Ministry of Sustainable
Develoment and Tourism

NATIONAL PLAN FOR IMPLEMENTATION OF STOCKHOLM CONVENTION, WITH AN ACTION PLAN FOR 2019-2023

July 2019

Contents

	LIST OF ABBREVIATIONS AND ACRONIMS
BAT	***Best Available Techniques***
BEP	***Best Environmental Practices***
DDE	***Dichlorodiphenyl Dichloroethylene***
DDT	***Dichlorodiphenyl Trichloroethane***
EC	***European Community***
ECHA	***European Chemical Agency***
EEC	***European Economic Community***
EFSA	***European Food Safety Authority of the European Union***
FAO	***Food and Agriculture Organization***
GDP	***Gross Domestic Product***
GEF	***Global Environment Facility***
HBB	***Hexabromobiphenyl***
HBCD	***Hexabromo cyclo dodecane***
HCB	***Hexachlorobenzene***
HCH	***Hexachloro Cyclohexane***
IARC	***International Agency for Research on Cancer***
IPCS	***International Programme on Chemical Safety***
IPPC	***Integrated Prevention and Pollution Control***
ISO	***International Organisation for Standardisation***
MSDT	***Ministry of sustainable development and tourism***
MARD	***Ministry of agriculture and rural development***
MIA	***Ministry of interior affairs***
MTMA	***Ministry of transport and maritime affairs***

NGOs	***Non-Governmental Organizations***
NIP	***National Implementation Plan***
NEPA	***Agency for Nature and Environment Protection***
OCPs	***Organochlorine pesticides***
OECD	***Organization for Economic Co-operation and Development***
PAH	***Polycyclic aromatic hydrocarbons***
PBDEs	***Polybrominated diphenyl ethers***
PCB	***Polychlorinated biphenyl***
PCDD/PCDF	***Polychlorinated dibenzo-p-dioxins and dibenzofurans***
PCT	***Polychlorinated Terphenyls***
PFOS	***Perfluorooctanesulfonic acid or perfluorooctane sulfonate***
PFOSF	*Perfluorooctane sulfonyl fluoride*
POPs	***Persistent Organic Pollutants***
PRTR	***Pollutant Release and Transfer Registers***
REACH	***Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals***
SAICM	***Strategic Approach to International Chemicals Management***
SC	***Stockholm Convention on Persistent Organic Pollutants***
SVHC	***Substances of very high concern***
TEQ	***Toxic Equivalent***
UN	***United Nations***
UNDP	***United Nations Development Programme***
UNECE	***United Nations Economic Commission for Europe***
UNIDO	***United Nations Industrial Development Organization***
UNEP	***United Nations Environmental Program***

USEPA	***United States Environmental Protection Agency***
WHO	***World Health Organization***
WID	***Waste Incineration Directive***
XRF	***X-ray fluorescence***

SUMMARY

Persistent organic pollutants (POPs) are chemicals that are toxic to humans and the living world, bioaccumulative and persistent in the environment. These properties of POPs chemicals make them one of the main topics in the field of environmental protection, where the need for a strategic action on a global level has been recognized. As the international community's response in the search for a systematic global solution of this issue, the Stockholm Convention on POPs was adopted, coming into force in 2004, with the primary objective of protecting human health and the environment from POPs. Montenegro is a signatory to the Stockholm Convention since 2010, and in November 2013, the Government of Montenegro adopted the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (NIP). Under Article 7 of this Convention, Montenegro is obliged to update its NIP, especially after the inclusion of new POPs in the Convention's list.

The National Implementation Plan for the Stockholm Conventione defines two strategic goals:

- Elimination or restriction of the production and use of POPs chemicals;
- POPs waste management in a safe, efficient and environmentally friendly way.

The elimination or restriction of the production and use of POPs will be reached through the achievement of the following operational objectives:

- OBJECTIVE 1: Proper management of products containing PBDEs, HBB and HBCDD chemicals, in accordance with the Stockholm Convention guidelines;
- OBJECTIVE 2: Safe removal from the market of products containing PFOS chemicals;
- OBJECTIVE 3: Monitoring of POPs in all segments of the environemnt and food;
- OBJECTIVE 4: Improvement of the availability of information on POPs chemicals and public awareness raising;
- OBJECTIVE 5: Reduction of the emission and release of unintentionally produced POPs chemicals into the environment;
- OBJECTIVE 6: Adequate POPs pesticide management.

POPs waste management in a safe, efficient and environmentally friendly way will be reached through the achievement of the following operational objectives:

- OBJECTIVE 1: Proper management of waste containing PBDEs, HBB and HBCDD chemicals, in accordance with the Basel Convention guidelines;
- OBJECTIVE 2: Treatment of waste containing PFOS chemicals;
- OBJECTIVE 3: Identified and eliminated use of PCB fluids in devices;
- OBJECTIVE 4: Remediation of identified sites contaminated by POPs chemicals.

The Action Plan, which is an integral part of the National Implementation Plan for the Stockholm Convention, foresees the implementationo 53 activities in the period 2019-2023, in order to improve the POPs management system in Montenegro. The implementatio of the planned activities will provide the necessary conditions and necesary facilities for the safe use and disposal of POPs chemicals in Montenegro, by applying modern EU practices and principles. Particular attention wil be paid to adequate information about POPs chemicals and public awareness raising on the potential adverse impact of POPs and appropriate preventive measures.

INTRODUCTION

Persistent Organic Pollutants (POPs) are chemicals that are hazardous to living organisms for several reasons:

- persistence – a feature by which the are named, is a long-term sustainability in unaltered form;
- portability – ability of dispersal through air and water, and also through biological systems via the fool chain, and entering into living organisms and being transmitted from one link to another with bioaccumulation and biomagification;
- toxic effect on living organisms;
- negative effects on the offsprings.

The Stockholm Convention of POPs, which came into force in 2004, is significant in terms of global action and registration of pollutants that release POPs into the environment. POPs are found in all areas on the Earth, which is why the global system for the control and management of toxic substances and waste is developing rapidly in the world.

The primary goal of the Stockholm Convention is to prohibit and restrict the production, use, emission, import and export of POPs in order to protect the human health and the environment.

Under Article 7 of this Convention, Montenegro is obliged to update its National Implementation Plan for the Stockholm Convention (hereinafter: NIP), especially after the inclusion of new POPs in the Convention's list (in the period from 2009 to date, 14 new chemicals have been included).

In accordance with the requirements of Article 7 of the Convention, in January 2016, the Ministry started the implementation of the project **"Revision of the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants".** The project was funded by the Global Environment Facility (GEF) in cooperation with UNEP as an implementation agency, while Montenegro provided in-kind contribution through the work of employees in competent state administration bodies. In July 2016, the Agreement

on Financing the Small Value Project between UNEP and the Centre for Ecotoxicological Research was signed.

In the period since the adoption of the NIP (2013) until its update (2016), Montenegro adopted a large number of strategic documents, among others the Chemicals Management Strategy for the period 2019-2022, the Waste Management Strategy by 2030, the National strategy for the transposition, implementation and enforcement of the EU Acquis in the environment and climate change with the action plan for the period 2016-2020, as well as a series of laws and accompanying by-laws that were defined by the action plans contained in the NIP (chemicals, waste, air, water, land) for the implementation of the provisions of the Stockholm Convention. Also, the issue of PCB/PCT will be resolved by 2021 through the project **"Sustainable Environmental Management of PCBs in Montenegro"**. The project will result in the updating of the PCB inventory and the recovery of PCB contaminated equipment and land in certain locations (export, disposal ...).

The Revision of the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants Project was implemented in accordance with the UN Guidance for the review and updating of NIPs of 2012, and consisted of five phases:

1. Identification of the mechanisms of coordination and organization of the work process;
2. Updating of preliminary inventories for old POPs, preparation of preliminary inventories for new POPs, and assessment of national infrastructure and capacity;
3. Setting priorities, setting goals and developing action plans;
4. Creating an updated NIP;
5. Finalization and approval of the updated NIP;
6. Adoption of the Proposed NIP by the Government of Montenegro.

Also, the Working Team for the project implementation was formed, consisting of representatives of all relevant institutions, and it participated in the development of Draft NIP.

The NIP adopted by the Montenegrin Government will be submitted to the Secretariat of the Stockholm Convention.

I NATIONAL PROFILE OF MONTENEGRO

Geographic characteristics and economic profile of the country

Montenegro is a predominantly mountainous country in the southeast of Europe. The capital is Podgorica, while Cetinje is old royal capital of Montenegro. The country's land borders are with Croatia in the west (14 km), Bosnia and Herzegovina in the west/northwest (225 km), Serbia and Kosovo in the north and northeast (203 km), and Albania in the east/southeast (172 km).

The total area of the state territory is 13,812 km^2, and the marine aquatorium area is about 2,540 km2. The total length of land borders is 614 km, while the length of the Adriatic coast is 293 km. According to the 2011 census, Montenegro has 620,029 inhabitants, which gives a population density of 44.9 inhabitants per km^2.

According to the data from the Spatial Plan until 2020, from the total area of Montenegro (13,812 km^2), 6,225 km^2 or 45% of the area is under forest, agricultural land extends to about 5,145 km^2, i.e. 37%, while settlements, roads, waters, rocky areas and other categories occupy about 2,442 km^2 or 18% of the territory. It should be emphasized that the aforementioned estimate of the area under forest is significantly lower compared to the recent data obtained by the National Forest Inventory according to which the forests of different structures and categories cover 59.9% of the territory of Montenegro.[1]

Montenegro is located in the central part of the moderate warm zone of the northern hemisphere (41°52' and 43°32' north latitude and 18°26' and 19°22' east longitude). Thanks to the latitude, i.e. closeness to the Adriatic and Mediterranean Sea, it has a Mediterranean climate, with warm and somewhat dry summers and moderately cold and rather humid winters.

1.2. Water resources

The total area of the Danube Basin is 7,260 km^2 or 52.5% of the territory of Montenegro. This part of the territory of Montenegro goes by the Ibar River and further by Zapadna Morava to the Danube, and by the rivers Tara, Piva, Lim and Ćehotina towards the Drina and the Danube. The Montenegrin part of the Adriatic basin is about 47.5% of the territory. The largest watercourses of this basin are Zeta and Morača, i.e. Morača after their confluence in Podgorica, as well as Bojana which is the border river with Albania.[2]

1.3. Forests

By forest coverage, Montenegro is at the top of the scale of European countries. Forests account for 59.9%, or 826,782 ha of land, and land under forest makes 9.8% or 137.480 ha. By this, the target value established under the Millennium Development Goal 7 related to achieving environmental sustainability, i.e. the share of land covered by forests (54%) was achieved[3].

In the past few years, key documents regulating the forestry sector were adopted, such as: National Forest Policy, Forest Law and National Action Plan for Combating Illegal Activities in Forestry. In 2014, the Strategy was adopted with a plan for the development of forests and forestry until 2023 and the Industrial Policy of Montenegro through 2020, the

[1]The Second National Report on Climate Change
[2]The Second National Report on Climate Change, p. 53
[3]Ministry of Agriculture and Rural Development, the First National Forest Inventory of Montenegro – Final Report, Podgorica, 2013.

implementation of which is expected to address the key problems that represent obstacles on the way to sustainable forest management.

1.4. Agriculture

The sector of agriculture plays an important role in the economy of Montenegro, with a significant share in the gross domestic product. By the Strategy for the Development of Food Production and Rural Areas, Montenegro opted for the concept of sustainable development of agriculture, which implies the establishment of a complete balance between economic development, environmental protection and social aspects. The starting point of the Strategy is the multi-functionality of agriculture, which places agriculture in a much wider context, not just in terms of participation in GDP.

As one of the key sectors of the Montenegrin economy, agriculture represents the important source of income, especially for the population of the northern region whose possibilities are limited when it comes to finding alternative income.

Generally speaking, favorable climate for the production of different types and varieties of plants, well-preserved nature, including high-quality, preserved and fertile land, low pollution levels due to minimal use of mineral fertilizers and pesticides are elements that contribute to the development of agriculture in Montenegro. Climate, rich biodiversity and nature and clean environment are excellent prerequisites for the development of organic agriculture. In addition, available land resources are an additional advantage along with traditional production of typical products and the use of autochthonous varieties, species and races in several sectors.

The increased demand for agricultural products, which is a consequence of tourism development, gives real expectations for the progress of this sector. In recent years, processing capacities have developed in several sectors, and are a good example of the development of new products offered on the market.

On the other hand, fragmented farms and small scale production, lack of skilled labor, low level of education of farmers and an unfavorable age structure, as well as poor mechanization and low level of application of modern technology and knowledge and experience, influence the low-level productivity of the sector. High prices and the lack of storage capacities (for example, for fruits and vegetables) influence the production to be of seasonal character, which limits the possibility of achieving higher income of agricultural producers and the continuous supply of the market.

The identified shortcomings require additional investment and it is difficult for agricultural producers to obtain credit support due to expensive loans. Insufficient implementation of

scientific research activities limits the use of innovative production technologies which results in a low percentage of new products on the market.[4]

1.5. Manufacturing industry

Montenegro opened accession negotiations with the EU in Chapter 20 - Entrepreneurship and Industrial Policy. On 30 June 2016, the Government of Montenegro adopted Industrial Policy of Montenegro until 2020 with the Action Plan for its implementation for the period 2016-2020, aimed at improving the competitiveness of industry, investment framework for industry modernizing, promoting innovation and entrepreneurship through increased productivity and employment, as well as better access to domestic and international markets in terms of simplifying procedures for trade.

Industrial Policy of Montenegro until 2020 identified the priority sectors with growth potential as drivers of economic development, as follows: manufacturing industry - food, wood, metal and pharmaceutical; energy and tourism, while transport, ICT (information and communication technologies) and creative industries, business services and construction sectors are defined as sectors with growth potential that should contribute to modern industrial development.

Regardless of a decreasing share in the total economic activity in Montenegro, the manufacturing sector remains one of the important areas of the economy, especially because the largest companies in Montenegro (Aluminium Plant Podgorica, Tosčelik Nikšić) operate in this area and multiplicative effects of which on the overall socio-economic situation are great. Apart from great contribution to the creation of added value, this sector is of importance for the overall economic development, both because of its importance for balanced regional development and the potential for improving the overall competitiveness of the Montenegrin economy, increase of labor force employment and attraction of foreign investments.

Based on the analysis of statistical indicators, it can be concluded that the manufacturing industry is significant for the overall economy of Montenegro, from the aspect of employment, participation in the creation of GDP, or participation in the total export of goods. Additionally, the area of production of basic metals and metal products remains a significant area of the manufacturing industry and the overall economy of Montenegro. Due to its dominant participation in the manufacturing industry, this area determines the trends in the industry, as well as the value of industrial production in the total amount. Accordingly, it is very important to create possibilities in the aluminum industry in Montenegro for profitable start of the entire raw materials chain - from the ore of bauxite to the finished product.

[4]Strategy for Development of Agriculture and Rural Areas 2015-2020, p. 50.

The subsector of chemical products shows a growing trend compared to 2000, but with very large annual oscillations, because of which it cannot be classified into strategic subsectors due to insufficient production volume in the manufacturing industry, lack of basic production, etc. It should be noted that the sub-sector of production of chemical products and fibers recorded the highest growth share, from 2.8% in 2001 to 11.2% in 2012 and thus became one of the more important sub-sectors within the manufacturing industry. Table 1 below gives an overview of producers of chemicals in Montenegro.[5]

Table 1.Overview of producers of chemicals in Montenegro

Producers of chemicals	Activity
Hemko d.o.o.	products in the field of hygiene (liquid detergents for hand washing of dishes, hair shampoos, laundry softeners, household cleaners...) and industrial chemicals
Darma d.o.o.	production of rennet and vinegar
Bordid d.o.o.	production of rennet
Matik d.o.o.	production of vinegar

II OVERVIEW OF ENVIRONMENTAL SITUATION[6]

2.1. Air

In 2018, air quality monitoring was carried out at measuring points in Podgorica, Niksic, Pljevlja, Bar, Tivat, Golubovci and Gradina (Pljevlja). Concentration of the following parameters was measured: sulfur dioxide (SO2), nitrogen monoxide (NO), nitrogen dioxide (NO2), total nitrogen oxides (NOx), carbon monoxide (CO), methane (CH4), non-methane hydrocarbons (NMHC), total hydrocarbons (THC), PM10 particles, ground-level ozone (O3), benzene, toluene, ethylbenzene, o-m-p-xylene (BTX). Exceedances of the PM particle concentration relative to the prescribed values at certain measuring points predominantly influenced the poorer air quality. The presence of these particles in concentrations above the prescribed levels is highest in Pljevlja. Exceedances most often occur during the heating season. Dominantly during the winter months, high air pollution episodes, primarily suspended particles (PM10 and PM2.5), are recorded. The frequent occurrence of temperature inversions, especially in the area of the Pljevlja Basin, prevents the dispersion of emissions and causes the retention of pollutants, which are the product of fossil fuel combustion, emissions from traffic and similar sources, just above the ground, leading to the appearance of high concentrations of pollutants in the ground layer of the atmosphere. Pollution of benzo(a)pyrene, which is a product of fossil fuel combustion, is evident in urban

[5] Source: Montenegrin Nature and Environment Protection Agency (NEPA)
[6] Information on the environmental status for 2018

areas, which is confirmed by the results of measurements of this pollutant at locations in Pljevlja, Niksic and Podgorica. High concentrations of this pollutant are common during periods of exceedance of PM particles, or most frequently during the heating season.

