocol in the base year (Source: CEAN, Annual report on the inventory of emissions 2018)

POPs	Emission levels in 1990*

Polycyclic aromatic hydrocarbons (PAH)**	21.8 t
Dioxins and furans (PCDD/PCDF)	48.5 g I-Teq
Hexachlorbenzene (HCB)	7.1 kg
Polychlorinated biphenyls (PCB)	482.8 kg

*defined in Annex III to the POPs Protocol

**for the purpose of calculating PAH emissions, four compounds are considered: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3,-cd)pyrene

Total quantities of POPs released into the air in the territory of the Republic of Croatia for 1990, 1995, 2000, 2005, 2010, 2015, 2016, 2017 and 2018 are shown in the table below together with shares of emission changes in the period from 1990 and in relation to the previous historical year.

Table 3.4-2 Emission trend for POPs in the Republic of Croatia

Pollutant	Unit	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	Share of change from 1990 to 2019	Share of change from 2018 to 2019
PCDD/ PCDF	g I-Teq	49.1	43.5	41.9	49.8	40.3	34.6	33.1	29.2	27.9	27.0	-45.1 %	-3.1 %
PAH	t	21.08	16.72	15.04	18.66	17.68	15.85	15.21	14.65	13.86	13.40	-38.8 %	-3.3 %
HCB	kg	7.09	6.43	1.99	0.45	0.85	0.43	0.47	0.46	0.55	0.60	-91.5 %	8.7 %
PCB	kg	482.8	468.2	441.4	435.7	433.7	424.9	422.1	415.3	411.8	409.7	-15.1 %	-0.5 %

3.4.2 UNEP METHODOLOGY USED FOR PCDD/PCDF EMISSION INVENTORIES ACCORDING TO THE OBLIGATIONS UNDER THE STOCKHOLM CONVENTION

The first PCDD/PCDF emission inventory in the Republic of Croatia was prepared based on the UNEP methodology Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP 2001) for 2001 during the preparation of the First NIP.

During the inventory process as part of the NIP revision project for the preparation of PCDD/PCDF inventory revision for 2001, and the inventories for 2007, 2009, 2013, 2015 and 2017, the UNEP methodology, Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs under Article 5 of the Stockholm Convention (UNEP, 2013) (hereinafter: Toolkit) was used, which ensures a complete, consistent and clear inventory of PCDD/PCDF emissions into the environment.

PCDD/PCDF releases are accompanied by releases of other unintentional POPs, which can be minimised or eliminated by implementing the same measures used to address PCDD and PCDF releases. The Toolkit recommends, for practical reasons, that inventory activities are focused on PCDD/PCDF, as these substances are indicative of the presence of other unintentional POPs. They are considered to constitute a sufficient basis for identifying and prioritising sources as well as for devising applicable control measures and for evaluating their efficacy for all POPs listed in Annex C to the Stockholm Convention.

The Toolkit/UNEP methodology proposes five basic steps in the inventory of PCDD/PCDF:

1) identification of the main PCDD/PCDF source groups
2) identification of categories, current activities and potential release routes of PCDD/PCDF in the environment
3) data collection on specific processes
4) quantification of PCDD/PCDF sources and emission inventory using the emission factors
5) summary of the inventory.

3.4.3 BASELINE RELEASE ESTIMATES AND UPDATING OF PCDD/PCDF

The Parties to the Stockholm Convention have to prepare their initial release estimates and update these estimates at regular intervals in order to establish and maintain the consistency for discerning meaningful trends in releases over time.

The basis for the release estimate is the first national (or regional) inventory of sources and releases of POPs listed in Annex C, usually as part of the NIP developed in accordance with Article 7 of the Act on the Ratification of the Stockholm Convention on Persistent Organic Pollutants (OG-IT 11/06).

This first inventory serves as a basis against which subsequent updated release estimates are updated in order to establish trends in releases over time and evaluate the efficacy of the adopted strategies for minimising and/or eliminating unintentional PCDD/PCDF and other POPs releases.

The first baseline release estimate for PCCD/PCDF according to the UNEP methodology/2001 Toolkit, as mentioned above, for the purposes of the first NIP, is shown in Table 3.4-3.

Table 3.4-3: Assessment of PCDD/PCDF emissions into the environment in 2001

No	Source groups	Annual PCDD/PCDF emissions (g I-TEQ year^{-1})				
		Air	Water	Land	Products	Waste
1	Waste incineration	1.4				3.6
2	Ferrous and non-ferrous metal production	3.1	?	?		22.3
3	Power generation 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 of chemicals and consumer goods	0.1	0.002?		0.8	0.3?

No	Source groups	Annual PCDD/PCDF emissions (g I-TEQ year^{-1})				
		Air	Water	Land	Products	Waste
8	Miscellaneous	0.001?			?	?
9	Waste recovery and disposal	?	?	?		2.7
1-9	**Total**	**115.7?**	**0.002?**	**1.7?**	**0.8?**	**49.5?**

* The values shown are medians; empty boxes show that the impact of potential release routes is insignificant.

? Potential release route is significant, but either data or activity is missing.

? After the number means that the number (data) is not representative because some subcategories have not been fully processed.

The inventory was revised within the Second NIP by taking into account changes/modifications according to the new revised UNEP 2013 Toolkit, as well as new data on activities. The results of the revised inventory of PCCD/PCDF emissions for 2001 are provided in Table 3.4-4.

Table 3.4-4: Results of the revised inventory of PCCD/PCDF emissions for 2001

No	Source groups	Annual PCDD/PCDF emissions (g I-TEQ year^{-1})				
		Air	Water	Land	Products	Residue
1	Waste incineration	1.3885	0.0000	0.0000	0.0000	3.5703
2	Ferrous and non-ferrous metal production	1.5216	0.0010	0.0000	0.0000	23.2100
3	Power generation and heating	111.1563	0.0000	0.0000	0.0000	0.2750
4	Production of mineral products	2.2806	0.0000	0.0000	0.1118	0.0373
5	Transport	0.7083	0.0000	0.0000	0.0000	0.0000
6	Uncontrolled combustion processes	0.0577	0.0000	0.0087	0.0000	0.0000
7	Production of chemicals and consumer goods	0.0001	0.0320	0.0000	0.7169	0.2325
8	Miscellaneous	0.0030	0.0000	0.0000	0.0000	0.0092
9	Waste recovery and disposal	0.0000	0.1555	0.0000	0.9158	5.4350
10	Identification of potential hotspots				0.0000	0.0000
1-10	**Total**	**117.116**	**0.189**	**0.009**	**1.744**	**32.769**
	Grand total	**152**				

3.4.4 OVERVIEW OF ENVIRONMENTAL RELEASE TRENDS

There are currently no municipal waste incineration plants in the Republic of Croatia (the only such incineration plant was closed in 2002). Three cement plants have valid permits for energy recovery of certain types of combustible waste.

The metal industry in the Republic of Croatia includes the production of steel, welded and seamless steel pipes, reinforcements, rolled wires, wire meshes for construction works and casting of metal. The primary production of pig iron produced in blast furnaces existed until 1992. It should be noted that in 1990 and 1991 the required quantity of sinter and pellets necessary for the production of pig iron was imported from abroad, so these activities were not present in the Republic of Croatia at that time. Steel was produced in the open hearth furnaces with Siemens Marten process up to 1991 and in the electric-arc steel furnaces which are still present in the Republic of Croatia. There are two steel manufacturers in Croatia. There was only one facility for primary aluminium production, but it was shut down during 1991.

The waste management system was established, and the implementation of the integrated waste management system is ensured through the application and meeting of the objectives defined by the Act on Sustainable Waste Management (OG 94/13, 73/17, 14/19, 98/19), Waste Management Strategy (OG 130/05) and Waste Management Plan of the Republic of Croatia for the 2017–2022 period (OG 03/17).

In order to depict emission trends, the same methodology for PCCD/PCDF emission inventories was used for 2007, 2009, 2011, 2013, 2015 and 2017. The total PCCD/PCDF emissions by source group for the mentioned years are presented in Tables 3-4.5– 3-4.10.

The PCCD/PCDF emission inventories for 2007, 2009, 2011 and 2013 were taken from the Second NIP.

The emission inventories for 2015 and 2017, as well as previous emission inventories, were carried out by using the Toolkit, while data on the groups of pollutants were taken from:

- PC AXIS database, CBS
- CIPH publications
- Databases (ERP, REDS/RRMA), IENP
- Annual reports on monitoring pollutant emissions from stationary sources into the air, IENP
- Register of use permits and decisions on integrated environmental requirements, IENP
- Register of licences and certificates for waste management, IENP
- Reports on municipal waste, IENP
- Overview of waste disposal and landfills, IENP
- Register of use permits and decisions on integrated environmental requirements, IENP
- Energy in Croatia: Annual energy review, ME
- Annual energy statistics, CBS.

Table 3.4-5: Total PCCD/PCDF emissions by main source categories in 2007

No	Source groups	Annual releases (g TEQ year^{-1})				
		Air	Water	Land	Products	Residue
1	Waste incineration	0.600	0.000	0.000	0.000	0.004
2	Ferrous and non-ferrous metal production	0.008	0.000	0.000	0.000	0.008
3	Power generation and heating	13.498	0.000	0.000	0.000	0.466
4	Production of mineral products	0.267	0.000	0.000	0.022	0.007
5	Transport	0.245	0.000	0.000	0.000	0.000
6	Uncontrolled combustion processes	0.126	0.000	0.019	0.000	0.000
7	Production of chemicals and consumer goods	0.001	0.000	0.000	0.005	0.001
8	Miscellaneous	0.003	0.000	0.000	0.000	0.011
9	Disposal	0.000	0.207	0.000	0.076	7.917
10	Identification of potential hotspots				0.000	0.000
1-10	**Total**	**14.747**	**0.207**	**0.019**	**0.103**	**8.413**
Grand total		**23.49**				

Table 3.4-6: Total PCCD/PCDF emissions by main source categories in 2009

No	Source groups	Annual releases (g TEQ year^{-1})				
		Air	Water	Land	Products	Residue
1	Waste incineration	0.570	0.000	0.000	0.000	0.004
2	Ferrous and non-ferrous metal production	0.040	0.000	0.000	0.000	0.282
3	Power generation and heating	14.434	0.000	0.000	0.000	0.374
4	Production of mineral products	0.200	0.000	0.000	0.014	0.005
5	Transport	0.291	0.000	0.000	0.000	0.000
6	Uncontrolled combustion processes	0.028	0.000	0.004	0.000	0.000
7	Production of chemicals and consumer goods	0.001	0.000	0.000	0.838	0.000
8	Miscellaneous	0.003	0.000	0.000	0.000	0.011
9	Disposal	0.000	0.314	0.000	0.062	8.454
10	Identification of potential hotspots				0.000	0.000
1-10	**Total**	**15.566**	**0.314**	**0.004**	**0.914**	**9.131**
Grand total		**25.93**				

Table 3.4-7: Total PCCD/PCDF emissions by main source categories in 2011

No	Source groups	Annual releases (g TEQ year^{-1})				
		Air	Water	Land	Products	Residue
1	Waste incineration	0.144	0.000	0.000	0.000	0.001
2	Ferrous and non-ferrous metal production	0.044	0.000	0.000	0.000	0.286
3	Power generation and heating	19.809	0.000	0.000	0.000	0.566
4	Production of mineral products	0.171	0.000	0.000	0.012	0.004
5	Transport	0.266	0.000	0.000	0.000	0.000
6	Uncontrolled combustion processes	0.033	0.000	0.005	0.000	0.000
7	Production of chemicals and consumer goods	0.000	0.000	0.000	0.805	0.000
8	Miscellaneous	0.003	0.000	0.000	0.000	0.012
9	Disposal	0.000	0.297	0.000	0.070	7.479
10	Identification of potential hotspots				0.000	0.000
1-10	**Total**	**20.470**	**0.297**	**0.005**	**0.888**	**8.347**
Grand total		**30.01**				

Table 3.4-8: Total PCCD/PCDF emissions by main source categories in 2013

No	Source groups	Annual releases (g TEQ year^{-1})				
		Air	Water	Land	Products	Residue
1	Waste incineration	0.025	0.000	0.000	0.000	0.044
2	Ferrous and non-ferrous metal production	0.051	0.000	0.000	0.000	0.334
3	Power generation and heating	20.054	0.000	0.000	0.000	0.392
4	Production of mineral products	0.151	0.000	0.000	0.009	0.043
5	Transport	0.222	0.000	0.000	0.000	0.000
6	Uncontrolled combustion processes	0.020	0.000	0.003	0.000	0.000
7	Production of chemicals and consumer goods	0.000	0.000	0.000	0.663	0.000
8	Miscellaneous	0.003	0.000	0.000	0.000	0.012

No	Source groups	Annual releases (g TEQ year^{-1})				
		Air	Water	Land	Products	Residue
9	Disposal	0.000	0.373	0.000	0.109	7.066
10	Identification of potential hotspots				0.000	0.000
1-10	**Total**	**20.527**	**0.373**	**0.003**	**0.781**	**7.892**
Grand total		**29.6**				

Table 3.4-9: Total PCCD/PCDF emissions by main source categories in 2015

No	Source groups	Annual releases (g TEQ year^{-1})				
		Air	Water	Land	Products	Residue
1	Waste incineration	0.032	0.000	0.000	0.000	0.055
2	Ferrous and non-ferrous metal production	0.052	0.000	0.000	0.000	0.329
3	Power generation and heating	20.797	0.000	0.000	0.000	0.392
4	Production of mineral products	0.177	0.000	0.000	0.011	0.055
5	Transport	0.254	0.000	0.000	0.000	0.000
6	Uncontrolled combustion processes	0.023	0.000	0.003	0.000	0.000
7	Production of chemicals and consumer goods	0.000	0.000	0.000	0.629	0.000
8	Miscellaneous	0.003	0.000	0.000	0.000	0.013
9	Disposal	0.000	0.373	0.000	0.131	7.066
10	Identification of potential hotspots				0.000	0.000
1-10	**Total**	**21.337**	**0.373**	**0.003**	**0.771**	**7.910**
Grand total		**30.4**				

Table 3.4-10: Total PCCD/PCDF emissions by main source categories in 2017

No	Source groups	Annual releases (g TEQ year^{-1})				
		Air	Water	Land	Products	Residue
1	Waste incineration	0.034	0.000	0.000	0.000	0.060
2	Ferrous and non-ferrous metal production	0.055	0.000	0.000	0.000	0.348
3	Power generation and heating	21.930	0.000	0.000	0.000	0.385
4	Production of mineral products	0.173	0.000	0.000	0.011	0.057
5	Transport	0.230	0.000	0.000	0.000	0.000
6	Uncontrolled combustion processes	0.024	0.000	0.004	0.000	0.000
7	Production of chemicals and consumer goods	0.000	0.000	0.000	0.685	0.000
8	Miscellaneous	0.003	0.000	0.000	0.000	0.013
9	Disposal	0.000	0.373	0.000	0.139	7.066
10	Identification of potential hotspots				0.000	0.000
1-10	**Total**	**22.449**	**0.373**	**0.004**	**0.835**	**7.929**
Grand total		**31.6**				

The overall trend of PCCD/PCDF emissions according to release vector and year is shown in Figure 3.4-1.

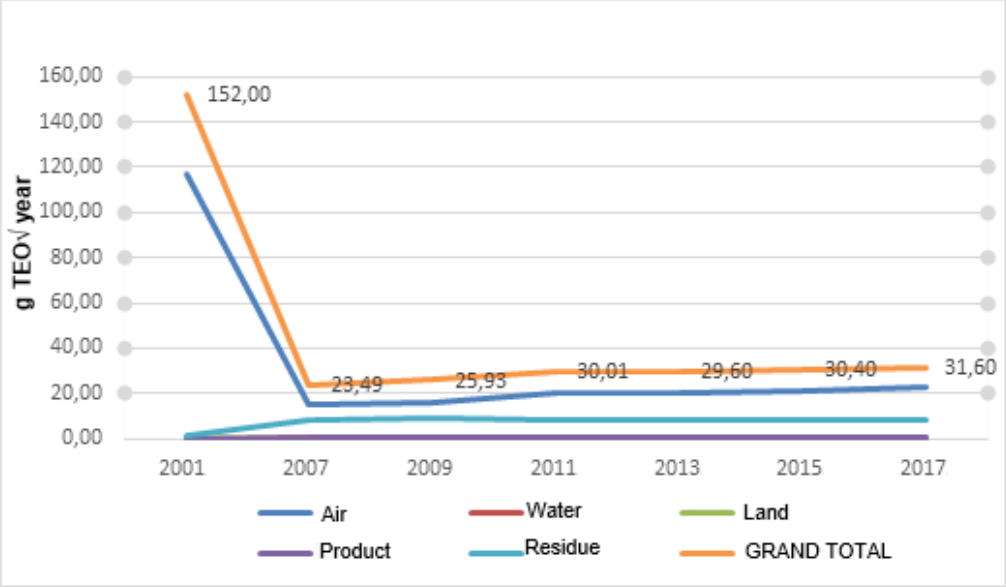


Figure 3.4-1: Overall trend of PCCD/PCDF emissions for the 2001–2017 period

3.4.4.1 EPIS – ENVIRONMENTAL PROTECTION INFORMATION SYSTEM

Pursuant to the Ordinance on the environmental pollution register (OG 87/15), data on POPs emissions into the air, water and/or sea and soil from individual sources and generation of waste containing PCB are collected in the EPR database. The data on emissions into the air from stationary sources for PAH in 2016, 2017 and 2018 were collected in the EPR database. Total PAH emissions reported by one operator amounted to 37.39 kg, in 2016, 36.67 kg in 2017, and 29.7 kg in 2018.

The data on emissions into the air from stationary sources for PCDD+PCDF in 2018 were collected in the EPR database. In 2018, the total PCDD+PCDF emission expressed as TEQ was reported by one operator and amounted to 3 g.

In the period from 2015 to 2017, emissions into the air, water and soil of other POPs in the Republic of Croatia were not reported to the EPR or E-PRTR database.

The Regulation on the prevention of major accidents involving dangerous substances (OG 44/14, 31/17 and 45/17) and the Ordinance on the Register of establishments in which dangerous substances are present and the Register of reported major accidents (OG 139/14) provide for POPs data collection in the REDS/RRMA database. The REDS/RRMA database keeps data on operators and areas of their installations that report the quantities of raw materials, intermediaries and products in accordance with Annex I to the said Regulation, and there are no reported POPs for the 2015–2019 period.

3.5 INFORMATION ON STOCKPILES, CONTAMINATED SITES AND WASTE

Based on data related to the use of POPs in certain areas of the Republic of Croatia, several areas should be defined in which the presence, particularly of pesticides containing the so-called "new" POPs, would be analysed.

By knowing the doses or concentrations of use, and understanding that pesticides were used in accordance with recommendations provided by the permit, there is very little prospect of finding locations significantly contaminated by pesticides. To confirm this, an analysis is recommended.

3.6 SUMMARY OF FUTURE PRODUCTION, USE AND RELEASE OF "OLD" POPS

At the moment in the Republic of Croatia, there is no on-going or planned future production of POPs because the same is prohibited or restricted. The current and projected production, use and release of all POPs covered by the Stockholm Convention is shown in the table below.

Table 3.6-1 Current and projected production, use and release of "old" and "new" POPs

Year		**2017**	**2025**	**2035**
POPs PESTICIDES				
PRODUCTION (TONNES)		***0***	***0***	***0***
Aldrin		0	0	0
Chlordane		0	0	0
Dieldrin		0	0	0
Endrin		0	0	0
Heptachlor		0	0	0
Hexachlorobenzene		0	0	0
Mirex		0	0	0
Toxaphene		0	0	0
Chlordecone		0	0	0
Alpha, beta and gamma hexachlorocyclohexane	Alpha hexachlorocyclohexane Beta hexachlorocyclohexane Lindane	0	0	0
Pentachlorobenzene		0	0	0
Technical endosulfan and its isomers		0	0	0
Pentachlorophenol and its salts and esters		0	0	0
USE (TONNES)		***0***	***0***	***0***
Aldrin		0	0	0
Chlordane		0	0	0
Dieldrin		0	0	0
Endrin		0	0	0
Heptachlor		0	0	0
Hexachlorobenzene		0	0	0
Mirex		0	0	0

Toxaphene		0	0	0
Chlordecone		0	0	0
Alpha, beta and gamma hexachlorocyclohexane	Alpha hexachlorocyclohexane Beta hexachlorocyclohexane Lindane	0	0	0
Pentachlorobenzene		0	0	0
Technical endosulfan and its isomers		0	0	0
Pentachlorophenol and its salts and esters		0	0	0
DDT				
PRODUCTION (TONNES)		***0***	***0***	***0***
USE (TONNES)		***0***	***0***	***0***
INDUSTRIAL CHEMICALS				
PRODUCTION (TONNES)		***0***	***0***	***0***
STOCKPILES/USE (TONNES)				
Hexachlorobenzene		0	0	0
Polychlorinated biphenyls				
Total mass of equipment containing PCB		714	*	*
Hexabromobiphenyl		0	0	0
Polybrominated diphenyl ethers	Tetrabromodiphenyl ether Pentabromodiphenyl ether Decabromodiphenyl ether	Preliminary inventory	0	0
Pentachlorobenzene		0	0	0
Hexabromocyclododecane		0	0	0
Hexachlorobutadiene		0	0	0
Polychlorinated naphthalenes		0	0	0
Short-chain chlorinated paraffins		0	0	0
Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride				
PRODUCTION (TONNES)		***0***	***0***	***0***
STOCKPILES/USE (TONNES)		***0***	***0***	***0***
UPOPs				
PCDD/PCDF (g TEQ year^{-1})			*	*
Waste incineration		0.094	*	*
Ferrous and non-ferrous metal production		0.403	*	*
Power generation and heating		21.930	*	*
Production of mineral products		0.241	*	*
Transport		0.230	*	*
Uncontrolled combustion processes		0.028	*	*
Production and use of chemicals and consumer goods		0.685	*	*
Miscellaneous		0.016	*	*

Disposal and landfill		7.578	*	*
Identification of potential hotspots		0	*	*
Hexachlorobenzene		0.46 kg	*	*
Polychlorinated biphenyls		415.3 kg	*	*
Pentachlorobenzene		0	*	*
Polychlorinated naphthalenes		0	*	*
Hexachlorobutadiene		0	*	*

* to be determined

3.7 EXISTING PROGRAMMES FOR MONITORING POPS RELEASES AND THEIR IMPACT ON HUMAN HEALTH AND THE ENVIRONMENT

Data on the existing programmes for monitoring POPs releases are taken from the Fourth report on the implementation of the Stockholm Convention on Persistent Organic Pollutants in the Republic of Croatia for the period January 2015 – December 2017 and the Fifth report on the implementation of the Stockholm Convention on Persistent Organic Pollutants in the Republic of Croatia for the period January 2018 – December 2019. All the data shown in this Chapter cannot be aligned to the same reference period as they pertain to different environmental components and different media for which the data are collected. They are collected according to different methodologies and for different time periods depending on reporting obligations prescribed in relevant national and European legislation and international treaties.

3.7.1 MONITORING OF POPS IN WATER

The status of natural, heavily modified and artificial surface water bodies in 2018, which includes rivers, lakes, transitional and coastal waters, was determined based on the ecological or chemical status of that body[8], and refers to the monitoring data collected until the end of 2018. The assessment of surface water status in 2018 was carried out according to the former Regulation on water quality standards (OG 73/13, 151/14, 78/15, 61/16 and 80/18).

Monitoring of the status of surface waters is performed as surveillance and operational monitoring and, if required, investigative monitoring.

Surveillance monitoring is carried out for the purpose of supplementing and validating the impact of human activities on the status of water, planning future monitoring, assessing long-term changes in natural conditions and long-term changes resulting from widespread anthropogenic activities, and it is carried out for all biological, hydromorphological and basic physico-chemical quality elements, all specific pollutants and all chemical status indicators.

The task of operational monitoring is to assess changes resulting from measures implemented in areas for which it was identified that they do not meet the good water status requirements.

[8] Regulation on water quality standards (OG 96/19, Annex 2c, Tables 5 –9 and Table 14 for the ecological status and Annex 5 for the chemical status).

Investigative monitoring is carried out where the reason for any exceedances of limit values if indicators for assessing the water status is unknown, where surveillance monitoring indicates that the water protection objectives for a specific water body are not likely to be achieved and operational monitoring has not already been established in order to ascertain the causes of failing to achieve the water protection objectives and to ascertain the magnitude and impacts of accidental pollution, and to provide information for the establishment of a programme of measures for the achievement of the water protection objectives and the definition of a programme of specific measures necessary to remedy the effects of accidental pollution.

Based on the monitoring results for each water body, their status is individually assessed and they are classified into an appropriate category (body status classification) in combination with the impact assessment; the risk that a specific surface or groundwater body will not meet the aquatic environment protection objectives, i.e. that it will not retain the status in accordance with the water protection objectives, is assessed. The monitoring results show the status of quality elements and thus also the progress in achieving the water protection objectives.

Article 15 of the Regulation on water quality standards prescribes that the ecological status is assessed based on the worst value, taking into account the values of the assessment results of biological elements, basic physico-chemical elements and chemical elements supporting the biological elements. The five categories of ecological status are: high, good, moderate, poor and bad. High ecological status is additionally verified with regard to hydromorphological elements and, in case that hydromorphological conditions for the high status are not met, good ecological status is determined.

Chemical status of inland surface waters is assessed in relation to the permitted average annual concentration and permitted maximum annual concentration of priority and priority hazardous substances in water prescribed in Annex 5, Table 5B Environmental Quality Standards (AEQS) of the Regulation on water quality standards. Chemical status is divided into two classes: achieving good chemical status and failing to achieve good chemical status.

When compared, emphasis is placed on substances whose aquatic environmental quality standards are stricter under Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy (OJ L 226, 24.8.2013) . These revised aquatic environmental quality standards for the existing priority substances should be met by the end of 2021 for the purpose of achieving good chemical status of surface waters. Priority substances are: anthracene, brominated diphenylethers, cadmium and its compounds, chloroalkanes (C10-C13), di(2-ethylhexyl)phthalate (DEHP), endosulfan, fluoranthene, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclohexane, mercury and its compounds, nonylphenols, pentachlorobenzene, polyaromatic hydrocarbons (PAH), tributyltin compounds, trifluralin, dicofol, perfluorooctane sulfonic acid and its derivatives (PFOS), conicsfen, dioxins and dioxin-like compounds, hexabromocyclododecane (HBCDD) and heptachlor and heptachloroepoxide. Good chemical status is determined at those monitoring stations in which average annual concentrations, calculated as the arithmetic mean values of the measured concentrations and the maximum annual concentration (MAC), do not exceed the water quality standards values.

When assessing the ecological status, chemical status and status of protected areas, all analytical results were, where applicable, taken into account where the limit of quantification (LOQ) of an indicator was below or equal to the limit value of good ecological status of physico-chemical quality elements and specific pollutants, the aquatic environmental quality standards (AEQS) and/or the limit value of indicators in protected areas.

3.7.1.1 MONITORING OF SURFACE WATERS FROM 2015 TO 2018

RIVERS

In 2015, the implementation of surveillance and operational monitoring of the status of waters was planned at 533 monitoring stations in inland surface waters. Among them, stations located in inland surface water bodies where abstractions of water intended for human consumption are located, stations in inland surface water bodies located in waters suitable for freshwater fish life, in vulnerable areas and in areas designated for the protection of habitats or species were identified.

The programme for monitoring the water status in Croatian rivers in 2016, 2017 and 2018 covered 107 surveillance monitoring stations, 408 operational monitoring stations (of which 53 surveillance and operational monitoring stations) and monitoring stations in special water protection areas: waters designated as suitable for freshwater fish life, waters from which water intended for human consumption is abstracted, and in vulnerable and potentially vulnerable areas. In 2016, the monitoring of ecological status indicators was carried out at 492 monitoring stations, and of chemical status indicators at 190 stations. In 2017, the monitoring of ecological status indicators was carried out at 535 monitoring stations, and of chemical status indicators at 297 monitoring stations. In 2018, chemical status indicators were determined at 336 monitoring stations, and ecological status indicators at 537 stations.

Ecological status of inland surface waters – rivers

In 2016, the ecological status of rivers was determined at 492 monitoring stations. At least one biological element was analysed at 220 monitoring stations, physico-chemical elements were tested at 492 monitoring stations, and at least one specific substance at 185 monitoring stations. High and good ecological status was determined at 195 monitoring stations, i.e. at 40 % of monitoring stations. At the remaining 60 % of monitoring stations, moderate status was determined at 169 of them, i.e. 34 %, mostly in the Sava river sub-basin. The Adriatic river basin district recorded the highest percentage of monitoring stations with high and good status (76 %). Out of the observed quality elements, biological elements at poor status have the highest percentage (70 %), while specific pollutants exceeded the limit values for good ecological status at only eight stations (4 %). Compared to other biological quality elements, phytobenthos indicated high or good status at the largest number of monitoring stations (65 %), while macrophytes and macrozoobenthos are at the lowest number (25 % and 37 %, respectively).

In 2017, high and good ecological status was determined at 163 monitoring stations, i.e. at 30.5 % of monitoring stations. At the remaining 69.5 % of monitoring stations, bad status was

determined at 78 of them, i.e. 14.6 %, mostly in the Sava and Drava river sub-basin. The largest percent of monitoring stations with high and good status (38.7%) is situated in the Adriatic river basin district. When observing biological quality elements, the highest percentage of them (73 %) are at poor status, while specific pollutants exceed the limit values for good ecological status at only 4 % of stations. Physico-chemical quality elements were tested at the largest number of monitoring stations (530), whereas high and good status was determined for 48 % of them. Macrozoobenthos was tested at the largest number of monitoring stations (193), of which 44 % has high and good status. Fish were tested at the smallest number of monitoring stations (29), of which 76 % has high and good status. Out of the total number of stations tested according to at least one biological element (232), of which 27 % has high and good status.