2.2. Water

Based on the analysis of the measured parameters, the watercourses where the highest pollution impacts were recorded in 2018, in fact parts of those watercourses (i.e. measurement points), are: the Vezišnica (above the mouth), the Ćehotina (Gradac, below Pljevlja and below the mouth of the Vežišnica), the Morača (below the influx of waters of the City Collector, Vukovci and Grbavci), the Ibar (Bac), the Lim (below Bijelo Polje) and the Grncar rivers (in the Gusinje area). The water of the Tara (in the section below Mateš, Mojkovac and Đurđevića Tara), the Ibar (in the part above Rožaje), the Crnojevic River and the Zeta River (in Vidrovan) had slightly less pollution. The Kutska River (Zlorečica) and the Cijevna (Trgaj) had better quality; good the Bojana and the Zeta (downstream) had good quality; and the Piva River had the best water quality.

One of the most significant causes of surface and groundwater pollution is the inadequate condition of sewage infrastructure, i.e., inadequate wastewater collection and treatment. Pressure on water is also evident through the pursuit of agricultural activities, industry (food, especially small and medium-sized enterprises), as well as the impact of transport and construction works.

2.3. Land

In order to monitor the state of land, i.e., determine the content of hazardous and harmful substances in soil during 2018, sampling and analysis of soil was performed on 33 locations, in 10 urban settlements in Montenegro.

Land pollution from the atmosphere - Emissions from industrial technological processes, due to the combustion of fossil fuels in industry, individual and local combustion ppoints, as well as the combustion of various organic matters are one of the major sources of pollution.

For the purpose of monitoring, the 2018 Program covers 3 locations in **Podgorica**, **Niksic** and **Pljevlja**, in the following settlements: Srpska (around KAP), Rubeza (around Steel Plant Nikšić) and Komini (around Thermal Power Plant Pljevlja).

The increased content of fluorine and polycyclic aromatic hydrocarbons in the soil sampled in the settlement called *Srpska* is a direct consequence of the emissions from KAP (aluminium plant). This year, only an increase in fluorine content was recorded in the settlement of *Rubeza*, which is not attributed to the impact of the work of the Steel Plant. Given that the values of all tested parameters were detected in the prescribed limits, the analysis of the soil sampled at the *Komini* site did not reveal the negative impact of the operation of the Pljevlja TPP.

Land pollution from transport - The impact of emissions from motor vehicles using oil and its derivatives has been examined through the analysis of 9 soil samples next to very busy roads in 8 municipalities (Berane, Kolašin, Nikšić, Pljevlja, Podgorica, Tivat, Ulcinj and Zabljak). Lead (from inorganic matter) and polycyclic aromatic hydrocarbons (PAH - from organic matter) are typical indicators of pollution emanating from motor vehicle exhaust.

In 2018, the analysis of soil samples taken in the vicinity of busy roads did not reveal any excess contents of the specified indicative parameters in relation to the prescribed concentrations.

Land pollution from waste disposal sites - Potential land pollution due to non-selective and improperly disposed industrial or municipal waste was examined through physical-chemical analysis of land sampled near municipal waste disposal sites in Zabljak, Bijelo Polje and Berane and near the industrial waste disposal sites of the Steel Plant in Nikšić, Brskovo Coal Mine in Mojkovac, and Jalovište and Gradac in Pljevlja. In the previous year, the following uncontrolled dump sites were rehabilitated in Montenegro: "Vrtijeljka" in the Historic Capital of Cetinje (in June 2018), "Vasove Vode" in the Municipality of Berane (in end-October 2018) and "Zauglina". in the Municipality of Savnik (in end-October 2018).

Impact of municipal waste landfills - In 2018, analyses of soil samples taken in the immediate vicinity of city landfills in the municipalities of Zabljak, Bijelo Polje and Berane (Vasove Vode) did not show any negative impact on the content of the soil parameters on the specified locations.

Impact of industrial waste landfills - In 2018, analyses of soil samples taken in the immediate vicinity of industrial plants revealed the following:

• An increase in the content of cadmium, lead, nickel, chromium, fluorine and zinc was recorded in the sample of non-arable land taken about 300 m from the waste *disposal site near the Steel Plant*. While the content of nickel, chromium and fluorine is attributed to the natural composition of the soil, the present forms of cadmium, lead and zinc, as well as the degree of their mobility and bio-availability in the soil at this site indicate a direct negative impact of the disposal site.

• Results of soil analysis near the *Brskovo mine* show increased fluorine and polycyclic aromatic hydrocarbon (PAH) content. Unlike fluorine, which is naturally very much present in soil in Montenegro, an increase in the content of PAHs is associated with the operation of the mine and is a direct anthropogenic influence at the site.

• In the soil sample taken near the *waste disposal site of TPP Pljevlja*, the content of all tested parameters does not exceed the prescribed norms. An exception is the increased fluorine content, which is not attributed to the waste disposal impact.

• The *Gradac* site recorded an increase in the content of cadmium, lead, mercury, arsenic, fluorine, copper, boron and zinc. It is pointed out that the whole area is characterized by high content of the mentioned metals of geochemical origin. The reason for this is the exploitation of those metals in the nearby mine.

Land pollution from the use of plant protection products - Through physicochemical analysis in 2018, the presence of the specified chemical groups did not exceed the detection limits for this type of sample in any of the analyzed samples.

Land pollution near substations - The monitoring program also included testing of 8 soil samples near substations in the municipalities of Berane, Pljevlja, Tivat and Ulcinj. In 2018, the presence of *PCB congeners* at a concentration above the prescribed levels was not determined at any of the locations mentioned.

The presence of *dioxins and furans* was analyzed in 16 soil samples. In the absence of an appropriate national legal framework defining the permitted values of these pollutants in different types of land, by categories of their use, the results obtained were compared with the values prescribed by EU legislation. Consequently, all dioxin/furan values obtained by soil monitoring in 2018 were much lower than those prescribed by EU regulation. Therefore, each of the soil samples tested for dioxin/furan content was safe from the point of being used as recreational land, residential land, sports grounds, playgrounds, agricultural land.

Land pollution at playgrounds - In 2018, the Program included 4 playground locations in the following municipalities: Nikšić, Pljevlja - playground in Skerlićeva Street, Podgorica - playground in Njegošev Park, and Tivat - playground in Dara Petković Park.

• Playground in Nikšić - Content of all analyzed hazardous and harmful substances, as well as toxic and carcinogenic substances, in the soil sample taken at this location was within the prescribed standards. An exception is the increased fluorine content, which is attributed to the geochemical composition of the soil, which is naturally rich in this element in Montenegro.

• Playground in Podgorica - At this location, deviation from the prescribed values of the monitored parameters was recorded in the case of chromium, nickel and fluorine content, which is attributed to the geochemical composition of the soil, which is naturally rich in these elements.

• Playground in Pljevlja - In the soil sample taken at this location, the content of lead and polycyclic aromatic hydrocarbons (PAH) exceeded the prescribed values, which is attributed to the proximity of parking lots and roads, while the content of all other inorganic and organic parameters was within the standard limits.

• Playground in Tivat - The results of analyses in 2018 show that there are no exceedances of the prescribed values for the content of inorganic pollutants in the soil sample from this site. The recorded content of polycyclic aromatic hydrocarbons (which are an indicator of the negative impact of the vicinity of the road), as well as 2 PCB congeners and 2 organotin compounds exceeded the prescribed limits.

Due to the increased content of these organic pollutants, in 2012 the municipality of Tivat conducted a four-stage process of land decontamination through bioremediation. Studies conducted in more recent years show that bioremediation did not produce the expected results, and that the increased content of these organic parameters at this site is present throughout the area of the park, and not only on the playground (within the park).

Further activities should investigate whether such a condition may possibly originate from some construction (or other) material, which has already been contaminated with these pollutants, and which was used to fill and level the terrain in this park in some earlier periods, on the basis of which remediation measures will be defined.

2.4. Environmental risk factors

2.4.1. Waste

Waste management is an area in which Montenegro must invest additional efforts in order to come up with a functional system that provides for sustainable development, maximum environmental protection, the resolution of existing problems in the field and the creation of databases necessary for decision-making at the national level.

In Montenegro, landfilling is still the most common method for the final resolution of waste issue. As for waste management infrastructure, Montenegro currently has: 2 regional sanitary landfills for non-hazardous waste (in Podgorica and Bar), 3 recycling centers (in Podgorica, Herceg Novi and Zabljak), 5 waste vehicle treatment plants (in Podgorica (1), Berane (1) and Niksic (3)), 2 transfer stations (in Kotor and Herceg Novi), 8 recycling yards (in Podgorica (6), Herceg Novi (1) and Kotor (1)), and 2 medical waste treatment facilities (in Podgorica and Berane).

Within the regional landfill "Livade" in Podgorica, non-hazardous waste disposal capacity has been expanded (with the construction of a third sanitary liner), and the completed leachate treatment plant was put into operation in mid-2018.

In addition to primary recycling centers in Podgorica and Herceg Novi (and smaller centers in Kotor, there are no recycling facilities in our country. Likewise, there is no waste incineration plant. In Montenegro, there is still no infrastructure for the disposal of hazardous waste, with technical and technological solutions in accordance with European standards. In accordance with the Law on Waste Management (Official Gazette of Montenegro 64/11, 39/16) and the requirements of the Basel Convention on the Control of

Trans-boundary Movements of Hazardous Waste and its Disposal, and pursuant to permits issued by the Nature and Environment Protection Agency (NEPA), hazardous waste is exported from Montenegro. In 2018, NEPA issued 9 permits for the export of hazardous waste, relating to the export of 4,615 tons of hazardous waste.

The problem of inherited industrial landfills is being addressed through the **Industrial Waste Management and Cleaning Project**, which addresses 4 environmental hot spots. Work on the remediation of the Bijela Shipyard site is ongoing. In mid-2019, works will begin on the remediation of the Gradac flotation site and the ash and sludge site Maljevac in Pljevlja, while the preparation of technical documentation for the sites (solid waste landfill and red mud pools) at the Podgorica Aluminum Plant is underway. By regular monitoring of land/soil that is carried out at the waste disposal sites of the mentioned industrial plants, as well as in their immediate vicinity, the existing pressure on land is continuously monitored, which is recorded by increase in the concentration of certain organic and inorganic pollutants.

2.4.2. Chemicals and Biocidal Products

By adopting the Law on Chemicals (Official Gazette of Montenegro 51/17) and the Law on Biocidal Products (Official Gazette of Montenegro 54/16), which are largely in line with the regulations of the European Union, as well as the adoption of a set of by-laws, a legislative framework aimed at adequate and safe chemicals management and biocidal products management has been established.

During 2018, the Agency received 570 requests for free circulation of chemicals. 542 licenses have been issued for the free marketing (import) of hazardous chemicals; 26 requests to import chemicals were rejected; 1 request was suspended at the request of the applicant and 1 was transferred to 2019. There were no requests to export chemicals. The PIC (prior informed consent) procedure is carried out for the import or export of chemicals that are found in the List of Chemicals for the PIC procedure and for the chemicals listed under the Rotterdam Convention. During 2018, 17 PIC licenses were issued.

According to the provisions of the Law on Biocidal Products (Official Gazette of Montenegro 54/16), pursuant to which the biocidal product, on request, is entered in the provisional list, if already placed on the market and in the use, the NEPA received 337 requests and transferred from the previous year 21, of which: 331 were issued a decision on entry in the Provisional List of Biocidal Products; 3 decisions referred to the performance of activities of marketing, use and storage of biocides; 20 requests were rejected and 4 requests were transferred to 2019.

In May 2018, with the aim of providing information and expert guidance, the Helpdesk was established to support interested parties that place chemicals and biocidal products into the

market and use. Interested parties may ask questions by email at help-desk@epa.org.me. From the start of the work of the Helpdesk to the end of 2018, 20 questions were received, mainly related to the registration of biocidal products and a smaller number to the free marketing of chemicals.

2.4.3. Chemical accidents

Industrial plants have a significant share in environmental pollution. Therefore, a part of EU policies and rights in the area of environmental policy is oriented towards the application of various measures in relation to sources of emissions of industrial polluting substances, especially when it comes to the management of hazardous chemicals and the safety of industrial plants. Having in mind the above, and with the aim of aligning with the Directive 2012/18/EU on the control of dangers from major accidents involving dangerous substances (Seveso III Directive), based on the Law on Environment (Official Gazette of Montenegro 52/16), the following rules were adopted: Rules on the quantities of dangerous substances by categories that determine the degree of risk of the Seveso plant (Official Gazette of Montenegro 63/16) and Rules on the detailed content of the prevention plan and plan of protection from accidents (Official Gazette of Montenegro 67/16).

The Seveso III Directive obliges EU Member States to ensure that operators have established policy for prevention of accidents. Operators handling hazardous substances above certain minimum quantities must prepare Prevention Plans, Safety Reports, and Accident Protection Plans.

Also, pursuant to the Law on Protection and Rescue (Official Gazette of Montenegro 13/07, 32/11 and 54/16), operators are obliged to draw up an action plan for protection and rescue, as well as to inform the Ministry of the Interior - Directorate for Emergency Situations, on the quantities of hazardous substances at their disposal and other data of importance for protection and rescue.

III INSTITUTIONAL AND LEGISLATIVE FRAMEWORK FOR POPs MANAGEMENT

This chapter presents the institutional and legislative framework that will be the basis for the implementation of the NIP. In addition, it outlines the forms of international cooperation of Montenegro considering the impact of POPs chemicals, and gives an overview of European legislation which is in direct or indirect relation with the safe management of POPs.

3.1. Institutional framework for POPs management

The Ministry of Sustainable Development and Tourism, among other things, carries out the tasks related to the management of chemicals and biocidal products, protection of air from pollution, integrated coastal area management, integrated protection of the sea from pollution, industrial pollution control and risk management, the application of new and

cleaner production technologies, waste management and wastewater, utility services, and other. Within the Ministry there are 2 Directorates that are especially important for the management of POPs chemicals: the Directorate for Environment and the Directorate for Waste Management and Utility Development.

The Directorate of Environment performs tasks related to: policy and system of protection and improvement of the environment (air, land, sea, plant and animal life in the totality of their interactions), development of strategies and other development documents, programs and projects in the field of environment. This Directorate comprises the Division for Control of Industrial Pollution, Chemicals Management and Nature Protection, which performs tasks related to: performing expert work related to harmonization of legislation with the regulations of the European Union in the fields of industrial pollution, chemicals and biocides management, implementation of obligations from relevant international agreements, monitoring of work and participation in working bodies related to Basel, Stockholm, Rotterdam, Minamata Conventions and other.

The Directorate for Waste Management and Utility Development performs tasks related to: proposing, monitoring and directing policies in the fields of waste management and communal services; harmonization of national legislation with EU legislation in the field of waste management and utility development; proposing, selecting and monitoring implementation of systemic measures for the implementation of strategic documents, plans, programs and action plans in the area of waste management.

Within **the Agency for Nature and Environmental Protection**, there are two departments which are relevant for the safe management of POPs: Department of Nature Protection, Monitoring, Analysis and Reporting and the Permitting Department. The Department for Nature Protection, Monitoring, Analysis and Reporting performs tasks related to: preparation of proposals for the environmental monitoring program containing monitoring programs for individual segments of the environment and areas adopted on the basis of special regulations, analysis of information obtained based on monitoring, relevant for the preparation of reports and strategies on the situation and protection of the environment, development and maintenance of databases on the environment; preparation of plans and programs for environmental protection, and other.

The Permitting Department performs tasks related to: issuing permits for the use of alternative chemical names, chemical safety assessment, expert assessment of data contained in the substance dossier, determining measures for reducing the risk and deadline for the implementation of requested measures, keeping records on chemicals, issuing permits for transport of hazardous chemicals, keeping records on dangerous chemicals, conducting prior notification procedure (PIC procedure), issuing permits for placing on the market and use of biocidal products; entry in the Provisional List of Biocidal Products;

maintaining a Provisional List of Biocidal Products; as well as issuing approvals for the production, transport, use and storage of biocides.

The management of plant protection products, and thereby POPs pesticides, which are intended for plant protection, is under the responsibility of the **Directorate for Food Safety, Veterinary and Phytosanitary Affairs**, which includes 3 departments. Food Safety Department performs tasks related to: safety of food of animal origin, animal feed safety, safety of food of non-animal origin, side animal products of animal origin and other tasks. Phytosanitary Department performs tasks related to laws in the field of plant health protection, plant protection products, plant nutrition products, seed material of agricultural plants, planting material, GMOs, protection of plant varieties, plant genetic resources and other regulations from its competence. The third, Veterinary Department is not of importance for the management of POPs substances. The Directorate also performs inspection tasks related to, inter alia: inspection supervision in the areas of human and animal food safety, plant protection, protection of plant varieties, health protection of plants, protection of planting material, seed material of agricultural plants, nutrition of plants, phytosanitary inspection of consignments of plants, plant products and facilities under control in traffic across the Montenegrin borders, veterinary, genetically modified organisms and other tasks.

The Ministry of Labor and Social Welfare performs tasks related to, inter alia, occupational health and safety.

The Biotechnical Faculty in Podgorica is responsible for examining biological efficiency of the plant protection products used in the field of agriculture, and also performs teaching, scientific and professional advisory activities.

The Agency for Medicines and Medical Devices is an administrative body responsible for medicines (for use in human and veterinary medicine) and medical devices; including their placing on the market (registration), control and monitoring of safe use, as well as licensing of legal entities dealing with supply and manufacturing of medicines and medical devices.