In 2018, ecological status was determined at 537 monitoring stations in rivers. Based on the obtained status assessments, at least one biological element was analysed at 201 monitoring stations, physico-chemical elements were tested at 534 monitoring stations, and at least one specific substance at 194 monitoring stations. Hydromorphological quality elements were assessed at 210 monitoring stations. High and good ecological status was determined at 222 monitoring stations, i.e. at 41 % of monitoring stations. At the remaining 59 % of monitoring stations, moderate status was determined at 181 of them, i.e. 34 %, mostly in the Sava river sub-basin. The Adriatic river basin district recorded the highest percentage of monitoring stations with high and good status (68 %). In accordance with the Regulation on water quality standards, specific pollutants include non-synthetic (arsenic, copper, zinc and chromium and their compounds), synthetic (fluorides) and others that include adsorbable organically bound halogens and PCBs. In 2018, specific pollutants, prescribed by the Regulation on water quality standards as limit values of chemical elements of ecological status classes for surface waters – specific pollutants, exceeded the limit values for good ecological status at 9 monitoring stations, namely at the following monitoring stations: Tomašica–Tomašica, Petak–spring, Lička Jesenica–Veliko Vrelo, Zagorska Mrežnica–spring Ogulin, Mrežnica–Mlinci upstream, Dretulja spring–Plaški, Bistrac–spring, Bužin well next to the spring, and Orašnica before confluence into Krka. When specific pollutants are concerned, in 2018 the reasons for failing to achieve good water status are, in the majority of cases, copper (6 monitoring stations), zinc (two measuring stations) and adsorbable organically bound halogens (one monitoring station). The results of monitoring specific pollutants in the Republic of Croatia in the period from 2016 to 2018 systematically show an increase in the number of monitoring stations on which specific pollutants are monitored, as well as an increase in the number of stations where testing results indicate good water status in terms of specific pollutants.

Chemical status of inland surface waters – rivers

In 2015, the monitoring of chemical status indicators at surveillance monitoring stations in the Sava river sub-basin was carried out at 15 stations. All chemical status indicators were analysed at all monitoring stations, but with different frequencies. With respect to average and/or maximum annual concentrations, good chemical status was determined for all indicators. The monitoring of chemical status indicators at operational monitoring stations in the Sava river sub-basin was carried out at 40 stations. Good chemical status was determined at 36 stations.

Good chemical status was not determined at four monitoring stations (Šumetlica, Spačva, Kutinica, stream Črnec V) due to exceeding maximum annual concentrations of mercury and cadmium and mean annual concentrations of the sum of cyclodiene pesticides.

In 2015, the monitoring of chemical status indicators at surveillance monitoring stations in the Drava and Danube river sub-basin was carried out at 17 stations. All chemical status indicators were analysed at all monitoring stations, but with different frequencies. With respect to average and/or maximum annual concentrations, good chemical status was determined for all indicators.

The monitoring of chemical status indicators at operational monitoring stations in the Drava and Danube river sub-basin was carried out at 21 stations. Good chemical status was determined at 15 stations. Good chemical status was not determined at three monitoring stations (Jalšovec, Gliboki II, Crni fok) due to exceeding maximum annual concentrations of mercury. Additionally, good chemical status was not achieved at three monitoring stations due to exceeding mean annual concentrations of the sum of cyclodiene pesticides (Baranjska Karašica, Županijski kanal and Javorica).

In 2015, the monitoring of chemical status indicators at surveillance stations in the Adriatic river basin district was carried out at one station (Cetina – Radmanove mlinice). With the exception of C 10-13 chloroalkanes and tributyltin compounds, which were not analysed in samples taken in January and April, all chemical status indicators were sampled with a frequency of 12 times per year. With respect to average and/or maximum annual concentrations, good chemical status was determined for all indicators.

The monitoring of chemical status indicators at operational monitoring stations in the Adriatic river basin district was carried out at nine stations. With respect to average and/or maximum annual concentrations, good chemical status was determined at all stations. The testing of all indicators envisaged under the monitoring plan was not fully realised.

In 2016, the monitoring of chemical status indicators for surface waters was carried out at 205 monitoring stations. The springs were processed according to the aquatic environmental quality standards (AEQS) for surface waters, and river estuaries according to the AEQS for transitional waters. With the exception of hexachlorocyclohexane, all chemical status indicators were tested. The limits of quantification (LOQ) of analytical methods for indicators of PFOS, cypermethrin, dichlorvos, heptachlor and heptachloroepoxide were higher than the average annual values of the relevant environmental quality standards (AEQS), and therefore these substances were not assessed. At some monitoring stations, the assessment for cadmium, tributyltin, endosulfan and the group of polyaromatic hydrocarbons (PAH) was also not carried out for the same reason. Good chemical status was determined at 170 monitoring stations, which represents 89 % of surveillance and/or operational monitoring stations at which the testing of chemical status indicators was carried out. According to monitoring results, several priority substances exceed the defined aquatic environmental quality standards at stations within the Danube river basin district. At most of these stations, the critical substance is mercury (ten monitoring stations), followed by lead and nickel (five monitoring stations). The Adriatic river basin district shows the reverse situation, i.e. at the same monitoring station, the aquatic

environmental quality standards for several substances (group of polyaromatic hydrocarbons and fluoranthene) were exceeded.

In 2017, the monitoring of chemical status was carried out at 306 monitoring stations for surface waters. The springs were processed according to the aquatic environmental quality standards (AEQS) for surface waters, and river estuaries according to the AEQS for transitional waters. All chemical status indicators were tested. The limits of quantification (LOQ) of analytical methods for indicators of benzo(a)pyrene, tributyltin, cypermethrin, heptachlor and heptachloroepoxide were higher than the average annual values of the relevant environmental quality standards (AAC – AEQS), and therefore these substances were not assessed according to the AAC – AEQS in cases when all measured values were below the limit of quantification. Good chemical status was determined at 267 monitoring stations, which represents around 90 % of surveillance and/or operational monitoring stations at which the testing of chemical status indicators was carried out. According to monitoring results, several priority substances exceed the defined aquatic environmental quality standards at stations within the Danube river basin district. At most of these stations, the critical substance is mercury (five monitoring stations) due to the exceeded average annual values of the AEQS. In the Adriatic river basin district, the critical substance is trichloromethane at seven monitoring stations.

In 2018, the chemical status, with individual chemical status indicators, was determined at 336 monitoring stations for surface waters. The springs were processed according to the aquatic environmental quality standards (AEQS) for surface waters, and river estuaries according to the AEQS for transitional waters. All chemical status indicators defined in Annex 5 of the Regulation on water quality standards were tested. The limits of quantification of analytical methods for indicators of benzo(a)pyrene, tributyltin, cypermethrin, heptachlor and heptachloroepoxide were higher than the average annual values of the relevant environmental quality standards (AAC – EQS), and therefore these substances were not assessed according to the AAC – EQS.

Good chemical status was determined at 291 monitoring stations for rivers, which represents 90 % of surveillance and/or operational monitoring stations for rivers at which the testing of chemical status indicators was carried out. According to monitoring results at stations within the Danube river basin district and the Adriatic river basin district, several priority substances exceed the defined aquatic environmental quality standards, namely as follows: hexabromocyclododecane (AAC), PFOS and its derivatives (AAC), trichloromethane (chloroform) (AAC), benzo(a)pyrene (AAC), nickel dissolved (AAC), mercury dissolved (MAC), lead dissolved (MAC and AAC), fluoranthene (AAC), cyclodiene pesticides (AAC), chlorpyrifos ethyl (MAC) and cadmium dissolved (AAC). At most of the stations, the critical substances are mercury (seven monitoring stations) and lead (six monitoring stations). In the Adriatic river basin district, the critical substance is trichloromethane at five monitoring stations. In the Danube river basin district, critical substances are hexabromocyclododecane (AAC exceeded at two monitoring stations), PFOS and its derivatives, trichloromethane, benzo(a)pyrene, cyclodiene pesticides, chlorpyrifos ethyl (AAC exceeded at one monitoring station each).

With respect to average and/or maximum annual concentrations, good chemical status was determined at all other stations. The testing of all indicators envisaged under the monitoring plan was not fully realised.

LAKES

Assessment of ecological and chemical status of inland surface waters – rivers

The ecological status of natural lakes in 2016, 2017 and 2018 was determined on seven lakes (two in the Sava river sub-basin and five in the Adriatic river basin district). In 2016, satisfactory ecological status was determined for all of them, good in six lakes and high in the Visovac Lake. The biological element phytoplankton was tested in six lakes in 2016, and high status was determined for all of them. Physico-chemical elements were tested in all lakes, and had high or good status, while specific pollutants were tested in five lakes, which also had good status. The monitoring of chemical status carried out in the same year covered all natural lakes in the Danube river basin district, where good chemical status was determined. The monitoring of chemical status in the Adriatic river basin district was carried out on only two natural lakes. Good chemical status was determined in all the lakes.

In 2017, good ecological status was not achieved in two lakes (Vrana Lake near Zadar and Visovac Lake). At the Vrana Lake near Zadar, good ecological status was not achieved according to the biological element phytoplankton and the physico-chemical element COD and, in the case of specific pollutants, according to adsorbable organic halogens (AOX). At the Visovac Lake, good ecological status was not achieved according to the biological element phytoplankton. The monitoring of chemical status carried out in 2017 included no natural lakes in the Danube river basin district. The monitoring of chemical status in the Adriatic river basin district was carried out on two natural lakes. Good chemical status was determined in all the lakes.

Of the seven typified natural lakes, in 2018 good ecological status was not determined in the Vrana Lake near Biograd and the Baćina Lake Crniševo, where the mean annual concentration of adsorbable organically bound halogens exceeded the limit value for good status (50 μg/l). The monitoring of chemical status carried out in 2018 included two natural lakes in the Danube river basin district. The monitoring of chemical status in the Adriatic river basin district was carried out in four natural lakes. Good chemical status was determined in all the lakes.

Reservoirs

Ecological and chemical status of inland surface waters – reservoirs

The water status monitoring programme in 2016, 2017 and 2018 covered 37 reservoirs and other artificial standing waters, primarily gravel pit lakes. In 2016, for the assessment of ecological status based on the classification for standing waters, the biological elements macrophytes, macrozoobenthos and fish were assessed in 36 reservoirs, physico-chemical elements in 32 reservoirs, and at least one specific pollutant in 22 reservoirs. According to these

biological elements, moderate to bad ecological status was determined, thus confirming the status of these water bodies as heavily modified standing water bodies. This justifies the initiation of research projects for developing the classification system for ecological potential of reservoirs.

Moderate and poor status according to physico-chemical indicators was determined in nine reservoirs, and according to specific pollutants in five reservoirs. In 2016, the monitoring of chemical status included only a small number of reservoirs. No chemical status indicators were analysed in reservoirs in the Danube river basin district. Out of 45 chemical status indicators, reservoirs in the Adriatic river basin district were tested only for metals (lead, nickel, cadmium and mercury), as well as fluoranthene, trichloromethane, isoproturon, chlorpyrifos and pentachlorophenol. Good chemical status was determined in all analysed reservoirs.

In 2017, ecological status of biological quality elements was not analysed. Physico-chemical quality elements were analysed in all tested reservoirs, and specific pollutants in 29 reservoirs. According to physico-chemical indicators, moderate status was determined in 12 reservoirs. According to specific pollutants, four reservoirs failed to achieve good status. In 2017, the monitoring of chemical status included only a small number of reservoirs: four reservoirs in the Danube river basin district and three reservoirs in the Adriatic river basin district. All chemical status indicators were tested at the monitoring station Rakitje. Reservoirs in the Adriatic river basin district were tested for metals (lead, nickel, cadmium and mercury), trichloromethane and pentachlorophenol. Good chemical status was determined in all analysed reservoirs.

During 2018, physico-chemical quality elements were tested in 37 reservoirs, and specific pollutants in 31 reservoirs. According to physico-chemical indicators, moderate and poor status was determined in 12 reservoirs, and according to specific pollutants in four reservoirs, namely the Lešće Reservoir–at the dam, Sabljaci Lake–Ogulin, HE Čakovec Reservoir and HE Dubrava Reservoir, where the mean annual concentrations of copper or zinc exceeded the limit values for good status. In 2018, the monitoring of chemical status included six reservoirs in the Danube river basin district and four reservoirs in the Adriatic river basin district. The reservoirs Pakra, Borovik and Lapovac II in the Danube river basin district were tested for all chemical status indicators, other than cadmium and tributyltin. Good chemical status was determined at these monitoring stations. Good chemical status was not determined in the HE Dubrava Reservoir. This was due to exceedance of the maximum annual value for benzo(ghi)perylene. Reservoirs in the Adriatic river basin district were tested for metals (lead, nickel, cadmium and mercury), trichloromethane and pentachlorophenol. Good chemical status was not determined at two monitoring stations due to exceedance of mercury values.

Ecological potential of reservoirs

Pursuant to Article 18 of the earlier Regulation on water quality standards, which was in force in the reporting period, the assessment of ecological potential of artificial and heavily modified surface water bodies is determined based on the worst value, taking into account the results of the assessment of biological elements, basic physico-chemical elements and chemical elements.

In 2016, research projects aimed at developing the classification system for ecological potential of reservoirs and other artificial standing waters were initiated and, within these projects, research of the biological elements phytoplankton, phytobenthos, macrophytes and macrozoobenthos were carried out. Also, the proposal for the system of assessment of the ecological potential for these four biological elements and the basic physico-chemical elements of total nitrogen and total phosphorus was prepared. In 2017, the biological elements phytobenthos, macrophytes and macrozoobenthos were not monitored, so the ecological potential assessment was conducted based on the biological element phytoplankton, as well as physico-chemical elements and specific pollutants. Good and better ecological potential was determined in 27 % of reservoirs. The biological element phytoplankton was assessed as having good and better ecological potential at 18 monitoring stations in reservoirs, which represents 90 % of monitoring stations in good and better ecological potential of the total number of stations at which phytoplankton was analysed. The physico-chemical elements used in the assessment of the ecological potential of reservoirs are total nitrogen and total phosphorus; according to these, 73 % of monitoring stations failed to achieve good and better ecological potential. Good and better ecological potential was achieved in reservoirs within the Adriatic river basin district (10), while reservoirs within the Danube river basin district achieved moderate ecological potential.

In 2018, good and better ecological potential was determined in only 24 % of reservoirs. The biological element phytoplankton was assessed as having good and better ecological potential at 22 monitoring stations in reservoirs, but significantly lower assessment was recorded in the same year for the assessed physico-chemical elements, total nitrogen and total phosphorus. Total nitrogen received a lower assessment in a larger number of reservoirs (19) than total phosphorus (16). In the Adriatic river basin district, the largest percentage of water bodies – reservoirs has satisfactory status (42 %), while in the Sava river sub-basin no water bodies have satisfactory status.

3.7.1.2 QUALITY OF RIVER SEDIMENTS FROM 2015 TO 2017

As regards river sediments of the Danube river basin district, the contents of the tested organic indicators were lower than the limits of quantification of the used analytical methods at nine monitoring stations.

The river sediments of the Danube river basin district were analysed at 51 operational monitoring stations. The contents of the tested organic indicators in river sediments at all operational monitoring stations were lower than the limits of quantification of the used analytical methods, except for the indicator fluoranthene which was measured at four monitoring stations: Bosut downstream of Vinkovci, channel Dren near Ivankovo, connecting channel and Slatinska Čađavica, Slatina, in the range 0.03 – 1.467 µg/kg. The largest concentration was recorded at the monitoring station Bosut downstream of Vinkovci.

With regard to eight surveillance monitoring stations in river sediments within the Adriatic river basin district, the contents of the tested organic indicators were lower than the limits of quantification of the used analytical methods at all stations.

In river sediments within the Adriatic river basin district, out of the six operational monitoring stations, the highest concentration of fluoranthene (0.96 μg/kg) was measured at the station Matica Rastok–spring Banja.

3.7.1.3 CHEMICAL STATUS OF GROUNDWATER IN THE REPUBLIC OF CROATIA FROM 2015 TO 2018

To assess the chemical status of groundwater bodies, indicators from Annex 6 to the Regulation on water quality standards are used, which are monitored under surveillance monitoring, namely: nitrates and active substances in pesticides, individual and total, as well as specific pollutants. The chemical status of groundwater bodies is classified into two categories: good and bad. The groundwater monitoring and assessment programme is implemented for the purpose of a clear and integrated overview and assessment of the status, including the monitoring of quantitative and chemical status of groundwater. The monitoring of groundwater status ensures an integrated overview of the chemical status of groundwater in river basin districts and enables the identification of the presence of significant and sustained upward trends in pollution.

In 2015, Croatian Waters (Hrvatske vode) prepared the Water Status Monitoring Plan in the Republic of Croatia, which envisaged the testing of water quality in captured springs, piezometers and wells of inflow areas of water pumping stations inthe Danube river basin district in a total of 18 grouped groundwater bodies (GGWB) – 13 in the Sava river sub-basin, 5 in the Drava and Danube river sub-basin, as well as captured springs and wells in the Adriatic river basin district in 10 GGWB. Monitoring was not carried out in two groundwater bodies, both in the Danube and Adriatic river basin districts.

To assess the chemical status of a grouped groundwater body, indicators are monitored within the surveillance and operational monitoring, and the average annual concentration of nitrates and active substances in pesticides (individual and total tested) is also used at all monitoring stations within a grouped groundwater body, and compared with the groundwater quality standard prescribed by the Regulation on water quality standards, Annex 6. In addition to the groundwater quality standards, the assessment of chemical status uses the average annual concentration of specific pollutants, namely: arsenic, cadmium, lead, mercury, ammonium, chloride, sulphate, orthophosphate, nitrite, total phosphorus, the sum of trichlorethylene and tetrachlorethylene and electrical conductivity at all monitoring stations within a grouped groundwater body, which are then compared with the limit values.

Surveillance monitoring is carried out for the purpose of assessing the status of groundwater bodies, validating and supplementing the pollution impact assessment procedure, and obtaining information for the assessment of significant and sustained upward trends resulting from changes in natural conditions and impacts of human activities.

The national monitoring of groundwater chemical status at monitoring stations in the Republic of Croatia includes surveillance and operational monitoring.

In 2015, good chemical status in relation to active substances in pesticides was determined at all monitoring stations for GGWB in the Adriatic and Danube river basin districts, except for the Sava river sub-basin, GGWB Zagreb, where bad status in relation to atrazine was determined at the monitoring station of the water pumping station Mala Mlaka (Mm-320).

In 2015, bad status in relation to the sum of trichlorethylene and tetrachlorethylene was determined in the Sava river sub-basin at three monitoring stations for the GGWB Zagreb in the inflow area of the water pumping station Sašnjak-Žitnjak; the mean annual concentration of 50.54 μg/l was recorded at the monitoring station V-25/2, 10.36 μg/l at the station Ž-8, and 21.04 μg/l at the station Črnkovec D-1. The quality standard for the sum of trichlorethylene and tetrachlorethylene was met and good chemical status was determined at all other monitoring stations in the Sava river sub-basin, as well as at all monitoring stations in the Drava and Danube river sub-basin and the Adriatic river basin district.

In the Sava river sub-basin, GGWB Zagreb, at the water pumping station Mala Mlaka and Velika Gorica, a linear downward trend of the mean annual concentrations of the herbicide atrazine was identified at the monitoring station P-7, which was most pronounced in the area of Mala Mlaka. The downward trend was also present at the water pumping station Velika Gorica. Although the sale of atrazine is banned since 30 June 2009, the groundwater of the water pumping station Velika Gorica at the monitoring station Čp-23 showed an upward trend in the mean annual concentration of atrazine.

In the 2007–2015 period, an upward trend in the concentration of the halogenated hydrocarbons trichlorethylene and tetrachlorethylene was detected in GGWB Zagreb at the monitoring station Sašnjak-Žitnjak Ž-8. Conversely, a downward trend in the concentration of the halogenated hydrocarbons trichlorethylene and tetrachlorethylene was detected at the monitoring station of the water pumping station Sašnjak-Žitnjak SK-16/2, while this trend was slightly lower at the station SK-15 and the stations Z-4 and Z-2. The groundwater of the inflow area of the water pumping station Stara Loza has not shown higher concentrations of trichlorethylene and tetrachlorethylene over the years, while in 2013 and 2015 the recorded concentration at the station Pr-7/2 exceeded 75 % of the groundwater quality standard, exhibiting an upward trend. In the Adriatic river basin district, the sum of trichlorethylene and tetrachlorethylene in 2015 did not exceed 75 % of the groundwater quality standard at the monitoring station Tivoli GGWB South Istria, and a slightly downward trend was observed.

In 2016, operational monitoring was conducted at 86 monitoring stations. For the purpose of operational monitoring, the monitoring of salinization of water and agricultural soils in the Neretva river valley was also established. Under the Water Status Monitoring Plan in the Republic of Croatia, in 2016 it was planned to conduct monitoring at 385 stations as part of surveillance monitoring and around a hundred stations as part of operational monitoring. The deviation from the Monitoring Plan in 2016 was related to one surveillance monitoring station, while operational monitoring was conducted at 86 monitoring stations. In 2016, changes were recorded in the following grouped groundwater bodies: GGWB Varaždin Area: the value of the quality standard for the parameter nitrate was exceeded at two monitoring stations, and for the parameter atrazine at three stations; GGWB Legrad – Slatina: one monitoring station indicated bad status for the parameter nitrate, while two monitoring stations recorded bad status for the

parameter ammonium; GGWB Eastern Slavonia – Drava and Danube Basin: the quality standard for the parameter orthophosphate was exceeded at four monitoring stations, the parameter total phosphorus at eight monitoring stations and the parameter nitrate at one monitoring station; GGWB Sutla and Krapina Basin: one monitoring station exceeded the quality standard for the parameter arsenic, and another for the parameter orthophosphate; GGWB Lonja – Ilova – Pakra Basin: the quality standard for the parameter arsenic was exceeded at two monitoring stations; GGWB Zagreb: the measured average annual concentrations at monitoring stations showed bad status for the following parameters: ammonium at seven monitoring stations, orthophosphate at four monitoring stations, atrazine at one monitoring station, the sum of trichlorethylene and tetrachlorethylene at eight monitoring stations and lead at one monitoring station; GGWB Eastern Slavonia – Sava Basin: the quality standard for orthophosphate was exceeded at three monitoring stations, while the quality standard for total phosphorus was exceeded at one monitoring station.

The Adriatic river basin district included 13 grouped groundwater bodies in 2016, of which no exceedance of the limit values of the monitored parameters was recorded in ten of them. Changes in the assessment of groundwater status in the Adriatic river basin district were recorded in: GGWB Bokanjac – Poličnik: one monitoring station indicated that groundwater has bad chemical status due to exceedance of the limit values for the parameters chloride and nitrite; GGWB Neretva; one monitoring station recorded bad status due to higher concentrations of chloride; GGWB Adriatic Islands covers a relatively extensive area of the largest islands. Since these are specific conditions, in which a limited aquifer is affected by the sea, i.e. in contact with sea water, salinization is of natural origin. Thus, the parameter chloride was exceeded 13 times, while electrical conductivity and sulphate were each exceeded once. However, as these are naturally higher concentrations of the parameters chloride and sulphate, and indirectly higher values of electrical conductivity, these values do not lead to bad status of groundwater at monitoring stations. Therefore, bad status was recorded for the parameter nitrite at one monitoring station.

In 2017, surveillance monitoring was conducted at 381 monitoring stations, and operational monitoring at 99 monitoring stations. In the Danube river basin district, the results of monitoring conducted under the National Programme in 2017 on grouped groundwater bodies indicate that groundwater bodies are in good chemical status. Changes in the assessment of groundwater status in 2017 were recorded in: GGWB Varaždin Area: the value of the quality standard for nitrate was exceeded at two monitoring stations; GGWB Legrad – Slatina: one monitoring station indicated bad status for the parameter nitrate, and two for the parameter ammonium; GGWB Eastern Slavonia – Drava and Danube Basin: the quality standard for the parameter orthophosphate was exceeded at five monitoring stations, the parameter total phosphorus at eight monitoring stations and the parameter nitrate at one monitoring station; GGWB Sutla and Krapina Basin: one monitoring station indicated bad status in relation to arsenic; GGWB Lonja – Ilova – Pakra Basin: the parameter arsenic was exceeded at two monitoring stations; GGWB Zagreb: the testing results at one monitoring stations show bad status due to atrazine, one monitoring stations shows bad status due to nitrite, two monitoring stations due to ammonium, three monitoring stations show bad status due to orthophosphate, five monitoring stations show bad status in relation to mercury (this is most probably due to

sudden pollution); GGWB Lekenik – Lužani: one monitoring station shows exceedance for the parameter total phosphorus; GGWB Eastern Slavonia – Sava Basin: the quality standard for orthophosphate was exceeded at two monitoring stations, and the standard for total phosphorus was exceeded at three monitoring stations. The Adriatic river basin district included 13 grouped groundwater bodies in 2017, of which no exceedance of the limit values of the monitored parameters was recorded in nine of them. Changes in the assessment of groundwater status were recorded in: GGWB Central Istria: the quality standard was exceeded at two stations, one for orthophosphate and one for chloride; GGWB Bokanjac – Poličnik: one monitoring station indicated that groundwater has bad chemical status due to exceedance of the parameter chloride; GGWB Neretva; one monitoring station recorded bad status due to higher concentrations of chloride; GGWB Adriatic Islands covers a relatively extensive area of the largest islands. Since these are specific conditions, in which a limited aquifer is affected by the sea, i.e. in contact with sea water, salinization is of natural origin. Therefore, the parameter chloride was exceeded at four monitoring stations, whereas the parameter ammonium was exceeded at one of them. However, as these are naturally higher concentrations of the parameter chloride, and indirectly higher values of electrical conductivity, these values do not lead to bad status of groundwater at monitoring stations.

The assessment of groundwater status in 2018 was carried out according to the former Regulation on water quality standards, which was in force in the reporting period. In 2018, surveillance monitoring was conducted at 379 monitoring stations in the Republic of Croatia. Under the Water Status Monitoring Plan in the Republic of Croatia, in 2018 it was planned to conduct monitoring at 383 stations as part of surveillance monitoring. Due to the inability to access monitoring stations, there is a deviation of four surveillance monitoring stations. Operational monitoring is conducted in the periods of the surveillance monitoring programme in order to identify the chemical status of all groundwater, and in 2018 operational monitoring included 99 monitoring stations, which is in line with the Monitoring Plan for 2018. In 2018, unsatisfactory status was determined in the Danube river basin district due to exceedance of the prescribed values of parameters such as metals, nutrient salts or atrazine at 23 monitoring stations. In the same year, satisfactory status was determined at 283 monitoring stations in the Danube river basin district. Out of 13 grouped groundwater bodies in the Adriatic river basin district, no exceedance of the limit values of the monitored parameters was recorded in 12 of them. Changes in the assessment of groundwater status were recorded in the grouped groundwater body Neretva for the parameter chloride, due to which one monitoring station has bad status.

3.7.1.4 STATUS OF TRANSITIONAL AND COASTAL WATERS IN THE REPUBLIC OF CROATIA FROM 2015 TO 2018

The status of transitional and coastal water bodies (ecological and chemical) is based on the results of surveillance and operational monitoring of biological quality elements, including chlorophyll a, supporting physico-chemical indicators, specific pollutants and hydromorphological conditions. As regards transitional and coastal waters, during 2014 and 2015 it was planned to implement surveillance monitoring at 141 monitoring stations,

operational monitoring at 72 monitoring stations and preliminary monitoring for designating new areas suitable for shellfish life and growth, all according to the criteria prescribed in Article 54 of the Regulation on water quality standards. Surveillance monitoring was not planned in two grouped water bodies in transitional waters of the Dragonja river. The stations in transitional and coastal water bodies located in areas for the protection of habitats or species were also designated.

The status of priority substances was tested in 2015 in all water bodies at least four times during the monitoring period, while in water bodies under operational monitoring (eight transitional water bodies and nine coastal water bodies), individual indicators were tested even more frequently. According to monitoring results, the status of specific pollutants can be assessed as high in all transitional and coastal water bodies. According to the results of the performed analyses, concentrations of priority substances in samples taken as part of surveillance monitoring from 2014 to 2015 were mostly lower than the limits of quantification of the used analytical methods and lower in relation to the prescribed quality standards (AAC, MRL) for the assessment of chemical status.

Transitional waters 2015 – 2018

Critical substances (substances for which AAC and/or MRL values were exceeded once or more) in transitional water bodies are most frequently compounds from the group of organochlorine pesticides (beta-hexachlorocyclohexane, para-para DDT, gamma-hexachlorocyclohexane and alpha-endosulfan). Chlorfenvinphos compounds from the group of organophosphorus pesticides and fluoranthene from the group of polyaromatic hydrocarbons were also recorded in one water body each. Although elevated concentrations were occasionally observed for all six listed compounds, the reason for failing to achieve good chemical status is only organochlorine pesticides. This result of testing priority substances in transitional waters indicates that agricultural activities (recent and/or previous) are the most significant anthropogenic pressure on the status of transitional waters. Considering that elevated concentrations of organochlorine pesticides were recorded in an approximately equal number of cases in the surface and bottom layers of the water column, it is assumed that, in some water bodies, sediment acts as a source of accumulated pesticides. Good chemical status in transitional waters was achieved in 18 of 25 of the tested water bodies (72 %), while good chemical status was not achieved in seven of 25 water bodies (28 %). If we take into account the surface of individual water bodies, we can say that good chemical status was achieved on 89 % of the total surface of transitional waters, while it was not achieved on 11 %. The analysis of chemical status according to the spatial distribution shows that good chemical status was achieved in transitional waters of four rivers (Neretva, Cetina, Zrmanja and Dragonja), partially in transitional waters of five rivers (Ombla, Jadro, Krka, Rječina and Mirna), while the worst status was established in the Raša river estuary.

During 2016, surveillance monitoring of the basic physico-chemical quality elements and phytoplankton in transitional waters was carried out at 28 monitoring stations (in all 25 water bodies), monitoring of fish was carried out at 37 stations (92 % of water bodies), while the

monitoring of biological quality elements of benthic invertebrates and macrophytes (sea grasses) was carried out at nine and ten monitoring stations, respectively (around 40 % of water bodies). Monitoring of priority substances in water and biota (fish, shellfish), as part of surveillance monitoring, was carried out at 26 monitoring stations in all transitional water bodies. The monitoring of specific pollutants (copper and zinc) in transitional waters was carried out in the same time period, and no concentrations of these two elements that would indicate moderate status were recorded at any monitoring station. The concentrations of priority substances in water indicate good status at 13 monitoring stations (50 %), while good status for biota was determined at only four stations (15 %). In summary, good chemical status was determined at only two monitoring stations in transitional water bodies of the Dragonja river. After the testing of priority substances was expanded to the medium biota (fish and shellfish), most water bodies showed concentrations of mercury (Hg) and polybrominated diphenyl ethers (PBDE) in fish higher than the prescribed aquatic environmental quality standards, which amount to 20 μg/kg wet weight for mercury, and 0.0085 μg/kg wet weight for PBDE. Elevated concentrations of tributyltin (TBT) were recorded in water. No monitoring stations in poor or bad ecological status were recorded. Good chemical status was determined at only two monitoring stations (8 %).