The Ministry of Health performs tasks related to, inter alia: monitoring the situation and strategic planning of the health care system, measures for ensuring the quality, safety and efficacy of medicines; preventive measures and prevention of drug abuse, monitoring and control of traffic of precursors, treatment of biological samples taken for medical purposes and scientific research; medical waste, as well as other tasks.

The Institute for Public Health is a healthcare institution at the tertiary level of health care, the activity of which is aimed at preserving and improving the health of citizens. Among other things, the Institute monitors and controls the implementation of preventive programs, and for that purpose coordinates and directs the work of health institutions,

proposes and implements measures for controlling the quality and safety of food stuff and consumable goods, controlling the hygienic of drinking water, surface and waste water, collects and processes prescribed health-statistical data and other.

The Center for Ecotoxicological Research (CETI) is an institution with a very wide range of activities: environmental testing/program monitoring, food safety, consumable goods - analysis of all toxics in toys, cosmetics, materials that come in contact with food, ionizing radiation protection and nuclear safety, waste categorization, occupational health and safety (preparation of a risk assessment document with a proposal of measures for their elimination, examination of working conditions: physical hazards, lightings, microclimate and chemical hazards), toxicological analysis - since the foundation CETI performs toxicological analyses of biological materials and unknown samples for health care purposes, judiciary, etc. In accordance with Article 7 of the Law on Air Protection, the Center for Ecotoxicological Research-Podgorica conducts the implementation of an annual program for monitoring the quality of air at the points of measurement in the state network established for the monitoring of air quality, except at the points of measurement for monitoring of cross-border air pollution and allergenic pollen.

The Directorate for Inspection Affairs performs tasks related to, inter alia: inspection supervision in the areas of environmental protection, mining, geology, energy efficiency, metrology, precious metals, space protection, health, water management, forestry, hunting and protection of plants in forests, and other tasks.

The Customs Administration is an administrative body within the Ministry of Finance that carries out tasks related to, inter alia: application of regulations relating to goods that are entered into the customs area until the determination of the customs approved treatment or use of goods (customs supervision, reporting of goods, submission of goods, storing of goods); control of import, export and transit of goods for which special measures are prescribed for protection of safety, health and life of people, animals and plants, environmental protection as well as other activities.

Statistical Office of Montenegro - MONSTAT is the body competent for the production of official statistics; it performs tasks related to: organization and implementation of statistical surveys; collection, processing, statistical analysis and publication of statistical data; development of methodologies for statistical research; issuing publications; application of statistical standards; development of a statistical information system in cooperation with the state administration body competent for information and other activities.

3.1.1. Relevant international stakeholders

The Global Environment Facility (GEF) was established to support environmental protection globally and promote sustainable development. GEF is providing new and additional grants to finance the additional costs involved in transforming projects of national importance into projects that benefit the environment globally. GEF donated funds to the project "*Revision of the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants*" (POPs), which also resulted in the Proposal of the National Implementation Plan for the Stockholm Convention.

The implementing agency for the mentioned project is **UNEP - United Nations Environment Program**. The advantage of the UNEP for GEF is that UNEP has an environmental focus for its core business. UNEP also provides GEF with the experience, ideas and knowledge on which future investments are based.

Also, the project "*Comprehensive environmentally friendly management of PCB waste in Montenegro*" is financed from GEF funds. The implementing agency for that project is **UNDP - United Nations Development Program**. The aim of the project is to identify equipment and waste containing PCBs, that is, to make an inventory, in order to then decontaminate or permanently dispose of it. The budget earmarked for the complete project is $23 million, of which the GEF is financing $3.5 million and the rest is funded by government (in kind) and project partners, namely CEDIS, Aluminum Plant Podgorica and other smaller entities. The advantage of UNDP for GEF lies in its global network of country offices, experience in integrated policy development, human resource development, institutional strengthening and the involvement of the non-governmental sector and the community. UNDP assists countries in designing and implementing activities in line with the GEF mandate and national sustainable development plans.

The Proposal of the NIP for the Stockholm Convention plans to prepare a project proposal to educate the public about the harmful effects of POPs, both on the environment and on human health. Funding for the implementation of this project is planned to come from the Quick Start Program Fund (QSP) established under the **Strategic Approach to International Chemical Management (SAICM**).

The problem of inherited industrial landfills is being addressed through the *Industrial Waste Management and Cleaning Project*, which addresses 4 environmental hot spots. The loan agreement for the implementation of this project was signed in 2014 with the **International Bank for Reconstruction and Development (IBRD)** with the repayment period of 27 years and a grace period of 5 years.

3.2. International agreements

Montenegro has ratified numerous international conventions that directly or indirectly regulate POPs.

The Law on the Confirmation of the Stockholm Convention on Persistent Organic Pollutants (Official Gazette of Montenegro - International Agreements 16/10) aims to eliminate or reduce the release of POPs. The main objectives of the Stockholm Convention can be divided into 5 the following areas:

- Control measures that include control measures for deliberately produced POPs, then for unintentionally produced POPs and control measures for storage and waste containing POPs substances;
- Adding new POPs to the annexes of the Convention;
- General obligations (determination of the national contact point, information exchange, raising awareness of the public)
- Implementation plans;
- Financial and technical assistance to developing countries and economies in transition.

The Law on the Confirmation of the Rotterdam Convention on the procedure of granting approval, based on the prior notice, for certain hazardous chemicals and pesticides in international trade (Official Gazette of Montenegro - International Agreements 03/11) aims to promote shared responsibility and cooperation between the contracting parties in the field of international trade with certain hazardous chemicals to protect human health and the environment from potential damage and to contribute to the use of chemicals in a way that is acceptable to the environment, by facilitating the flow of information on their characteristics, taking care of the decision-making process at the national level on import and export.

The Rotterdam Convention includes pesticides and industrial chemicals that are prohibited or severely restricted in order to protect human health or the environment. When a chemical is listed in Annex III of the Convention, the Decision Guidance Document is submitted to all Contracting Parties containing all the information on the chemical and the final regulatory measures that prohibit or severely restrict the use of the chemicals. The Contracting Parties have a period of nine months from the submission of the Decision Guidance Document to prepare a response concerning the future import of the chemical concerned. The answer can be final (allowing future imports, not allowing future imports, or allowing imports under certain conditions) or the response may be temporary. Decisions of importing countries are forwarded every six months to all Contracting Parties, through the PIC circulars, and the Exporting Parties are obliged under the Convention to take appropriate measures to ensure that exporters within their competence comply with these decisions. Each Contracting Party

shall be obliged to designate one or more state authorities that will be empowered to act on their behalf in performing administrative duties in accordance with the requirements of the Convention. The Agency for Protection of Nature and Environment has been appointed as a state-level body to coordinate the implementation of the Rotterdam Convention in Montenegro.

The Law on the Confirmation of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Official Gazette of the FRY - International Agreements 02/99) defines the control of transboundary or international movement of waste. The main objective of the Convention is the prohibition of trade in hazardous waste and the prevention of its export to undeveloped or less developed country under the "recycling" mask. All contracting parties will take measures to reduce the amount of waste produced at the source. Safe hazardous waste management should be secured before cross-border movement of waste by obtaining the necessary approval from the competent authorities of all stakeholders (including transit countries). Annex I of the Convention defines the following waste categories for control:

- Y4 Waste from the production, formulation and use of biocides and phytopharmaceutical products
- Y5 Waste from the production, formulation and use of chemicals for wood protection
- Y6 Waste from the production, formulation and use of organic solvents
- Y8 Waste mineral oils that do not correspond to their original purpose
- Y10 Waste substances and objects containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (CPBPs).

The Law on the Confirmation of the 1979 Convention on Long-range Transboundary Air Pollution (Official Gazette of Montenegro - International Agreements 11/86) aims at protecting people and their environment from air pollution as well as limiting, and as much it is possible, gradually reducing and preventing air pollution, including air pollution at large distances and beyond borders. Within the framework of this Convention, the Contracting Parties shall, by exchange of information, consultation, research and monitoring, elaborate a policy and strategy that will serve as a means of combating the emission of pollutants into the air, taking into account the efforts already made at the national and international levels. Bearing in mind the aforementioned, the **Action Plan for the confirmation and implementation of the Protocol on Heavy Metals, the Protocol on Persistent Organic Pollutants and Protocol on Preventing Acidification, Eutrophication and Ground Ozone** together with the Convention on the Long-Range Transboundary Air Pollution was prepared in October 2010.

By the Law on the Confirmation of the Protocol on POPs with the 1979 Convention on Long-Range Transboundary Air Pollution (Official Gazette of Montenegro - International Agreements 8/11) main obligations of the Contracting Parties are defined as follows:

- Eliminate the production and consumption of 11 substances listed in Annex I of the Protocol.
- Restrict the use of substances from Annex II of the Protocol (DDT, HCH and PCB) for special purposes and under certain conditions.

Montenegro ratified the **Convention on Access to Information, Public Participation in Decision-Making and the Right to Legal Protection in Environmental Matters** (Official Gazette of Montenegro - International Agreements 03/09) in 2009. The goal of adopting the Aarhus Convention is to protect the rights of every individual, current and future generations to life in an environment that is adequate to their health and well-being. The Aarhus Convention is an international legal instrument for the protection of the environment, which contains three sets of rules that relate to citizens' rights on access to information, citizens' rights of to participate in decision-making on environmental matters, and access to the justice in the event that the previous two rights are violated (legal protection).

Montenegro ratified the **Protocol on Pollutant Release and Transfer Register**s in July 2017 (Official Gazette of Montenegro - International Agreements 06/17).

In 1976, 16 Mediterranean countries (including the then SFR Yugoslavia) and the EU signed **The Convention on Protection of the Mediterranean Sea against Pollution (Barcelona Convention)** that came into force in 1978. Barcelona Convention and its protocols, together with the Mediterranean Actin Plan (MAP) are components of the UNEP Regional Seas Programme.

The Mediterranean Action Plan (MAP), which was established in 1975 by UNEP as the first Regional Seas Program. The main objective of UNEP/MAP was to establish co-operation between countries in the region to protect the Mediterranean Sea against pollution, but also to ensure a better quality of life for the inhabitants of the countries surrounding the Mediterranean Sea, and to establish and strengthen mutual cooperation and harmonize shared natural resource management strategies. It focuses on environmental protection, promoting a sustainable governance model, and harmonizing relations between Mediterranean countries.

Today, UNEP/MAP brings together 21 Mediterranean countries and the European Union (EU) that have ratified the Barcelona Convention of 1995, entitled **Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean**, which entered into force on 9 July 2004. In addition to the Barcelona Convention, a legal

framework called the "Barcelona System" is made up of seven Protocols that address specific aspects of protecting the marine and coastal ecosystems.

Finally, it is important to point out the **Strategic Approach to International Chemicals Management (SAICM**), which obliges states to assess the situation and develop national programs for the safe management of chemicals. In accordance with the mentioned program, the Government of Montenegro adopted the National Strategy for the Management of Chemicals 2019-2022 with the Action Plan 2019-2022, but since the POPs are very specific, and given the requirements of the Stockholm Convention, it is necessary to adopt the National Implementation Plan for the Stockholm Convention and in that way give a broader approach to managing POPs.

3.3. European legislation

The principal instrument for implementation of the Stockholm Convention is **Regulation (EC) No. 850/2004 on persistent organic pollutants** which aims to protect human health and environment while prohibiting, and gradually abolishing or limiting manufacture, placing on the market and use of substances subject to the Stockholm Convention or to the Protocol on POPs to the Convention on Long-Range Transboundary Air Pollution.

Regulation (EC) No. 1907/2006 concerning the registration, evaluation, authorisation and restriction of chemicals (REACH) and establishing a European Chemicals Agency aims to increase knowledge of the specificities of chemicals and improve safe chemical management, while also contributing to the identification and control of substances which manifest specificities of POPs.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals incorporates obligations laid down in the Rotterdam Convention for PIC procedure (Prior Informed Consent) and, among others, includes prohibitions of import of 10 POPs which are currently specified in the Stockholm Convention.

Moreover, another important legal instrument of the EU is **Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT),** the aim of which is taking all the necessary measures in order to dispose used PCBs, eliminate and decontaminate PCBs and equipment that contains PCBs within the shortest time possible.

As for the obligations that are needed for protection of the placing on the market and use of the “new POPs”, vitally important are the **CLP Regulation, Directive on the plant protection products and Biocidal Products Regulation**.

As for unintentionally produced POPs, there is a set of EU legislation which has impact on reduction of the emission of POPs. The main safeguard is set out in the **Directive 2010/75/EC** on industrial emissions, which also lays down rules for prevention or, where that is not feasible, reduction of emissions into the air, water and soil and prevention of the generation of waste in order to achieve high level of the overall environmental protection.

European Pollutant Emission Register (EPER) is register of major industrial emissions into the soil and water which was set up under the Decision 2000/479/EC which includes all unintentionally produced POPs set out in the Regulation No. 850/2004 (except for PCB). In 2007, the Register was replaced by **Regulation No. 166/2006/EC** which governs reporting on PCB, discharges into the soil and off-site transfer of waste.

Directive on the incineration of waste 2000/76/EC covers all the waste incineration plants and addresses very important issue involving sources of by-products of POPs. It also sets out limit values for emissions of dioxins and furan into the air (0.1 mg I-TEQ/m^3) and water (0.3 mg/l). In addition, **Directive on limitation of emissions into the air from large combustion plants** 2001/80/EC is also relevant from the perspective of the emission of POPs. **Directive 2000/53/EC on end-of-life vehicles** sets out segregation of hazardous components from vehicles before any shredding and proper disposal. **Directive 2002/96/EC** highlights the need to establish collection schemes, the aim of which is to increase recycling and/or reuse of waste from electric and electronic equipment; it was amended by **Directive 2012/19/EC on waste electrical and electronic equipment**. Moreover, **ROHS Directive 2011/65/EU** sets out that heavy metals, such as lead, mercury, cadmium, hexavalent chromium, flame retardants such as polychlorinated biphenyls (PBB) and polychlorinated diphenyl ethers (PBDE) must be replaced by safer alternatives.

With respect to the release of POPs into water, a list of priority substances is attached to **Directive 2013/39/EU amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy**.

EU legislation in the field of waste, and particularly **Directive 2008/98/EC** which constitutes legal framework for waste management policy lays down waste management principles such as “polluter pays” and “waste hierarchy”, while it is also relevant from the perspective of POPs. Cross-border movement of waste is covered by **Regulation No. 1013/2006,** which also transposes Basel Convention into the EU law. Movement of the waste that consists of or contains POPs is governed by the Regulation mentioned above. The type of control depends on waste classification, waste destination and on whether it is disposal or recovery that has been planned.

Unlike Regulation No. 315/96 EC which included a small number of POPs (mainly dioxins and PCB), **Directive 2002/32/EC** on undesirable substances in animal feed covers the majority of POPs.

In the **EU Common Position for Chapter 27**: **Environment and Climate Change,** the EU stated that Montenegro, in its negotiating position, accepts, inter alia, all of the acquis in Chapter 27, which must be implemented from the date of accession to the European Union, with the exception of certain requests for transitional deadlines. A transitional deadline was requested, inter alia, for Article 3 of Directive 96/59/EC on the disposal of polychlorinated biphenyls (PHBs) and polychlorinated terphenyls (PHTs) by 31 December 2025.

Montenegro's Indicative Strategy Paper for IPA 2014-2020 provides an analysis of all areas for which the EU plans to provide financial support to Montenegro during the integration process, including the environment and climate change. The document outlines all the challenges and objectives in the area of safe management, as well as the activities to be implemented that will directly impact the adequate management of chemicals and related POPs substances.

3.4. Master strategy papers

The Government of Montenegro's Mid-Term Work Program 2018-2020 has identified, among other things, priority 5 *"Montenegro - a state that cares for the health and well-being of its citizens and a healthy environment"*, which aims inter alia to create conditions for accessible, quality and long-term sustainable health care system, improvement of living and housing conditions of citizens, poverty reduction, effective and timely support to vulnerable groups and permanent protection of the most vulnerable, especially children, respecting the principle of equal opportunities for all. This priority implies, among other things, improving the environment. Improving the monitoring system for POPs and meeting the measures foreseen in the Action Plan for Contaminated Sites of the NIP for the Stockholm Convention are just some of the ways in which they will contribute to the improvement of the environment.

Development Directions of Montenegro 2018-2021 represent an umbrella development implementation document, setting out a vision for socio-economic development and covering, among other things, part of the environment, with a focus on the National Strategy for the Transposition, Implementation and Enforcement of the EU Environmental and Climate Change Acquis with the Action Plan in the period 2016-2020. Adoption of an updated NIP is one of the priorities defined by the stated Strategy for the period 2016-2020.

It is also important to point out the **Strategy for Regional Development of Montenegro for the period 2014-2020**, which defines "Protection of human health and the environment from persistent organic pollutants" as one of its priorities. The measure defined in the Strategy as “Establishment of a System for Identification, Labelling, Removal, Storage and Permanent Disposal of PCBs Equipment and Waste with PCBs” is also covered by the NIP for the Stockholm Convention and the PCB Action Plan.

The **National Sustainable Development Strategy until 2030** points to the importance of persistent organic pollutants in the “Environment and Health” section.

The Europe 2020 Strategy aims at the EU's economic development based on knowledge while preserving the environment, and achieving high levels of employment, productivity and social cohesion. The Europe 2020 strategy is not only important for EU Member States, but also represents a significant potential for EU candidate and potential EU membership candidates to guide their reform processes. The analysis of the formulated goals of Europe 2020 reveals that the EU priorities are at the same time the priorities of the development of Montenegro, which are covered by the umbrella national strategic documents.

Also, the **European Commission's Strategic Plan 2016-2020**, part of which relates to sustainable environmental management, indicates, among other things, the need to have an adequate chemicals management policy, their knowledge of the market, and to reduce exposure to hazardous chemicals, including POPs chemicals.

3.5. Sectoral strategic documents

The National Implementation Plan for the Stockholm Convention 2014-2021 was adopted by the Government of Montenegro in November 2013. The aim of the NIP for the Stockholm Convention is to provide assistance in fulfilment of the obligations arising from the Convention, raise awareness about POPs and measures for their control, set out measures taken to reach that goal and establish strategy and action plans for further steps to be taken in respect of persistent organic pollutants. The said NIP has covered POPs that were added at the conferences of the parties in 2009 and 2011, but no inventory was made for new POPs.

In accordance with Article 63 of the Chemicals Law (Official Gazette of Montenegro 51/17), the **National Chemical Management Strategy 2019-2022** with Action Plan 2019-2022 was adopted with the aim to ensure adequate management of chemicals, from production or import to disposal. The overall strategic goal pursued by this strategy is to build a chemical management system that provides a high level of protection of human health and the environment, as well as to improve free trade with EU countries and other countries while encouraging the competitiveness of the Montenegrin economy through the introduction of safer chemicals and technological processes. The stated objective will be achieved through

the achievement, inter alia, of a goal directly related to the NIP for the Stockholm Convention, namely "Advancing technologies in industrial plants and addressing industrial waste and obsolete chemicals".

On 20 April 2017, the Government of Montenegro adopted the **Fourth Report on implementation of the National Strategy for Air Quality Management accompanied by the Action Plan for the period 2017-2020**. The Action Plan sets out the implementation of 43 measures for the improvement of air quality, including measures that will improve legal and strategic framework and system for air quality monitoring, while it also raises public awareness about importance of air quality for human health.

Waste Management Strategy of Montenegro by 2030 entails a broad range of the achieved goals, for the purpose of creating desired conditions which should result in improvement of the quality of life of the population. The Strategy sets its goals in line with the need to ensure synergy between development of the state and preservation of the environment in respect of impact of waste on the quality of its basic parameters. The Strategy also treats waste containing PCBs, which can be considered as one of the most important types of industrial waste by origin and place of production.

National Waste Management Plan for Montenegro 2015-2020 includes, among other things, data on the quantities of waste equipment that contains PCB and data on exports of PCB waste (types, quantities and origin of the exported waste).

Water Management Strategy of Montenegro was adopted in June 2017 and ensures continuity in the long-term planning of the functioning of the water sector, on the principle of sustainable development, that is, the conduct of water activities in its core areas. According to the Strategy, the chemical status of surface waters must be such that the concentration of pollutants (hazardous and priority substances) does not exceed the environmental standard under the regulations. Chemical status is based on 2 categories: satisfactory (good status) or not satisfactory (poor status). POPs are priority substances.

National Strategy for transposition, implementation and enforcement of the EU acquis on environment and climate change accompanied by the Action Plan for the period 2016-2020 was drawn up in order to achieve gradual and full approximation with the EU acquis for Chapter 27 – Environment and Climate Change. The update of the NIP for the Stockholm Convention is one of the measures planned to implement Regulation (EC) 850/2004 (POPs).

3.6. Montenegrin Legislation

Basis for environmental legal framework is to be found in the Constitution of Montenegro, which affirms the right of citizens to a healthy environment, as well as the obligation of citizens to protect and improve environment.

The legislative and legal framework regulating the POPs management in Montenegro is being harmonized with the EU legislation in this area, i.e. Regulation (EC) No. 850/2004 on persistent organic pollutants (POPs), which is transposed through a number of laws and enabling regulations, as described in more detail below.

The main piece of legislation in Montenegro governing the environment is the **Law on the Environment** (Official Gazette of Montenegro 52/16) which defines persistent organic pollutants as the substances that: possess toxic properties; are difficult to decompose; are bio-accumulative; are transmitted through the atmosphere and deposited at faraway distances; and produce significant negative effects on human health and environment in the proximity and far away from the source of their occurrence.

The said Law prohibits manufacture, placing on the market and use of POPs in preparations or as constituent parts of articles. The prohibition does not apply to POPs used for laboratory testing or as a reference standard; nor does it apply to those appearing in traces and whose presence in substances, preparations or articles in unintentional.

On the basis of the aforementioned Law, the **Rulebook on the contents and method of keeping a cadastre of environment polluters** (Official Gazette of Montenegro 45/17) was adopted, which prescribes the more detailed content and method of keeping the cadastre of environment polluters, abiding entities, method and timeline for collecting and submitting data on emissions or discharges and other data of importance for maintaining the polluter cadastre.

Also, the **Rulebook on criteria to be met by the reference laboratory for environmental monitoring** (Official Gazette of Montenegro 11/17) was adopted.

In addition to the Law on the Environment, as an overarching law, a whole range of other laws was also adopted along with implementing acts relevant for both the environment and establishment of the system for safe POPs management, and these include:

Law on Chemicals (Official Gazette of Montenegro 51/17) which regulates classification, packaging and labelling of chemicals, placing on the market, imports and exports of hazardous substances and other matters relevant for the protection of life and health of humans and environment against harmful impact of chemicals. Based on this law, numerous

implementing acts were adopted regulating in more detail the area of chemical management, and the most important in respect of POPs are:

Rulebook on the list of hazardous chemicals and products whose export is prohibited (Official Gazette of Montenegro 31/14) whose Annex 1 contains POPs specified on the list in Annexes A and B to the Stockholm Convention. This Rulebook already includes all the POPs added in 2009 and 2011.

Rulebook on the more detailed content of prior notification for the export of chemicals (Official Gazette of Montenegro 61/17) regulates in more detail the export of chemicals on the basis of notification and export of chemicals on the basis of prior informed consent. For instance, endosulfan is specified on the list of chemicals for which it is necessary to conduct consent granting procedure on the basis of prior notification, while pentachlorophenol and its salts and esters (POP added in 2015) is specified in Annex 1 and is a chemical which is subject to the PIC procedure.

POPs may be used in accordance with the **Decree on prohibited and/or allowed methods of use, production and placing on the market of the chemicals that represent an unacceptable risk to human health and the environment** (Official Gazette of Montenegro 70/18). The Decree fully transpose Annex I and II of the POPs Regulation as well as all recent amendments to Annex XVII of REACH Regulation (Regulation 519/2012 amending Regulation 850/2004 of the European Parliament and of the Council on POPs as regards Annex I, Regulation 2016/293 amending Regulation 850/2004 of the European Parliament and of the Council on POPs as regards Annex I).

Law on Plant Protection Products (Official Gazette of Montenegro 51/08, 40/11, 18/14) sets out the manner of classification, registration, placing on the market and use of plant protection products and active substances, maximum allowed level of residues of plant protection products, manner of keeping registers and records, exchange of data and other matters relevant for plant protection products. Plant protection products and active substances which are established to be harmful to human lives and health and to the environment are classified, labelled and packed in accordance with the Law on Chemicals. Classification and labelling of waste, treatment of waste of the plant protection products and packaging are done in accordance with the Law on Waste Management.

After gaining insight into the **List of active substances allowed for use in plant protection products for 2019** (Official Gazette of Montenegro 15/19), a conclusion was reached that this list did not contain a single active substance classified as POPs pesticides.

Rulebook on the maximum level of residues of the plant protection products on or in plants, plant products, food or animal feed (Official Gazette of Montenegro 21/15, 44/15) regulates maximum levels of residues of the plant protection products (pesticides) on/in the

plants or plant products, food or animal feed, as well as the plants and plant products, food or animal feed for which maximum level of pesticides are established, for the purpose of protecting consumers and monitoring pesticide residues. The maximum levels of pesticide residues are specified in the said Rulebook.

Pursuant to the Law on Food Safety (Official Gazette of Montenegro 57/15) and with reference to Article 10 of the Law on Plant Protection Products (Official Gazette of Montenegro 51/08 and 18/14), the Ministry of Agriculture and Rural Development, with the consent of the Ministry of Health, adopted the **Programme for monitoring pesticide residues in the food of plant and animal origin** (Official Gazette of Montenegro 10/19). The Programme sets out the requirements and methods of monitoring, methods of control, conditions, manner and methods of taking and storing samples, keeping records on samples and methods of laboratory testing for the purpose of monitoring the level of pesticide residue. The programme aims to assess threat to the population health and implementation of the legislation, in accordance with the levels of pesticide residues set out in the Rulebook on the maximum level of residues of the plant protection products on or in the plants, plant products, food or animal feed (Official Gazette of Montenegro 21/15 and 44/15). Samples of food intended for infants and young children shall be evaluated on products ready for use or prepared according to the manufacturer's instructions, taking into account the maximum residue levels laid down in the Regulation on the manner and conditions for the placing on the market of food for particular nutritional uses (Official Gazette of Montenegro 10/17). If such food can be consumed as a finished product and as a product for preparation, results for the finished product shall be provided.

Law on Medicinal Products (Official Gazette of Montenegro 79/04) regulates manufacture, placing on the market and clinical testing of medicinal products that are to be used in human medicine, while **Law on Medicines** (Official Gazette of Montenegro 56/11, 6/13) lays down conditions for the manufacture, placing on the market and testing of medicines to be used on humans and in veterinary medicine, measures for quality assurance, safety and efficiency of medicines, competences of bodies in the area of medicines and other matters relevant for the performance of this activity. In this regard, the licenses for lindane-based prescription medicines against pediculosis have lapsed.

Law on Biocidal Products (Official Gazette of Montenegro 54/16) regulates the manner of placing on the market and using biocidal products, exports, imports and other matters relevant for the use of biocides. Biocide contains active substances that are allowed to be used in biocides and biocidal products which pose lower risk. Since none of the POPs have suitable status of active substances in biocidal product, they are not specified in the **Rulebook on the lists of active substances that are allowed to be used in biocidal products and biocidal products that pose lower-risk** (Official Gazette of Montenegro 72/16), placing on the market and use of biocidal products is prohibited by law.

Law on Waste Management (Official Gazette of Montenegro 64/11, 39/16) regulates types and classification of waste, planning, requirements for and manner of waste management and other matters relevant for waste management. Waste management means prevention of occurrence, reduction of the quantity of waste or reuse of waste and collection, transport, treatment and management of waste, supervision of these procedures and subsequent maintenance of landfills, including activities of waste traders and intermediaries.

The Law mentioned above defines PCB as polychlorinated biphenyls, polychlorinated terphenyls (PCT), monomethyl-tetrachloro-diphenyl-methanes, diphenyl-methanes, monomethyl-dibromo-diphenyl-methanes or any other mixture that contains some of these substances in the concentration higher than 0,005% of the mass fraction, including devices, objects, materials or liquids which contain, are composed of are contaminated by PCB.

Moreover, National Waste Management Plan as a fundamental document which sets out long-term waste management goals and conditions for rational and sustainable waste management in Montenegro also contains, amongst other things, measures for segregation of PCB and decontamination of equipment and PCB contained in it, as well as the time-limits for waste decontamination and disposal.

The Law on Waste Management prohibits mixing of waste oil for lubrication and liquids during collection and storage with other hazardous waste, including waste that contains PCB.

Moreover, the Law on Waste Management prohibits treatment of PCB and packaging that contains PCB. Segregation of PCB from equipment, treatment of PCB and decontamination of equipment can be performed either by a company or by entrepreneur provided that they possess proper equipment, facility for temporary storage of PCB and necessary number of employees, and this is to be done on the basis of a licence for hazardous waste disposal. PCB is burnt in waste incinerators which meet requirements set out by this Law. Import of the equipment that contains PCB is prohibited. Incineration of PCB on ship decks and charging transformers and other enclosed systems (condensers) by using liquids that contain PCB is also prohibited.

Holder of equipment and waste that contain PCB is obliged to draw up a management plan for equipment and waste that contain PCB and keep records on the equipment and waste that contain PCB and on quantities of PCB (and to submit data from the records to the Agency until 31 March of the current year for the previous year). Numerous implementing acts were adopted based on this Law for the purpose of regulating waste management in more detail, and the most important ones for PCB are listed below:

Rulebook on waste classification and waste catalogue (Official Gazette of Montenegro 59/13) regulates waste classification, waste catalogue, treatment, processing and removal

of waste. The waste catalogue is a list of waste which is, according to its properties and place of generation, classified into groups, subgroups and types of waste, while it also specifies activities which lead to waste generation. Waste is classified based on the waste catalogue. Waste is classified according to the place in which it is generated and its origin into 20 groups which are marked by two-digit number from 01 to 20. According to the processes in which waste is generated, the groups of waste have either one or more subgroups marked by four-digit numbers. According to the part of the process in which waste is generated, subgroups may be classified into either one or more types. Types of waste are marked by six-digit numbers, of which the first four digits mark a subgroup, while the remaining two mark a part of the process in which waste is generated (e.g. 16 02 09* transformer and condenser that contain PCB).

Rulebook on handling equipment and waste that contain PCB (Official Gazette of Montenegro 48/12, 67/18) regulates the manner of drawing up management plans for equipment and waste that contain PCB, manner of and procedure for keeping records, manner of marking decontaminated equipment, manner of and procedure for handling equipment and waste that contain PCB and decontamination of equipment and quantities of PCB in equipment. This Rulebook also applies to: PCB and waste that contains PCB; equipment that contains more than 5dm^3 of PCB, except for waste generated by electrical and electronic products; construction material that contains PCB. If the equipment mentioned above consists of condensers, the volume of 5dm^3 of PCB refers to the volume of PCB in all condensers in the equipment.

Rulebook on the treatment of waste oil (Official Gazette of Montenegro 48/12) regulates treatment of waste oils in accordance with technical and technological requirements for the treatment of waste oils. Waste oil collectors deliver collected waste oil to the company or to the entrepreneur who hold licence for the treatment of waste oil by regeneration or removal. Waste oil collectors check the content of water and PCB in waste oil after each 200 t the waste oils they receive. The check of the content of PCB in waste oils is performed in accordance with standards EN 12766-1 and EN 12766-2. If it is established during the check, based on the standards mentioned above, that the mass of PCB in waste oil is higher than 0.005% of the waste oils mass, waste oil collectors may refuse to accept such waste oil and notify competent inspector thereof.

Waste oils may be regenerated only if waste oil contains maximum 5 mg of PCB and maximum 30 mg of halogens in 1 kg of oil. Waste oils may be refined only if they contain maximum 50 mg of PCB in 1 kg of oil. Waste oils that contain more than 50 mg of PCB in 1 kg of oil may be refined only if the oil contains maximum 5 mg of PCB and maximum 30 mg of halogens in 1 kg of oil after regeneration process. Waste oils may be incinerated as fuel at the incinerator only if they contain maximum 15% of water in the total mass of water and oil mixture, maximum 10 mg of PCB in 1 kg of oil, if their flash point exceeds 63^{o}C and their

caloric value exceeds30 MJ/kg. If waste oils do not meet these requirements, i.e. they cannot be regenerated, refined or used as fuel, such waste oils are removed as hazardous waste.

Having in mind that a certain quantity of c-penta BDE is found in end-of-life vehicles, it is important to point out Article 48 of the Law on Waste Management, which stipulates that an end-of-life vehicle owner delivers such vehicle to a company or an entrepreneur having a license for the treatment of end-of-life vehicles. The procedure for collecting and delivering end-of-life vehicles whose owners are unknown is set out by the **Rulebook on the collection and delivery of end-of-life vehicles whose owners are unknown** (Official Gazette of Montenegro 47/13). The end-of-life vehicles whose owners are unknown are vehicles that are not registered, do not have license plates, and are not taken care of by anybody. For those vehicles, when they are located on public areas (public roads, city streets and streets in settlements, parks, parking lots, aquatic lands), legal entities that manage those areas (utility companies, legal entities that manage public roads, coastal area, national parks and waters) provide collection and transfer to the receiving point or treatment plant. The vehicles that are located on real properties other than public areas are to be collected and transferred to the receiving point or treatment plant by owners of those real properties.

The **Rulebook on the limit values for the presence of hazardous substances in electrical and electronic products** (Official Gazette of Montenegro 67/18) was adopted, where the limit values for most new POPs (c-penta BDE, c-vinegar BDE) are in compliance with RoHS Directive 2011/65/EC.

The adoption of a new Law on Waste Management is planned for 2020 and it will, inter alia, be supplemented with provisions regulating POPs waste management. In order to improve national legislation regarding the POPs waste management, the Law on Waste Management should be supplemented by the provisions of Article 7 of the POPs Regulation. Also, the Law will provide the legal basis for the adoption of the **Rulebook on the handling and management of POPs waste**, which will, inter alia, regulate the concentration limits for the content of POPs substances in the waste, thereby fully transposing Annexes IV and V of the POPs Regulation (Regulation No. 756/2010 amending Regulation No. 850/2004 of the European Parliament and of the Council on POPs as regards Annexes IV and V; Regulation No. 1342/2014 amending Regulation No. 850/2004 of the European Parliament and of the Council on POPs as regards Annexes IV and V; and Regulation 2016/460 amending Annexes IV and V to Regulation No. 850/2004 of the European Parliament and of the Council on POPs as regards Annexes IV and V).

Law on Air Protection (Official Gazette of Montenegro 25/15, 43/15) regulates the manner of monitoring air quality, safeguards, evaluation and improvement of air quality, as well planning and air quality management.