As regards transitional water bodies, during 2017 *operational monitoring of ecological status* was carried out at 13 monitoring stations (44 % of water bodies) for supporting physico-chemical indicators and phytoplankton, and at one monitoring station for benthic invertebrates. In addition to operational monitoring, *surveillance monitoring* of the biological quality element of macrophytes – sea grasses was also carried out in the same year at six monitoring stations (20 % of water bodies). *Hydromorphological monitoring* was conducted in 19 water bodies (76 % of the total number of water bodies). *Operational monitoring of the chemical status* of water was conducted in seven water bodies (28 % of the total number of water bodies) for the compounds endosulfan, hexachlorocyclohexane and p,p-DDT. According to most indicators, the majority of water bodies are in high status. In transitional waters, it was determined that 11 % of water bodies are in high status, 16 % each are in good and moderate status, while poor and bad status was determined in 32 % and 26 % of water bodies, respectively. According to the priority substances tested, all monitoring stations were in good status.

During 2018, *surveillance monitoring* of the basic physico-chemical quality elements and phytoplankton in transitional waters was carried out at 28 monitoring stations (in all 25 water bodies), monitoring of fish was carried out at 37 stations (92 % of water bodies), while the monitoring of biological quality elements of macrophytes (sea grasses) and benthic invertebrates was carried out at three monitoring stations each. Monitoring of priority substances in water was carried out at 26 monitoring stations (in all transitional water bodies), while priority substances in biota were monitored at 22 monitoring stations (88 % of water bodies). The monitoring included 15 priority substances in water and 11 in biota. Monitoring of specific pollutants (copper and zinc) in transitional waters was carried out in the same time period, and no concentrations of these two elements that would indicate moderate status were recorded at any monitoring station. The concentrations of priority substances in water indicate good status at 17 monitoring stations (65 %), while good status for biota was determined at two monitoring stations (9 %). In summary, good chemical status was determined at only three

monitoring stations (upstream water body Rječina and downstream water body of the Dragonja and Neretva rivers). At most monitoring stations, the concentrations of mercury (Hg) and polybrominated diphenyl ethers (PBDE) in fish were higher than the prescribed aquatic environmental quality standards, which amount to 20 μg/kg wet weight for mercury, and 0.0085 μg/kg wet weight for PBDE. Elevated concentrations of fluoranthene and benzo(a)pyrene were recorded at the monitoring station of the water body Raša in mussels. Elevated concentrations of perfluorooctane sulfonic acid (PFOS), tributyltin (TBT) and hexachlorocyclohexane (HBCDD) were recorded in water. Good chemical status was determined at only three monitoring stations (12 %).

Coastal waters

In 2015, compounds from the group of organochlorine pesticides (beta-, delta- and gamma-hexachlorocyclohexane) were recorded, but they were not the reason for failing to achieve good chemical status. Nevertheless, their occurrence in coastal waters demonstrates their transfer through different types of surface water bodies. However, tributyltin has emerged as the most problematic priority substance in the coastal area, which was the reason for failing to achieve good chemical status in four water bodies (O313-NEK, O313-BAZ, O413-STLP and O423-KVS). Although the production, trade and use of tributyltin-based antifouling paints for vessels is banned under various international conventions and domestic legislation, failure to achieve good chemical status in these four water bodies, which are subject to intense maritime traffic, indicates the need to strengthen inspection services. It should also be noted that failure to achieve good chemical status in the Split Port due to tributyltin was also recorded in 2011.

During 2016, *operational monitoring of the ecological status* of coastal water bodies was carried out at 18 stations (32 % of the total number of stations) for supporting physico-chemical indicators and phytoplankton, at three stations (of the same water body) for sea grasses, at three stations for macroalgae, and at one station for benthic invertebrates. In addition to operational monitoring, *surveillance monitoring* of individual biological quality elements was also carried out in the same year at ten monitoring stations for sea grasses and at six monitoring stations for macroalgae. The majority of ecological status indicators at almost all stations was in high and good status. The moderate status was recorded at two monitoring stations for phytoplankton (water body Lim Channel) and at one monitoring station for macroalgae (water body Split Port), while bad status was recorded at one station for phytoplankton (water body Pula Port). *Operational monitoring of the chemical status* was carried out at five monitoring stations (9 %) for tributyltin compounds in water. Tributyltin compounds in water were detected at monitoring stations in water bodies of the Bakar Bay, Split Port and Town of Pag coves.

During 2017, monitoring of the basic physico-chemical quality elements and phytoplankton in transitional waters was carried out at 45 monitoring stations (in all 26 water bodies). Monitoring of biological quality elements of macrophytes – macroalgae was carried out at 16 monitoring stations (61 % of water bodies), while macrophytes – sea grass and benthic invertebrates were monitored at 17 and ten monitoring stations, respectively (around 40 % of water bodies). The status assessment according to *hydromorphological indicators* was conducted at the water body

level in a total of 18 water bodies (69 % of the total number). *Monitoring of priority substances* in water and biota (fish, shellfish) was carried out in the same year at 42 monitoring stations in all coastal water bodies. In the same period, monitoring of specific pollutants (copper and zinc) in coastal waters was carried out, and the results show good status at all monitoring stations. The worst status of priority substances in coastal waters was recorded in biota, and good status was determined at only five monitoring stations (14 %), while concentrations of priority substances indicate good status at 85 % of monitoring stations. Overall, good chemical status was determined at only nine monitoring stations (21 %). After the testing of priority substances was expanded to the medium biota (fish and shellfish), most water bodies showed concentrations of mercury (Hg) and polybrominated diphenyl ethers (PBDE) in fish higher than the prescribed aquatic environmental quality standards, which amount to 20 μg/kg wet weight for mercury, and 0.0085 μg/kg wet weight for PBDE. Elevated concentrations of tributyltin (TBT) and cybutryne were recorded in water.

During 2018, *operational monitoring of the ecological status* of coastal water bodies was carried out at 19 monitoring stations (42 %) for supporting physico-chemical indicators, phytoplankton and chlorophyll a, and at four stations each for benthic invertebrates and macroalgae. In addition to operational monitoring, *surveillance monitoring* of the biological quality element of macrophytes – sea grasses was also carried out in the same year at eight monitoring stations (two water bodies) and of macrophytes – macroalgae at three monitoring stations. *Operational monitoring of the chemical status* was carried out at six monitoring stations (14 %) for tributyltin compounds in water. Operational monitoring of the chemical status was conducted in five water bodies (15 % of the total number of water bodies) for tributyltin compounds in water and sediment. Tributyltin compounds in water and sediment were detected in all tested coastal water bodies (water bodies Kaštela Bay and Bakar Bay, and water bodies Rijeka, Pula and Split ports).

3.7.2 SEA

In 2015, under the "Agreement on the systematic testing of transitional and coastal water quality in 2014 –2015" financed by Croatian Waters (Hrvatske vode), analyses of a number of organic pollutants belonging to the group of POPs were carried out (Table 3.7-1). The project contractor was a consortium consisting of the Institute of Oceanography and Fisheries from Split (IOR), Ruđer Bošković Institute from Zagreb (IRB) and Rheinisch-Westfalisches Institut fur Wasser Beratungs und Entwicklungsgesellschaft mbH, Mulheim and der Ruhr, Germany (IWW). The POPs analyses were performed in IWW and Croatian Waters laboratories.

Table 3.7-1 List of POPs measured in water, sediment and biota as part of monitoring transitional and coastal water bodies of the eastern Adriatic coast in the 2015 –2017 period

Marine environmental component	**POPs**
Water	Hexachlorobutadiene Hexachlorobenzene

	DDT Endrin Aldrin Dieldrin Alpha-, beta-, gamma hexachlorocyclohexane Endosulfan Pentachlorobenzene Polybrominated diphenyl ethers Pentachlorophenol Chloroalkanes C10-C13
POPs measured in 2016 (transitional waters) and 2017 (coastal waters)	
Water	Polybrominated diphenyl ethers DDT Endosulfan Pentachlorobenzene
Biota	Polybrominated diphenyl ethers Hexachlorobenzene Hexachlorobutadiene Alpha-, beta-, gamma hexachlorocyclohexane Perfluorooctane sulfonic acid Dioxins and dioxin-like compounds Hexabromocyclododecane Heptachlor and heptachloroepoxide
Sediment	Polybrominated diphenyl ethers Chloroalkanes C10-C13 Organochlorine pesticides (hexachlorobenzene and hexachlorocyclohexane) Pentachlorobenzene Perfluorooctane sulfonic acid Dioxins and dioxin-like compounds Hexabromocyclododecane Heptachlor and heptachloroepoxide

In the 2016–2017 period, under the "Agreement on the systematic testing of transitional and coastal water quality in 2016 –2017" financed by Croatian Waters (Hrvatske vode), analyses of a number of organic pollutants belonging to the group of POPs were carried out (Table 2.3-1). The project contractor was a consortium consisting of the Institute of Oceanography and Fisheries from Split (IOR), Ruđer Bošković Institute from Zagreb (IRB) and Nacionalni laboratorij za zdravje, okolje i hrano from Maribor, Slovenia (NZLO). The POPs analyses were performed in IRB and NZLO laboratories.

The analyses were carried out in accordance with the requirements of the Water Framework Directive on monitoring priority substances in water, and the assessment of the chemical status

was conducted in accordance with applicable European and Croatian legislation, *inter alia*, the Regulation on water quality standards (OG 73/13, 151/14 and 78/15), which define allowed concentrations of these substances in water and biota. The status assessment for sediment (for which there is no Croatian or European legislation) was carried out according to the available scientific literature. In 2015, organic pollutants were monitored only in water (coastal waters), and in the 2016–2017 period they were monitored in water, sediment and biota, namely in the area of transitional waters in 2016 and in the area of coastal waters in 2017.

Coastal waters, 2015

The majority of POPs monitored in water in the area of coastal waters of the eastern Adriatic coast in 2015 (four seasonal site visits to 26 stations) were lower than the limits of quantification of the used analytical methods and the allowed concentrations for these compounds according to the existing legislation. Concentrations of the isomer hexachlorocyclohexane (beta-, gamma- and delta-) exceeding the AAC were recorded in several samples, but none exceeded the MAC; thus, in view of POPs monitored in water, chemical status of coastal waters was good.

Transitional waters, 2016

WATER

During 2016, monitoring of POPs in transitional waters included four seasonal site visits to 26 stations and showed that the water status in relation to burdens for the monitored substances was mostly good. At all stations and in all seasons, the concentrations of organochlorine pesticides pentachlorobenzene, endosulfan, hexachlorocyclohexane and p,p-DDT were below the limit of determination of the used method (0.1 and 0.5 ng/l), which is below the prescribed AAC values (0.7 ng/l, 0.5 ng/l, 2 ng/l and 10 ng/l). The concentration of the sum of PBDE congeners in transitional water bodies in 2016 ranged from <0.12 ng/l to 1.25 ng/l. According to the old Croatian criterion for surface waters from 2013 (AAC = 0.2 ng/l), the values measured at some sites exceeded this AAC; however, the 2015 regulation contains only MAC (14 ng/l) as the AEQS criterion, and none of the elevated concentrations exceeded this criterion. Therefore, it can be said that, with regard to PBDE concentration in the water column, the situation is satisfactory.

BIOTA

In 2016, concentrations of hexachlorobenzene (<0.03 – 0.06 ng/g), hexachlorobutadiene (<0.1 ng/g) and dioxins and dioxin-like compounds (0.00009 – 0.0045 ng/g, TEQ sum) in samples of fish from transitional waters were considerably lower than the relevant AEQS values for biota (in whole fish or fish muscle, depending on the substance). In some samples, concentrations of heptachlor and heptachloroepoxide (<0.05 – 0.53 ng/g) were significantly higher than the very demanding AEQS value of 0,0067 ng/g.

From the perspective of meeting the AEQS criterion for biota, the most critical indicator are polybrominated diphenyl ethers (PBDE) in fish muscle. Due to the exceptionally strict AEQS criterion of 0.0085 ng/g for the sum of representative six PBDE congeners, none of the samples met this criterion. The range of concentrations was from 0.04 to 0.99 ng/g, and the average concentration of 0.32 ng/g was multiple times higher than the prescribed criterion. According

to the spatial distribution of concentrations in transitional waters, the strongest hotspots for PBDE inputs were recorded in the Ombla estuary (FP-P1 and FP-P2), but concentrations were also significant in Neretva (FP-P5b), Cetina (FP-8), Jadro (FP-P9), Krka (FP-P13) and Rječina (FP-18) estuaries.

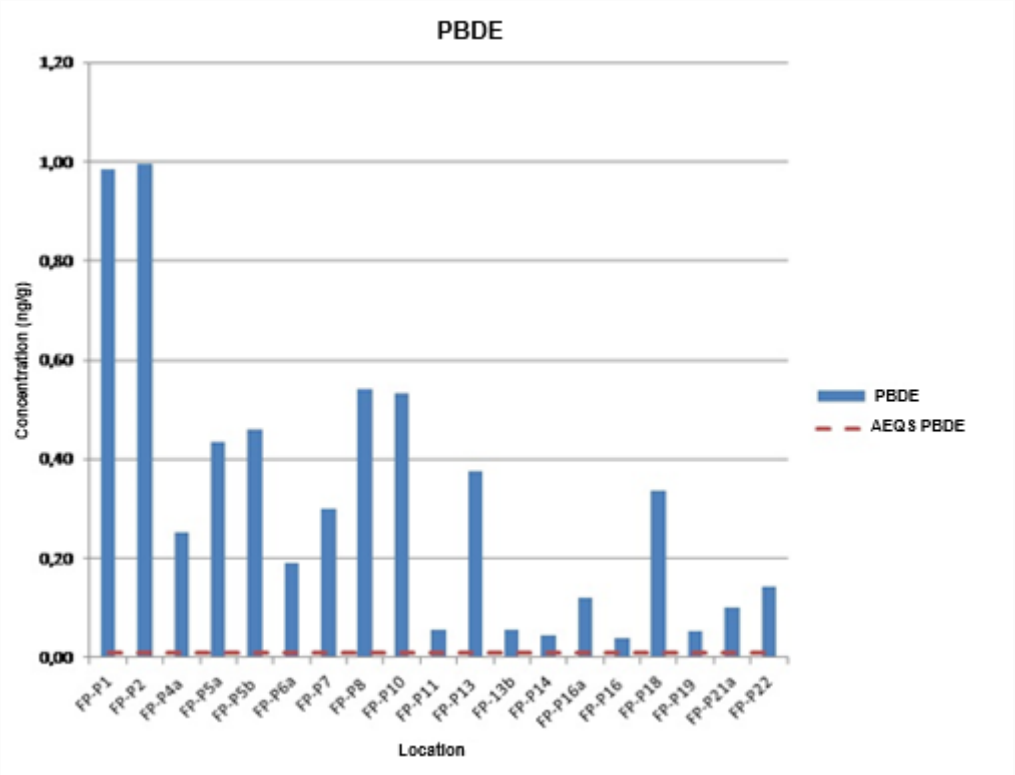


Figure 3.7-1 Distribution of polybrominated diphenyl ethers (PBDE) in transitional water fish 2016

Another type of brominated flame retardants included in biota monitoring, hexabromocyclododecane (HBCDD), showed concentrations of similar magnitude (<0.1 – 0.5 ng/g; mean value 0.13 ng/g) as PBDE. However, AEQS for HBCDD concentration in fish is, as opposed to PBDE, quite high (167 ng/g), so all measured values are at least one hundred times lower than the prescribed AEQS criterion. It should be also that there is no correlation between the occurrence of elevated PBDE and HBCDD levels. The highest concentrations of HBCDD were measured in fish from Krka (FP-P13), Rječina (FP-P18) and Raša (FP-P19) estuaries.

PFOS (perfluorooctane sulfonic acid) are chemical compounds which, in addition to lipophilic properties, also have a polar character, which means that, according to their physico-chemical characteristics, they belong to the group of surfactants. This property significantly distinguishes them from other types of persistent priority substances. Their concentration in fish was of very similar magnitude as the concentration of polybrominated flame retardants (concentration range <0.1–0.5 ng/g), which is lower than the prescribed AEQS criterion (9.1 ng/g). Given the ratio between the mean (0.22 ng/g) and maximum measured concentration (0.5 ng/g) and the AEQS criterion, it seems there is no pronounced risk of exceeding the prescribed values.

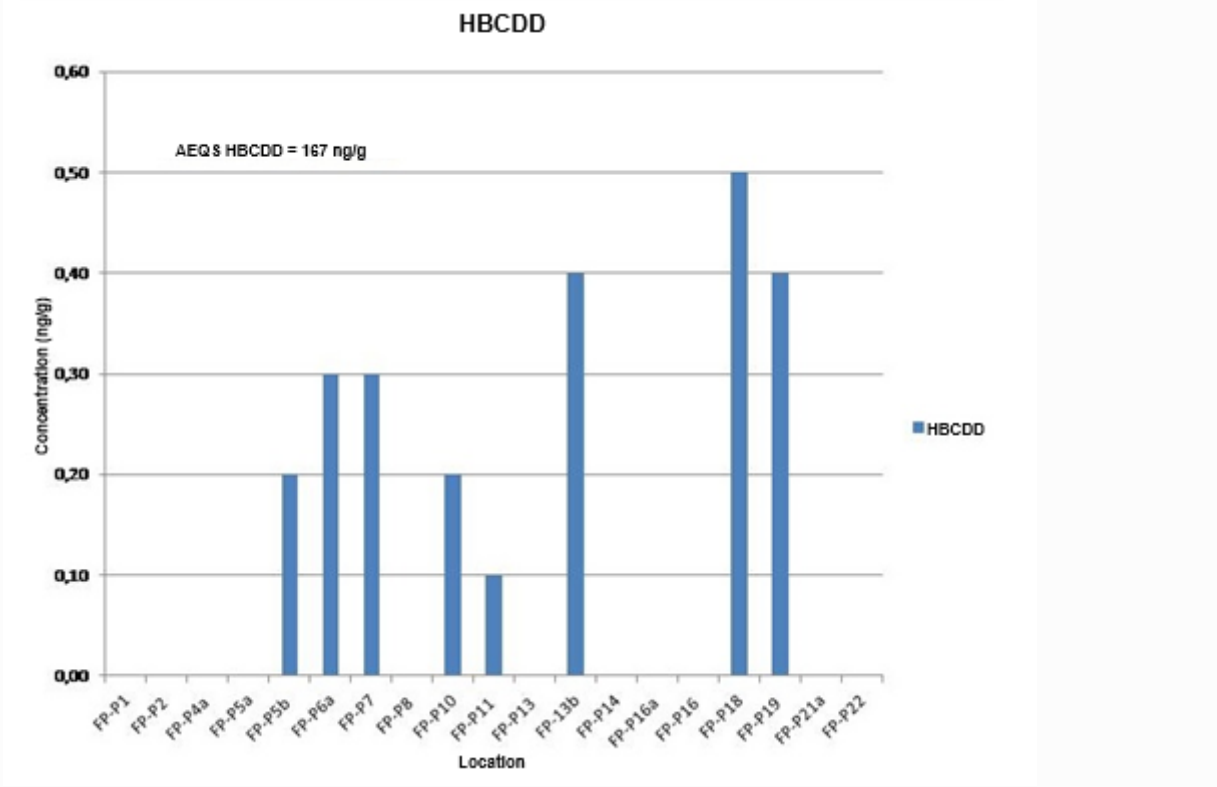


Figure 3.7-2 Distribution of hexabromocyclododecane (HBCDD) in transitional water fish 2016

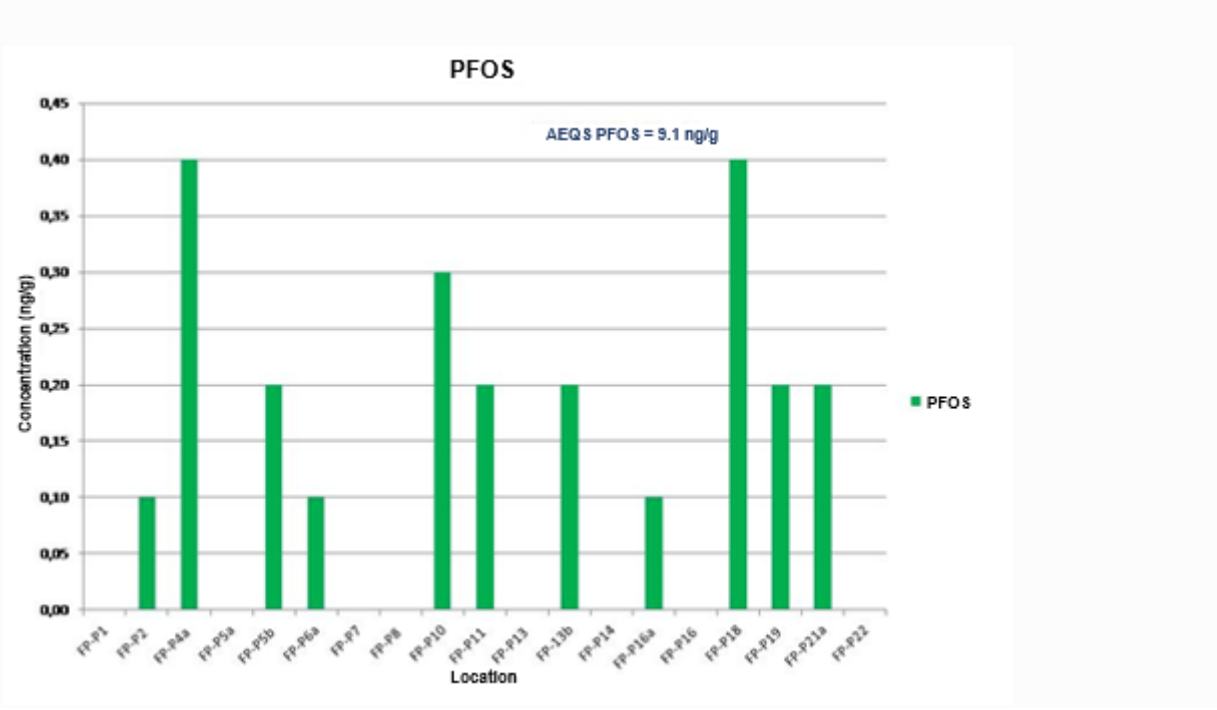


Figure 3.7-3 Distribution of perfluorooctane sulfonic acid (PFOS) in transitional water fish 2016

The results of the study of POPs concentrations in edible fish species from different fishing zones of the Adriatic Sea conducted in 2016 indicate that they are safe for human consumption according to the parameters prescribed by the EU legislation. The selected target species in the research were pelagic fish species (sardine, anchovy, carp, and round sardinella), on which the appropriate toxicological analysis was carried out. The results showed the presence of

organochlorine pesticides n fish samples in the concentration range of 0.02–2.32 ng/g and polychlorinated biphenyls in the range of 0.02–3.29 ng/g. As regards more significant pesticides, DDE was the most represented, while congeners PCB-153, PCB-138 and PCB-180 were the most represented in polychlorinated biphenyls. The main reason for higher concentrations of these POPs in the samples is considered to be the higher biopersistence due to a longer half-life of these compounds in the marine environment. However, a slight increase in PCBs in sardine samples compared to 2014 was also observed, indicating the possibility of continuous enrichment with these compounds and the need for their continuous monitoring in fish for human consumption. The results also showed no significant difference in POPs levels between the groups of sardines from different parts of the Adriatic Sea.

SEDIMENT

In 2016, POPs concentrations in sediments of transitional water bodies were relatively low and met the used criteria for the majority of monitored indicators. This included organochlorine insecticides hexachlorobenzene and hexachlorocyclohexane (<0.1 ng/g), hexabromocyclododecane (<0.1–1.8 ng/g), pentachlorobenzene (<0.1–0.3 ng/g), heptachlor and heptachlor epoxide (<0.1 ng/g), PFOS (<0.1–0.29 ng/g) and dioxins and dioxin-like compounds (<0.00005–0.0048 ng/g, TEQ sum). As no uniform European criteria for sediment quality are prescribed, as is the case for water and biota, the status assessment was conducted according to the criteria suggested by Bakke *et al.* (2010) in Norway. According to Bakke *et al.*, sediment quality is classified into five categories, whereas the first two are, as regards the environmental status, considered good and/or satisfactory, while III, IV and V are considered unsatisfactory since toxic effects may be expected in this concentration range.

According to Bakke *et al.* (2010), the criterion for significant sediment pollution with PBDE is 62 ng/g, which is very high compared to the concentrations measured in sediments of Croatian transitional water bodies. The concentration range of PBDE in sediments was 0.03 ng/g to 0.44 ng/g (mean value 0.14 ng/g), which is over one hundred times lower than the proposed criterion. In this case, the relationship between the measured concentrations and the environmental quality criteria is completely reversed from that recorded for biota. It is interesting to notice that there is no correlation between sediment and biota burdens, but the possible variation may be related to the fact that microlocations of sampling sediments and biota often do not overlap. However, the highest concentrations were measured at the sites in Ombla, Neretva, Rječina and Raša estuaries.

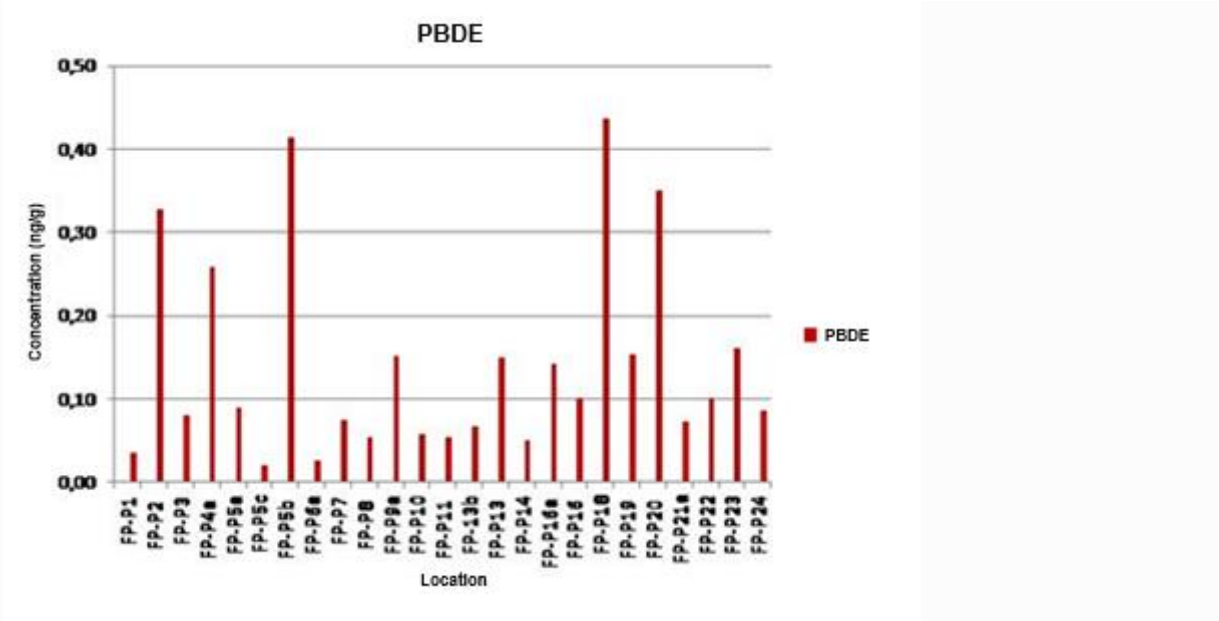


Figure 3.7-4 Distribution of perfluorooctane sulfonic acid (PFOS) in transitional water fish 2016

Significant concentrations of long chain chloroalkanes were also measured in sediments of transitional water bodies. As these are priority substances of industrial origin, their spatial distribution shows elevated values at the sites in Ombla, Neretva, Jadro, Krka and Rječina estuaries (FP-P2, FP-P5b, FP-P10, FP-P13 and FP-P18), which also had increased levels of some other priority substances. However, according to the Canadian criteria (Environment Canada, 2016), these concentrations are over 1,000 times lower than the critical ones.

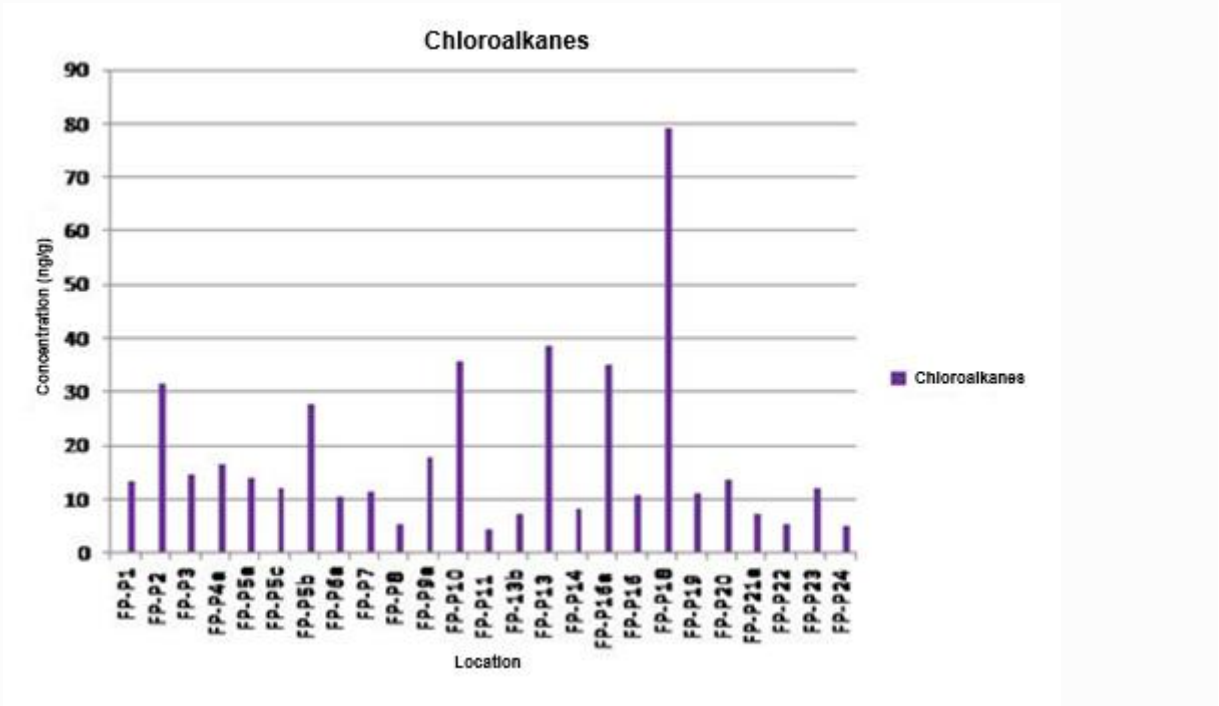


Figure 3.7-5 Distribution of long chain chloroalkanes (C10-C13) in transitional water sediments 2016

Coastal waters, 2017

WATER

During 2017, monitoring of POPs in coastal waters included four seasonal site visits to 37 stations and showed that the water status in relation to burdens for the monitored substances was mostly very good. At all stations and in all seasons, the concentrations of organochlorine pesticides pentachlorobenzene, endosulfan, hexachlorocyclohexane and p,p-DDT were below the prescribed AAC values (0.7 ng/l, 0.5 ng/l, 2 ng/l and 10 ng/l). The concentration of the sum of PBDE congeners in coastal waters in 2017 ranged from <0.12 ng/l to 2.21 ng/l, which is very similar to the range identified in transitional waters. As already mentioned in Chapter on transitional waters, under the AEQS for other surface waters prescribed in the 2013 Croatian legislation (PGK 0.2 ng/l), AAC values at some sites would not meet the prescribed levels; however, the 2015 regulation contains only MAC (14 ng/l) as the AEQS criterion. None of the elevated concentrations exceed this criterion.

BIOTA

In 2017, concentrations of hexachlorobenzene (<0.06–0.48 ng/g), hexachlorobutadiene (<0.1 ng/g) and dioxins and dioxin-like compounds (<0.00001–0.0123 ng/g, TEQ sum) in samples of fish from coastal waters were mostly considerably lower than the relevant AEQS values for biota (in whole fish or fish muscle, depending on the substance). However, it should be noted that, at three sites (Split Port – FP-O15a, Pula Port – FP-O45 and the site FP-O21a in the Šibenik aquatorium), concentrations of dioxins and dioxin-like compounds in fish muscle were detected (0.00685–0.0123 ng/g, TEQ sum) that slightly exceed AEQS for these compounds (0.0065 ng/g, TEQ sum). It should be also noted that, due to the very strict AEQS value (0.0067 ng/g), the critical group includes both heptachlor and heptachlor epoxide, and that the concentrations of heptachlor and heptachlor epoxide (<0.05–0.06 ng/g) in some samples were higher than the prescribed AEQS.

The distribution of PBDE (0.04 to 0.68 ng/g) in coastal sea fish shows significant differences between the polluted and less burdened sites; however, all measured concentrations exceed the AEQS criterion (0.0085 ng/g) from 10 to 100 times. At the moment, the hotspots with elevated PBDE levels are Split Port (FP-O15a), Kaštela Bay (FP-O16a), Šibenik area (FP-O21 and FP-O23), Rijeka Port (FP-O38), Rijeka Bay (FP-O39), Kvarner (FP-O42) and Kvarnerić (FP-O30).

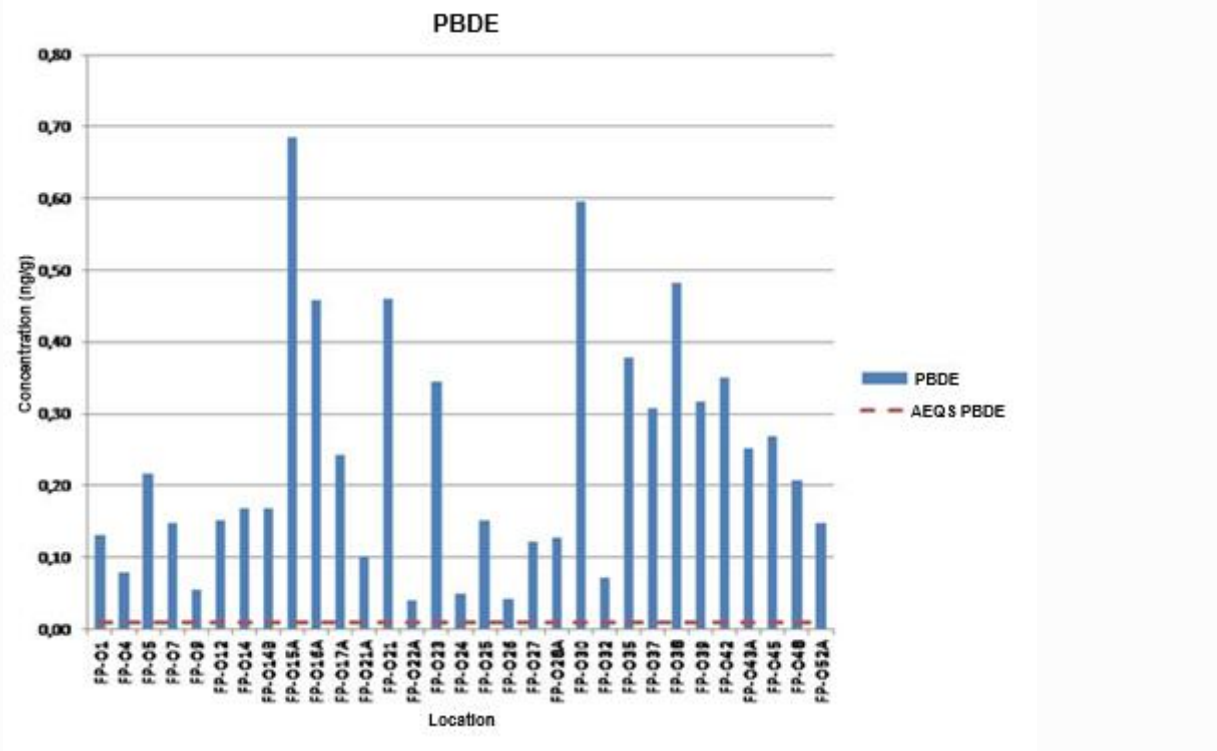


Figure 3.7-6 Distribution of polybrominated diphenyl ethers (PBDE) in coastal water fish 2017

In 2017, the level of another type of brominated flame retardants, HBCDD (<0.1–0.5 ng/g), in transitional water fish was on average lower than in transitional waters, but their concentration ranges were quite similar. Furthermore, HBCDD levels were very similar to those described for PBDE, and elevated levels were detected in the same areas: Split (sites FP-O14 and FP-O15a, FP-O16A), Šibenik (FP-O21) and Rijeka (FP-O37, FP-O42).

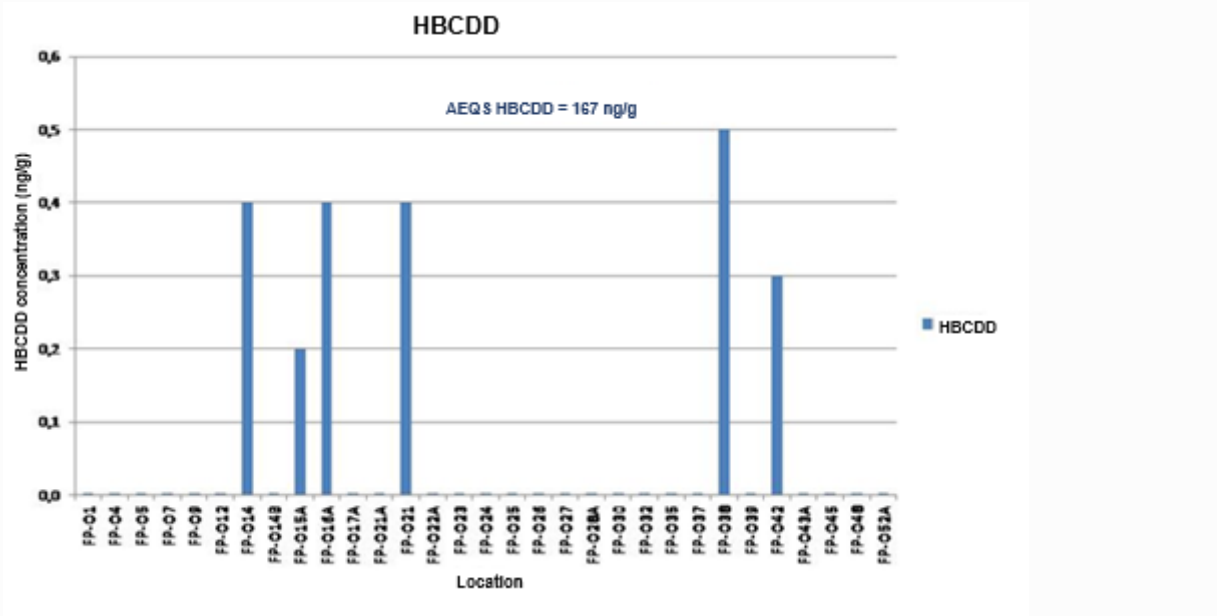


Figure 3.7-7 Distribution of hexabromocyclododecane (HBCDD) in coastal water fish 2017

The levels of perfluorooctane sulfonic acid (PFOS) were very similar to the levels of brominated flame retardants, but their spatial distributions are quite different. The PFOS level was over ten times lower than the prescribed AEQS (9.1 ng/g), and elevated concentrations were, somewhat surprisingly, detected at the sites FP-O4, FP-O5 (Mali Ston Bay) and FP-O7 (Neretva Channel). Measurable concentrations were also detected in the Zadar Bay (FP-O24), Bakar Bay (FP-O37) and Rijeka Bay (FP-O39). For now, it does not seem that PFOS should pose a direct risk to coastal water quality, but, as these were just the initial measurements of this indicator in national waters, its systematic monitoring in the forthcoming period should be ensured in order to timely detect unfavourable trends.

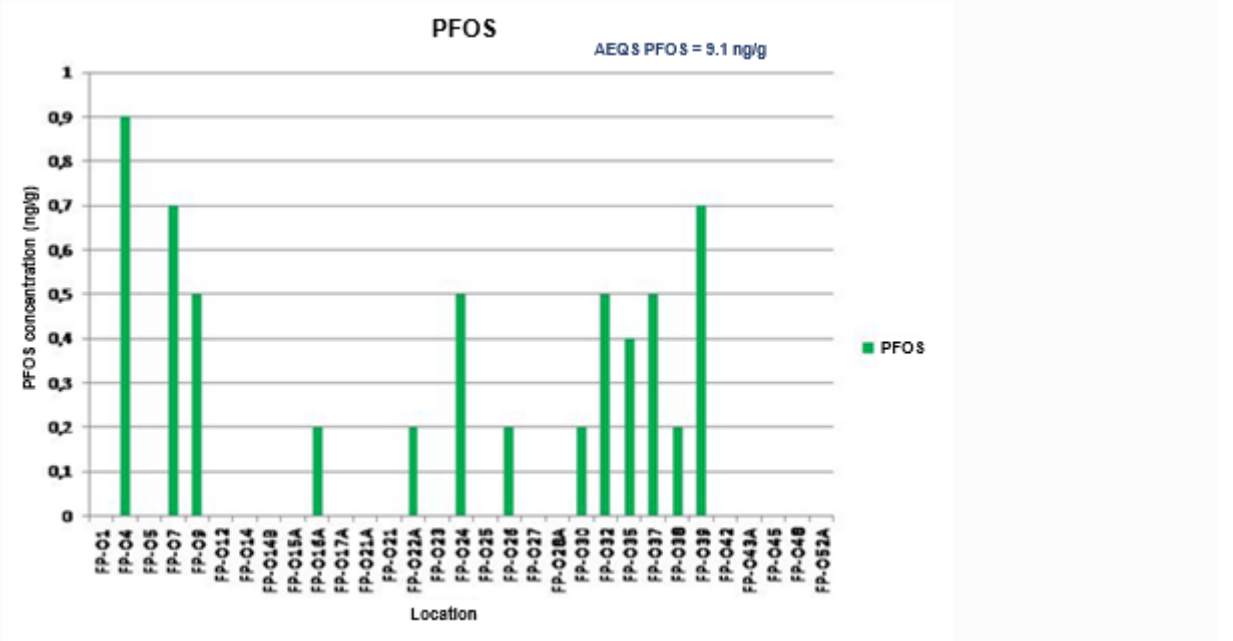


Figure 3.7-8 Distribution of perfluorooctane sulfonic acid (PFOS) in coastal water fish 2017

SEDIMENT

In 2017, POPs concentrations in sediments of coastal water bodies were relatively low and met the used criteria for the majority of monitored indicators. This included organochlorine insecticides hexachlorobenzene (<0.03–5.89) and hexachlorocyclohexane (<0.03 ng/g), hexabromocyclododecane (<0.1–1.5 ng/g), pentachlorobenzene (<0.02–1.48 ng/g), heptachlor and heptachlor epoxide (<0.03–0.04 ng/g), PFOS (<0.1–0.4 ng/g) and dioxins and dioxin-like compounds (<0.00005–0.0084 ng/g, TEQ sum). The status assessment was conducted according to the criteria suggested by Bakke *et al.* (2010) in Norway. According to Bakke *et al.*, sediment quality is classified into five categories, whereas the first two are considered good and/or satisfactory, while III, IV and V are considered unsatisfactory since toxic effects may be expected in this concentration range.

The criterion for significant sediment pollution with PBDE is 62 ng/g, which is significantly higher than the concentrations measured in sediments of Croatian transitional water bodies. The concentration range of PBDE in sediments of coastal water bodies was slightly lower than in transitional water bodies (ranging from <0.05 ng/g to 0.23 ng/g; mean value 0.09 ng/g), which is over one hundred times lower than the proposed criterion. However, because of the possible

transfer of PBDE in biota through sediments, it is important to detect sites that show elevated values. These are the sites FP-O14 and FP-17A in the Split area and the sites FP-O27 and FP-28A in southern part of the Velebit Channel and Town of Pag cove, respectively.

The concentrations of long chain chloroalkanes in sediments of coastal water bodies were quite lower than in transitional water bodies.

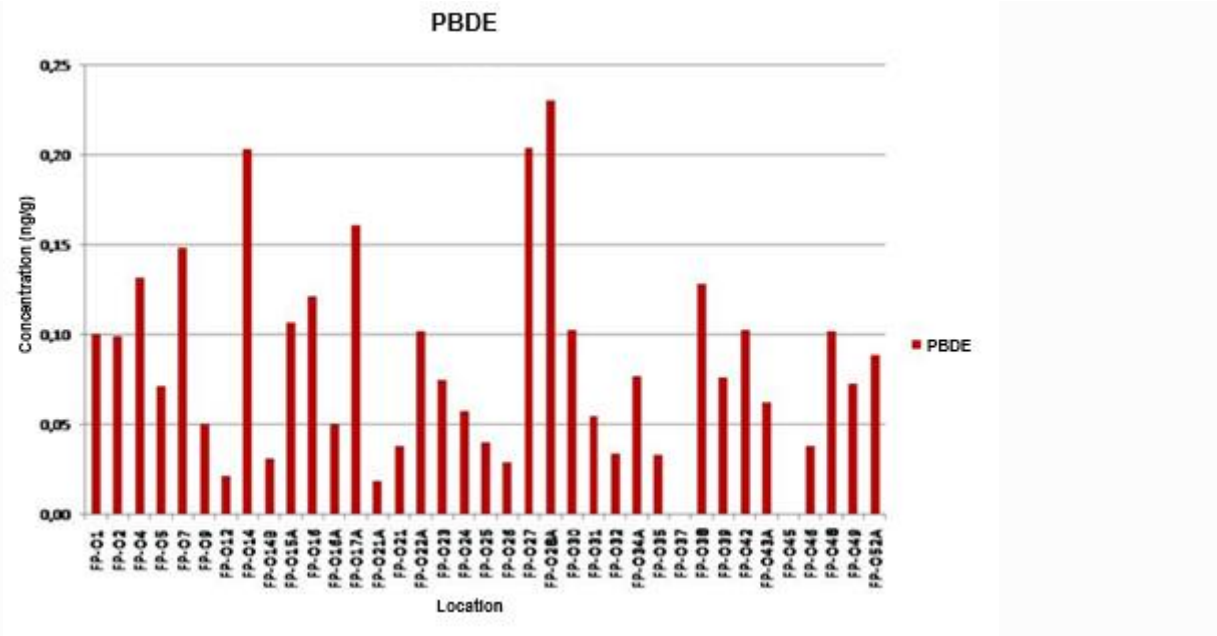


Figure 3.7-9 Distribution of polybrominated diphenyl ethers (PBDE) in coastal water sediments 2017

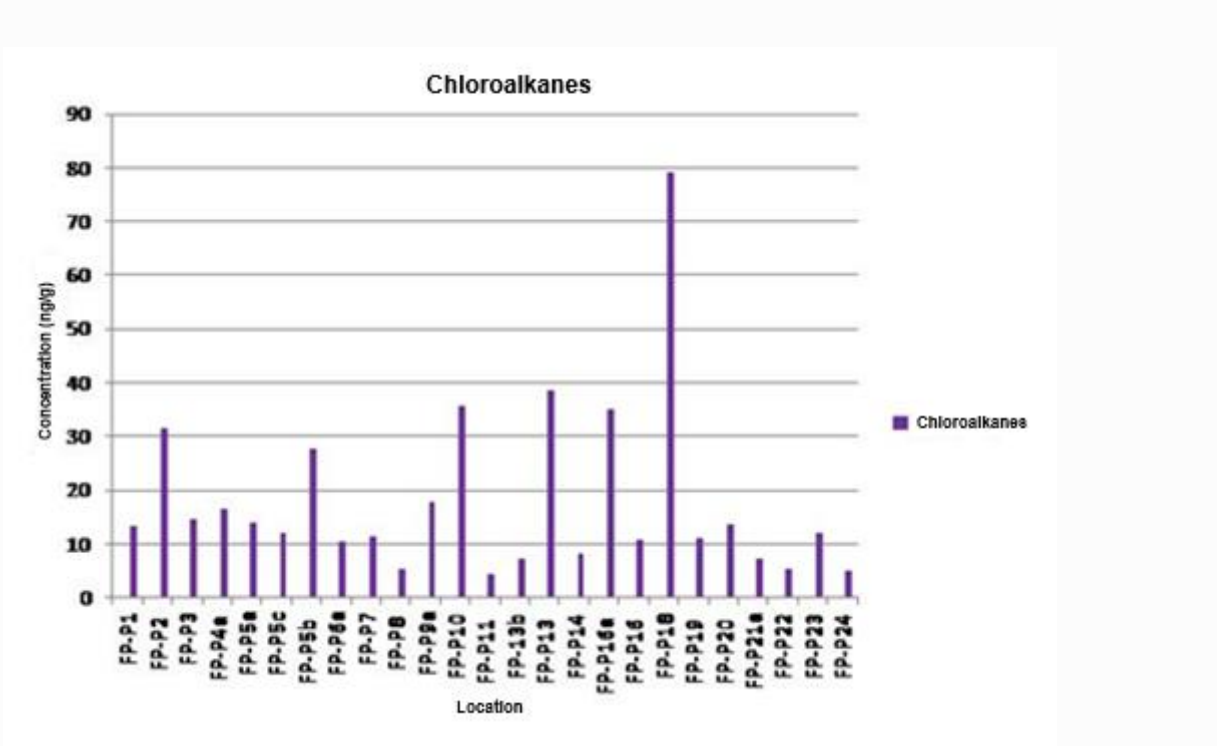


Figure 3.7-10 Distribution of long chain chloroalkanes (C10-C13) in coastal water sediments 2017

3.7.2.1 POPs IN TRANSITIONAL WATER BODIES IN 2018

In the 2018–2019 period, under the "Agreement on the systematic testing of transitional and coastal water quality in 2018–2019" financed by Croatian Waters (Hrvatske vode), analyses of a number of organic pollutants belonging to the group of POPs were carried out (*Table 3.7-2*). The contractor was a consortium consisting of the Institute of Oceanography and Fisheries from Split (IOR), Ruđer Bošković Institute from Zagreb (IRB) and Nacionalni laboratorij za zdravje, okolje i hrano from Maribor, Slovenia (NZLO). The POPs analyses were performed in IRB and NZLO laboratories.

Table 3.7-2 List of POPs measured in water, sediment and biota as part of monitoring transitional water bodies of the eastern Adriatic coast in 2018

Marine environmental component	**Persistent organic pollutant (POP) measured in 2018**
Water	DDT Endosulfan Perfluorooctane sulfonic acid (PFOS) Hexabromocyclododecane (HBCDD)
Biota	Polybrominated diphenyl ethers Hexachlorobenzene Hexachlorobutadiene Alpha-, beta-, gamma hexachlorocyclohexane Perfluorooctane sulfonic acid (PFOS) Dioxins and dioxin-like compounds Hexabromocyclododecane (HBCDD) Heptachlor and heptachloroepoxide
Sediment	Polybrominated diphenyl ethers Chloroalkanes C10-C13 Organochlorine pesticides (hexachlorobenzene and hexachlorocyclohexane) Pentachlorobenzene Perfluorooctane sulfonic acid (PFOS) Dioxins and dioxin-like compounds (TEQ) Hexabromocyclododecane Heptachlor and heptachloroepoxide

The analyses were carried out in accordance with the requirements of the Water Framework Directive on monitoring priority substances in water, and the assessment of the chemical status was conducted in accordance with applicable European and Croatian legislation which defines allowed concentrations of these substances in water and biota. 73/13 and 78/15). The status assessment for sediment (for which there is no Croatian or European legislation) was carried out according to the available scientific literature.

WATER

In 2018, monitoring of POPs in transitional waters included three seasonal visits, whereas three different groups of priority substances were monitored: hexabromocyclododecane, perfluorooctanoic acid and its derivatives, and in a smaller number of sites, organochlorine pesticides endosulfan and p,p-DDT. At all stations and in all seasons, the concentrations of organochlorine pesticides endosulfan and p,p-DDT were below the limit of determination of the used method (0.1 and 0.5 ng/l), which is below the prescribed AAC values. In the majority of samples, the HBCDD level was lower than the prescribed criterion (AAV=0.8 ng/l), while elevated concentrations (up to 6.4 ng/l), which however did not exceed MAC (50 ng/l), were measured in the Raša estuary. At the site FP-P19 in the Raša estuary, the average annual concentration for the whole water column (1.5 ng/l), and especially the bottom layer (2.4 ng/l), was multiple times higher than the allowed AAC. The measured PFOS levels were, in the majority of samples, lower than 1 ng/l; however, they exceeded AAC (0.13 ng/l) in a smaller number of sites. The highest levels (0.5–1 ng/l) were measured in Neretva, Cetina, Jadro, Raša, Mirna and Dragonja estuaries, whereas slightly higher values were recorded in the surface layer.

BIOTA

From the perspective of meeting the criterion in biota samples, the most critical indicator is PBDE concentration in fish muscle. Due to the exceptionally strict AEQS criterion of 0.0085 ng/g for the sum of representative six PBDE congeners, none of the samples met this criterion. The range of concentrations was from 0.013 to 0.24 ng/g, and the average concentration of 0.09 ng/g was multiple times higher than the prescribed criterion; the highest concentrations were recorded in Ombla (FP-P2), Neretva (FP-P5b), Cetina (FP-6a) and Krka (FP-P13) estuaries. A very similar situation was found in some other areas of Europe. The issue of the environmental status in relation to the concentration of brominated flame retardants in fish and the prescribed AEQS values was recently discussed in detail in the screening study by Eljarrat & Barcela (2018), which pointed out that, in the majority of areas, PBDE concentrations are multiple times higher than the AEQS prescribed in the EU countries. The study emphasises the presence of a downward trend in PBDE concentrations, but concludes that, at this rate, it cannot be expected that the required AEQS level is reached by 2021, as envisaged by the Water Framework Directive. It is obvious that almost all EU Member States will face this problem, and that systematic arrangements are required concerning the implementation of criteria and additional measures to reduce PBDE inputs to the environment.

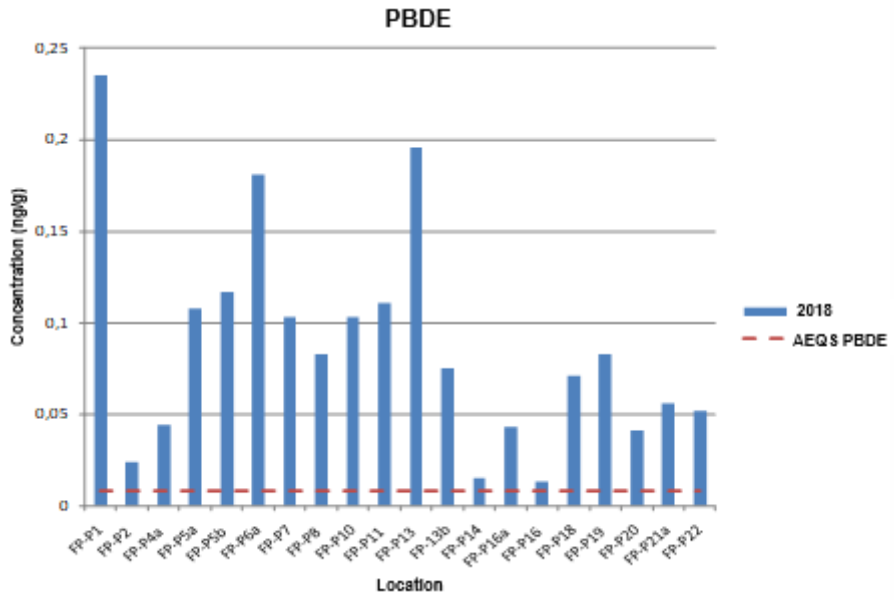


Figure 3.7-11 Distribution of PBDE in transitional water fish 2018

Another type of brominated flame retardants, HBCDD, which is analysed in whole fish, showed concentrations of similar magnitude in analysed fish (<0.1–0.3 ng/g; mean value 0.04 ng/g). However, AEQS for HBCDD in fish is, as opposed to PBDE, quite high (167 ng/g), so all measured values are at least one hundred times lower than the prescribed criterion. It should be also that there is no correlation between the occurrence of elevated PBDE and HBCDD levels. The highest concentrations of HBCDD were measured in fish from Ombla (FP-P2; 0.3 ng/g), Neretva (FP-P5b; 0.1 ng/g) and Krka (FP-P13; 0.2 ng/g) estuaries. The low HBCDD concentrations measured in biota are consistent with relatively low levels in the water column of coastal waters (typically below 0.2 ng/l).

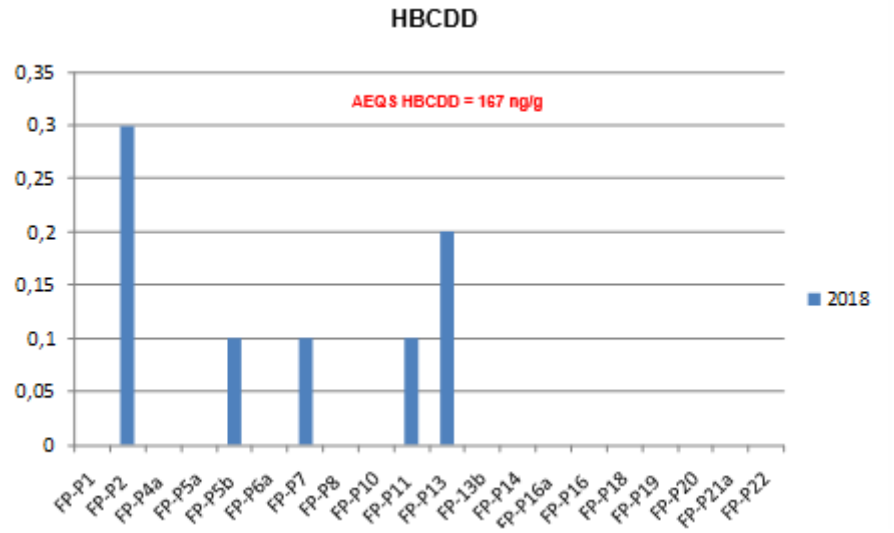


Figure 3.7-12 Distribution of HBCDD in transitional water fish 2018

It is interesting to compare the concentrations of brominated flame retardants with some classic lipophilic priority substances such as chlorinated insecticides and dioxins. The concentrations of heptachlor and heptachloroepoxide were, in the majority of samples, lower than the limit of determination (0.05 ng/g) and did not indicate any significant contamination with these substances. However, it should be noted that AEQS for heptachlor and heptachloroepoxide is very rigorous (0.0067 ng/g) and that, by using the available method (determination limit of 0.05 ng/g), the fulfilment of the AEQS criterion cannot be determined. For a very similar chlorinated insecticide, hexachlorobenzene, the criterion is much less strict (AEQS 10 ng/g) and all measured values (ranging from 0.04 to 0.16 ng/g) are significantly lower than the prescribed ones, while their spatial variability does not indicate the existence of more significant sources. The levels of hexachlorobenzene in fish were of very similar magnitude as PBDE.

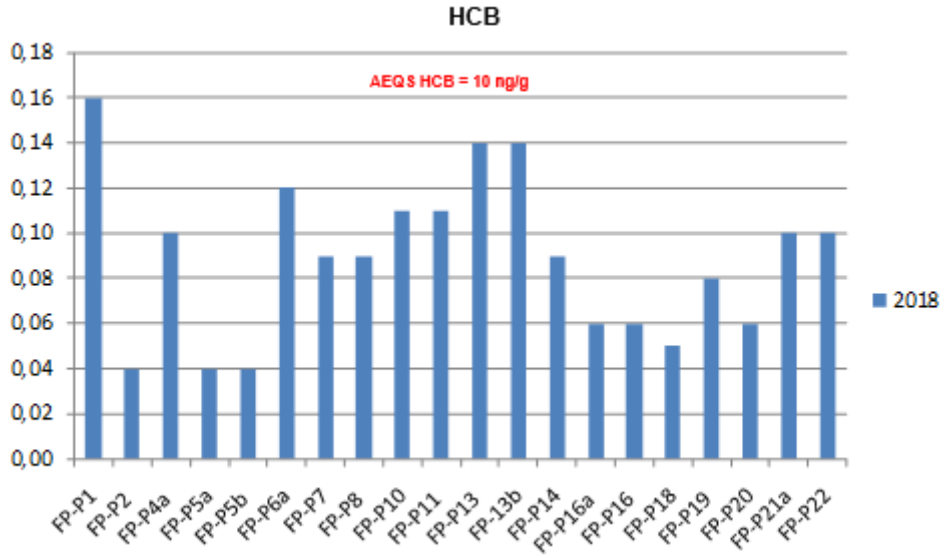


Figure 3.7-13 Distribution of HCB in transitional water fish 2018

The levels of dioxins and dioxin-like compounds ranged from <0.00002 to 0.0025 ng/g TEQ, and were lower than the prescribed AEQS (0.0065 ng/g TEQ) in all samples. The highest levels were recorded in Ombla (FP-P2; 0.0025 ng/g TEQ) and Krka (FP-P11; 0.0025 ng/g TEQ) estuaries.