Limit values for emissions of pollutants and other safeguards for protection of the air from stationary sources and activities causing emissions of pollutants into the air are regulated in the **Decree on limit values for emissions of pollutants into the air from stationary sources** (Official Gazette of Montenegro 10/11). Limit values for polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) (dioxins and furans) amount to 0.25 μg/h for the mass flow and 0.1 ng/m^3 for the mass concentration, where the mass of dioxins and furans is expressed by multiplying mass with the toxic equivalency factor. Correction factors of toxic equivalency for individual dioxins and furans are specified in Annex II to the Rulebook mentioned above.

On the basis of the aforementioned law, the **Rulebook on detailed method and necessary documentation for issuing a licence for permissible emissions of air pollutants** (Official Gazette of Montenegro 25/13, 61/13) was adopted, which defines the documents and method of issuing the license for permitted emissions of pollutants into the air.

Also, the **Decree on activities that affect or may affect air quality** (Official Gazette of Montenegro 61/12) identifies the activities that affect or may affect air quality.

By ratifying the Convention on Long-Range Transboundary Air Pollution (CLRTAP), Montenegro is obliged to update the Gas Emission Inventory.

Pursuant to Article 36, paragraph 3 of the Law on Air Protection, the Ministry of Sustainable Development and Tourism has adopted a **Data collection plan for the preparation of an inventory of greenhouse gas emissions for 2018** (Official Gazette of Montenegro 92/17). The annual inventory of greenhouse gas emissions is prepared in accordance with the UNFCCC Secretariat Guidelines and the Intergovernmental Panel on Climate Change (IPCC) methodology, continuously since 2008, when it was first developed within the preparation of the First National Communication.

Moreover, **Law on Industrial Emissions** (Official Gazette of the Republic of Montenegro 80/05, Official Gazette of Montenegro 54/09, 40/11, 42/15, 54/16) sets out instruments for implementation of the measures related to reduction or elimination of the emission of unintentionally produced POPs in accordance with Article 5 of the Stockholm Convention.

Under Article 67 of the Law on Arable Land (Official Gazette of the Republic of Montenegro 15/92), the Ministry of Agriculture, Forestry and Water Management adopted **Rulebook on allowed quantities of hazardous and harmful substances in soil and methods for their testing** (Official Gazette of the Republic of Montenegro 18/97). This Rulebook sets out maximum allowed quantities of hazardous and harmful substances in soil, which may lead to its pollution, and which result from improper use of mineral fertilizers and plant protection products by legal and physical persons and from discharge of waste substances from various sources. Maximum allowed quantities of plant protection products in soil for

organochlorine compounds amount to DDT + DDD + DDE 0.01 mg/kg. Maximum allowed quantities of toxic and carcinogenic substances in soil for polychlorinated biphenyls and terphenyls (PCB and PTC) for each of congeners (28, 52, 101, 118, 138, 153 and 180) amount to 0.004 mg/kg.

Law on Waters (Official Gazette of the Republic of Montenegro 27/07, Official Gazette of Montenegro 32/11, 47/11, 48/15, 52/16, 55/16) regulates legal status and manner of integrated management of water, soil under water and alongside water and water structures, requirements for and manner of performing water related activities etc. Surface waters are evaluated and classified into appropriate categories according to their chemical and ecological status, i.e. potential for heavily modified and artificial water bodies, while groundwater is assessed and classified into appropriate categories according to their quantitative and chemical status. The categories of surface water status are: very good, good, moderate, poor and bad. The groundwater status categories are: good and bad.

In April 2019, **The Regulation on the manner and deadlines for determining the status of surface waters** (Official Gazette of Montenegro 25/19) was adopted, prescribing the manner and deadlines for determining the status of surface waters, the manner of monitoring the chemical and ecological status of surface waters, a list of priority substances and measures to be taken to improve the status of surface waters.

Rulebook on the quality and sanitary-technical requirements for discharging waste water into the recipient and public sewer system, manner of and procedure for testing waste water quality, minimum number of tests and content of the report on the established quality of waste water (Official Gazette of Montenegro 45/08, 9/10, 26/12, 52/12, 59/13) sets out quality and sanitary-technical requirements for discharging waste water into the recipient and public sewer system, manner of and procedure for testing waste water quality, minimum number of tests and content of the report on the established water quality. Maximum allowed concentrations of hazardous and harmful substances in waste water that maybe discharged into the public sewer system are given in Table 2 below:

Table 2 - Maximum allowed concentrations of hazardous and harmful substances in waste water that maybe discharged into the public sewer system

Parameter	Maximum allowed concentration
Total aromatic hydrocarbons	0.4 mg/l
Total halogenated hydrocarbons	1.0 mg/l
Total organochlorine pesticides	0.05 mg/l

Maximum allowed concentrations of hazardous and harmful substances in waste water that may be discharged into the **surface water** are given in Table 3 below:

Table 3 - Maximum allowed concentrations of hazardous and harmful substances in waste water that may be discharged into the surface water

Parameter	Maximum allowed concentration
Total aromatic hydrocarbons	0.05 mg/l
Total halogenated hydrocarbons	0.25 mg/l
Total organochlorine pesticides	0.025 mg/l

Moreover, the monitoring is carried out by systematic monitoring of the status of waters to determine the status of water on the basis of the program covering all water areas. The monitoring program includes for:

1) surface waters: volume and water level or flow to a level that is significant for ecological and chemical status and ecological potential; ecological and chemical status and ecological potential;
2) groundwater: chemical and quantitative status;
3) protected areas: includes data of importance for protected areas in accordance with the document on the protection of those areas.

The monitoring may also include the supervisory monitoring, which is carried out in order to obtain data for monitoring long-term changes in water status; operational monitoring, conducted to determine the status of water bodies that have been identified as being at risk of failure to meet environmental objectives; and research monitoring, which is carried out in order to determine the reasons for changing status of water bodies. The water monitoring is performed by the Institute for Hydrometeorology and Seismology.

Occupational health and safety are ensured and implemented by using modern technical-technological, organisational, health, social and other measures and means of protection in accordance with **Law on Occupational Health and Safety (Official Gazette of Montenegro 034/14, 44/18)**. A large number of implementing acts was adopted based on this Law including, among others, **Rulebook on occupational health and safety measures for the purpose of protection against the risk of exposure to chemical substances (Official Gazette of Montenegro 81/16, 30/17 and 40/18),** which prescribes the minimum requirements to be fulfilled by the employer in taking occupational health and safety measures, including limit values, to eliminate or reduce risks of occupational injuries, occupational diseases and work-related illnesses that occur during work when exposed to the chemical substances.

Rulebook on occupational health and safety measures for the purpose of protection against the risk of exposure to carcinogenic and mutagenic substances (Official Gazette of Montenegro 60/16, 11/17, 43/18, 20/19), which set out minimum requirements to be met by employer in ensuring implementation of the occupational health and safety measures, including limit values, in order to eliminate or reduce risks of occurrence of work related injuries, occupational diseases and diseases related to work which occur during exposure of employee to the chemical substances and carcinogenic and mutagenic substances.

Law on Liability for the Harm Caused to Environment (Official Gazette of Montenegro 27/14, 55/16) regulates the manner of and procedure for establishing liability for the harm caused to environment, as well as the application of preventive and remediation measures in order to prevent and eliminate harm caused to the environment. Legal and physical persons that caused harm to the environment in the course of performance of their activity i.e. while undertaking actions are liable for the damage they caused and are obliged to take measures for prevention and remediation of such damage in accordance with this Law.

Law on Food Safety (Official Gazette of Montenegro 57/15) prescribes the conditions for the safety of food and feed, the obligations and responsibilities of the entities conducting business with food and feed, including traditional products, in order to protect the lives and health of people, the environment, consumers and the efficient operation of the market.

IV MANAGING OF POPs CHEMICALS IN MONTENEGRO

4.1. Assessment of POPs pesticides

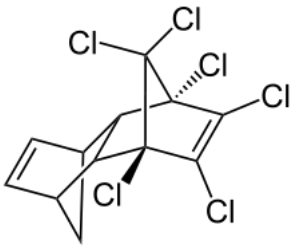
4.1.1. POPs pesticides

The Stockholm Convention is an international treaty to protect human health and the environment from POPs. It became effective in 2004 and initially included 12 chemicals. Of these 12 initial components from the Stockholm Convention list, 9 are pesticides: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex and toxaphene. Each of these components is categorized into one of the 3 Annexes.

- **Annex A:**Parties to the Convention must take measures to eliminate the production and use of the chemicals listed under Annex A. Specific exemptions for use and production are listed in the Annex and apply only to Parties that register for them.
- **Annex B:**Parties must take measures to restrict the production and use of the chemicals listed under Annex B in light of any applicable acceptable purposes and/or specific exemptions listed in the Annex.
- **Annex C:** Parties must take measures to reduce the unintentional releases of chemicals listed under Annex C, with the goal of continuing minimization and, where feasible, ultimate elimination.

4.1.1.1. Initial 9 POPs pesticides

- **Aldrin –**Pesticide listed under Annex A



Fugure 1 – Structural formula of Aldrin

A pesticide applied to soils to kill termites, grasshoppers, corn rootworm, and other insect pests, aldrin can also kill birds, fish, and humans. In humans, the fatal dose for an adult male is estimated to be about five grams. Humans are mostly exposed to aldrin through dairy products and animal meats.

- **Chlordane** - Pesticide listed under Annex A

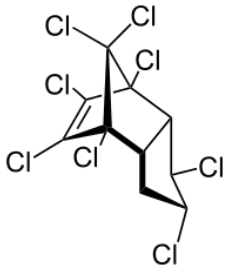


Figure 2- Structural formula of Chlordane

Used extensively to control termites and as a broad-spectrum insecticide on a range of agricultural crops, chlordane remains in the soil for a long time and has a reported half-life of one year. The lethal effects of chlordane on fish and birds vary according to the species. Chlordane may affect the human immune system and is classified as a possible human carcinogen. It is believed that human exposure occurs mainly through the air.

- **DDT** - Pesticide listed under Annex B

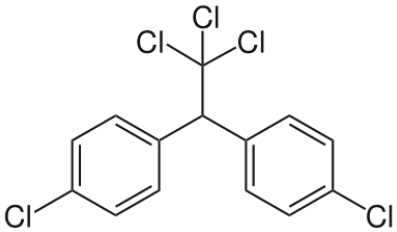


Figure 3- Structural formula of DDT

DDT was widely used during World War II to protect soldiers and civilians from malaria, typhus, and other diseases spread by insects. After the war, DDT continued to be used to control disease, and it was sprayed on a variety of agricultural crops, especially cotton. DDT continues to be applied against mosquitoes in several countries to control malaria. Its stability, its persistence (as much as 50% can remain in the soil 10-15 years after application), and its widespread use have meant that DDT residues can be found everywhere; residual DDT has even been detected in the Arctic.

Perhaps the best known toxic effect of DDT is egg-shell thinning among birds, especially birds of prey. Its impact on bird populations led to bans in many countries during the 1970s. The short-term acute effects of DDT on humans are limited, but long-term exposures have been associated with chronic health effects. DDT has been detected in breast milk, raising serious concerns about infant health.

- **Dieldrin** - Pesticide listed under Annex A

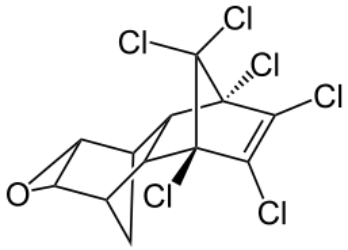


Figure 4 – Structural formula of Dieldrin

Used principally to control termites and textile pests, dieldrin has also been used to control insects living in agricultural soils. Its half-life in soil is approximately five years. The pesticide aldrin rapidly converts to dieldrin, so concentrations of dieldrin in the environment are higher than dieldrin use alone would indicate. Dieldrin is highly toxic to fish and other aquatic animals, particularly frogs, whose embryos can develop spinal deformities after exposure to low levels. Dieldrin residues have been found in air, water, soil, fish, birds, and mammals, including humans. Food represents the primary source of exposure to the general population. For example, dieldrin was the second most common pesticide detected in a US survey of pasteurized milk.

- **Endrin** - Pesticide listed under Annex A

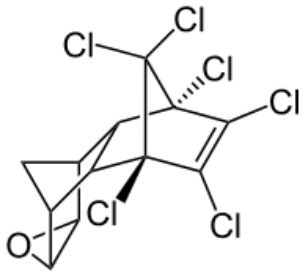


Figure 5 – Structural formula pf Endrin

This insecticide is sprayed on the leaves of crops such as cotton and grains. It is also used to control rodents such as mice. Animals can metabolize endrin, so it does not accumulate in their fatty tissue to the extent that structurally similar chemicals do. It has a long half-life, however, persisting in the soil for up to 12 years. In addition, endrin is highly toxic to fish. The primary route of exposure for the general human population is through food, although current dietary intake estimates are below the limits deemed safe by the World Health Organization.

- **Heptachlor** - Pesticide listed under Annex A

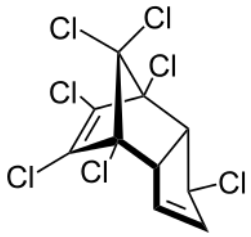


Figure 6 - Structural formula of Heptachlor

Primarily used to kill soil insects and termites, heptachlor has also been used more widely to kill spiders, grasshoppers, other crop pests, and malaria-carrying mosquitoes. It is believed to be responsible for the decline of several wild bird populations, after eating seeds treated with levels of heptachlor lower than the usage levels recommended by the manufacturer, indicating that even responsible use of heptachlor may kill wildlife. Laboratory tests have also shown high doses of heptachlor to be fatal to rats and rabbits, with lower doses causing adverse behavioural changes and reduced reproductive success. Heptachlor is classified as a possible human carcinogen. Food is the major source of exposure for humans, and residues have been detected in the blood of cattle from the US and from Australia.

- **Hexachlorobenzene (HCB)** - Pesticide listed under Annex A and Annex C

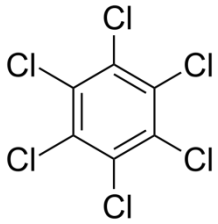


Figure 7 - Structural formula of HCB

First introduced in 1945 to treat seeds, HCB kills fungi that affect food crops. It was widely used to control wheat bunt. It is also a byproduct of the manufacture of certain industrial chemicals and exists as an impurity in several pesticide formulations. When people in eastern Turkey ate HCB-treated seed grain between 1954 and 1959, they developed a variety of symptoms, including photosensitive skin lesions, colic, and metabolic disorders and not a few died. Mothers also passed HCB to their infants through the placenta and through breast milk. In high doses, HCB is lethal to some animals and, at lower levels, adversely affects their reproductive success. HCB has been found in food of all types. A study of Spanish meat found HCB present in many samples.

- **Mirex**- Pesticide listed under Annex A

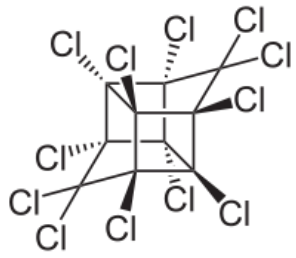


Figure 8 - Structural formula of Mirex

This insecticide is used mainly to combat different types of ants and termites. It has also been used as a fire retardant in plastics, rubber, and electrical goods. Direct exposure to mirex does not appear to cause injury to humans, but studies on laboratory animals have caused it to be classified as a possible human carcinogen. In studies mirex proved toxic to several plant species and to fish and crustaceans. It is considered to be one of the most stable and persistent pesticides, with a half-life of up to 10 years. The main route of human exposure to mirex is through food, particularly meat, fish, and wild game.

- **Toxaphene**- Pesticide listed under Annex A

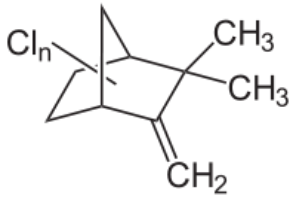


Figure 9 - Structural formula of Toxaphene

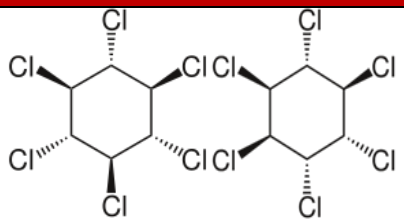
This insecticide is used on cotton, cereal grains, fruits, nuts, and vegetables. It has also been used to control ticks and mites in livestock. Toxaphene was the most widely used pesticide in the US in 1975. Up to 50% of a toxaphene release can persist in the soil for up to 12 years. For humans, the most likely source of toxaphene exposure is food. While the toxicity to humans of direct exposure is not high, toxaphene has been listed as a possible human carcinogen due to its effects on laboratory animals. It is highly toxic to fish; brook trout exposed to toxaphene for 90 days experienced a 46% reduction in weight and reduced egg viability, and long-term exposure to levels of 0.5 micrograms per litre of water reduced egg viability to zero.