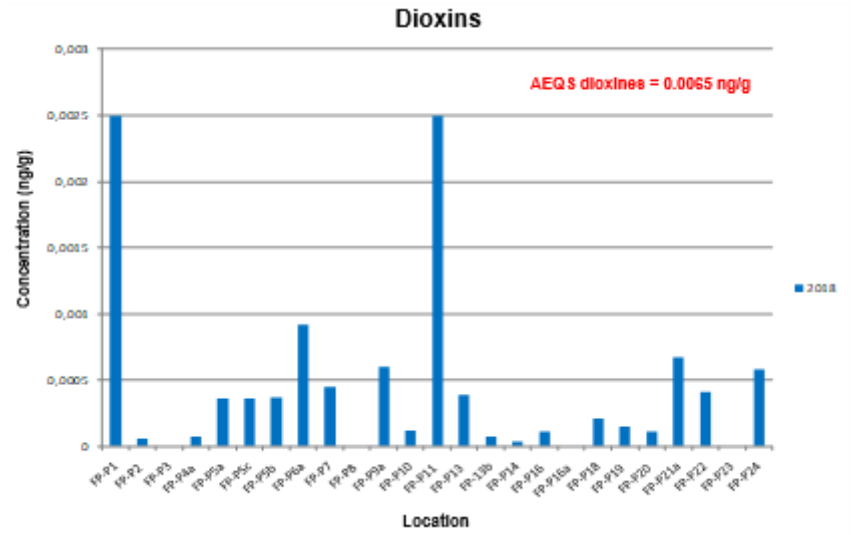


Figure 3.7-14 Distribution of dioxins and dioxin-like compounds in transitional water fish 2018

PFOS are chemical compounds which, in addition to lipophilic properties, also have a polar character, which means that, according to their physico-chemical characteristics, they belong to the group of surfactants. This property significantly distinguishes them from other types of persistent priority substances. Their concentration in fish ranged from 0.1 to 1 ng/g, which is quite lower than the prescribed AEQS criterion (9.1 ng/g). The current level of pollution in biota does not exceed 10 % of the prescribed values, and there seems to be no imminent risk that they will be exceeded.

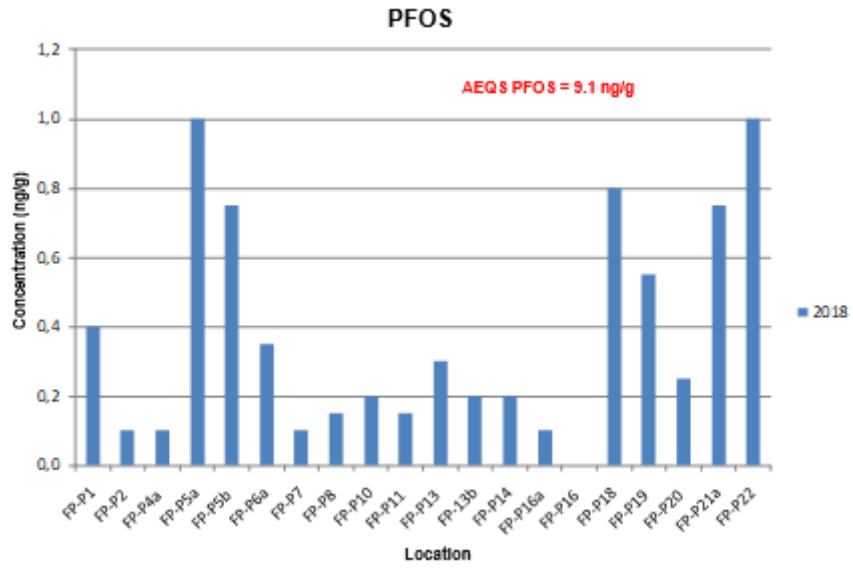


Figure 3.7-15 Distribution of PFOS in transitional water fish 2018

SEDIMENT

In 2018, POPs concentrations in sediments of transitional water bodies were relatively low for the majority of monitored indicators. This included typical pollutants, for which it is known

they tend to accumulate in sediments, such as organochlorine insecticides, dioxins and dioxin-like compounds, polybrominated diphenyl ethers, as well as some less researched types of priority substances such as HBCDD, chloroalkanes and perfluorooctane sulfonic acid. As no uniform European criteria for sediment quality are prescribed, as is the case for water and biota, the status assessment was conducted according to the criteria suggested by Bakke *et al.* (2010) in Norway. According to Bakke *et al.*, sediment quality is classified into five categories, whereas the first two are, as regards the environmental status, considered good and/or satisfactory, while III, IV and V are considered unsatisfactory since toxic effects may be expected in this concentration range.

According to Bakke *et al.* (2010), the criterion for significant sediment pollution with PBDE is 62 ng/g, which is very high compared to the concentrations measured in sediments of Croatian transitional water bodies. As shown in Figure 3.7-16, the concentration range of PBDE in sediments was <0.02 ng/g to 0.5 ng/g (mean value 0.12 ng/g), which is over one hundred times lower than the proposed criterion. In this case, the relationship between the measured concentrations and the environmental quality criteria is completely reversed from that recorded for biota. However, sediment should be viewed as an important medium for the transfer of PBDF congeners to biota and, therefore, it is important to try to detect hotspots. Furthermore, it is interesting to notice that there is no ideal correlation between sediment and biota burdens, but the possible variation may be related to the fact that microlocations of sampling sediments and biota often do not overlap. The highest concentrations of PBDE in 2018 were measured at the sites in Cetina (FP-P8), Rječina (FP-P18), Raša ((FP-P19) and Mirna (FPP-21a) estuaries.

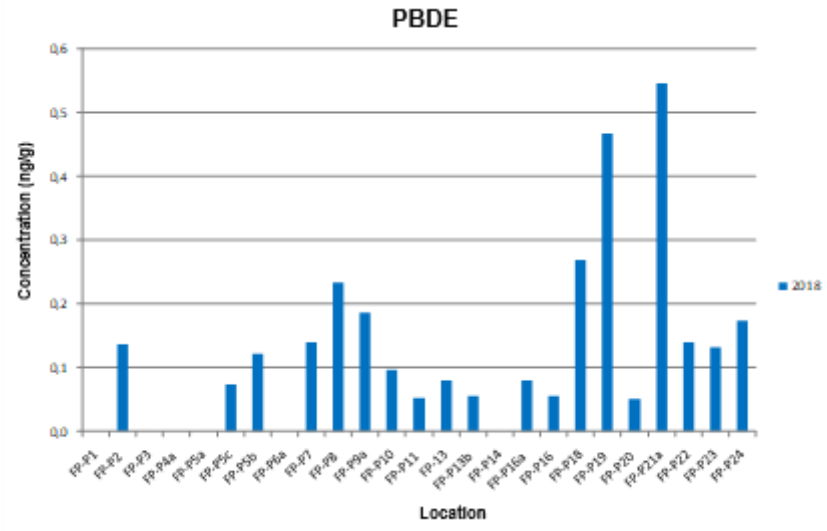


Figure 3.7-16 Distribution of PBDE in transitional water sediments 2018

The concentration of HBCDD in sediments showed that the levels of these compounds are, at most sites of Croatian transitional water bodies, relatively low (<1 ng/g), but significantly elevated values ranging from 1 to 8.7 ng/g were recorded at several sites. This indicates that there are significant sources of HBCDD at particular sites. These are primarily stations in Ombla (FP-P2; 4.7 ng/g), Jadro (FP-P9a and FP-P10; 7.4 and 8.7 ng/g) and Krka (FP-P13; 7.1

ng/g) estuaries, which are generally characterised by increased anthropogenic burden. However, even these elevated levels are multiple times lower that the limit criterion for polluted sediment (86 ng/g) according to Bakke *et al.* (2010).

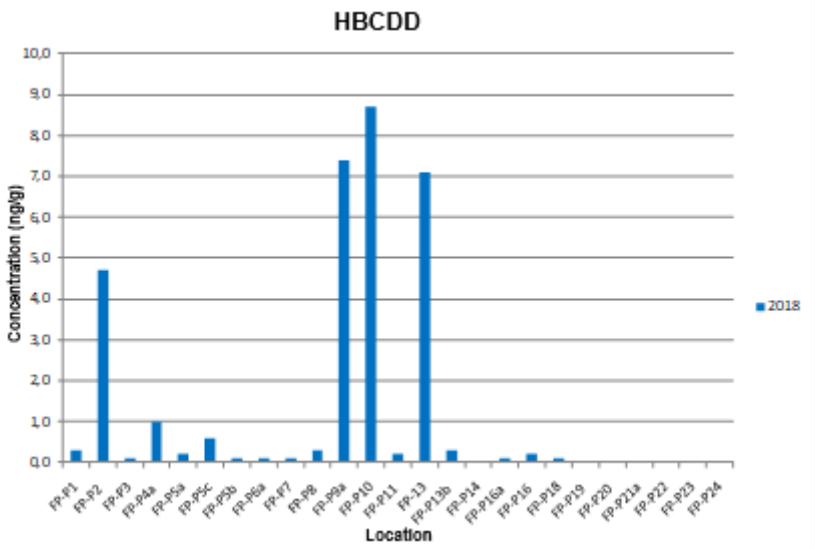


Figure 3.7-17 Distribution of HBCDD in transitional water sediments 2018

Classic lipophilic priority substances, such as HCB and dioxins and dioxin-like compounds, are present in sediments of transitional water bodies in relatively low levels. These levels are multiple times lower than the criterion for significantly polluted sediment according to Bakke *et al.* (17 ng/g for HCB and 0.03 ng/g TEQ for dioxin compounds). This suggests that there is no stronger specific source of HCB and dioxin compounds in Croatian transitional water bodies.

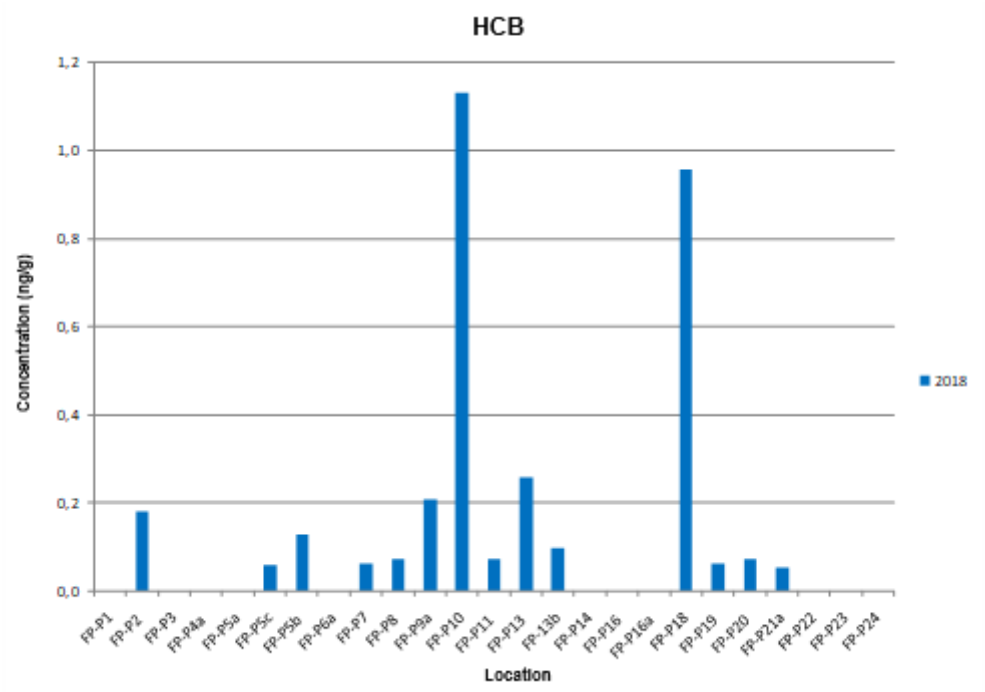


Figure 3.7-18 Distribution of HCB in transitional water sediments 2018

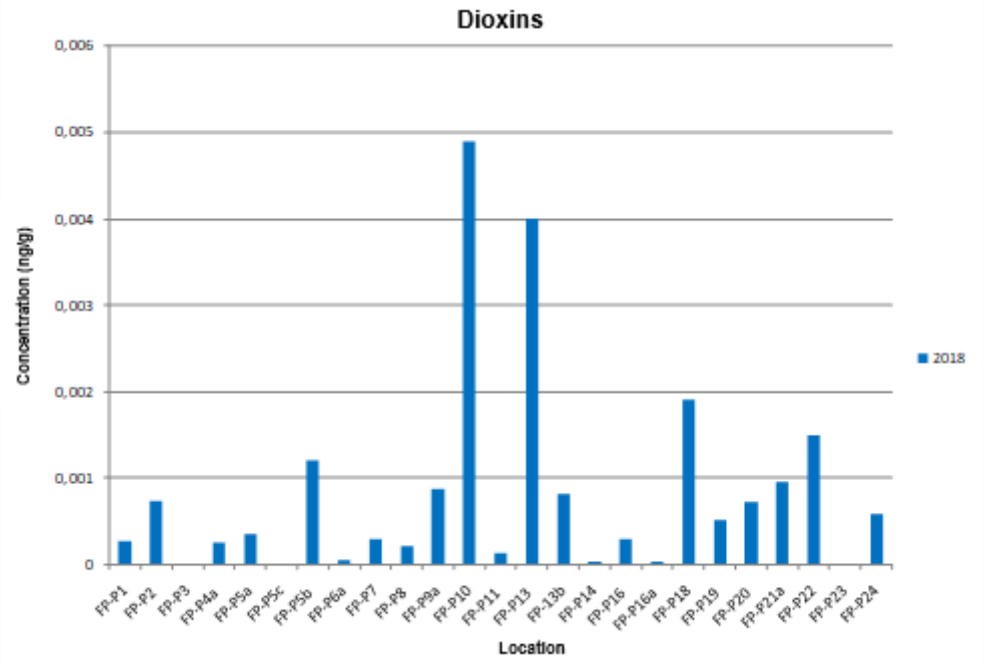


Figure 3.7-19 Distribution of dioxins and dioxin-like compounds in transitional water sediments 2018

In addition to chlorinated insecticides and dioxin compounds, significant concentrations of long-chain chloroalkanes (C10-13) were also measured.

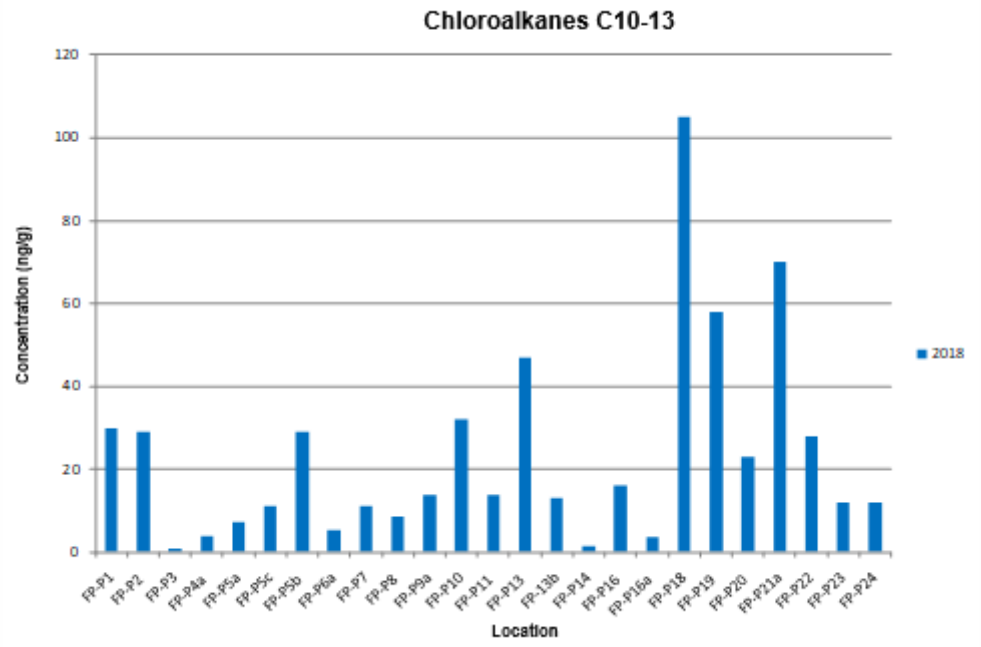


Figure 3.7-20 Distribution of long chain chloroalkanes (C10-C13) in transitional water sediments 2018

As these are priority substances of industrial origin, their spatial distribution shows elevated values at the characteristic sites in Ombla (FP-P2), Neretva (FP-P5b), Jadro (FP-P10), Krka (FP-P13), Rječina (FP-P18), Raša (FP-P19) and Mirna (FP-P22) estuaries, which also had increased levels of some other priority substances. The highest level (105 ng/g)was recorded in the Rječina estuary. Bakke *et al.* (2010) did not suggest the criterion for assessing contamination with chloroalkanes. However, according to the Canadian criteria (Environment Canada, 2016), these concentrations are over 1000 times lower than the critical ones.

The concentration of PFOS in sediments of transitional water bodies in 2018 was quite low, ranging from <0.1 to 0.4 ng/g. This situation is consistent with low levels of these substances in the water column (<1 ng/l). Slightly elevated values (0.2 to 0.4 ng/g) were recorded in Krka and Zrmanja estuaries. The distribution of PFOS in sediments confirms that there are no significant point sources of these priority substances in Croatian coastal water bodies. The measured PFOS levels were over one hundred times lower than the criterion for significantly polluted sediment (220 ng/g) according to Bakke *et al.* (2010).

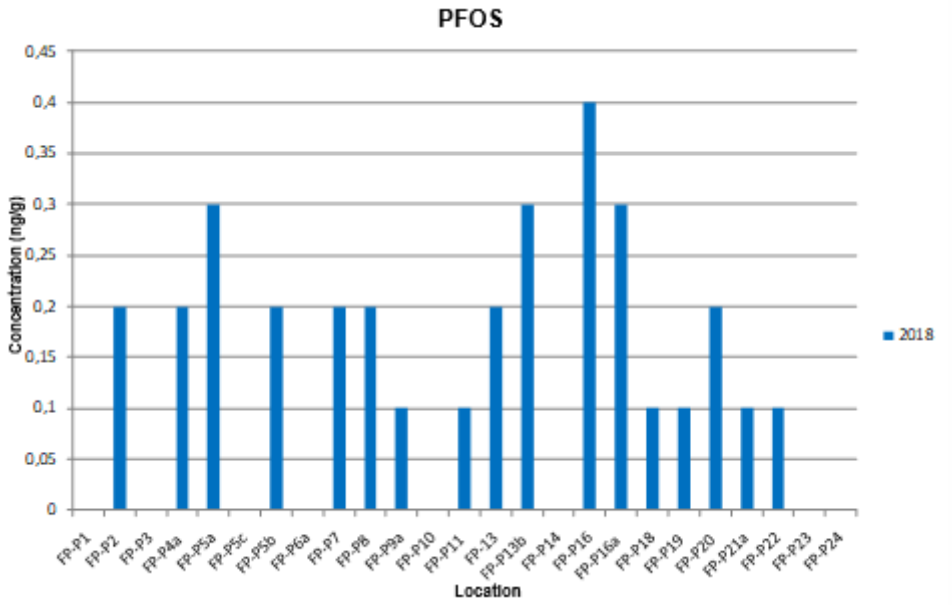


Figure 3.7-21: Distribution of perfluorooctane sulfonic acid (PFOS) and its derivatives in transitional water sediments 2018

3.7.3 MONITORING OF POPs IN SOIL (AGRICULTURAL LAND)

A new Agricultural Land Act (OG 20/18) entered into force in March 2018 and the Agricultural Land Agency ceased its operations, while the Department for monitoring the status of agricultural land changed its name to the Institute for Soil and is again operating as an organisational unit of the Croatian Centre for Agriculture, Food and Rural Affairs (hereinafter: CCAFRA). The CCAFRA took over all activities of the Institute for Soil. Pursuant to Article 13 of the Act on the Croatian Agency for Agriculture and Food (OG 111/18), which entered into force on 1 January 2019, CCAFRA, established by the Act on the establishment of the Croatian Agency for Agriculture and Food (OG 25/09, 124/10 and 39/13) with headquarters in Zagreb, continues its operations under the name: Croatian Agency for Agriculture and Food (hereinafter: CAAF) with headquarters in Osijek. Under the provisions of the said Act, Article 4, the Institute for Soil changed its name to the Centre for Soil with headquarters in Osijek.

Pursuant to Article 6 of the Agricultural Land Act (OG 20/18, 115/18 and 98/19), in order to protect agricultural land from damage, the determination of the level of agricultural land damage is performed, as well as the monitoring of agricultural land, which includes continuous monitoring of all changes in agricultural soil (physical, chemical and biological), and the information system for the protection of agricultural land is kept; these activities are carried out by CAAF, Centre for Soil.

In the 2014–2017 period, CEAN implemented the project "Changes in carbon stocks and calculation of trends of total nitrogen and organic carbon in soil and the carbon-to-nitrogen ratio". The sources were the Croatian Geodetic Institute, Croatian Forest Research Institute and the Agricultural Land Agency. The field and laboratory study of the soil status was conducted at 725 representative sites. General data on sampling sites were collected, which contain administrative, location, geographic and other data (relief, climate and meteorological data,

detailed data on land use and plant life, description of surface soil properties). The samples are archived by the contractors and, until national monitoring of agricultural land is established, subsequent analysis of some organic pollutants for the purpose of implementing the Convention will be possible.

In the period from January 2018 to December 2019, in the entire territory of the Republic of Croatia, CAAF – Centre for Soil has, in compliance with the obligations stipulated by the Act and subordinate legislation, carried out monitoring of agricultural land by testing soil fertility, but the funds for implementing the prescribed activities of continuous monitoring of agricultural land, information system development, and field and laboratory control of the implementation, were not provided in the given period.

In 2019, subordinate legislation was amended, and the new Ordinance on the methodology for monitoring of the status of agricultural land (OG 47/19) prescribed the methodology for monitoring the status of agricultural land (soil fertility monitoring and testing), information system for the protection of agricultural land, required documents and contents of the application, as well as detailed conditions to be met by authorised laboratories, tasks of the reference laboratory, obligations of laboratories and institutes, and the method of carrying out controls.

In the period from January 2018 to December 2019, CAAF – Centre for Soil in Osijek has, in compliance with the obligations stipulated by the Act and subordinate legislation, carried out monitoring of agricultural land by testing soil fertility.

Pursuant to Article 39 of the Ordinance on the methodology for monitoring of the status of agricultural land (OG 47/19), all laboratories authorised for testing soil fertility have submitted to the Centre for Soil in Osijek, as the reference laboratory, written consolidated soil fertility test reports for 2019 in electronic form. The consolidated reports contain 10,825 results of soil analyses that were, for the purpose of fertility testing, performed in the reference laboratory and authorised laboratories by applying the methods prescribed by the Ordinance and under the same conditions for all laboratories.

General data on sampling sites were also collected, which contain administrative, location, geographic and other data.

The users are obliged to determine the geolocation of soil sampling sites by taking reference points (GPS coordinates).

The samples for soil fertility testing are archived and they can, until monitoring of agricultural land is established, be analysed for some POPs for the purpose of implementing the Convention.

3.7.4 MONITORING OF POPs IN FEED

The Ministry of Agriculture, as part of official controls, carries out the Feed Monitoring Plan in which samples of feed are analysed for organochlorine pesticides (DDT, HCH, HCB and chlordane), and dioxins and dioxin-like PCBs.

3.7.5 MONITORING OF FOREST ECOSYSTEMS

The Forest Act (OG 68/18, 115/18, 98/19, 32/20 and 145/20), particularly in Chapter VI – Forest protection, regulates the obligations related to establishing preconditions for efficient implementation of measures arising from the requirements under the Convention.

Pursuant to these legal obligations, and harmonising them with the EU *acquis*, the Ordinance on the methods for monitoring the damage to forest ecosystems (OG 54/19) stipulates the methods for systematic and long-term monitoring of damage to forest ecosystems, networks of sites, methods of collecting data and keeping the register, and conditions for the use and delivery of the collected data on damage to forest ecosystems to domestic and international bodies and institutions.

Monitoring of damage to forest ecosystems in the Republic of Croatia is carried out within the framework of the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests at the network of Level 1 sites and Level 2 plots, pursuant to the LRTAP Convention.

The objectives of the programme are:

a) to develop monitoring of air pollution and its effects, and observation of other causes and factors that have an impact on forests (biotic, abiotic and anthropogenic factors)
b) to assess requirements for monitoring of forest ecosystems and to develop monitoring of soils, carbon sinks, climate change impacts and biodiversity, and protective function of forests
c) to permanently evaluate the efficiency of monitoring in the assessment of damage to forest ecosystems and further development of monitoring activities.

The monitoring carried out by the Croatian Forest Research Institute (National coordination centre for assessment and monitoring of the impact of atmospheric pollution and other factors on forest ecosystems) is, in the part related to analyses of forest ecosystem components (plant material, air, soil, water in soil), directed towards analysis and identification of impacts of chemical elements and inorganic compounds on forests.

Since POPs that damage forests primarily through atmospheric pollution (PCDD and PCDF, as by-products of burning of forest matter) are singled out by the Convention, the prevention and mitigation of forest fires is a direct contribution of the forestry sector to reducing the harmful emissions of PCDD and PCDF into the air.

The Republic of Croatia continuously invests significant funds to minimise damage from forest fires caused naturally and by anthropogenic influence.

The Ordinance on the procedure for obtaining the right to funds from the fee for utilisation of forest functions of general benefit for works performed in forests (OG 22/15, 93/15, 57/17 and 46/18) prescribes that 20 % of the funds from the fee for forest functions of general benefit are allocated for the provision of equipment and training for firefighting organisations, of which 5 % is for firefighting organisations pursuant to a special regulation in the field of firefighting, and the remaining 15 % for firefighting organisations from the territory of the Republic of Croatia, which is a significant increase in the funds allocated for this purpose (from 5 % to 20 %).

The remediation and reforestation of burned areas coupled with effective fire protection measures and operations are carried out together with coordinated campaigns aimed at raising awareness of the importance of forests, with a particular emphasis on prevention of forest fires. The Rural Development Programme of the Republic of Croatia for the period 2014–2020 will, through operations 4.3.3 "Investment in forest infrastructure" and 8.5.1 "Conversion of degraded forest stands and forest cultures", enable larger scale investments in fire protection and prevention and forest protection by increasing the accessibility of forest areas via forest roads and forest works which, through sustainable and professional management of degraded forests and forest monocultures, reduce the risk of forest fires.

Fire protection and prevention in forestry is regulated by the Ordinance on the protection of forests against fires (OG 33/14), which prescribes technical, preventive and cultivation measures, as well as other forest protection measures against fire which have to be carried out by owners and users of forests and forest land.

In accordance with the Forest Act, the Register of Fires (system of documentation, data and information on forest fires), harmonised with the European Forest Fire Information System (EFFIS) database, became operational on 1 January 2009 . The operation of the Register is prescribed by the Ordinance on the method of data collection, keeping the register and requirements for the use of data on forest fires (OG 75/13, 150/14 and 21/17). The same Ordinance also stipulates the obligation of the Republic of Croatia to, by 1 July each year, for the purposes of EFFIS deliver to the Joint Research Centre of the European Commission seven types of data on every forest fire that occurred in the territory of the Republic of Croatia during the previous year. The objective of the described measures is early detection and notification on the occurrence and spread of forest fire, and ensuring timely extinguishing action. Croatian State Forests Ltd (Hrvatske šume d.o.o.), a company responsible for the management of state forests, holds an international FSC certificate that forests are managed in accordance with strict ecological, social and economic standards. Indeed, it is the strict environmental standards of the FSC certificate that guarantee that Croatian forests are not treated or in any other way contaminated with some of the POPs included in Annexes to the Convention.

3.7.6 MONITORING OF POPs IMISSIONS IN THE AIR

One of the MESD's obligations is the preparation of regular annual reports on air quality monitoring in the Republic of Croatia. Reports are developed in the current year for the previous calendar year and include data on pollutant concentrations collected from the national and local networks for air quality monitoring, which are also published on the website http://www.haop.hr/hr/tematska-podrucja/zrak-klima-tlo/zrak/izvjesca

The POPs measured at the stations of the state and local network in the Republic of Croatia include polycyclic aromatic hydrocarbons (PAH): benzo (a) pyrene (BaP), benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, indenopyrene and dibenzo(a)anthracene in PM_{10} particulate matter fractions at the following sites: state network monitoring stations in the Zagreb agglomeration: Zagreb-1 (Miramarska Street and Vukovarska Street intersection) and Zagreb-3 (Sarajevska Street and Kauzlarićev Prilaz intersection) and

the monitoring station of the state network Sisak-1 (at the site Caprag) located in the Industrial Zone (HR2). From 2018, in the Industrial Zone (HR2), POPs are also measured at the monitoring station Slavonski Brod-1.

The then valid Regulation on levels of pollutants in ambient air (OG 117/12 and 84/17) prescribed the target value (CV) PAH BaP in PM_{10} of 1.0 ng m^{-3}.

3.7.6.1 RESULTS OF DETERMINATION OF BENZO(A)PYRENE (BAP) IN PM10 PARTICULATE MATTER – 2015

Based on analysis of the 2015 results, it was assessed that BaP concentrations in PM_{10} were higher than the proscribed target values in the Zagreb agglomeration at the monitoring stations Zagreb-1 and Zagreb-3, as well as in the Industrial Zone (HR 2) at the monitoring station Sisak-1.

3.7.6.2 RESULTS OF DETERMINATION OF BENZO(A)PYRENE (BAP) IN PM10 PARTICULATE MATTER – 2016

Based on analysis of the results, it was assessed that BaP concentrations in PM_{10} were higher than the proscribed target values in the Zagreb agglomeration at the monitoring stations Zagreb-1 and Zagreb-3, and in the Industrial Zone (HR 2) at the monitoring station Sisak-1.

3.7.6.3 RESULTS OF DETERMINATION OF BENZO(A)PYRENE (BAP) IN PM10 PARTICULATE MATTER – 2017

Based on analysis of the results, it was assessed that BaP concentrations in PM_{10} were higher than the proscribed target values in the Zagreb agglomeration at the monitoring station Zagreb-3 and in the Industrial Zone (HR 2) at the monitoring station Sisak-1.

3.7.6.4 RESULTS OF DETERMINATION OF BENZO(A)PYRENE (BAP) IN PM10 PARTICULATE MATTER – 2018

In 2018, measurements of BaP in PM_{10} from three monitoring stations were processed (Source: 2018 Annual Report on Air Quality Monitoring in the Republic of Croatia, MEPE, 2019): Zagreb-1, Zagreb-3 in the Zagreb agglomeration and Sisak-1 in the Industrial zone. Based on analysis of the 2018 results, it was assessed that BaP concentrations in PM_{10} were higher than the proscribed target values in the Zagreb agglomeration at the monitoring stations Zagreb-1 and Zagreb-3, as well as in the Industrial Zone (HR 2) at the monitoring station Sisak-1.

3.7.6.5 RESULTS OF DETERMINATION OF BENZO(A)PYRENE (BAP) IN PM10 PARTICULATE MATTER – 2019

In 2019, measurements of BaP in PM_{10} from three monitoring stations were processed (Source: 2019 Annual Report on Air Quality Monitoring in the Republic of Croatia, MESD, 2020):

Zagreb-1, Zagreb-3 in the Zagreb agglomeration and Sisak-1 in the Industrial zone. Based on analysis of the 2019 results, it was assessed that BaP concentrations in PM_{10} were higher than the proscribed target values at three monitoring stations, in the Zagreb agglomeration at the monitoring station Zagreb-3, as well as in the Industrial Zone (HR 2) at the monitoring station Sisak-1.

3.7.7 POPS EMISSIONS REPORTED TO THE ENVIRONMENTAL POLLUTION REGISTER (EPR) DATABASE AND QUANTITIES REPORTED TO THE REGISTER OF ESTABLISHMENTS IN WHICH DANGEROUS SUBSTANCES ARE PRESENT / REGISTER OF REPORTED MAJOR ACCIDENTS (REDS/RRMA) DATABASE

Pursuant to the Ordinance on the environmental pollution register (OG 87/15), data on POPs emissions into the air, water and/or sea and soil from individual sources and generation of waste containing PCB are collected in the EPR database[9].

The data on emissions into the air from stationary sources for PCDD+PCDF and PAH in 2015 were collected in the EPR database for four counties. In 2016 and 2017, the data on PAH emissions were collected in only one county.

In 2015, a total of 0.00003555 kg PCDD+PCDF (as TEQ) was reported, of which the highest quantity of this pollutant was reported in Sisak-Moslavina County (around 81 % of total releases). As regards PAH releases in 2015, a total of 32.69 kg was reported in Split-Dalmatia County.

A total of 29.77 kg of PAH was reported in Split-Dalmatia County in 2016, and a total of 36.68 kg in 2017. In 2016 and 2017, PCDD+PCDF emissions were not reported to the EPR database.

The data on emissions into the air from stationary sources for PCDD+PCDF and PAH in 2018 were collected in the EPR database for two counties.

In 2018, a total of 0.00324 kg PCDD+PCDF (as TEQ) was reported in Šibenik-Knin County. As regards PAH releases in 2018, a total of 37.39 kg was reported in Split-Dalmatia County.

3.7.7.1 QUANTITIES OF POPS EMITTED INTO THE AIR ACCORDING TO THE REDS/RRMA DATABASE

According to the REDS/RRMA database, there are no reported POPs for the period from 2015 to 2019.

[9] http://roo.azo.hr/

3.7.8 MONITORING OF PESTICIDE RESIDUES THAT ARE ALSO POPs ON PRODUCTS OF PLANT AND ANIMAL ORIGIN

The implementation of the National monitoring programme for pesticide residues started in 2007. Monitoring of pesticide residues in and on food aims to establish the amount of pesticide residues, check their compliance with the prescribed maximum residue level (MRL) of pesticides and in this way inspect whether manufacturers adhere to principles of good agricultural practices, and establish the extent to which pesticide residues that exceed MRL pose a risk to humans who consume food that contains such level of pesticide residues. The National monitoring programme for pesticide residues complies with standards for the implementation of monitoring carried out in the EU Member States.

As regards pesticides with POPs characteristics, systematic monitoring is conducted for the following active substances: aldrin, dieldrin, alpha-HCH, beta-HCH, eldrin, heptachlor, HCB, endosulfan, lindane, DDT.

According to the National Programme, in the reporting period from 2015 to 2017, none of these active substances were detected in concentrations above the maximum residue level of pesticides.

According to the National Programme, in the reporting period from 2018 to 2019, none of these active substances were detected in concentrations above the limit of determination.

3.7.9 MONITORING OF THE STATUS OF PESTICIDE RESIDUES IN AND ON FOOD

The 2015 National Programme for monitoring pesticide residues included monitoring pesticide residues in 16 products of plant and animal origin. A total of 484 samples were analysed. Samples of plant origin were analysed for 247 active substances, and samples of animal origin for 57 active substances; 348 (72 %) samples contained no pesticide residues (below the limit of determination). Pesticide residues below MRL were found in 134 samples (28 %), while residues exceeded MRL in one sample (0.2 %).

The 2016 National Programme for monitoring pesticide residues in and on food of plant and animal origin included the monitoring of pesticide residues in 20 products, 16 of which in accordance with the Commission Implementing Regulation (EU) 2015/595 of 15 April 2015 concerning a coordinated multiannual control programme of the Union for 2016, 2017 and 2018 to ensure compliance with maximum residue levels of pesticides and to assess the consumer exposure to pesticide residues in and on food of plant and animal origin (OJ L 99, 16.4.2015), which also includes products originating from organic farming and baby food.

In addition to these products, two products that were not yet sampled under the Programme were included (celery root and honey), as well as two products (sweet peppers and mandarins) for which previous studies detected MRL exceedances or unauthorised use. A total of 547 samples were analysed. Samples of plant origin were analysed for 361 active substances, and samples of animal origin for 49 active substances; 331 (60.51 %) samples contained no

pesticide residues (below the limit of determination). Pesticide residues below MRL were found in 210 samples (38.5 %), while residues exceeded MRL in six samples (1.10 %).

The 2017 National Programme for monitoring pesticide residues in and on food of plant and animal origin included the monitoring of pesticide residues in 22 products of plant and animal origin, 15 of which were selected in accordance with the Commission Implementing Regulation (EU) 2016/662 of 1 April 2016 concerning a coordinated multiannual control programme of the Union for 2017, 2018 and 2019 to ensure compliance with maximum residue levels of pesticides and to assess the consumer exposure to pesticide residues in and on food of plant and animal origin (OJ L 115, 29.4.2016), and seven products for which previous studies determined MRL exceedances or unauthorised use were added: apples, tomatoes, strawberries, head cabbages, sweet peppers, celery root and lettuces. A total of 630 samples were analysed. No pesticide residues (above the limit of determination) were found in 418 samples (66.30 %), pesticide residues below MRL were found in 206 samples (32.70 %) and pesticide residues above MRL were found in six samples (1 %). The 2018 National Programme for monitoring pesticide residues in and on food of plant and animal origin included the monitoring of pesticide residues in 28 products, 13 of which in accordance with the Commission Implementing Regulation (EU) 2017/660 of 6 April 2017 concerning a coordinated multiannual control programme of the Union for 2018, 2019 and 2020 to ensure compliance with maximum residue levels of pesticides and to assess the consumer exposure to pesticide residues in and on food of plant and animal origin (OJ L 94, 7.4.2017) (hereinafter: Commission Implementing Regulation (EU) 2017/660), which also includes products originating from organic farming (for each of the products specified in the said Regulation) and baby food. In addition to these products, 13 products for which previous monitoring programmes determined MRL exceedances or unauthorised use were included (apples, tomatoes, strawberries, head cabbages, lettuces, carrots, oranges, pears, celery root, leeks, onions, cauliflowers and kiwi fruits), as well as two products that are also important in the population's diet (blueberries and cucumbers). A total of 595 samples were analysed. Samples of plant origin were analysed for 337–455 active substances, and samples of animal origin for 64 active substances; 356 (59.83 %) samples contained no pesticide residues (below the limit of determination). Pesticide residues in permitted concentrations (below MRL) were found in 226 samples (37.98 %)), while residues exceeded MRL in six samples (1.27 %).

The 2019 National Programme for monitoring pesticide residues in and on food of plant and animal origin included the monitoring of pesticide residues in 20 products of plant and animal origin, 13 of which were selected in accordance with the Commission Implementing Regulation (EU) 2018/555 of 9 April 2018 concerning a coordinated multiannual control programme of the Union for 2019, 2020 and 2021 to ensure compliance with maximum residue levels of pesticides and to assess the consumer exposure to pesticide residues in and on food of plant and animal origin (OJ L 92, 10.4.2018) (hereinafter: Commission Implementing Regulation (EU) 2018/555), and seven products for which previous monitoring programmes determined MRL exceedances or unauthorised use were added: oranges, pears, blueberries, bananas, grapefruits, celery and kiwi fruits. A total of 290 samples were analysed. No pesticide residues (above the limit of determination) were found in 192 samples (66.21 %), pesticide residues below MRL

were found in 93 samples (32.07 %) and pesticide residues above MRL were found in six samples (2.07 %).

No exceedances of pesticides that are also POPs were found.

3.7.10 MONITORING OF POPs RESIDUES IN HUMAN BREAST MILK

In order to monitor the implementation, that is, the effectiveness of implementing the obligations prescribed by the Convention, one of the most important mechanisms is active participation/inclusion in the global monitoring plan for monitoring the effectiveness of the Convention which, *inter alia*, includes the analysis of POPs in breast milk samples. The institutions of the Republic of Croatia, in cooperation with scientific institutions from the Republic of Serbia, continuously participate in research and development of analyses.

The subject of research were the levels and distribution of 17 congeners of polychlorinated biphenyls (PCB) and organochlorine pesticides (OCP) (HCB, α-HCH, β-HCH, γ-HCH, p, p'-DDE, p, p'-DDD and p, p-DDT) in placentas sampled from healthy mothers collected in the period from November 2012 to February 2013. This is the first such research in Croatia. All analysed compounds were detected in all samples, while genotoxic studies indicated no damage.

(authors: D. Želježić, S. Herceg Romanić, D. Klinčić, M. Matek Sarić, J. Grzunov Letinić. "Persistent Organochlorine Pollutants in Placentas Sampled from Women in Croatia and an Evaluation of Their DNA Damaging Potential In Vitro Toxicology" published in: Archives of Environmental Contamination and Toxicology (2018) 74:284–291).

In order to better understand the relationship and distribution of 17 congeners of PCB and the above listed OCP in breast milk, sophisticated methods such as numerical and statistical modelling were applied, and the so-called machine learning algorithms were used in the processing of the results of breast milk analysis, and preliminary data were published.

(authors: G. Jovanović, S. Herceg Romanić, A. Stojić, D. Klinčić, M. Matek Sarić, J. Grzunov Letinić, A. Popović. "Introducing of modelling techniques in the research of POPs in breast milk – A pilot study" published in: Ecotoxicology and Environmental Safety 172 (2019) 341–347).

According to the presented results, the Croatian population is not at high risk of organochlorine contamination. However, it is necessary to monitor the levels of organochlorine compounds, both in people and ecosystems in the areas with secondary pollution sources.

3.7.11 MONITORING OF RESIDUES – OTHER SOURCES

The Veterinary Act (OG 82/13, 148/13 and 115/18) in Article 93 defines the monitoring programme of systematic monitoring of residues and other pollutants harmful for human health in products of animal origin intended for human consumption. Under the National monitoring programme for residues (NMPR), samples of cattle, pigs, poultry, sheep, goats, horses,

freshwater and salt-water fish, honey, milk and eggs are checked for organochlorine compounds (pesticides which are also POPs), for dioxins and dioxin-like PCBs.

3.7.12 REPORTS FROM AUTHORISED LABORATORIES

The laboratories of the *Department for Environmental Protection and Environmental Health of the Teaching Institute for Public Health "Dr. Andrija Štampar"* are authorised by competent ministries in, *inter alia*, areas specifically related to monitoring and analysis of substances included in the list of persistent organic pollutants pursuant to the Act on the Ratification of the Stockholm Convention on Persistent Organic Pollutants (OG- IT 11/06) and the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants.

In the period from January 2015 to December 2017, the Department performed analyses of the following parameters/substances: aldrin, dieldrin, endosulfan, endrin, hexachlorobenzene (HCB), heptachlor, chlordane, lindane, pentachlorobenzene, PCB and PCDD/PCDF.

A total of 1,157 water samples (including water for human consumption, surface water, groundwater or wastewater) were analysed for a total of 11,755 parameters (substances included in the list of POPs in the Republic of Croatia).

- A total of 479 water samples were assessed as correct, one as incorrect, and 97 results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.
- A total of 3,238 parameters analysed in water were assessed as correct, one as incorrect, and 701 results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.
- A total of 4,788 food samples (samples of fatty foods, fruits, vegetables and products) were analysed for a total of 34,157 parameters (substances included in the list of persistent organic pollutants in the Republic of Croatia).
- A total of 4,623 food samples were assessed as correct, zero as incorrect, and 165 results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.
- A total of 33,026 parameters analysed in food were assessed as correct, zero as incorrect, and 1,131 results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.
- A total of 1,659 samples of soil, waste and sludge were analysed for a total of 2,211 parameters (substances included in the list of persistent organic pollutants in the Republic of Croatia).
- A total of 828 samples of soil, waste or sludge were assessed as correct, zero as incorrect, and 831 results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.
- A total of 1,031 parameters analysed in soil, waste or sludge samples were assessed as correct, zero as incorrect, and 1,180 results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.
- In the period from January 2018 to December 2019, the Department performed analyses of the following parameters/substances: aldrin, dieldrin, endosulfan, endrin,

hexachlorobenzene (HCB), heptachlor, chlordane, lindane, pentachlorobenzene, PCB, as well as organochlorine dioxins and furans and similar polychlorinated biphenyls.

- A total of 1,041 water samples (including water for human consumption, surface water, groundwater or wastewater) were analysed for a total of 12,492 parameters (substances included in the list of POPs in the Republic of Croatia).
- A total of 498 water samples were assessed as correct, zero as incorrect, and 543 results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.
- A total of 5,976 parameters analysed in water were assessed as correct, zero as incorrect, and 6,516 results were assessed as undetermined because the maximum residue level for the relevant type of the analysed sample is not prescribed.
- A total of 2,300 food samples (samples of fatty foods, fruits, vegetables and products) were analysed for a total of 20,151 parameters (substances included in the list of persistent organic pollutants in the Republic of Croatia).
- A total of 2,300 food samples were assessed as correct, zero as incorrect.
- A total of 20,151 parameters analysed in food in were assessed as correct, zero as incorrect.

A total of 118 samples of soil, waste and sludge were analysed for a total of 1,154 parameters (POP- in the list of POPs in the Republic of Croatia).

A total of 283 parameters analysed in soil, waste or sludge samples were assessed as correct, zero as incorrect, and 871 results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.

The laboratory of the *Environmental Health Service, Department for Pesticides, of the Croatian Institute for Public Health, Zagreb*, is authorised by the competent ministries, *inter alia*, in areas specifically related to monitoring and analysis of substances included in the list of persistent organic pollutants pursuant to the Act on the Ratification of the Stockholm Convention on Persistent Organic Pollutants (OG- IT 11/06) and the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants.

In the period from January 2015 to December 2017, the Department for pesticides performed analyses of the following parameters/substances: aldrin, dieldrin, endosulfan, endrin, hexachlorobenzene (HCB), heptachlor, chlordane, lindane, dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCB).

A total of 3,295 water samples (including water for human consumption, surface water and groundwater) were analysed for a total of 36,245 parameters (substances included in the list of POPs in the Republic of Croatia).

- A total of 2,172 water samples were assessed as correct, 1,121 as incorrect, and two results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.
- A total of 933 food samples (samples of fruits and vegetables, cereals and confectionery products) were analysed for a total of 10,263 parameters (POP- in the list of POPs in the Republic of Croatia).

- A total of 722 food samples were assessed as correct, 44 as incorrect, and 167 results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.
- In the period from January 2018 to December 2019, the Department for pesticides performed analyses of the following parameters/substances: aldrin, dieldrin, endosulfan, endrin, hexachlorobenzene (HCB), heptachlor, chlordane, lindane, dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCB).
- A total of 1,464 water samples (including water for human consumption, surface water and groundwater) were analysed for a total of 36,245 parameters (substances included in the list of POPs in the Republic of Croatia).
- A total of 1,366 water samples were assessed as correct, 97 as incorrect, and one result was assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.
- A total of 244 food samples (samples of fruits and vegetables, cereals and confectionery products)) were analysed for a total of 10,263 parameters (substances included in the list of POPs in the Republic of Croatia).
- A total of 88 food samples were assessed as correct, five as incorrect, and 151 results were assessed as undetermined because the maximum residue level in the relevant type of the analysed sample is not prescribed.

3.7.13 GLOBAL MONITORING PLAN FOR POPS

The Global Monitoring Plan (GMP) for POPs is an important component of effectiveness evaluation of the Stockholm Convention. The Global Monitoring Plan provides a harmonised organisational framework for the collection of comparable monitoring data on the presence of POPs from all regions, in order to identify the trend in their levels, as well as to provide information on their regional and global environmental transport. The first GMP phase was completed in 2009, when the first regional monitoring reports/results were presented to the Conference of the Parties at its fourth meeting. The reports include baseline concentrations of POPs in the key matrices based on which changes can be monitored over a specific time period/trend. Furthermore, the Guidance on the GMP is also available, which supports the comparability and consistency of monitoring results and includes guidelines for the collection, analysis, and reporting of information and data. The Guidance also includes information on the collection and analysis of new POPs on the list, together with the implementation plan, and sets up the foundations for the implementation of coordinated monitoring activities within the Global Monitoring Plan.

3.8 CURRENT STATE OF PUBLIC INFORMATION, AWARENESS AND EDUCATION

The general Croatian public is not sufficiently informed about POPs and their adverse effect on humans and the environment. The issue of POPs in the Republic of Croatia is not adequately covered in primary and secondary schools' curricula. A sufficient level of information is present only in scientific institutions and among professionals whose activities are related to this issue,

as well as at the universities which cover the topic of POPs and their issues through their existing teaching programmes and courses, but not as a separate topic.

It is also important to provide sufficient information to the holders of civil protection system activities at local, regional and national level for the purpose of planning the implementation of measures in civil protection action plans.

Croatia is a Party to the UNECE Aarhus Convention and the Protocol on Pollutant Release and Transfer Registers (PRTR) to the Aarhus Convention and provides, in periodic national reports, information on the implementation of these international agreements in Croatia (https://mingor.gov.hr/o-ministarstvu-1065/djelokrug-4925/medjunarodna-suradnja/multilateralni-medjunarodni-sporazumi-1138/1138).

Consequently, and in accordance with the EU legislation, a legislative framework has developed that contributed to the transparency and inclusion of citizens in environmental policies. Different databases and browsers have developed that provide information on pollutants and the state of the environment in Croatia, and are easily accessible to the public. A system was developed that enables public participation in decision-making and provides access to justice in environmental matters without the cost of reviewing decisions. The Code of Practice on Consultation with the Interested Public in Procedures of Adopting Laws, Other Regulations and Acts, adopted by the Government of the Republic of Croatia, provides guidance, i.e. establishes general principles, standards and measures for consultation with the interested public in procedures of adopting laws, other regulations and acts of state administration bodies, which regulate the issues and form positions that are of general interest (protection and promotion of human rights, public services, judiciary, environmental protection, etc.) (OG 140/09).

3.9 REPORTING MECHANISMS PURSUANT TO ARTICLE 15 OF THE STOCKHOLM CONVENTION ON THE MEASURES TAKEN AND EXCHANGE OF INFORMATION BETWEEN THE PARTIES

Because of a multi-disciplinary approach to the regulation of POPs, a working group for monitoring the fulfilment of obligations under NIP was established, consisting of representatives of all state administration bodies responsible for the implementation of the Stockholm Convention. The MESD was appointed the national focal point for the exchange of information with the Stockholm Convention Secretariat as well as the Parties to the Stockholm Convention. This ministry regularly exchanges and submits information to the Stockholm Convention Secretariat, which it collects from competent institutions and it, among other things, submitted in 2008 the first, in 2010 the second, in 2014 the third and in 2018 the fourth Report on the implementation of the Stockholm Convention on Persistent Organic Pollutants in the Republic of Croatia pursuant to Article 15 of the Stockholm Convention.

3.10 ACTIVITIES AND WORK OF NON-GOVERNMENTAL ORGANISATIONS

There are currently several associations in the Republic of Croatia that are indirectly dealing with POPs, through their engagement in areas of air and water protection and waste management. The Committee for monitoring the implementation of the NIP revision project was established in July 2014, and all potential stakeholders, including representatives of some non-governmental organisations/associations, were appointed and actively participated in its work; in July 2017, the Working Group for monitoring the fulfilment of obligations was established under the Decision on the adoption of the Second NIP.

3.11 OVERVIEW OF TECHNICAL INFRASTRUCTURE FOR POPS ASSESSMENT, MEASUREMENT, ANALYSIS, ALTERNATIVE AND PREVENTION MEASURES, MANAGEMENT, RESEARCH AND DEVELOPMENT

3.11.1 NATIONAL CAPACITIES FOR MONITORING POPs RELEASES INTO THE ENVIRONMENT

There are laboratories in the Republic of Croatia equipped for determining organochlorine pesticides and PCBs and, according to the latest available information, also equipped for monitoring PCDD/PCDF levels. Such measurements are also possible in cooperation with internationally verified foreign institutions. Monitoring of PCDD/PCDF emissions into the air from stationary sources can be carried out by a small number of legal entities in the Republic of Croatia which have obtained a permit from the ministry responsible for environmental protection. The Croatian Institute for Public Health, Croatian Veterinary Institute, Teaching Institute for Public Health "Dr. Andrija Štampar" and to some extent certain regional public health institutes possess the equipment and knowledge for determining the levels of other POPs. It should also be noted that the public scientific institutes – Ruđer Bošković Institute and Institute for Medical Research and Occupational Health possess adequate equipment, have highly educated staff in this area and are able to carry out such measurements, which has to date been proven by numerous research results. However, there is a need for more detailed research and information, as well as capacity building in scientific and research institutions related to research and analysis methodology for the so called new POPs.

3.11.2 NATIONAL CAPACITIES FOR MONITORING THE EFFECTS ON HUMAN HEALTH

Measurements of the concentrations of organochlorine pesticides and PCBs in blood and human milk are carried out in the Republic of Croatia, while analyses of PCDD/PCDF levels were, until recently, mostly carried out in cooperation with foreign institutions, but it will be possible to carry them out in the Republic of Croatia. The Republic of Croatia has a sufficient number of medical doctors and occupational medicine specialists who should, on the basis of the education they received, be able to recognise health changes caused by organochlorine compounds.

The Croatian health system does not have organised networks for collecting data related to the exposure and health problems caused by POPs, but this is mainly performed within the framework of specific projects.

The European Human Biomonitoring Initiative (HBM4EU) is a project implemented under the HORIZON2020 programme. This is a joint project of EU Member States and the European Commission, the main objective of which is to coordinate and advance human biomonitoring in Europe. It will run for five years with the aim to, by establishing a platform of existing knowledge, research and capacity building, provide evidence of the exposure of citizens to chemicals and potential health effects. HBM4EU directly contributes to improving the health and well-being of the population and establishing positive policies. The official start of the project was on 1 January 2017.

Within the project, a national team of the Republic of Croatia for coordinating the implementation of the HBM4EU project, the members of which are the Croatian Institute for Public Health, Institute for Medical Research and Occupational Health, and the Ministry of Health. More information on the project is available on the following links: https://www.hzjz.hr/medunarodna-istrazivanja/europska-inicijativa-za-humani-biomonitoring-hbm4eu/ i https://www.hbm4eu.eu/. First round (2016) priority substances within the project are, among others, the following: PAHs, per- and poly-fluorinated compounds (PFAS) and flame retardants (including POPs flame retardants), while pesticides were included as a group of compounds in 2017.

3.11.3 PROPOSAL FOR IMPROVEMENT OF EXISTING PRACTICES

Although data about these compounds in humans is available, studies have not covered all Croatian regions. In order to estimate the level of burden in the population, research should be expanded to more regions, taking into account the lifestyle of individuals, primarily their dietary habits. It would be interesting to monitor groups of inhabitants living in the vicinity of destroyed industrial plants where it is known that PCB contamination occurred. Similarly, it would be useful to monitor the population in the vicinity of sources of contamination, especially with PCDD/PCDF, such as the areas surrounding industrial plants (metal and metal manufacturing facilities, cement plants, heating plants and landfills), as well as professionally exposed individuals (fire-fighters, workers in sub-station workshops, workers who handle PCB equipment).

Out of the POPs that are the subject of the First, Second and Third NIP, the least results were collected about PCDD/PCDF in any media. Hence, further measurements should be directed primarily towards evaluation of these compounds as well as new POPs in samples taken from the environment and humans, taking into account the regional distribution.

Particular attention should be paid to a more detailed analysis of capabilities for testing the so-called new POPs, as well as those that are under consideration (POPRC) in all environmental components and matrices, by using certain comparable methodologies. The obtained results

would serve as an expert basis for proposing new measures/activities. It is recommended to strengthen cooperation between scientific research institutions and policy makers, and more active participation and exchange of information in the subsidiary bodies of the Stockholm Convention.

3.12 IDENTIFICATION OF THE PART OF POPULATION OR ENVIRONMENT WITH ESTABLISHED NEGATIVE IMPACT CAUSED BY POPS

The analysis of existing research results in the Republic of Croatia shows no exact indicators that there are clearly defined risk groups within a group of persons occupationally exposed to POPs. Given that pesticides containing POPs are no longer used in the Republic of Croatia, it is to be expected that there would be no work-related exposure to pesticides containing these substances.

Considering the nature of their job, workers in sub-station workshops, i.e. those who make and repair PCB-filled transformers and capacitors are exposed to PCB. It can be expected that, during potential accidents involving PCB-filled transformers and capacitors, local pollution would occur whose extent is hard to predict. Such accidents usually involve accidental exposure of a certain part of the population, and those who handle such equipment, as well as fire-fighters and persons carrying out remediation, are certainly the risk group. Fire- fighters belong to the risk group because of their exposure to PCDD/PCDF. It is a known fact that any fire generates PCDD and PCDF and, due to the nature of their work, fire-fighters are persons most exposed to post-fire smoke. In addition to fire-fighters, persons from the civil protection system also participate in response to different accidents, so they belong to the risk group as well. Furthermore, persons who can be exposed to POPs include employees in waste management, especially those managing waste that is proven to contain or potentially contains POPs, e.g. employees who work in decontamination of equipment containing PCB, recovery of EEE, end-of-life vehicles, etc. In the Republic of Croatia, there is no data on PCDD and PCDF concentrations in the blood of fire-fighters, but similar is true for many other countries.

As mentioned before, studies of groups in the general population show that the highest levels of POPs occur in infants, who are considered a vulnerable group. The daily intake of POPs by infants through breast milk is decreasing and more and more rarely exceeds the acceptable daily intake (ADI) recommended by international organisations. However, this intake is not considered harmful even if it exceeds ADI because the period of breast-feeding is relatively short relative to the total lifespan.

3.13 RELEVANT MECHANISMS FOR THE MANAGEMENT OF CHEMICALS ON THE MARKET AND NEW CHEMICALS, INCLUDING FULL LIFE-CYCLE CHEMICAL AND WASTE MANAGEMENT SYSTEMS AND CIRCULAR ECONOMY, AND

DEVELOPMENT AND RECOMMENDATIONS OF SYNERGISTIC MECHANISMS FOR OTHER INTERNATIONAL AGREEMENTS

As already mentioned, legislation regulates the placing on the market, application/use and production of chemicals and products containing chemicals/substances such as:

- medications for human and veterinary use
- produce and general use products and substances that come in direct contact with food
- cosmetics
- plant protection products
- dangerous chemicals, etc.

State administration bodies responsible for the management and control of chemicals in the Republic of Croatia are:

- ministry competent for health (registration, authorisation, evaluation and ban/restriction of chemicals, classification, labelling and packaging of chemicals, export and import of banned or severely restricted chemicals, biocidal products, detergents, Rotterdam and Minamata Convention)
- ministry competent for environmental protection and economy (Stockholm Convention, Basel Convention, LRTAP Convention, Aarhus Convention and PRTR Protocol, ESPOO Convention, UNEP Focal Point; chemical weapons, EEE products)
- ministry competent for agriculture (plant protection products (PPP))
- ministry competent for finance – Customs Administration (export and import of chemicals, cooperation with MH)

The ministry competent for health is responsible for carrying expert tasks of risk assessment, evaluation of substances, proposals regarding restrictions and prohibitions, and, in the execution of these tasks, it cooperates with authorised expert institutions such as the Croatian Institute for Public Health and the Institute for Medical Research and Occupational Health, and others.

The Ordinance on the manner of keeping the register of chemicals and the manner and deadlines for submission of data from the register prescribes the method for keeping the register of chemicals that are produced and imported, that is, introduced into the territory of the Republic of Croatia.

Under the Act on the Implementation of the POPs Regulation, inspectional supervision of the implementation of the POPs Regulation is performed by sanitary inspectors, water inspectors, agricultural inspectors and environmental inspectors of the State Inspectorate pursuant to the regulations governing their respective scope and powers.

4 STRATEGIES AND ACTION PLANS

4.1 POLICY OF THE GOVERNMENT OF THE REPUBLIC OF CROATIA AND THE NIP IMPLEMENTATION STRATEGY

Under the Act on the Ratification of the Stockholm Convention on Persistent Organic Pollutants, the division of responsibilities between state administration bodies competent for environmental protection, agriculture, forestry and water management, health and the economy, labour and entrepreneurship was defined.

The ministry competent for environmental protection was, pursuant to item II of the Decision on the adoption of the National Implementation Plan for the Implementation of the Stockholm Convention on Persistent Organic Pollutants and the Decision on the adoption of the Second National Implementation Plan for the Implementation of the Stockholm Convention on Persistent Organic Pollutants, in cooperation with other competent bodies, prepares and submits a biennial report on the fulfilment of obligations to the Government of the Republic of Croatia.

So far the following reports on the implementation were prepared:

- First report, for the period January 2009 – December 2010
- Second report, for the period January 2011 – December 2012
- Third report, for the period January 2013 – December 2014
- Fourth report, for the period January 2015 – December 2017
- Fifth report, for the period January 2018 – December 2019.

The reports are available to the public on the website of the ministry competent for environmental protection and economy.

In line with the conclusion from the Second NIP, the working group has been expanded, and now includes the ministry competent for science, ministry competent for defence, ministry competent for occupational health and safety, Customs Administration and representatives of scientific research institutions, with the aim of more effective coordination and exchange of information.

The ministry competent for environmental protection and economy is also responsible for the delivery of the revised/Third NIP to the Stockholm Convention Secretariat. Following the above, the ministry competent for environmental protection and economy is charged with the task to, in cooperation with all involved stakeholders responsible for the implementation of activities from the revised/Third NIP, continue reporting biannually to the Government of the Republic of Croatia on its implementation.

Besides the obligation to manage POPs with the aim of protecting its people and the environment in its territory, as a member of the international community the Government of the Republic of Croatia undertakes measures to protect the environment of the neighbouring countries from the outcomes of the long-range transport of POPs.

Informing and active participation of the public, potentially vulnerable groups and professionals in resolving the issues related to POPs is already a part of existing policies of the Government of the Republic of Croatia. Therefore, the management of chemicals throughout their life cycle in the form of an active substance/product until it becomes waste is aimed at increasing the awareness about the hazards from bad and uncontrolled management of POPs or from the activities that generate them as by-products.