4.1.1.2. New POPs pesticides

At the Fourth Conference of the member states (04-08 May 2009), the decision was made to amend Annexes A, B and C by adding the following chemicals from the POPs pesticide group:

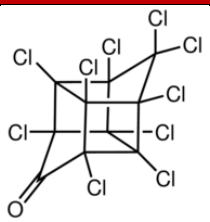
- Alpha hexachlorocyclohexane
- Beta hexachlorocyclohexane
- Chlordecone
- Lindane
- Pentachlorobenzene

Table 4 .- Alfa and beta hexachlorocyclohexane

Alfa and beta hexachlorocyclohexane	
Structure	
CAS No:	319-85-7 319-84-6 319-84-6

Use and production	Although the use of alpha-HCH as an insecticide was phased out 10 years ago, this chemical is still produced as by-product of lindane. For each ton of lindane produced, around 6-10 tons of the other isomers including alpha- and beta-HCH are created. Large stockpiles of alpha- and beta-HCH are therefore present in the environment and may lead to pollution.
POPs characteristics	Alpha- and beta-HCH are highly persistent in water in colder regions and may bioaccumulate and biomagnify in biota and arctic food webs. This chemical is subject to long-range transport, is classified as potentially carcinogenic to humans and adversely affects wildlife and human health in contaminated regions.
Alternative	Today, alpha- and beta-HCH are only produced unintentionally during the production of lindane. Releases occur from remaining stockpiles and contaminated sites. Therefore, absence of intended use does not require identification of possible replacement.

Table 5 - Chlordecone

Chlordecone	
Structure	
CAS No:	143-50-0
Use and production	Chlordecone is a synthetic chlorinated organic compound, which was mainly used as an agricultural pesticide. It was first produced in 1951 and introduced commercially in 1958. Currently, no use or production of the chemical is reported as many countries have already banned its use and production. Chlordecone is chemically related to mirex.
POPs characteristics	Chlordecone is highly persistent in the environment, has a high potential for bioaccumulation and biomagnification and based on physico-chemical properties and modelling data, chlordecone can

	be transported for long distances. It is classified as a possible human carcinogen and is very toxic to aquatic organisms.
Alternative	Alternatives to chlordecone exist and can be implemented inexpensively. Many countries have already banned its sale and use. The main objective to phase out chlordecone would be to identify and manage obsolete stockpiles and wastes.

Table 6 - Lindane

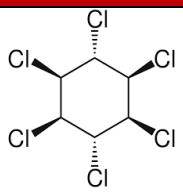
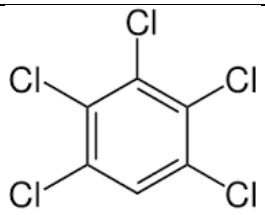
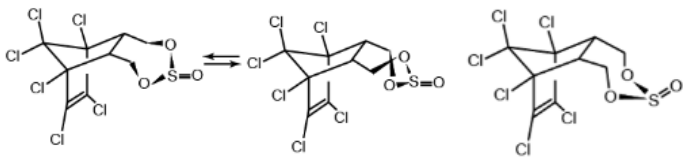
Lindane	
Structure	
CAS No:	58-89-9
Use and production	Technical HCH is an isomeric mixture that contains mainly five forms, namely alpha-, beta-, gamma-, delta- and epsilon-HCH. Lindane is the common name for the gamma isomer of HCH.
POPs characteristics	Lindane has been used as a broad-spectrum insecticide for seed and soil treatment, foliar applications, tree and wood treatment and against ectoparasites in both veterinary and human applications. The production of lindane has decreased rapidly in the last few years due to regulations on the use and monitoring of lindane in several countries. However, few countries are still known to produce lindane.
Alternative	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.

Table 7 - Pentachlorobenzene

Structure	
CAS No:	608-93-5
Use and production	PeCB belongs to a group of chlorobenzenes that are characterized by a benzene ring in which the hydrogen atoms are substituted by one or more chlorines. 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. PeCB is also produced unintentionally during combustion, thermal and industrial processes. It is also present as impurities in products such as solvents or pesticides.
POPs characteristics	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.
Alternative	The production of PeCB ceased some decades ago in the main producer countries as efficient and cost-effective alternatives are available. Applying Best Available Techniques and Best Environmental Practices would significantly reduce the unintentional production of PeCB.

At the Fifth Conference of member states (25-29 May 2011), the decision was made to amend Annex A by adding a chemical from the POPs pesticide group - Technical endosulfan and its related isomers.

Table 8 - Technical endosulfan and its related isomers

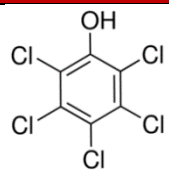
Technical endosulfan and its related isomers		
Structure		
CAS No:	alpha-endosulfan	beta-endosulfan

	959-98-9 332132-65-9
Use and production	Endosulfan occurs as two isomers: alpha- and beta-endosulfan. They are both biologically active. Technical endosulfan (CAS No: 115-29-7) is a mixture of the two isomers along with small amounts of impurities. According to the risk management evaluation on endosulfan, adopted by the POPRC, endosulfan is an insecticide that has been used since the 1950s to control crop pests, tsetse flies and ectoparasites of cattle and as a wood preservative. As a broad-spectrum insecticide, endosulfan is currently used to control a wide range of pests on a variety of crops including coffee, cotton, rice, sorghum and soy. A total of between 18,000 and 20,000 tons of endosulfan are produced annually in Brazil, China, India, Israel and South Korea. Colombia, the United States of America and several countries in Europe that used to produce endosulfan have stopped its production.The largest users of endosulfan (Argentina, Australia, Brazil, China, India, Mexico, Pakistan and the United States) use a total of about 15,000 tons of endosulfan annually. An additional 21 countries report using endosulfan. The use of endosulfan is banned or will be phased out in 60 countries that, together, account for 45 per cent of current global use.
POPs characteristics	According to the risk profile on endosulfan, adopted by the POPRC, endosulfan is persistent in the atmosphere, sediments and water. Endosulfan bioaccumulates and has the potential for long-range transport. It has been detected in air, sediments, water and in living organisms in remote areas, such as the Arctic, that are distant from areas of intensive use.Endosulfan is toxic to humans and has been shown to have adverse effects on a wide range of aquatic and terrestrial organisms. Exposure to endosulfan has been linked to congenital physical disorders, mental retardations and deaths in farm workers and villagers in developing countries in Africa, Asia and Latin America. Endosulfan sulfate shows toxicity similar to that of endosulfan.
Alternative	Chemical and non-chemical alternatives to endosulfan are available in many geographical situations both in developed and developing countries. Some of these alternatives are being applied in countries where endosulfan has been banned or is being phased-

	out. However, in some countries, it may be difficult and/or costly to replace endosulfan for specific crop-pest complexes. Some countries also prefer to use endosulfan in pollinator management, insecticide resistance management, integrated pest management systems and because it is effective against a broad range of pests. Some countries want to continue to use endosulfan to allow time for the phase-in of alternatives.

At the Seventh Conference of the member states (May 4-15, 2015), the decision was made to amend Annexes A and C by adding the following chemical from the POPs pesticides group - Pentachlorophenol and its salts and esters.

Table 9 - Pentachlorophenol and its salts and esters

Pentachlorophenol and its salts and esters	
Structure	
CAS No:	87-86-5 (Pentachlorophenol); 131-52-2 (sodium pentachlorophenate); 27735-64-4 (as monohydrate); 3772-94-9 (pentachlorophenyl laurate); 1825-21-4 (pentachloroanisole)
Use and production	PCP can be found in two forms: PCP itself or as the sodium salt of PCP, which dissolves easily in water. PCP has been used as herbicide, insecticide, fungicide, algaecide, disinfectant and as an ingredient in antifouling paint. Some applications were in agricultural seeds, leather, wood preservation etc. Its use has been significantly declined due to the high toxicity of PCP and its slow biodegradation. First produced in the 1930s, it is marketed under many trade names.
POPs characteristics	People may be exposed to PCP in occupational settings through the inhalation of contaminated workplace air and dermal contact or with wood products treated with PCP. Short-term exposure to large amounts of PCP can cause harmful effects on the liver, kidneys, blood, lungs, nervous system, immune system, and gastrointestinal tract. Elevated temperature, profuse sweating,

	uncoordinated movement, muscle twitching, and coma are additional side effects. Contact with PCP can irritate the skin, eyes, and mouth. Long-term exposure to low levels such as those that occur in the workplace can cause damage to the liver, kidneys, blood, and nervous system. Finally exposure to PCP is also associated with carcinogenic, renal, and neurological effects.
Alternative	Both chemical and non-chemical alternatives exist.

4.1.2. Production of pesticides in Montenegro

In the territory of Montenegro, there are no, and there have never been any plants for the production of pesticides. However, the production of pesticides in this case must be viewed in a wider context, since Montenegro renewed its independence in 2006, while after the World War II it was an integral part of the common state of SFR Yugoslavia. Pesticide production was intensified in that period, primarily in the territories of today's Serbia, Croatia and Slovenia. Also, in the period from 1992 to 2006, when Montenegro was an integral part of the joint state with Serbia (FRY 1992-2003, SCG 2003-2006), there was a significant production of pesticides in Serbia. Some of the most famous factories that produced pesticides during this period were: Župa Kruševac, Zorka Šabac, Galenika Beograd, Prva Iskra Barič, Agrohem Novi Sad and others.

Table 10 lists the plant protection products based on "old" POPs pesticides that were produced in Serbia.[7]

Table 10: Plant protection products based on "old" POPs pesticides that were produced in Serbia

Name of product	Producer	Years of sale and use
Aldrin		
Aldrin P 2,5	Zorka, Šabac	1960-1970
Aldrin powder Župa	Župa, Kruševac	1960-1971
DDT		
Pepein S-50	Zorka, Šabac	1960-1971
Diditin	Zorka, Šabac	1957-1971
Phytosan E-25 Župa	Župa, Kruševac	1966-1971/76
Pepein P-5	Zorka, Šabac	1964-1971
Pepein G-5	Zorka, Šabac	1968-1971

[7] The source of data is the Plant Protection Administration of Serbia

Aerosol 20	Zorka, Šabac	1957-1966
Aerosol 15	Zorka, Šabac	1960-1971/86
Aerosol 12	Zorka, Šabac	1962-1966
Aerosol 6	Zorka, Šabac	1962-1966
Pepein 53	Zorka, Šabac	1957-1971
Dilicide E-16 Župa	Župa, Kruševac	1966-1971/76
Rapein 53	Zorka, Šabac	1957-1971
Dilidene	Zorka, Šabac	1957-1971
Dilicin P-5 Župa	Župa, Kruševac	1966-1970
Zoralin	Zorka, Šabac	1960-1971
Neosol 6	Zorka, Šabac	1957-1971
Neosol 10	Zorka, Šabac	1958-1971
Galodit	Galenika, Zemun	1964-1970
Dieldrin		
Dieldrin S-50	Zorka, Šabac	1966-1971
Dieldrin E-20	Zorka, Šabac	1966-1971
Dieldrin P-2	Zorka, Šabac	1962-1971
Heptachlor		
Heptachlor G-5	Zorka, Šabac	1968-1973
Chlordane		
Chlordane E-40	Zorka, Šabac	1962-1971
Toxaphene		
Toxaphene Župa	Župa, Kruševac	1957-1982

Table 11 lists the plant protection products based on the "new" POPs pesticides that were produced in Serbia.[8]

Table 11: Plant protection products based on "new" POPs pesticides that were produced in Serbia

Name of product	Producer	Years of sale and use
Lindan		
Aerosol-50 MF	Zorka-Plant Protection, Šabac	1975-1988
Drvolin	Zorka-Plant Protection, Šabac	1998-2005

[8] The source of data is the Plant Protection Administration of Serbia

Ferti lindane 15:15:15 with 0.3% lindane	Zorka-Plant Protection, Šabac	1977-1986
Ferti lindan 15:15:15 with 1% lindane	Zorka-Plant Protection, Šabac	1977-1986
Ferti lindane G-0,3	Zorka-Plant Protection, Šabac	1979-1986
Foral-G	Zorka-Plant Protection, Šabac	1985-1990
Geolin	Zorka-Plant Protection, Šabac	up to 1976
Geolin G-1,5	Zorka-Plant Protection, Šabac	1976-2003
Geolin G-3	Zorka-Plant Protection, Šabac	1976-2003
Geolin G-5	Zorka-Plant Protection, Šabac	up to 1976
Kombicid G-5	Zorka-Plant Protection, Šabac	1981-1991
Lindane-20	Zorka-Plant Protection, Šabac	1998-2002
Lindane E-10	Zorka-Plant Protection, Šabac	1972-1986
Lindane P-1	Zorka-Plant Protection, Šabac	1976-1979
Lindane P-2,8	Zorka-Plant Protection, Šabac	up to 1982
Lindane S-25	Zorka-Plant Protection, Šabac	up to 1976
Oidin	Zorka-Plant Protection, Šabac	up to 1987
Neosol-6	Zorka-Plant Protection, Šabac	up to 1976
Tiramlin	Zorka-Plant Protection, Šabac	up to 1979
Zoralin	Zorka-Plant Protection, Šabac	up to 1976
Dilicid E-16	Župa, Kruševac	up to 1976
Lindane 2,8 Župa	Župa, Kruševac	1972-1986
Lindane E-20 Župa	Župa, Kruševac	1983-2002
Lindane powderŽupa	Župa, Kruševac	up to 1976
Lindane S-25 Župa	Župa, Kruševac	1972-1986
Lindane 20-EC	Zorka, Subotica	1981-2002
Insektofert G-0,3 L	Zorka, Subotica	1978-1986
Insektofert G-0,5 L	Zorka, Subotica	1977-1986
Xylolin	Galenika-Fitofarmacija, Zemun	1962-2007
Galition plus	Galenika-Fitofarmacija, Zemun	1984-1990
Bevedan 20-EC	BV Komerc, Novi Sad, in cooperation with IHP Prahovo	1998-2002
Lindane EC	Zorka– Mineral Fertilizers, Šabac	1997-2002
Endosulfan		
Tiocid E-35	Župa, Kruševac	1980-2007

Based on the above, it is concluded that in the period prior to the renewal of independence, plant protection products and other preparations from the group of organochlorine pesticides produced in the territory of the common state could be placed in the territory of Montenegro without any control. It was not possible to obtain data on the amount of products marketed before 2006.

4.1.3. Sale of pesticides in Montenegro

Since there is no pesticide production in Montenegro, the total quantity used and marketed comes from imports. According to the data from the Register for the marketing of plant protection products, as of January 2017, 76 companies (entrepreneurs) have been registered for this activity. There is still no list of approved plant protection products in Montenegro, and the import licenses are given on the basis of the list of authorized active substances allowed for use in plant protection products. This list is determined every year by the Directorate for Food Safety, Veterinary and Phytosanitary Affairs, pursuant to Article 30 paragraph 1 of the Law on Plant Protection Products.

4.1.4. Use of POPs pesticides in Montenegro from 1945 to 2006

In the group of organochlorine pesticides, DDT, aldrin, dieldrin, endrin, toxaphene, lindane and endosulfan were in use in Montenegro.

DDT (Dichloro-diphenyl-trichloroethane) was used to control the malaria mosquito in the territory of Podgorica municipality in 1946. This insecticide was applied on a larger scale in 1956 and 1957 on the territory of the municipalities of Podgorica, Niksic, Danilovgrad, Cetinje, Ulcinj and Tivat for suppression of gnawing in oak forests. For these purposes, 39 960kg DDT (1.9kg/ha) were spent in air treatment over an area of 21,011 ha in the municipalities of Cetinje, Podgorica and Niksic, in 1956. During 1957, this campaign was extended to the municipalities of Tivat and Ulcinj, the area treated was 47,036 ha and 78,070 kg of DDT (1.66 kg/ha) were spent.

In addition to air treatment, in 1956, dusting was carried out from land by motor sprayers in the locations of Crmnica and Ostrog (Municipality of Bar and Danilovgrad). Around 650 ha of forest were treated and 9,000 kg of Bentox 20 insecticide (active substance lindane - gamma HCH) was consumed.[9]

In the territory of the Berane municipality, endrin and toxaphene were used for the control of voles, while toxaphene was also used for suppression of hairy beetle (*Tropinota hirta*) and

[9] Dimitrije Batrićević (1957): "Gradacije gubara u Crnoj Gori i preuzete mjere za njihovo suzbijanje" (Gradation of gypsy moths in Montenegro and measures taken for their suppression). "Naša poljoprivreda" (Our Agriculture), no. 5-6, Vol. 3, Podgorica.

hornet (*Vespa sp*.). In this municipality, aldrin and dieldrin as terrestrial insecticides were used. The mentioned insecticides were used in the period from 1968 to 1977.

In the publication "Pregled sredstava za zaštitu bilja u Jugoslaviji, Glasnik zaštite bilja" (Review of Plant Protection Products in Yugoslavia, Plant Protection Bulletin, no. 3-4 of 1989, there are no products from the group of organochlorine compounds, except lindane and endosulfan. The latest publication of this type related to Montenegro (among other countries) is "Pesticides in Agriculture and Forestry in Serbia and Montenegro" from 2004, issued by the Plant Protection Society of Serbia, which was published on the basis of official lists of permitted active substances and preparations. In this publication, the organochlorine preparations listed were lindane (used for treating logs) and endosulfan (application in agriculture - fruit growing as insecticide).

4.1.5. Use of POPs pesticides in Montenegro after 2006

There are two laws in force in Montenegro in the field of pesticides. The first one is the Law on Plant Protection Products ("Official Gazette of Montenegro" No. 51/08, 40/11, 18/14), and the second one is the Law on Biocidal Products ("Official Gazette of Montenegro" No. 54/16).

Based on the Law on Plant Protection Products, each year the list of active substances allowed for application in agriculture in Montenegro is published. The list of active substances is issued starting from 2009 (the first list was published in the "Official Gazette of Montenegro" No. 70/2009 of 21 October 2009). The current and most recent list of active substances allowed for use in plant protection products is for the year 2019 ("Official Gazette of Montenegro", No. 15/19). The lists of permitted active substances (starting from 2009), and there were nine, did not include any active substance in the group of POPs pesticides.