The Stockholm Convention came into force in the Republic of Croatia on 30 April 2007, which confirmed the country's commitment to assume obligations arising from it. The NIP's overall objective, as of the Stockholm Convention itself, is to protect human health and the environment from negative effects of POPs.

The most important priority objectives that are to be achieved through NIP implementation are:

- elimination of all potential sources of PCB emissions into the environment, as well as of the other so-called new POPs
- systematic control of the levels of POPs in all environmental components
- restriction and control of POPs emissions from unintentional release/production, encouraging the application of BAT solutions that result in the reduction or cessation of POPs releases from stationary sources; and
- information dissemination and informing the wider public about the impact of POPs on human health and the environment, especially the potential sources of the so-called new POPs, ways of their intake into the human body, measures to be taken to avoid exposure and procedures to be taken in the case of accident, as well as environmentally sound waste management.
- informing local and regional self-government units in whose territory POPs sites are located.

NIP contributes to the implementation of environmental protection strategic and planning documents (National Environmental Action Plan, Strategy for Sustainable Development of the Republic of Croatia).

The planned gradual reduction of POPs in the environment presupposes active participation of the public and all stakeholders who will participate in disseminating information on POPs effects and the necessity for the reduction of their use and control of their unintentional production. Public education is an indispensable part of the activities, and will be realised through the media, organisation of workshops/seminars, expert panels, preparation of various publications (brochures/flyers/guidelines) and distribution to target and vulnerable groups, etc. Already during the NIP revision process, a brochure containing basic information about the Stockholm Convention and the so-called new POPs was produced with the assistance from UNEP.

The results of monitoring POPs concentrations in the environment will be/are available to the public through the MESD's means of communication (website, publications, reports for the Government of the Republic of Croatia, and technical reports from competent state administration bodies) in accordance with the current legislation related to international and national obligations, and public information.

A basic approach that will be used during the implementation of NIP is the joint and comparable implementation of all measures and activities, with the aim to ensure appropriate NIP implementation and avoid overlapping or discrepancy of implementation activities.

During the implementation of the revised/Third NIP, each institution/body/organisation will periodically, on an annual basis, report on the implemented measures/activities from NIP within the scope of its competence, i.e. the progress in the implementation of activities in the proposed time frame, so that the ministry competent for environmental protection and economy could prepare the biennial Implementation Report, and report to the Government of the Republic of Croatia thereon.

4.2 ACTIVITIES, STRATEGIES AND ACTION PLANS

The main limitations in defining specific activities, strategies and action plans are related to the following:

- responsibilities of individual state administration bodies and public institutions cannot be defined by action plans but can only be proposed, and it is uncertain what will fall under the competence of individual institutions
- financing dynamics depend on the state budget as well as on the financial resources of local self-governments and the priorities given in the allocation, and
- financing the implementation of an action plan also depends on the willingness of the international community to provide financial assistance in carrying out certain activities, or funding opportunities from other sources of financing.

One of the key methodological issues in the assessment of costs for certain activities for the implementation of the Third NIP is to separate these costs from other environmental protection costs. Very often, POPs-related impacts manifest together with the impacts of other substances, and therefore measures and instruments for their prevention or mitigation are applied simultaneously. Considering the above, proposed measures for the continued implementation of the Stockholm Convention commitments, by particular activities, along with the definition of the competent authorities, with expert and technical support, deadlines and approximate estimates of required financial resources are given below.

4.2.1 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES, AND WASTES OF POPS PESTICIDES (ANNEX A, PART I)

As mentioned before, pesticides containing POPs are not produced in the Republic of Croatia, nor are active substances imported from which ready formulations for placing on the market would be produced. Today, there are numerous preparations registered in the Republic of Croatia that have gradually replaced the toxicologically unfavourable pesticides, including POPs. Since the production of pesticides containing POPs is prohibited in the Republic of Croatia, future production is not anticipated nor possible.

Given the fact that the current status complies with requirements of the Stockholm Convention, no additional activities have been proposed nor is there a need to improve current practices and regulatory framework for management and handling of pesticides.

The only area for which improvement is proposed is the systematic monitoring of pesticides containing POPs in the environment (including the identification of contaminated sites) aimed at determining concentrations of these compounds and thereby confirming the conclusion of the latest inventory that pesticides containing POPs do not represent a real/significant problem/risk in the Republic of Croatia with regard to their impact on human health and the state of the environment.

During the NIP revision process, the Institute for Plant Protection of the Croatian Centre for Agriculture, Food and Rural Affairs (now the Centre for Plant Protection, Croatian Agency for Agriculture and Food) prepared the expert background document "Report on the use of lindane and endosulfan in the territory of Republic of Croatia", in which it was determined that the largest quantities of lindane were applied in Osijek-Baranja and Vukovar-Srijem County, while endosulfan was frequently used in wine-growing areas of the Republic of Croatia. The mentioned report concluded there is a need to conduct more extensive research by which residue could also be found in soil, which greatly depends on the quality of soil and crops that were later grown. Endosulfan residue could be found on the evergreen plants in the vicinity of the treatment spot. Given the above, the “Centre for Plant Protection, CAAF”, and other competent bodies/institutions are charged with the task of developing the Programme for monitoring lindane and endosulfan substances and basic parameters in the soil with a list of activities, and related to soil sampling in 12 Croatian counties, along with consideration of the need for potential expansion to other counties. The aim of this programme would be to develop a trend of the presence of lindane and endoslufan, or determine the need for further monitoring in view of the degree of potential risk to human health and the environment. Soil samples intended for monitoring the listed substances were collected in the previous period, and analysis of their presence in soil is planned during the next period. As regards pesticides with POPs characteristics, systematic monitoring is conducted for the following active substances: aldrin, dieldrin, alpha-HCH, beta-HCH, eldrin, heptachlor, HCB, endosulfan, lindane, DDT. According to the National Programme for monitoring pesticide residues, in the reporting period 2108–2019, none of these active substances were detected in concentrations above the maximum residue level of pesticides.

The 2018 National Programme for monitoring pesticide residues in and on food of plant and animal origin included the monitoring of pesticide residues in 28 products, 13 of which in accordance with the Commission Implementing Regulation (EU) 2017/660, which also includes products originating from organic farming (for each of the products specified in the said Regulation) and baby food. In addition to these products, 13 products for which previous monitoring programmes determined MRL exceedances or unauthorised use were included (apples, tomatoes, strawberries, head cabbages, lettuces, carrots, oranges, pears, celery root, leeks, onions, cauliflowers and kiwi fruits), as well as two products that are also important in the population’s diet (blueberries and cucumbers). A total of 595 samples were analysed. Samples of plant origin were analysed for 337–455 active substances, and samples of animal

origin for 64 active substances; 356 (59.83 %) samples contained no pesticide residues (below the limit of determination). Pesticide residues in permitted concentrations (below MRL) were found in 226 samples (37.98 %)), while residues exceeded MRL in six samples (1.27 %).

The 2019 National Programme for monitoring pesticide residues in and on food of plant and animal origin included the monitoring of pesticide residues in a total of 20 products of plant and animal origin, 13 of which were selected in accordance with the Commission Implementing Regulation (EU) 2018/555, and seven products for which previous monitoring programmes determined MRL exceedances or unauthorised use were added: oranges, pears, blueberries, bananas, grapefruits, celery and kiwi fruits. A total of 290 samples were analysed. No pesticide residues (above the limit of determination) were found in 192 samples (66.21 %), pesticide residues below MRL were found in 93 samples (32.07 %) and pesticide residues above MRL were found in six samples (2.07 %).

Considering the obligations under the Stockholm Convention regarding pesticides containing POPs, it is clear that the requirements relating to the production, use, import and export have already been met.

4.2.2 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, IDENTIFICATION, LABELLING, DECONTAMINATION, STORAGE AND DISPOSAL OF PCBS AND EQUIPMENT CONTAINING PCBS (ANNEX A, PART II)

During the preparation of the PCB inventory, it was established that in the Republic of Croatia there was no production of PCBs, but there was use of equipment containing PCBs.

The requirements listed in the Stockholm Convention regarding the PCB management and removal could be summarised as follows:

- remove equipment containing PCBs at the latest by 2025
- make significant efforts to identify, label and remove from use equipment containing more than 0.05 % of PCBs in relation to the total mass of fluid and volumes greater than five litres
- prohibit import and export of equipment containing PCBs, except in the case of waste disposal in an environmentally sound manner
- prohibit, except for the purposes of servicing and maintenance, recovery of liquids with a PCB content above 0.005 % for the purpose of reuse in other equipment
- achieve sustainable management of waste liquids containing PCBs and equipment contaminated with PCBs having a PCB content above 0.005 % as soon as possible but no later than 2028, and
- every five years prepare a report on the progress in eliminating PCBs and submit it to the Conference of the Parties.

The priority (specific) objectives for this activity are:

- labelling, identification and removal of equipment containing PCBs (> 50 mg/l) at the latest by 2025, and the disposal of liquids/equipment containing PCBs > 50 mg/l in an

environmentally sound manner in line with the Stockholm Convention requirements, or until deadlines set by the national legislature, and

- education and raising awareness of target groups.

4.2.2.1 REMOVAL OF EQUIPMENT CONTAINING PCBS UNTIL 2025

Proposed measures:

- on the basis of reports on PCB equipment in use, determine possible priority sites, abandoned/unprotected sites, and
- conduct the removal of equipment from use or the disposal of equipment containing PCBs.

It is necessary to carry out a detailed analysis of the equipment containing PCBs according to type, condition, age, location, etc. based on the collected reports on equipment. Priority, high risk sites should be assessed, if they exist, and the equipment should be removed from them as quickly as possible. The Framework plan for removing the equipment containing PCBs should be developed based on the data submitted by the holders of the equipment and their intended plans for decontamination and disposal, by which a timeframe for the removal of all equipment containing PCBs from the territory of the Republic of Croatia would be set.

4.2.2.2 EDUCATION AND RAISING AWARENESS OF TARGET GROUPS

Proposed measures:

- educating entities in order to improve the fulfilment of the assumed obligations regarding the replacement and disposal of equipment containing PCBs.

Education, as well as dissemination and availability of information, are the key preconditions for an effective implementation of the plan. The timely availability of information should be ensured for all interested parties.

For the purpose of raising awareness and informing the public about PCBs, the Guide for the safe handling of equipment and management of waste containing the persistent organic pollutant PCB in an environmentally sound manner was prepared, containing general information on the properties and characteristics of PCBs, their health and environmental impact, and possible routes and risks of exposure. The Guide is available to the public on the website of the ministry competent for environmental protection and economy.

Other than the prescribed obligations, at the moment there are no unique instructions for identification, decontamination, use, transport, storage and disposal of equipment containing PCBs available to the holders of equipment. To ensure compliance with the requirements under the Stockholm Convention related to the handling of equipment and waste containing PCBs, it is proposed to draft guidelines for the holders of equipment that would contain information on the requirements for:

- identification and labelling of the equipment containing PCBs in operation (method of determining the PCB content in the equipment suspected to contain it)

- use of equipment containing PCBs (functioning of the equipment, areas where it can(not) be used)
- proper/safe handling of equipment containing PCBs
- transportation of equipment containing PCBs
- management of stockpiles of PCBs and equipment containing PCBs
- safe handling and disposal of PCB waste in an environmentally sound manner
- labelling of PCB waste
- temporary storage of PCB waste at the production site
- procedure in case of PCB leakage from equipment in operation or equipment out of use and
- risk assessment and providing for a procedure in case that the consequences of an accident exceed the limits of the plant area because in such cases the civil protection system is activated.

Table 4.2-1 provides a description of the measures and activities to be implemented in order to fulfil all the obligations under the Stockholm Convention relating to the management of PCBs in the Republic of Croatia, identification of the institutions responsible for their implementation, as well as the time schedule and the estimated necessary funds.

Table 4.2-1: Activity: Production, import and export, use, identification, labelling, decontamination, storage and disposal of PCBs and equipment containing PCBs

OBJECTIVES/MEASURES	IMPLEMENTING AGENCY (PROFESSIONAL AND TECHNICAL SUPPORT)	IMPLEMENTATION PERIOD	COSTS (HRK)
MAIN OBJECTIVE: IDENTIFICATION AND SAFE REMOVAL OF EQUIPMENT CONTAINING PCBs IN THE TERRITORY OF THE REPUBLIC OF CROATIA			
Specific objective 1: Removal of equipment containing PCBs until 2025, monitoring			
Measure 1.1: Record keeping and preparation of periodical reports on equipment containing PCBs, and PCBs (including information about disposed PCBs and remaining PCBs/equipment)	MESD	continuously	0
Measure 1.2: Carry out removal from use/disposal of equipment containing PCBs	Mandatory for holders/owners of equipment (MESD; control over implementation – State Inspectorate)	no later than 2025/2028	1,600,000
Measure 1.3: Coordination of competent bodies in the remediation of PCB equipment	MESD/MA	by 2028	0
Specific objective 2: Education and raising awareness of target groups			
Measure 2.1: Education of entities on the obligation and replacement of equipment containing PCBs and preparation of instructions for equipment holders	MESD (MI – Civil Protection)	2022–2023	30,000.00
TOTAL			**1,630,000**

Within the workshop on raising awareness about the harmful effects of POPs and possibilities to improve the current system of monitoring POPs in the environment, the ministry competent for environmental protection issued the "Guide for the safe handling and management of waste containing PCBs in an environmentally sound manner". The said Guide can be found on the Ministry's website.

4.2.3 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES AND WASTES OF HEXABDE AND HEPTABDE (ANNEX A, PART IV), AND TETRABDE AND PENTABDE (ANNEX A, PART V) AND HBB, WHERE APPLICABLE (ANNEX A, PART I)

PBDE or their commercial mixtures are not produced in the Republic of Croatia, however, the use of products/equipment containing these substances has been assumed. Since the production of HBB was discontinued in the 1970s, the majority of products and articles that contained HBB have been discarded/disposed of long ago. Therefore, this chemical is not considered significant for the preparation of the inventory.

The requirements regarding the so-called new POPs, including PBDE, are as follows:

- implementation of control measures for each chemical listed in the Stockholm Convention (Articles 3 and 4)
- preparation of the inventory of chemicals in stockpiles (Article 6)
- preparation of a revised and updated NIP (Article 7)
- inclusion of "new" POPs, including PBDE, in reports (Article 15), and
- inclusion of "new" POPs, including PBDE, in the effectiveness evaluation programme (Article 16).

Specific measures and activities are identified that need to be carried out in accordance with defined priorities and objectives in order to successfully implement all obligations related to the management of PBDE in the Republic of Croatia. The main objective is reduction, gradual phase-out of use and final cessation of use of equipment that contains or is contaminated with PBDE, preventing release of PBDE into the environment, and ensuring conditions for the disposal of PBDE waste in an environmentally sound manner.

Specific objectives are as follows:

- raising awareness and strengthening technical capacities related to the safe management of PBDE, raising awareness of target groups on potential sources and harmful effects on health and the environment, information on the methods of environmentally sound management of waste that contains them, and its systematic removal, and
- information and analysis of capabilities and methodology for the rapid detection of PBDE in used imported EEE, furniture and vehicles.

4.2.3.1 RAISING AWARENESS AND STRENGTHENING TECHNICAL CAPACITIES FOR PBDE MANAGEMENT

Proposed measure:

- revise the developed preliminary inventory with the aim of preparing a more detailed inventory of PBDE in the Republic of Croatia to achieve, in the upcoming years, a decreasing trend in articles that potentially contain them, including a report on stockpiles (for the purposes of regular reporting in line with the requirements under the Stockholm Convention).

4.2.3.2 EDUCATION AND RAISING AWARENESS OF TARGET GROUPS

Proposed measure:

- prepare educational activities for further raising of awareness on the harmful effects of PBDE and possibilities to improve the current monitoring system, and
- strengthening interdepartmental cooperation and cooperation with scientific research institutions.

Instructions should be based on the technical guidelines for the environmentally sound management of waste containing POPs (UNEP-CHWCOP.12-BC-12/3).

Table 4.2-2 provides a description of the measures and activities to be implemented in order to fulfil all the obligations under the Stockholm Convention relating to PBDE management in the Republic of Croatia, identification of the institutions responsible for their implementation, as well as the time schedule and the estimated necessary funds.

Table 4.2-2: Activity: Production, import and export, use, stockpiles and wastes of hexaBDE, heptaBDE, tetraBDE, pentaBDE, and HBB

Objectives/Measures	IMPLEMENTING AGENCY (PROFESSIONAL AND TECHNICAL SUPPORT)	IMPLEMENTATION PERIOD	COSTS (HRK)
MAIN OBJECTIVE: IDENTIFICATION AND SAFE REMOVAL OF PRODUCTS CONTAINING PBDE IN THE TERRITORY OF THE REPUBLIC OF CROATIA			
Specific objective 1: Raising awareness and strengthening technical capacities for PBDE management			
Measure 1.1: Revise the preliminary inventory with the aim of preparing a more detailed inventory of PBDE in the Republic of Croatia, and prepare a Report for the purposes of regular reporting in accordance with obligations under the Stockholm Convention	MESD (CIPH – Toxicology Department/CBS/Customs Administration)	continuously	0
Specific objective 2: Education and raising awareness of target groups			
Measure 2.1: Continuation of educational activities	MESD (MH/CIPH – Toxicology Department/MI – Civil Protection)	2021	10,000
TOTAL			**10,000**

Within the workshop on raising awareness about the harmful effects of POPs and possibilities to improve the current system of monitoring POPs in the environment, the ministry competent for environmental protection issued the “Guide for the safe handling and management of waste

containing persistent organic pollutants (POPs – PBDE, PFOS and HBCD)". The said Guide can be found on the MESD's website.

4.2.4 ACTIVITY: INSTITUTIONAL AND LEGAL STRENGTHENING MEASURES

During the preparation of the POPs inventory, institutional responsibilities and regulatory frameworks were specified for each segment of POPs treatment and management (production, use, import, export, monitoring, waste management, control, etc.).

In the EU accession process, environmental legislation was fully transposed into national legislation and therefore this document does not include additional measures related to the changes in the legislative framework in the Republic of Croatia in the field of POPs.

However, possible modifications in the terms of the mechanism of data collection, amendments to forms for reporting purposes etc. are proposed for consideration.

Representatives responsible for the implementation of all three related Conventions closely linked by issues of safe management of chemicals and waste management, the Stockholm, Basel and Rotterdam conventions, participated in all synergy conferences of the parties, as well as regular Conferences of the Parties, and will continue to participate in them in the future. Meetings related to other similar issues such as safe management of chemicals at the international level are systematically monitored; Strategic Approach to International Chemicals Management (SAICM), Convention on mercury (Minamata Convention), and the LRTAP Convention. The Republic of Croatia continues to strongly support activities related to SAICM.

A representative of the Republic of Croatia was appointed in the CEE-Environmental Network for Optimizing Regulatory Compliance on Illegal Traffic related to issues under the Basel Convention.

Furthermore, representatives of the Republic of Croatia also actively participate in working groups within ECHA that work to determine the method of risk management and their analysis.

The inclusion and more active participation of scientific and professional institutions in the work of subsidiary bodies of the Stockholm Convention, as well as of related conventions, with the aim of capacity building is proposed.

Specific activities with related time schedules to ensure the implementation of necessary changes in the institutional framework of the Republic of Croatia are proposed in the Chapters below.

The areas requiring additional adjustments are as follows:

- sites contaminated with POPs
- systematic monitoring of POPs in the environment, food and humans
- analysis of products in use, in stockpiles and waste (end-of-life vehicles, EEE, textile, furniture, carpets, plastics, rubber products...) that might contain the so-called new POPs

- education and information activities concerning the methods of environmentally sound management of waste containing POPs and the safe removal of contaminated materials/products
- raising awareness of target groups
- improvement/expansion of the existing mechanism for information exchange at the national level, and
- preparation of the risk assessment in accordance with Annex E to the Act on the Ratification of the Stockholm Convention on Persistent Organic Pollutants (OG 11/06).

4.2.5 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES, AND WASTES OF DDT (ANNEX B) IF USED IN THE COUNTRY

No special action plan was prepared nor further activity relating to DDT proposed within the NIP revision process, given that it was assessed that DDT did not present a problem in the Republic of Croatia regarding the potential risk to health and the environment (it is not produced or imported and its use is prohibited since 1972).

4.2.6 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES, AND WASTES OF PFOS, ITS SALTS AND PFOSF (ANNEX B, PART III)

During the preparation of the inventory, no production, import or export of PFOS and its derivatives nor current use were recorded in the Republic of Croatia. Ten to twenty years ago firefighting foam that contained PFOS was very popular in the Republic of Croatia. There is no precise data on existing stockpiles or the quantities of that foam used. It should be noted that the inventory of firefighting foams is very extensive, involving many stakeholders and requiring thorough planning.

It would therefore be advisable, as mentioned before, that firefighting services carry out a detailed assessment of firefighting foams used and of those on stockpiles.

The Stockholm Convention requirements regarding the so-called new POPs, including PFOS, are:

- implementation of control measures for each chemical listed in the Stockholm Convention (Articles 3 and 4)
- preparation of the inventory of chemicals in stockpiles (Article 6)
- preparation of a revised and updated NIP (Article 7)
- inclusion of "new" chemicals, including PFOS, in reports (Article 15), and
- inclusion of "new" chemicals, including PFOS, in the effectiveness evaluation programme (Article 16).

In order to successfully implement all obligations under the Stockholm Convention relating to PFOS management in the Republic of Croatia, specific measures and activities were identified to be carried out in accordance with the defined priorities and objectives. The main objective is

to reduce, gradually phase out and ultimately stop the utilisation of PFOS and equipment containing or contaminated with PFOS, to prevent release of PFOS into the environment, and ensure conditions for the disposal of waste containing PFOS in an environmentally sound manner.

Specific objectives are as follows:

- strengthening of technical capacities for PFOS/PFOSF management, and
- education and raising awareness of target groups.

4.2.6.1 STRENGTHENING OF TECHNICAL CAPACITIES FOR PFOS/PFOSF MANAGEMENT

Proposed measure:

- revise the preliminary inventory with the aim of preparing a more detailed inventory of PFOS/PFOSF in the Republic of Croatia to achieve, in the upcoming years, a decreasing trend in articles that potentially contain them, including a report on stockpiles (for the purposes of regular reporting in line with the requirements under the Stockholm Convention).

4.2.6.2 EDUCATION AND RAISING AWARENESS OF TARGET GROUPS

Proposed measure:

- prepare additional information material on potential sources, harmful effects on health and the environment, substitutes and how to manage waste that potentially contains them in an environmentally sound manner in accordance with the Guide for the safe handling and management of waste containing persistent organic pollutants (POPs – PBDE, PFOS and HBCD).

Further to education and raising awareness of target groups, the Second NIP proposed the measure of preparing information material on potential sources, harmful effects on health and the environment, substitutes and how to manage waste that potentially contains them in an environmentally sound manner.

The Guide for the safe handling and management of waste containing PCBs in an environmentally sound manner (POPs – PBDE, PFOS and HBCD) was prepared based on the technical guidelines for the environmentally sound management of waste containing POPs (UNEP-CHWCOP.12-BC-12/3).

Table 4.2-3 provides an overview of specific objectives and activities for PFOS management that need to be realised in order to ensure the implementation of the Stockholm Convention.

Table 4.2-3: Activity: Production, import and export, use, stockpiles and wastes of PFOS, its salts and PFOSF

OBJECTIVES/MEASURES	IMPLEMENTING AGENCY (PROFESSIONAL AND TECHNICAL SUPPORT)	IMPLEMENTATION PERIOD	COSTS (HRK)
MAIN OBJECTIVE: IDENTIFICATION AND SAFE REMOVAL OF PRODUCTS CONTAINING PFOS/PFOSF IN THE REPUBLIC OF CROATIA			
Specific objective 1: Strengthening of technical capacities for PFOS/PFOSF management, monitoring			
Measure 1.1: Revise the preliminary inventory with the aim of preparing a more detailed inventory of PFOS in the Republic of Croatia, and prepare a Report for the purposes of regular reporting in accordance with the obligations under the Stockholm Convention	MESD (CIPH – Toxicology Department/CBS/Customs Administration)	continuously	0
Measure 1.2: Control of extinguishing agents produced by 2010	MESD in cooperation with the Croatian Firefighting Association	priority	0
Specific objective 2: Education and raising awareness of target groups			
Measure 2.1: Continued education	MESD (MH/CIPH – Toxicology Department/MI – Civil Protection)	continuously	40,000
TOTAL			**40,000**

Within the workshop on raising awareness about the harmful effects of POPs and possibilities to improve the current system of monitoring POPs in the environment, the ministry competent for environmental protection issued the "Guide for the safe handling and management of waste containing persistent organic pollutants (POPs – PBDE, PFOS and HBCD)". The said Guide can be found on the Ministry's website.

4.2.7 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES AND WASTES OF HBCD

The preliminary inventory established that there was no available data on the production of HBCD in the Republic of Croatia, however, the use of HBCD was confirmed. Companies that imported/used HBCD are in the process of substituting HBCD with other less harmful alternative solutions.

The Stockholm Convention requirements regarding the so-called new POPs, including HBCD, are:

- implementation of control measures for each chemical listed in the Stockholm Convention (Articles 3 and 4)
- preparation of the inventory of chemicals in stockpiles (Article 6)
- preparation of an updated and revised NIP (Article 7)
- inclusion of "new" chemicals, including HBCD, in reports (Article 15), and
- inclusion of "new" chemicals, including HBCD, in the effectiveness evaluation programme (Article 16).

In order to successfully implement all obligations under the Stockholm Convention related to the main objective of this activity – the establishment of appropriate HBCD management in the Republic of Croatia, specific measures and activities were identified to be carried out in accordance with the defined priorities and objectives.

Specific objectives are as follows:

1) strengthening of technical capacities for HBCD management with the aim of monitoring the implementation of the disposal of stockpiles in an environmentally sound manner, and
2) education and raising awareness of target groups.

4.2.7.1 STRENGTHENING OF TECHNICAL CAPACITIES FOR HBCD MANAGEMENT

Proposed measures:

- regularly keeping records of the remaining stockpiles (for the purposes of regular reporting in line with the obligations under the Stockholm Convention and the POPs Regulation), and
- information and analysis of capabilities and methodology for rapid detection of HBCD.

4.2.7.2 EDUCATION AND RAISING AWARENESS OF TARGET GROUPS

Proposed measure:

- prepare additional information material on potential sources, harmful effects on health and the environment, substitutes and how to manage waste that potentially contains them in an environmentally sound manner in accordance with the Guide for the safe handling and management of waste containing persistent organic pollutants (POPs – PBDE, PFOS and HBCD).

Further to education and raising awareness of target groups, the Second NIP proposed the measure of preparing information material on potential sources, harmful effects on health and the environment, substitutes and how to manage waste that potentially contains them in an environmentally sound manner.

In line with the proposed measure, the Guide for the safe handling and management of waste containing PCBs in an environmentally sound manner (POPs – PBDE, PFOS and HBCD) was prepared based on the technical guidelines for the environmentally sound management of waste containing POPs (UNEP-CHWCOP.12-BC-12/3).

Table 4.2-4 provides a description of the measures and activities to be implemented in order to fulfil all the obligations under the Stockholm Convention relating to HBCD management in the Republic of Croatia, identification of the institutions responsible for their implementation, as well as the time schedule and the estimated necessary funds.

Table 4.2-4: Activity: Production, import and export, use, stockpiles and wastes of HBCD

OBJECTIVES/MEASURES	IMPLEMENTING AGENCY (PROFESSIONAL AND TECHNICAL SUPPORT)	IMPLEMENTATION PERIOD	COSTS (HRK)
MAIN OBJECTIVE: IDENTIFICATION AND SAFE REMOVAL OF HBCD AND PRODUCTS CONTAINING HBCD IN THE REPUBLIC OF CROATIA			
Specific objective 1: Strengthening of technical capacities for HBCD management, monitoring			
Measure 1.1: Keep a record on use/import/export/ production/stockpiles and waste	CIPH – Toxicology Department / MESD	continuously	0
Specific objective 2: Education and raising awareness of target groups			
Measure 2.1: Continued education	MESD (MH/CIPH – Toxicology Department)	continuously	30,000
TOTAL			**30,000**

4.2.8 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES AND WASTES OF HCBD

No further activity relating to HCBD was proposed within the NIP revision process, given that it was assessed that HCBD did not present a problem in the Republic of Croatia regarding the potential risk to health and the environment (it is not produced or imported and its use is prohibited since 1970).

4.2.9 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES AND WASTES OF PENTACHLOROPHENOL AND ITS SALTS AND ESTERS

No further activity relating to PCN was proposed within the NIP revision process, given that it was assessed that PCN did not present a problem in the Republic of Croatia regarding the potential risk to health and the environment (there are no available data that would indicate that PCN was used in the Republic of Croatia).

4.2.10 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES AND WASTES OF DECABROMODIPHENYL ETHER (BDE-209)

The preliminary inventory established that there was no available data on the production of decabromodiphenyl ether in the Republic of Croatia.

The Stockholm Convention requirements regarding the so-called new POPs, including decabromodiphenyl ether (BDE-209), are:

- implementation of control measures for each chemical listed in the Stockholm Convention (Articles 3 and 4)
- preparation of the inventory of chemicals in stockpiles (Article 6)
- preparation of an updated and revised NIP (Article 7)
- inclusion of "new" chemicals, including decaBDE, in reports (Article 15), and

- inclusion of "new" chemicals, including decaBDE, in the effectiveness evaluation programme (Article 16).

In order to successfully implement all obligations under the Stockholm Convention related to the main objective of this activity – the establishment of appropriate decaBDE management in the Republic of Croatia, specific measures and activities were identified to be carried out in accordance with the defined priorities and objectives.

Specific objectives are as follows:

- carrying out testing of equipment for the presence of decaBDE
- education and raising awareness of target groups.

4.2.10.1 CARRYING OUT TESTING OF EQUIPMENT FOR THE PRESENCE OF DECABDE

Proposed measures:

- carrying out testing of equipment for the presence of decaBDE in EEE on the market
- information and analysis of capabilities and methodology for rapid detection of decaBDE

4.2.10.2 EDUCATION AND RAISING AWARENESS OF TARGET GROUPS

Proposed measure:

- prepare additional information material on potential sources, harmful effects on health and the environment, substitutes and how to manage waste that potentially contains them in an environmentally sound manner in accordance with the Guide for safe handling and management of waste containing persistent organic pollutants with the focus on decaBDE.

Instructions should be based on the technical guidelines for the environmentally sound management of waste containing POPs (UNEP-CHWCOP.12-BC-12/3).

Table 4.2-5 provides a description of the measures and activities to be implemented in order to fulfil all the obligations under the Stockholm Convention relating to decaBDE management in the Republic of Croatia, identification of the institutions responsible for their implementation, as well as the time schedule and the estimated necessary funds.