Since in the "legal gap" in the period from 2006 to 2009, the state of Montenegro did not have a list of active substances allowed for application in agriculture, the laws that were inherited from the state union with Serbia were applied. During this period, the list of allowed substances from 2004 was applicable. Preparations based on lindane and endosulfan were allowed on this list. Therefore, products with lindane and endosulfan as active substances could potentially be available on the Montenegrin market by 2009.

According to the data of the Directorate for Food Safety, Veterinary and Phytosanitary Affairs, the last quantity of plant protection products based on POPs pesticides in Montenegro was imported in 2006. These were 2 preparations, as follows:

- Xylolin, whose active substance is lindane. A total of 1650 litres(1650 pieces in one litre packages) were imported,

- Endofan 35, whose active substance is endosulfan. A total of 12 litres (120 pieces in 100 ml packages) were imported.

Based on data obtained from the Directorate for Food Safety, Veterinary and Phytosanitary Affairs, it has been established that the entire amount of these preparations has been sold and that there are no backlogs in the stores of the then suppliers. After the import of these preparations, no licenses were issued for the import of plant protection products based on POPs pesticides, so it can be considered that in the territory of Montenegro in the last 11 years, after 2006, POPs-based pesticides used for the plant protection have not been placed on the market.

We could not obtain valid data through the questionnaire we sent to the Customs Administration on the import of pesticides in Montenegro, because we received a table relating to the import of all chemicals. The plant protection products were not classified according to biological activity, but insecticides, fungicides, herbicides, biocides, mineral fertilizers and others were in the same group.

When it comes to biocides based on lindane and endosulfan, their import was possible after 2009 as well. Pursuant to the Law on Chemicals ("Official Gazette of Montenegro", No. 11/2007) and the List of toxins classified into groups ("Official Gazette of FRY", No. 012/2000), which was adopted pursuant to Article 9 paragraph 4 of the Law on Chemicals (Official Gazette of FRY, No. 15/95), the Ministry of Health approved import of 10,000 l of endosulfan (35% concentration) between December 2007 and March 2013. The authorized imports of these preparations by years was: 2,000 l in 2009, 2,000 l in 2010, 3,000 l in 2011, 2,000 l in 2012 and 1,000 l in 2013. Out of the authorized quantities, 8,000 l of endosufan (35% EC) was imported, which according to the importer was used for disinfection of stables and basements. The overall quantity of endosulfan was imported by V.U. "Veterinum" from Ulcinj, from the producers, and also the suppliers:
1) "IPROCHEM COMPANY LIMITED" Shenzhen, China
2) "SHENZHEN QINFENG PESTICIDES CO., LTD" Shenzhen, China

On the basis of information obtained on the import of 8000 l of endosulfan-based biocidal products in the period since 2007, representatives of the POPs pesticide working group visited the importers "Veterinum" from Ulcinj, where, based on interviews with representatives of the company, and an official response via e- mail, they concluded that the total amount of these products was sold in 2013, which was also the year of the last import.

Since 1 March 2013, the jurisdiction for import of chemicals has been transferred to the Agency for Nature and Environmental Protection. The Law on the Production and Trade of Toxic Materials ("Official Gazette of FRY", No. 15/95) has been repealed by the adoption of

the Law on Chemicals, which came into force on 1 March 2013, and the issuance of licenses for import of these preparations has passed within the competence of the Agency for Nature and Environmental Protection

Based on the questionnaire sent to the Agency, the working group received the answer that in the period from March 2013 no license was issued for import of endosulfan and lindane based products.

Wood Industry

Based on the past registration of products and literature data that showed that organochlorine compounds were used in the wood industry (especially lindane), for treating logs and timber, a questionnaire was prepared and distributed to business entities in the field of wood processing industry.

As an attachment to the questionnaire, a list of active substances and products that could potentially be found on our market was given.The questionnaire was sent to five addresses, and we received only one answer, from Drvex d.o.o. Niksic, stating that they do not use any wood treatment/coating agents in the primary wood processing they are dealing with.

Farmers' Cooperatives

The Directorate for Food Safety, Veterinary and Phytosanitary Affairs, the Phytosanitary Affairs Division, contacted farmers' cooperatives, which stopped working, to obtain information on possible stockpiles of POPs pesticides in their warehouses. We visited one such warehouse, and we found 95 litres of Kidan fungicide (active substance iprodione, chemical group dicarboximides) and 11 kg of Dithane M-70 fungicide (active substance mancozeb, chemical group dithiocarbamates). This warehouse was owned by Agropolimlje Cooperative and is located in Berane. In the second cooperative that stopped working (Doganje, Pljevlja) there is a greater amount of plant protection products as well as a greater number of preparations. We received a list of goods on the stock via e-mail. There were 15 fungicidal and insecticidal preparations in the warehouse. The review of the list showed that no organohlorine compounds were present in the warehouse.

4.2. Preliminary inventory of hexabromocyclododecane (HBCD)

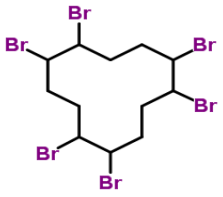
The process of establishing inventories of hexabromocyclododecane followed the tools and techniques contained in the Guidance for the inventory, identification and substitution of hexabromocyclododecane (HBCD).

Have been identified economic sectors that will be subject to inventory in the case of HBCD, as follows: production of expanded polystyrene and import of expanded and extruded polystyrene. Also, an overview and analysis of the data of already implemented projects and/or programs that are in progress, and which have to do with POPs chemicals, were undertaken.

Commercially available hexabromocyclododecane is a white solid substance. Its structural formula is a cyclic ring structure with Br-atoms attached. HBCD is used as a flame retardant additive, providing fire protection during the service life of vehicles, buildings or articles, as well as protection while stored. The main uses of HBCD globally are in expanded and extruded polystyrene foam insulation while the use in textile applications and electric and electronic appliances is smaller and smaller. The production of hexabromocyclododecane is a batch-process. Elemental bromine is added to cyclododecatriene at 20 to 70°C in the presence of a solvent in a closed system.

Like all POPs, hexabromocyclododecane possesses toxic properties, resists degradation, and bioaccumulates. It is transported through air, water and migratory species, across international boundaries and deposited far from the place of release, where it accumulates in terrestrial and aquatic ecosystems. HBCD has been on the world market since the 1960s. The wider use of HBCD in insulation boards started in the 1980s. The basic information on hexabromocyclododecane is given in Table 12.

Table 12. The basic information on hexabromocyclododecane

Chemical structure and characteristics	
Structure	
Molecular formula	$C_{12}H_{18}Br_6$ (641.7 g/mol)
Identification number (CAS number, EC number)	CAS No. 25637-99-4, 1,2,5,6,9,10-hexabromocyclododecane (CAS No: 3194-55-6) EC number: 247-148-4
Names of the major diastereoisomers identified	alpha-hexabromocyclododecane (CAS No: 134237-50-6) beta-hexabromocyclododecane (CAS No: 134237-51-7) gamma-hexabromocyclododecane (CAS No: 134237-52-8)

Trade name	Cyclododecane, hexabromo; HBCD; Bromkal 73-6CD; Nikkafainon CG 1; Pyroguard F 800; Pyroguard SR 103; Pyroguard SR 103A; Pyrovatex 3887; Great Lakes CD-75P™; Great Lakes CD-75; Great Lakes CD75XF; Great Lakes CD75PC (compacted); Dead Sea Bromine Group Ground FR 1206 I-LM; Dead Sea Bromine Group Standard FR 1206 I-LM; Dead Sea Bromine Group Compacted FR 1206 I-CM.
Density	2.24 g/cm^3 to 2.38 g/cm^3
Auto-flammability	Decomposes at >190 °C
Vapour pressure	$6.3 \cdot 10^{-5}$ Pa (21 °C)

4.2.1. Use and production of HBCD

HBCD is used as a flame retardant additive to reduce ignition of flammable polymers and textiles in buildings, vehicles or electrical and electronic equipment (EEE). The main uses of HBCD globally are in expanded and extruded polystyrene foam insulation while the use in textile applications and electric and electronic appliances is smaller.

The main application of HBCD is in polystyrene foam that is used in insulation boards, which are widely used in the building and construction. Insulation boards with HBCD may also be found in transport vehicles, and in road and railway embankments (UNEP 2010a). These polystyrene foams exist in two forms, as expanded polystyrene (EPS) and extruded polystyrene (XPS) foams, with HBCD concentrations ranging from 0.7% to 3.0%. The manufacture of EPS, XPS and HIPS involves polymerisation and extrusion processes where HBCD is added in the process as one of the additives used. The second most important application is in polymer dispersion on cotton or cotton mixed with synthetic blends, in the back-coating of textiles where HBCD can be present in concentrations ranging from 2.2–4.3%.

A further smaller application of HBCD is in high impact polystyrene (HIPS) which is used in electrical and electronic equipment and appliances at levels ranging from 1–7%. HBCD-containing HIPS is used in electric and electronic appliances, such as in audio visual equipment cabinets, in refrigerator lining as well as in distribution boxes for electrical lines and certain wire and cable applications. HBCD may also be added to latex binders, adhesives and paints. Table 13 shows use patterns of HBCD.

Table 13 Use patterns of HBCD

Material	Use/Function	End-products (Examples)
Expanded Polystyrene (EPS)	Insulation	• Construction, insulation boards (packaging material); • Insulation boards (against cold or heat) of transport vehicles e.g. lorries and caravans; • Insulation boards in building structures e.g. house walls, cellars and indoor ceilings and "inverted roof" (outdoor); • Insulation boards against frost heaves of road and railway embankments; • Packaging material (minor use food packaging).
Extruded Polystyrene (XPS)	Insulation	• Construction, insulation boards; • Insulation boards (against cold or heat) of transport vehicles e.g. lorries and caravans; • Insulation boards in building structures e.g. house walls, cellars and indoor ceilings and "inverted roof" (outdoor); • Insulation boards against frost heaves of road and railway embankments.
High Impact Polystyrene (HIPS)	Electrical and electronic parts	• Electric housings for VCR; • Electrical and electronic equipment e.g. distribution boxes for electrical lines; • Video cassette housings.
Polymer dispersion for textiles	Textile coating agent	• Upholstery fabric; • Bed mattress ticking; • Flat and pile upholstered furniture (residential and commercial furniture); • Automobile interior textiles; • Draperies and wall coverings; • Interior textiles e.g. roller blinds.

Due to the long service-life of products where HBCD has mainly been used, stockpiles and waste management is a potential increasing source of HBCD releases to the environment. The major HBCD containing wastes are listed in Table 14.

Table 14. The major HBCD containing wastes

Source	Released media	Examples of waste types	Contaminants
1. HBCD Manufacture			
1.1 Production process	Solid waste, off-gas, waste water	Dust, products residues, wastewater treatment sludge, waste products, discarded waste filter cloth, wastes from filtration	HBCD
2. HBCD use (process)			
2.1. Building materials production	Waste gas, waste water and solid waste	Dust, production residues, wastewater sludge, waste products, packaging waste	HBCD
2.2. Furniture manufacturing	Waste gas, waste water and solid waste	Dust, production residues, wastewater sludge, waste products and packaging waste clothing	HBCD
2.3. Textile production	Waste gas, waste water and solid waste	Dust, production residues, wastewater sludge, waste products and packaging waste clothing	HBCD
2.4. Production of High Impact Polystyrene (HIPS)	Waste gas, waste water and solid waste	Dust, waste residues and sludge, waste products and packaging waste	HBCD
3. Consumer Use			
3.1 Leaching and evaporation from products	Waste gas, waste water and solid waste	Dust/particles, waste residues	HBCD

3.2. Fires	Waste gas, waste water and solid waste	Waste residues, contaminated soil, hot spots	HBCD and PBDD/PBDF
4. Waste recycling			
4.1. Building material waste recycling	Solid waste	HBCD containing EPS and XPS; waste from recycling or from separation of HBCD from polymer	HBCD and other chemicals
2.5 Waste plastic recycling	Solid waste	Waste HIPS, and other plastics; electrical and electronic plastic shells, circuit boards, wire and polyurethane foams which will not be recycled after dismantling	HBCD and other chemicals
2.6 Incineration	Exhaust, solid waste, wastewater	Solid residues (ash, flue gas cleaning residues); exhaust gas	HBCD and PBDD/PBDF
2.7 Landfill	Solid waste and leachate; air releases (fires)	Leachates; fumes from open burning	HBCD and other chemicals; PBDD/PBDF

4.2.2. POPs characteristics of HBCD

HBCD has a strong potential to bioaccumulate and biomagnify. It is persistent in the environment, and has a potential for long-range environmental transport. It is very toxic to aquatic organisms. Though information on the human toxicity of HBCD is to a great extent lacking, vulnerable groups could be at risk, particularly to the observed neuroendocrine and developmental toxicity of HBCD.

Alternatives

The production of HBCD has decreased in the last few years and there are chemical alternatives already available on the market to replace HBCD in high-impact polystyrene (HIPS) and textile back-coating. After any alternative becomes available in commercial quantities, it will take some time for the industry to seek qualification and re-certification of polystyrene bead and foam products for fire‑rating.

4.2.3. Preliminary inventory of HBCD

Products that potentially contain HBCD

There are no registered producers of HBCD and granules of extruded and expanded polystyrene in the Central Register of Business Entities of Montenegro. Therefore, the development of the HBCD inventory was based on an analysis of imports.

In order to obtain the list of importers and the data on quantities of goods imported in the period 2006-2016, the Customs Administration of Montenegro was provided with questionnaires about the import of products that can potentially contain HBCD. Analysis of the obtained data showed that pure HBCD was not imported in Montenegro in the mentioned period.

On the basis of the obtained data, one business entity was identified, which imported granules of expanded polystyrene in the period 2006-2016 for the purpose of producing insulating boards in the total amount of 434.9 tons.

Table 15. Amount of imported expanded polystyrene granules (t) in the period 2006-2016

Import year	Imported amount of expanded polystyrene granules (t)
2006	-
2007	9.4
2008	33.1
2009	18.6
2010	11.9
2011	22.0
2012	21.9
2013	87.0
2014	92.4
2015	115.5
2016	23.1
TOTAL	**434.9**

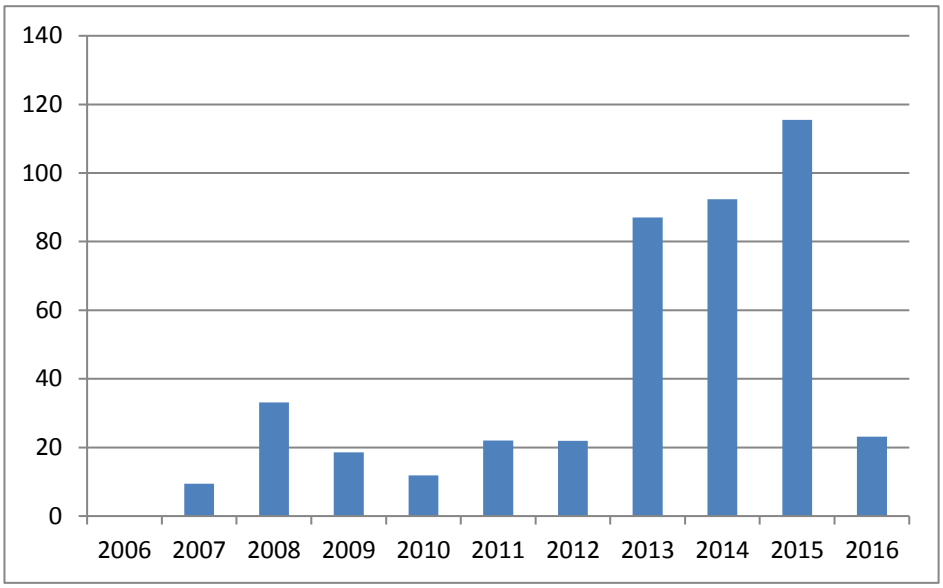


Figure 10. Amount of imported expanded polystyrene granules (t) in the period 2006-2016

Based on the insight into the technical specifications/safety data sheets of imported granules, out of eight types of granules, only one was found to contain HBCD in the concentration of 0.1-1% m/m. From the interview with the representative of importer, it was concluded that all types of imported products were represented in approximately the same quantities. Therefore, it is concluded that the percentage content of granules containing HBCD in the total amount of product was 12.5% (54.36 t). Furthermore, based on the obtained data, the quantities of imported polystyrene-based products for the period 2006-2016 were calculated (Table 16 and Figure 11), as follows:

1. EPS insulation for flat roofs
2. EPS insulation for pitched roofs
3. Gypsum board for insulation of interior walls based on EPS
4. Insulation of external walls based on EPS
5. Hollow plates for wall insulation
6. Insulating concrete forms (ICF)
7. Underfloor heating systems
8. Sound insulation of floating floors (in order to avoid contact noise transmission)
9. EPS drainage plates
10. EPS concrete bricks, EPS concrete
11. EPS foam for soil stability (use in civil engineering)
12. EPS seismic isolation
13. EPS packaging materials made of PS foam
14. Other shaped EPS products such as ornaments, decorations, logos etc.