Table 4.2-5: Activity: Production, import and export, use, stockpiles and wastes of decaBDE

OBJECTIVES/MEASURES	IMPLEMENTING AGENCY (PROFESSIONAL AND TECHNICAL SUPPORT)	IMPLEMENTATION PERIOD	COSTS (HRK)
MAIN OBJECTIVE: IDENTIFICATION AND SAFE REMOVAL OF decaBDE AND PRODUCTS CONTAINING decaBDE IN THE REPUBLIC OF CROATIA			
Specific objective 1: Carrying out testing of equipment for the presence of decaBDE, monitoring			
Measure 1.1: Test equipment for the presence of decaBDE	Authorised laboratory	continuously	0

OBJECTIVES/MEASURES	IMPLEMENTING AGENCY (PROFESSIONAL AND TECHNICAL SUPPORT)	IMPLEMENTATION PERIOD	COSTS (HRK)
Measure 1.2: Revise the preliminary inventory according to the test results, prepare a report on stockpiles for the purposes of regular reporting	MESD (CIPH – Toxicology Department)	continuously	0
Specific objective 2: Education and raising awareness of target groups			
Measure 2.1: Continued education	MESD (MH/CIPH – Toxicology Department/MI – Civil Protection)	2023	20,000
TOTAL			**20,000**

Within the workshop on raising awareness about the harmful effects of POPs and possibilities to improve the current system of monitoring POPs in the environment, the ministry competent for environmental protection issued the "Guide for the safe handling and management of waste containing persistent organic pollutants (POPs – PBDE, PFOS and HBCD)". The said Guide can be found on the Ministry's website.

4.2.11 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES AND WASTES OF CHLORINATED PARAFFINS (SCCP)

In the market of the Republic of Croatia, SCCP neither appear in concentrations higher than 1 % by weight in preparations nor in concentrations lower than 0.15 % by weight in articles, which is in compliance with the permitted concentrations under the Stockholm Convention.

The Stockholm Convention requirements regarding the so-called new POPs, including chlorinated paraffins, are:

- implementation of control measures for each chemical listed in the Stockholm Convention (Articles 3 and 4)
- preparation of the inventory of chemicals in stockpiles (Article 6)
- preparation of an updated and revised NIP (Article 7)
- inclusion of "new" chemicals, including SCCP, in reports (Article 15), and
- inclusion of "new" chemicals, including SCCP, in the effectiveness evaluation programme (Article 16).

In order to successfully implement all obligations under the Stockholm Convention related to the main objective of this activity – the establishment of appropriate SCCP management in the Republic of Croatia, specific measures and activities were identified to be carried out in accordance with the defined priorities and objectives.

The specific objective is as follows:

- analysis of the assessment of the need for new information on SCCP

4.2.11.1 ANALYSIS OF THE ASSESSMENT OF THE NEED FOR NEW INFORMATION ON SCCP

Proposed measures:

- assessment of the need for new information in cooperation with construction companies, land owners, plants and other stakeholders involved in the renovation and demolition of buildings.

Table 4.2-6 provides a description of the measures and activities to be implemented in order to fulfil all the obligations under the Stockholm Convention relating to SCCP management in the Republic of Croatia, identification of the institutions responsible for their implementation, as well as the time schedule and the estimated necessary funds.

Table 4.2-6: Activity: Production, import and export, use, stockpiles and wastes of SCCP

OBJECTIVES/MEASURES	IMPLEMENTING AGENCY (PROFESSIONAL AND TECHNICAL SUPPORT)	IMPLEMENTATION PERIOD	COSTS (HRK)
MAIN OBJECTIVE: IDENTIFICATION AND SAFE REMOVAL OF SCCP AND PRODUCTS CONTAINING SCCP IN THE REPUBLIC OF CROATIA			
Specific objective 1: Analysis of the assessment of the need for new information on SCCP			
Measure 1.1: Inspectional supervision of entities recovering/disposing of waste with the focus on illegal recovery/disposal	State Inspectorate (MESD)	2021–2023	0
TOTAL			**0**

4.2.12 ACTIVITY: REGISTER OF EXEMPTIONS AND ONGOING NEED FOR EXEMPTIONS (ARTICLE 4)

The Republic of Croatia did not submit an application for any exemptions listed in Annex A or Annex B related to POPs. It was decided that the Republic of Croatia will not register for such exemptions in the future and for the moment no activities are required related to the obligations under Article 4 of the Stockholm Convention.

In case a need arises for exemptions, the Republic of Croatia will in due time inform the Secretariat of the Stockholm Convention thereof.

4.2.13 ACTIVITY: MEASURES TO REDUCE RELEASES FROM UNINTENTIONAL PRODUCTION (ARTICLE 5)

The highest PCDD and PCDF emissions occur due to residential wood burning. Other processes that contribute to these emissions are the processes of steel production in arc furnaces, fuel combustion in the transport sector, as well as waste incineration and cremation. HCB emissions primarily originate from biomass and solid fuel combustion and to a lesser extent from thermal treatment of waste. In the Republic of Croatia, the dominant source of HCB emissions is fuel combustion in stationary sources in the energy sectors. The dominant source of PCBs are

emissions from refrigeration and air conditioning equipment using halogenated hydrocarbons and electrical equipment. Other sources such as steel production, thermal treatment of infectious waste and fuel combustion have a minor contribution to PCB emissions.

The Parties to the Stockholm Convention are required to prepare their initial assessments of the releases and update the assessments at regular intervals. Also, the Parties may revise their initial and subsequent assessments in order to establish and maintain the consistency of assessment trends over time.

The main objective of this national action plan is to ensure an adequate framework for PCDD/PCDF management in the Republic of Croatia, including the reduction and prevention of their future releases into the environment.

As the Parties to the Stockholm Convention have the obligation to revise the action plan related to Article 5 every five years, this activity was carried out during the NIP revision process. This action plan/activities and measures are included in this document.

The proposed measures are divided into four categories of activities/specific objectives:

- further development and updating of the POPs Releases Inventory
- strengthening the capacity of competent state administration bodies and improving cooperation and information exchange for a more efficient management of POPs
- information development and dissemination programme, and
- reduction and removal of Annex C POPs releases.

4.2.13.1 FURTHER DEVELOPMENT AND MAINTENANCE OF THE POPS RELEASES INVENTORY

Proposed measures:

- harmonisation of requirements pursuant to the obligations related to the development and reporting under the LRTAP Convention and the Stockholm Convention
- development of instructions/guidelines for data collection and preparation of the Inventory
- periodic review of the Release Inventory.

Measures within the framework of this activity aim to improve the methods of data collection and future revisions of the Release Inventory.

First of all, it is necessary to compare and harmonise the reporting obligations and requirements under the LRTAP Convention and the Stockholm Convention in order to allow better insight into activity data according to each category and class of sources, data on the status of equipment for emission reduction/restriction and data on specific technological processes, as well as to avoid duplication in the data collection process.

Strengthening the capacity of competent state administration bodies and improving cooperation and information exchange for a more efficient management of POPs

Proposed measure:

- further improvement of the implementation of supervision over the fulfilment of the Stockholm Convention requirements.

The implementation of the Stockholm Convention and the efficient management of POPs require the involvement of state administration bodies and organisations with different fields of responsibility. To ensure adequate cooperation and information dissemination, as well as regular monitoring of the implementation, it is necessary to further improve the implementation of supervision over the fulfilment of the Stockholm Convention requirements.

Information development and dissemination programme as well as the reduction and removal of Annex C POPs releases Proposed measures:

- further work on the promotion and increase of energy efficiency in the industrial and public sectors and in households, renewable energy sources, as well as education and dissemination of information on the proper use of fuel and management of combustion plants and the effects of uncontrolled combustion in residential buildings, and
- dissemination of information about the harmful effects and potential risks to health and the environment.

A very important target group for the reduction of releases of POPs listed in Annex C are households, which participate with around 65 % in total emissions of PCDD/PCDF into the air. Measures to reduce these releases include public information, awareness raising and education programmes on the appropriate selection of a combustion plant and fuel and on the effects of uncontrolled combustion in residential buildings.

In addition, the existence of sites contaminated with POPs listed in Annex C was not indisputably determined during the preparation of the POPs inventory in the first and second NIP, but rather potential contaminated sites were preliminary identified.

In order to identify contaminated sites, it is necessary to develop procedures or guidelines for the assessment of pollution, assessment of the impact on humans and the environment and for determining remediation priorities. A prerequisite for identifying contaminated sites is a consideration/adjustment of existing and/or development of new regulations that will set the limit values for pollutants in soils used for various purposes.

There is legislation in place for the soil used for agricultural purposes, namely the Ordinance on the protection of agricultural land from pollution. Table 4.2-7 provides a description of the measures and activities to be implemented in order to fulfil all the obligations under the Stockholm Convention relating to the reduction of releases from unintentional production in the Republic of Croatia, identification of the institutions responsible for their implementation, as well as the time schedule and the estimated necessary funds.

Table 4.2-7: Activity plan: Measures to reduce and control releases from unintentional production

OBJECTIVES/MEASURES	IMPLEMENTING AGENCY (PROFESSIONAL AND TECHNICAL SUPPORT)	IMPLEMENTATION PERIOD	COSTS (HRK)
MAIN OBJECTIVE: REDUCTION OF RELEASES FROM UNINTENTIONAL PRODUCTION IN THE REPUBLIC OF CROATIA			
Specific objective 1: Further development and maintenance of the POPs Releases Inventory			
Measure 1.1: Preparation of an annual inventory according to the requirements of the Stockholm Convention, with periodic revision of the inventory every three years	MESD	continuously	0
TOTAL			**0**

4.2.14 ACTIVITY: MEASURES TO REDUCE RELEASES FROM STOCKPILES AND WASTES (ARTICLE 6)

Article 6 of the Stockholm Convention requires the Parties to:

- develop appropriate strategies for identifying stockpiles and wastes (including products and articles that have become wastes) containing, consisting of or contaminated with chemicals listed in Annex A, B or C
- identify and manage stockpiles in a safe, efficient and environmentally sound manner
- implement measures to reduce or eliminate releases from stockpiles and wastes containing chemicals listed in Annex A, B or C in a manner that protects human health and the environment
- take appropriate measures to ensure that waste products and articles containing chemicals listed in Annex A, B or C are handled in an environmentally sound manner
- dispose of waste products and articles containing chemicals listed in Annex A, B or C in a way that destroys or irreversibly transforms the POPs content, taking into consideration international rules, standards and guidelines
- develop strategies for identifying sites contaminated with chemicals listed in Annex A, B or C; if remediation is required, it must be performed in an environmentally sound manner, and
- cooperate in the activities on the implementation of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

The abovementioned should be taken into account when implementing the measures set out in Chapters:

- 4.2.3 Activity: Production, import and export, use, stockpiles and waste pesticides (residues) (Annex A, Part I)
- 4.2.4 Activity: Production, import and export, use, identification, labelling, decontamination, storage and disposal of PCBs and equipment containing PCBs (Annex A, Part II)
- 4.2.5 Activity: Production, import and export, use, stockpiles and wastes of hexaBDE and heptaBDE (Annex A, Part IV), and tetraBDE and pentaBDE (Annex A, Part V) and HBB, where applicable (Annex A, Part I)

- 4.2.7 Activity: Production, import and export, use, stockpiles, and wastes of PFOS, its salts and PFOSF (Annex B, Part III)
- 4.2.8 Activity: Production, import and export, use, stockpiles and wastes of HBCD

4.2.15 STRATEGY: IDENTIFICATION OF STOCKPILES, ARTICLES IN USE AND WASTES

The Strategy for identification of stockpiles, articles in use and wastes is not separately analysed because it is a part of the following Chapters:

- 4.2.3 Activity: Production, import and export, use, stockpiles and waste pesticides (residues) (Annex A, Part I)
- 4.2.4 Activity: Production, import and export, use, identification, labelling, decontamination, storage and disposal of PCBs and equipment containing PCBs (Annex A, Part II)
- 4.2.5 Activity: Production, import and export, use, stockpiles and wastes of hexaBDE and heptaBDE (Annex A, Part IV), and tetraBDE and pentaBDE (Annex A, Part V) and HBB, where applicable (Annex A, Part I)
- 4.2.7 Activity: Production, import and export, use, stockpiles, and wastes of PFOS, its salts and PFOSF (Annex B, Part III)
- 4.2.8 Activity: Production, import and export, use, stockpiles and wastes of HBCD

4.2.16 STRATEGY: IDENTIFICATION OF CONTAMINATED SITES (ANNEXES A, B AND C) AND ENVIRONMENTALLY SOUND REMEDIATION

Given the fact that during the preparation of the preliminary inventory, the existence of sites contaminated with POPs was not indisputably determined, but rather potential contaminated sites were preliminary identified, this Chapter will contain the activities and measures necessary for potential development of the national Programme for the identification of contaminated sites, scope of contamination and potential environmentally sound remediation, as well as specify technical measures needed for a timely implementation of this Programme.

During development of the POPs Inventory, based on the available data, the existence of sites contaminated with POPs pesticides was not determined. However, given the fact that in the Republic of Croatia pesticides were produced, used, imported and exported, further systematic investigation needs to be carried out in the areas where they were applied in larger quantities when in use.

These investigations should be carried out in the territory of Osijek-Baranja, Vukovar-Srijem and Bjelovar-Bilogora Counties. With regard to the previous and current existence of equipment containing PCBs in the Republic of Croatia (transformers and capacitors) and the past war period (1991–1995) that caused considerable destructions and shelling of power plants, there was a post-war preliminary identification of sites at which environmental contamination with PCBs could have occurred. At these sites, the presence of PCB compounds in soil and air was determined. On the basis of past examination and the carried out inventory of POPs, three sites were identified in the coastal part (Zadar, Rijeka Dubrovačka and Bilice near Šibenik)

which require further investigation in order to indisputably determine their actual status and potential level of contamination.

Additional investigations are required to identify sites potentially contaminated with PCDD/PCDF since such data is lacking. When identifying potential contaminated sites, attention should be given to sites near potential sources of PCDD/PCDF emissions and to those where preliminary studies revealed the presence of PCBs in soil, because it is likely that certain quantities of PCDD/PCDF will be found there.

The main objective of this strategy is to reduce environmental pollution through the remediation and recovery of identified sites contaminated with POPs.

The specific objective is as follows:

- establishment of a management system for contaminated areas.

4.2.16.1 ESTABLISHMENT OF A MANAGEMENT SYSTEM FOR CONTAMINATED AREAS

Proposed measures:

- carry out a detailed investigation of identified sites contaminated with POPs
- identify priority contaminated sites
- prepare plans for remediation of sites contaminated with POPs
- carry out remediation of contaminated areas (respecting prioritised areas), and
- monitor the effects of remediation.

In the period 2018 –2020, preliminary investigations of potential sites contaminated with POPs were carried out, the register of contaminated areas was established, and guidelines for remediation of contaminated areas were defined.

It is necessary to, at a professional level, develop procedures or instructions for identification of sites contaminated with POPs and assessment of their level of pollution (along with determining remediation priorities). Competent state administration bodies and competent public institutions should carry out a preliminary investigation at sites potentially contaminated with POPs, selected based on the agreed criteria, such as the types of industrial activities related to POPs emission/release into environmental components, natural characteristics and sensitivity of the area, as well as the available POPs monitoring data in the Republic of Croatia (see Chapter 2.3.10). The data collected during preliminary investigations will be used for the establishment of the register of contaminated areas. After the identification of priority sites for remediation, it is necessary to develop instructions and procedures for the implementation of environmentally sound remediation of contaminated sites. Owners of contaminated sites, in cooperation with competent ministries, have to prepare plans for remediation and decontamination of these sites. Dynamics of monitoring of remediation/decontamination of potentially identified contaminated sites will be adjusted to specificities of individual cases.

One of the potential sources of releases into the environment and a potential risk to the environment are undoubtedly illegal landfills and, for now, unremediated municipal waste landfills.

However, great progress was made with regard to remediation of landfills across the Republic of Croatia. According to CEAN (IENP, MESD) data, in 2015 waste was disposed of in 148 landfills. Municipal waste was disposed of in 135 landfills, while only production waste was disposed of in 13 sites. In 2015, a total of 1,889,201 tonnes (of all types of waste) were disposed of, which is a 5.35 % decrease compared to 2010, when a total of 1,995,954 tonnes of waste were disposed. By the end of 2015, 174 landfills were closed, and waste was relocated from 83 sites where landfills were once located. From 2008 to end-2015, the number of remediated landfills increased from 63 to 171, while remediation is ongoing or under preparation at 134 sites.

Table 4.2-8 provides a description of the measures and activities to be implemented in order to fulfil all the obligations under the Stockholm Convention relating to the identification and remediation of contaminated sites in the Republic of Croatia, identification of the institutions responsible for their implementation, as well as the time schedule and the estimated necessary funds.

Table 4.2-8: Activity: Identification of contaminated sites and environmentally sound decontamination

OBJECTIVES/MEASURES	IMPLEMENTING AGENCY (PROFESSIONAL AND TECHNICAL SUPPORT)	IMPLEMENTATION PERIOD	COSTS (HRK)
MAIN OBJECTIVE: REDUCTION OF ENVIRONMENTAL POLLUTION THROUGH REMEDIATION AND RECOVERY OF IDENTIFIED SITES CONTAMINATED WITH POPs			
Specific objective 1: Establishment of a management system for contaminated areas			
Measure 1.1: Carry out a detailed investigation of sites contaminated with POPs in addition to establishing priority contaminated sites	MESD/MA/ CAAF/MDRC/ LRSGUs (MI – Civil Protection)	2021–2023	Within the limits of regular funds allocated for activities of individual institutions
Measure 1.2: Prepare plans for remediation of sites contaminated with POPs	Owners, LRSGUs	2021–2023	Private owners: own financing; Counties, municipalities, cities: within the limits of the funds available
Measure 1.3: Carry out remediation of contaminated areas (respecting prioritised areas)	Owners, EPEEF (MESD)	2021–2025	For the implementation of this activity, it is necessary to ensure additional funds from remediation programmes of the EPEEF and international funds (grants, projects). The exact amount required will be determined after detailed investigations have been carried out and

OBJECTIVES/MEASURES	IMPLEMENTING AGENCY (PROFESSIONAL AND TECHNICAL SUPPORT)	IMPLEMENTATION PERIOD	COSTS (HRK)
			remediation plans prepared.
Measure 1.4: Monitor the effects of remediation	MESD/MA	–	The dynamics of monitoring contaminated sites and the amount of necessary funds will be determined on a case-by-case basis
TOTAL			**Total funds cannot be estimated at this time**

4.2.17 ACTIVITY: ENABLING OR IMPLEMENTATION OF INFORMATION EXCHANGE AND INVOLVEMENT OF INTERESTED PARTIES

The exchange of information on POPs in the Republic of Croatia is not at a satisfactory level. The main objective of the activity is to improve the exchange of information and to enable/ensure the exchange of information on the production, use and release of POPs and on their substitutes, including information on their harmful properties, as well as financial and social costs that they might generate.

The Parties to the Convention can exchange information with each other through direct contact or through the Stockholm Convention Secretariat.

The main task of the national focal point is to represent a link between the Stockholm Convention and all interested parties in the country, i.e. between all stakeholders which will participate in information exchange at the international and national level. The practice to date has been the exchange of available information between competent state administration bodies or research institutions.

The identified specific objective is as follows:

- development of the information exchange system between relevant institutions in the Republic of Croatia and the national focal point.

4.2.17.1 DEVELOPMENT OF THE INFORMATION EXCHANGE SYSTEM BETWEEN RELEVANT INSTITUTIONS IN THE REPUBLIC OF CROATIA AND THE NATIONAL FOCAL POINT

Proposed measures:

- extending the working group responsible for the NIP implementation and reporting to the Government of the Republic of Croatia by the ministry competent for environmental protection
- appointment of contact persons for data collection and exchange of information depending on the issue and the Stockholm Convention requirements, inclusion of representatives from economy, scientists, non-governmental organisations and other stakeholders, and
- improving the system for exchange of information between all stakeholders.

A need for improvement of the system for exchange of information between civil society organisations, government sector and institutions responsible for the implementation of the Stockholm Convention was identified.

4.2.18 ACTIVITY: PUBLIC AWARENESS RAISING, INFORMING AND EDUCATION (ARTICLE 10)

It is necessary to work on the improvement of public awareness and education levels regarding the issue of POPs. The level of public awareness about the impact of POPs on humans and the environment is not satisfactory, which can result in inadequate handling of chemicals and waste, particularly with regard to the so-called new POPs.

It is necessary to adopt individual programmes for education and raising of public awareness for each of the identified target groups. The ultimate aim of such programmes is primarily to inform the public about the potential sources of the so-called new POPs, their potential harmful effects on health and the environment, since their production and use is prohibited or restricted. However, efforts should be invested in the prevention of releases into the environment and ensuring the disposal of waste containing POPs in an environmentally sound manner.

4.2.19 ACTIVITY: EFFECTIVENESS EVALUATION (ARTICLE 16)

The Conference of the Parties to the Stockholm Convention has decided on mechanisms for periodical effectiveness evaluation of the implementation of the Stockholm Convention.

The Stockholm Convention requirements regarding the so-called new POPs, among other things, encompass the inclusion of "new" chemicals/POPs in the effectiveness evaluation programme (Article 16). In order to provide the Conference of the Parties with data on monitoring of the presence of POPs listed in Annexes A, B and C to the Stockholm Convention, and on their regional and global presence/distribution, the ministry competent for environmental protection will, as the national focal point, report for the purposes of the required effectiveness evaluation of the implementation and fulfilment of the Stockholm Convention requirements related to Article 15 and provide a regular four-year report. The Republic of Croatia participated in the first and second phase of the UNEP/WHO research, as well as of the RECETOX Institute (Czech Republic, Stockholm Convention Regional Centre) related to the analysis of two of the four key matrices; air quality monitoring in passive samplers and analysis of human milk, of old and even some of the new POPs.

The results can be found in the following documents: First regional monitoring report for Central and Eastern Europe from September 2008 and the Second regional monitoring report for Central and Eastern Europe from December 2014 (http://chm.pops.int/Implementation/GlobalMonitoringPlan/MonitoringReports/tabid/525/Default.aspx). In the COP-7 document UNEP/POPS/COP.7/IN/39 the "Guidance on the global monitoring plan for persistent organic pollutants" was presented, including the old and the so-called new POPs with appropriate recommendations.

4.2.20 ACTIVITY: REPORTING (ARTICLE 15)

The Republic of Croatia has prepared and so far submitted four Reports to the Secretariat of the Stockholm Convention pursuant to Article 15 of the Stockholm Convention and fulfilled the obligation of reporting on taken measures, strategies and stockpiles, which are published on the website of the Stockholm Convention (the dates of delivery: 1) 31. 7. 2008, 2) 21. 10. 2010, 3) 16. 9. 2014, 4) 05.10.2018)

4.2.21 ACTIVITY: RESEARCH, DEVELOPMENT AND MONITORING (ARTICLE 11)

During the development of the inventory, it was confirmed that the current level of research programmes was insufficient, so consideration of additional research programmes is proposed for more effective control and monitoring of POPs in the environment, including the impact of these compounds on humans, in particular regarding the so-called new POPs (as described in detail in Chapter 3.7 Existing programmes for monitoring POPs releases and their impact on human health and the environment). Through upgrading the existing monitoring, a more complete picture of the state of the environment will be provided.

The main objective of this activity is to improve the systematic research and monitoring of POPs, especially the so-called new POPs which would confirm and complement the information on their concentrations in the environment, biota and humans, and, among other things, improve and extend the scope of research and analysis results carried out to date (e.g. through analyses of contaminated sites, articles in use, landfills) and confirm the hypothesis that POPs do not pose a significant problem with regard to negative effects on health and the environment in the Republic of Croatia, and cross-border risk.

Specific objectives are as follows:

- strengthening technical capacity for monitoring of POPs in the environment and humans, including new POPs
- analyses of the presence of potential POPs that are under consideration (POPRC) and harmful effects on health and the environment, and
- monitoring in the environment and humans.

4.2.21.1 STRENGTHENING TECHNICAL CAPACITY FOR MONITORING OF POPS IN THE ENVIRONMENT AND HUMANS, INCLUDING NEW POPS

Proposed measures:

- continue with the development of research programmes for more efficient control and monitoring of POPs in the environment and assessment of the impact of POPs on humans, and
- ensure conditions and adequate equipment necessary for the implementation of research, development and monitoring activities.
-

Given the shortcomings of the existing research programmes and lack of inclusion of the so-called new POPs in them established during the development of the inventory, it is necessary to provide additional programmes or amend the existing ones and ensure appropriate conditions for more efficient control and monitoring of POPs in the environment and for assessing the impact on humans, which should be implemented in all regions of the Republic of Croatia.

4.2.21.2 MONITORING OF POPS IN THE ENVIRONMENT AND HUMANS

Proposed measure:

- continue with the existing monitoring and amend the programme for control and monitoring of POPs in the environment and assessment of the impact of POPs on humans.

Table 4.2-9 provides a description of the measures and activities to be implemented in order to fulfil all the obligations under the Stockholm Convention relating to research, development and monitoring of POPs in the Republic of Croatia, identification of the institutions responsible for their implementation, as well as the time schedule and the estimated necessary funds.

Table 4.2-9: Activity: Research, development and monitoring

OBJECTIVES/MEASURES	IMPLEMENTING AGENCY / PROFESSIONAL, TECHNICAL AND FINANCIAL SUPPORT	IMPLEMENTATION	COSTS (HRK)
MAIN OBJECTIVE: RESEARCH, DEVELOPMENT AND MONITORING OF POPs IN THE REPUBLIC OF CROATIA			
Specific objective 1: Strengthening technical capacity for monitoring of POPs in the environment and humans, including new POPs			
Measure 1.1: Continue with the development of research programmes for more efficient control and monitoring of POPs in the environment and assessment of the impact of POPs on humans	MSE (MESD, MA, CIPH, EPEEF)	continuously	Within the limits of regular funds allocated for activities of individual institutions
Measure 1.2: Ensure conditions and adequate equipment necessary for the implementation of research, development and monitoring activities	MSE (MESD, other institutions and organisations responsible for carrying out specific research and monitoring)	continuously	The cost of this measure will be determined after development/amendment of certain programmes
Specific objective 2: Monitoring of POPs in the environment and humans, including new POPs			
Measure 2.1: Continue with the monitoring according to the amended/expanded programmes	MESD, MH (MA, CIPH, MSE, CW, CAAF, EPEEF)	continuously	The cost of this measure will be determined after development/amendment of certain programmes
TOTAL			**Total funds cannot be estimated at this time**

Summary of information on the existing level of research and development programmes and POPs monitoring:

Define objectives of the activity/plan depending on the inventory results, as well as the implementation of necessary measures, the time schedule and the costs of implementing the measures.

Measures aimed at creating higher quality and more integrated monitoring of POPs levels (environmental levels and monitoring their removal):

- legal framework to create the conditions required for monitoring stockpiles, waste, equipment and environmental levels
- review of available national monitoring capacities and resources
- development of national, regional and local institutions competent for monitoring (sites, medium, sampling frequency) and dissemination of information on the results of monitoring POPs
- capital investment requirements for areas which need to increase investments in the implementation of activities/plans, that is, for the purpose of supplementing the national POPs inventory (reorganisation of monitoring, procurement of equipment, staff training).

4.2.22 ACTIVITY: TECHNICAL AND FINANCIAL ASSISTANCE (ARTICLES 12 AND 13)

The requirements for successful implementation of NIP are to ensure the necessary funds within the budget of the Republic of Croatia, LRSGUs, own sources of financing of the obliged entities, or other forms of financing/co-financing based on the estimates and planned activities.

4.3 AREAS REQUIRING FURTHER CAPACITY STRENGTHENING

The areas in which strengthening of the current capacities is required are defined in the overview of individual activities given in Chapter 4.3.

Priorities are defined as follows:

1) Capacity building with the aim of continuing the process of developing inventories and monitoring for the purpose of reporting to the Secretariat of the Stockholm Convention

    - the need was established for more efficient inventory procedures, especially regarding landfills, dumpsites and potential contaminated sites

2) Improvement of public awareness and level of education

    - the level of public awareness about the effects of POPs on humans and the environment is not at a satisfactory level, which can result in inappropriate handling of equipment, articles or management of waste containing POPs

3) Additional research programmes for more efficient control and monitoring of POPs in the environment and humans

   - during the inventory phase and revision of NIP, the need was identified for extension of research programmes to the so-called new POPs.

The requirements for successful implementation of NIP are as follows:

- ensuring necessary funds based on estimates and plans for listed activities/measures, and
- successful coordination of all NIP activities.

4.4 NIP IMPLEMENTATION TIMETABLE

The timetable is based on the estimate of the time necessary for implementation of each measure and activity (see Chapter 4.2/4.3).

The overlapping of implementation of specific measures and activities for which the timetable is proposed shows that the implementation is based on:

- organisation phase
- development of technical instructions, guidelines, procedures that ensure the implementation of regulations, and
- implementation of the measures proposed in action plans/activities and strategies.

The planning of specific activities is the short-term objective. This phase is very important as proper organisation and initiation of individual activities can ensure their continued implementation in the future.

The medium-term objective is to continue with the implementation of the initiated measures covering the period of five to ten years. In the long-term period (ten or more years), it is necessary to continuously carry on with activities resulting from specific measures and activities. The duration of these activities depends on how quickly the activities are carried out in the midterm period.

In the table below (Table 4.4-1), the sequence of implementation, competent authorities for the implementation of measures/activities and envisaged time limits are presented.

Table 4.4-1: NIP implementation timetable

Activity/Measure	Implementing agency[10]	Implementation period
Activity plan	MESD/MA/MH/State Inspectorate/MSE	2021–2026

[10] Implementing agencies are defined pursuant to Article 3 of the Act on the Implementation of the POPs Regulation and this NIP.

Implementation of measures, programmes and activities	MESD/MA/MH/State Inspectorate/MSE	from 2021 onwards

4.5 FUNDS NECESSARY FOR NIP IMPLEMENTATION

The funds required for the implementation of the Third/revised NIP in the Republic of Croatia include an approximate cost assessment for certain previously analysed activities (see Chapters 4.2 and 4.3).

As previously mentioned, it should be noted that one of the key methodological issues in the process of the assessment of costs for certain activities for the implementation of the Third/revised NIP is the separation of NIP implementation costs from other environmental costs.

Very often, POPs-related impacts manifest together with the impacts of other substances, and therefore measures and instruments for their prevention or mitigation are applied simultaneously.

Considering all of the above, the total cost of NIP implementation in its key segments is estimated to the amount of around HRK 1,730,000.00, which includes activities integrated into the existing programmes, excluding the costs for the implementation of additional research and monitoring programmes that will be prepared during the development of individual programmes.