15. Packaging for XPS food packaging
16. Cold bridge insulation based on XPS
17. Flooring based on XPS
18. Basis of XPS walls and foundation
19. Inverted roofs based on XPS
20. Composite panels and laminates based on XPS
21. Other XPS products

Table 16. Quantities of imported polystyrene based products (t) in the period 2006-2016

Import year	Total quantity of polystyrene based products (t)
2006	943
2007	1,812
2008	2,816
2009	2,049
2010	1,531
2011	1,845
2012	1,710
2013	2,057
2014	2,054
2015	1,662
2016	2,230
TOTAL	**20,709**

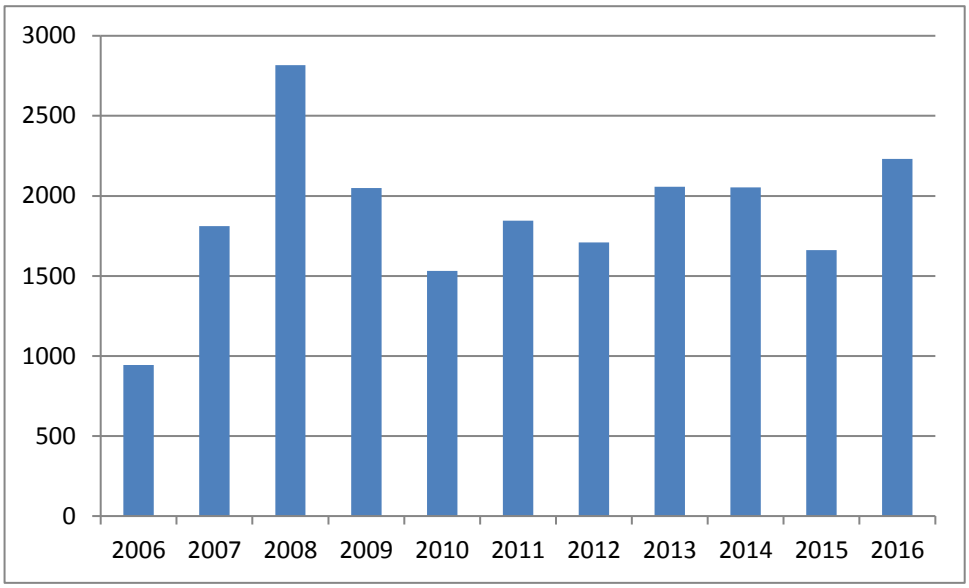


Figure 11. Quantities of polystyrene based products (t) imported in the period 2006-2016

Of all economic entities (importers), five that imported the largest quantities of products containing polystyrene in the period 2006-2016 were singled out (Table 17 and Figure 12).

Table 17. Quantities of polystyrene products (t) imported by major importers in the period 2006-2016

Importer tag[10]	**1**	**2**	**3**	**4**	**5**
Year of import	**Total quantity of polystyrene based product (t)**				
2006	47.5	6.8	88.6	7.1	2.8
2007	171.2	6.6	104.2	12.4	10.7
2008	219.6	9.5	209.2	26.4	17.2
2009	22.1	10.3	193.7	15.5	22.6
2010	144.3	10.1	180.4	23.0	15.8
2011	181.4	8.2	190.2	25.8	22.4
2012	176.7	7.6	128.3	26.0	15.4
2013	230.9	9.8	33.6	55.6	40.1
2014	238.3	51.2	56.7	86.4	48.0

[10] The names of business entities and cities where they are located are not shown for confidentiality reasons.

2015	226.3	86.6	131.2	37.4	18.3
2016	192.2	180.7	151.7	81.1	75.4

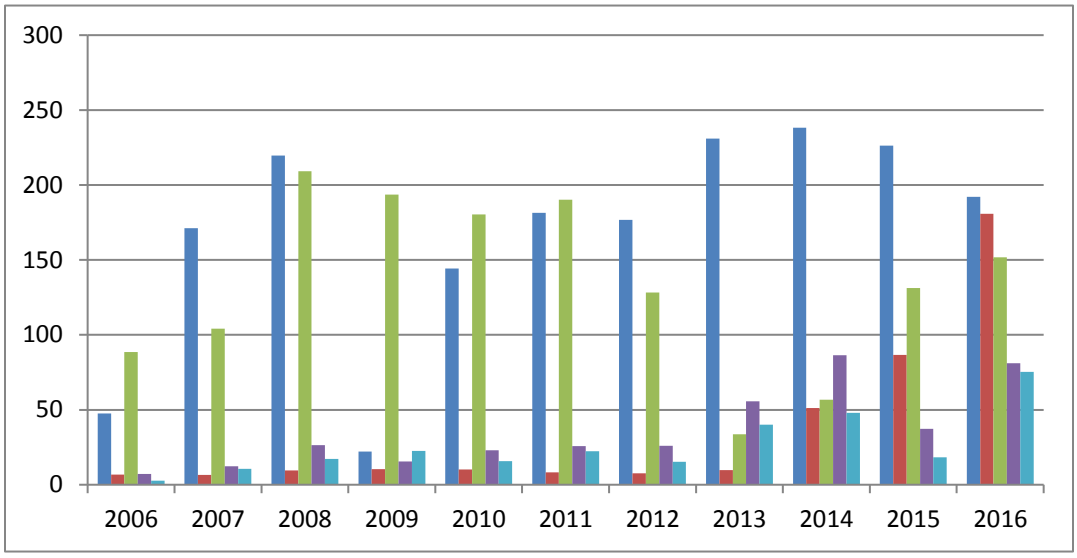


Figure12. Quantities of polystyrene based products (t) imported by the largest importers in the period 2006-2016

Since it was found that 12.5% of the imported granulate of expanding polystyrene contains HBCD, an approximation of HBCD content of 12.5% was applied to the total amount of imported material (Table 5) produced from polystyrene.

A small fraction of HBCD, which can be present in textile, synthetic fibers, etc., has also been added to this amount, by multiplying the total amount of polystyrene from imports by coefficient of 1.3[11].

Estimate of the amount of HBCD on the Montenegrin market for the period 2006-2016 was made using the following equation:

$$HBCD_{uk} = \left[A + \frac{0{,}125 \cdot B}{100} + \frac{0{,}125 \cdot C}{100} \right] \cdot 1{,}3$$ where:

$HBCD_{uk}$ - Total amount of HBCD

A - Total amount of pure HBCD

B - Total amount of HBCD in imported PS granules

C - Total amount of HBCD in imported PS insulation boards

0,125 – Factor for calculating HBCD based on presence in 12.5% of products in the amount of 1%

[11] Draft risk profile on hexabromocyclododecane, document UNEP / POPS / POPRC.5 / 10

1,3 – coefficient for the calculation of HBCD present in textile, synthetic fibres, and the like.

Table 18 and Figure 13 show the estimated amount of HBCD in Montenegro, calculated from the above equation for the period 2006-2016, by year.

Table 18. Estimated amount of HBCD in Montenegro by years (2006-2016)

Year of import	Estimated amount of HBCD in Montenegro (t)
2006	1.534
2007	2.960
2008	4.630
2009	3.360
2010	2.507
2011	3.034
2012	2.814
2013	3.484
2014	3.488
2015	2.888
2016	3.661
TOTAL	34.359

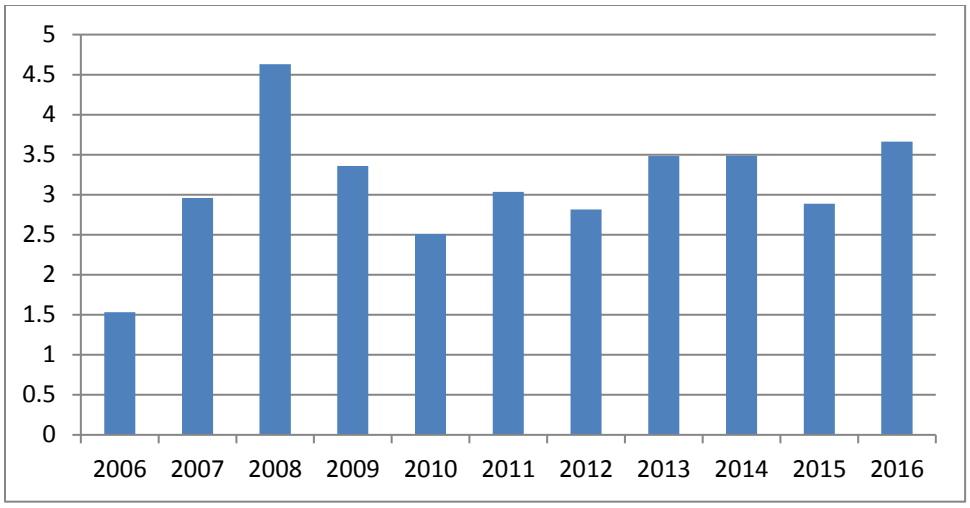


Figure 13. Estimated amount of HBCD in Montenegro by years (2006-2016)

Estimated total amount of HBCD in Montenegro for the period 2006-2016 is 34,359 t.

4.2.3.2. HBCD in waste

An analysis of the treatment of waste that potentially contains HBCD was carried out by sending all local government secretariats in Montenegro and companies in charge of collecting, transporting and storing waste at the local level a questionnaire with this question. It was concluded from the obtained answers that the selected construction waste material (concrete, bricks and terracotta) is deposited at the designated locations, while the rest such as polystyrene insulation material is disposed together with municipal waste. Data from literature indicate that the share of insulation material in the total amount of construction waste ranges from 1 to 2%, so the amount of HBCD from this source is:

HBCDD in waste = 0.01 x total construction waste per year x 0.125 x 0.01

If you take into account the estimate that 0.623 t of construction waste is generated per capita, then in the case of Montenegro it is:

620,029 x 0.623 t = 386,278 t

Therefore:

HBCDD in waste = 0.01 x 386,278 x 0.125 x 0.01 = 4.828 t

There are no facilities for recycling waste from construction materials or waste plastics in Montenegro.

4.2.3.3. Total estimated amount of HBCD in Montenegro

Based on the above, it can be concluded that the total amount of HBCD originating from products that potentially contain it and from the construction waste is 39,187 t.

4.3. PFOS and its related substances

Introduction

PFOS (Perfluorooctane sulphonic acid) is a fully fluorinated (perfluorinated) substance, which is commonly used as a salt in some applications. While PFOS can exist in anionic, acid and salt forms, the PFOS anion is the most common form in the environment and in the human body.[12]

The term "PFOS-related substances" is used for all substances that contain one or more PFOS moieties (defined as $C_8F_{17}SO_2$). Since PFOS-related substances are considered PFOS precursors, the related substances will be considered to have the same POPs characteristics as PFOS. These PFOS-related substances are restricted through the listing of PFOSF (perfluorooctane sulfonyl fluoride), the basic material for their manufacture, and the listing of PFOS in the Convention.

PFOS-related substances refer to a larger group of substances containing perfluorinated sulfonyl with eight-carbon chain length, which may be simple salts of PFOS (e.g. potassium, lithium, ammonium, diethanolamine) or polymers that contain PFOS. Figure 1 illustrates the structural formula of PFOS shown as its potassium salt[13].

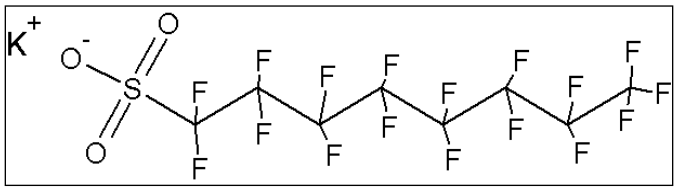


Figure 13. Structural formula of PFOS shown as its potassium salt

Any molecule containing the PFOS precursor moiety ($C_8F_{17}SO_2$) can be a precursor to PFOS and is called PFOS-related substance. PFOS can be formed by environmental microbial degradation or by metabolism in larger organisms from PFOS-related substances[14].

PFOS is very persistent and has substantial bioaccumulations and biomagnifying properties, although it does not follow the classic pattern of other POPs by partitioning into fatty tissues. Unlike other POPs substances, PFOS binds to proteins in the blood and liver. PFOS and related substances have a capacity to undergo long-range transport and PFOS and PFOS-

[12] Environment Canada, 2006
[13] UNEP, 2006b
[14] UNEP, 2006b

related substances can be released to the environment from manufacturing processes and during their use in industrial and consumer applications, as well as from disposal of the chemicals or products and articles[15].

PFOS status under the Stockholm Convention

Perfluorooctane sulphonic acid (PFOS), its salts, and perfluorooctane sulfonyl fluoride (PFOSF) were listed in Annex B of the Stockholm Convention on Persistent Organic Pollutants (POPs) in 2009 . According to the Stockholm Convention, the use and production of PFOS and its related substances is permitted but limited for certain purposes.[16]List of acceptable purposes and specific exemptions for the production and use of PFOS, its salts and PFOSF is given in Table 19.

Table 19. List of acceptable purposes and specific exemptions for the production and use of PFOS, its salts and PFOSF

Chemical	Acceptable purpose	Specific exemptions
Perfluorooctane sulfonic acid (CAS No: 1763-23-1), its salts[a] and perfluorooctane sulfonyl fluoride (CAS No: 307-35-7) For example: potassium perfluorooctane sulfonate (CAS no. 2795-39-3); lithium perfluorooctane sulfonate (CAS no. 29457-72-5); ammonium perfluorooctane sulfonate (CAS no. 29081-56-9); diethanolammonium perfluorooctane sulfonate (CAS no. 70225-14-8); tetraethylammonium perfluorooctane sulfonate (CAS no. 56773-42-3);	• Photo imaging • Photo resist and anti-reflective coatings for semi-conductors • Etching agent for compound semi-conductors and ceramic filters • Aviation hydraulic fluids • Metal plating (hard metal plating) only in closed-loop systems • Certain medical devices (such as ethylene tetrafluoroethylene copolymer (ETFE) layers and radio-opaque ETFE production, in vitro diagnostic medical	• Photo masks in the semiconductor and liquid crystal display (LCD) industries • Metal plating (hard metal plating) • Metal plating (decorative plating) • Electric and electronic parts for some colour printers and colour copy machines • Insecticides for control of red imported fire ants and termites • Chemically driven oil production

[15] Bossi et al., 2008; Oliaei et al., 2011; UNEP, 2006b; Weber et al., 2011

[16] UNEP, 2009, SC-6/4: Process for the evaluation of the continued need for perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride for the various acceptable purposes and specific exemptions

didecyldimethylammonium perfluorooctane sulfonate (CAS no. 251099-16-8).	devices, and CCD colour filters) • Fire fighting foam • Insect baits for control of leaf-cutting ants from Atta spp. and Acromyrmex spp	

4.3.1. Production and use of PFOS and its related substances

PFOS and PFOS-related substances have been manufactured for more than 50 years. Due to their unique physical properties, such as surface resistance/repellence to water, oil, low reactivity, low surface tension, chemical stability, resistance to acid and high temperature, PFOS and PFOS-related substances have been used in a wide variety of applications in industry. They are typically used for surface treatment, and are common in non-stick products, stain-resistant fabrics and all-weather clothing. Due to their surface-active properties, PFOS and its related substances have been used in a wide variety of applications, including fire fighting foams and surface resistance/repellence to oil, water, grease or soil.

PFOS and its related substances have different specific uses as chemicals in the electronics, semiconductor and photographic industries. They are used in these industries in small quantities in closed-loop systems and their use is not intended to be the content of the final product but to be been used as process chemicals in the production of a particular product.

The production chain may be complicated and end-users are often unaware that PFOS is used in manufacturing processes. PFOS and its related substances were widely used in many applications and types of industries, and some uses are in open applications with potential exposure of humans and environment, while others are in closed controlled systems.

PFOS and PFOS-related substances are also used as surfactants in the oil and gas industry, drilling fluids in the mining industry, and as surfactants or wetting agents in the metal plating industry.

The major PFOS producer 3M, ended its production in 2002 and by beginning of 2003 all 3M production has stopped[17]. At around the same time, production started in Asia with a rapid increase in production volume to approximately 200 tonnes/year[18]. The current production of approx. 200 tonnes and use is therefore only approximately 5% of the former production of 3M.

[17] UNEP, 2006b
[18] Lim et al., 2011; Zhang et al., 2012

In total it is estimated that approximately 96,000 tonnes of PFOSF has been produced and additionally 26,500 tonnes of unusable waste[19] so for PFOS a major task is the management of the legacy of historic productions. Model global use of PFOS and PFOS-related substances is described in Table 20[20], in which estimates of the global usage amount are based on 3M Company data from 2000[21].

Table 20: The global use of PFOS and its related substances

	Setting	Applications	Global usage amount in 2000
Surface treatments	Industrial	Textile mills, leather tanneries, finishers, fibre producers, carpet manufacturers	2160 t
	General public or professional applicators aftermarket treatment	Apparel and leather, upholstery, carpet, automobile interiors	
Paper protection	Paper mills	Food contact applications (plates, food containers, bags, and wraps) Non-food contact applications (folding cartons, containers, carbonless forms, masking papers)	1490 t
Performance chemicals	Industrial, commercial, and consumer applications	Fire fighting foams	151 t
		Mining and oil well surfactants, surfactant/wetting agent and mist suppressants for metal plating, electronic etching baths, photolithography, electronic chemicals, hydraulic fluid additives, alkaline cleaners, floor polishes, photographic film, denture cleaners, shampoos, chemical intermediates, coating additives, carpet spot cleaners, insecticide in bait stations	680 t

[19] Paul et al., 2008
[20] Lim et al., 2011
[21] 3M Company, 2000

4.3.2. Inventory process

The main objective of the inventory is to obtain the data necessary for further management of PFOS and PFOS-related substances and the implementation of obligations under the Stockholm Convention. More specifically, the objectives are:

- to provide the basis for the development of the NIP strategy (i.e. identify sectors that should be prioritized in terms of PFOS inventory and types of activities required for these sectors);
- to create bases for assessing whether current national use, production, and chemical and waste management meets the requirements of the Convention and identifies areas where it does not.

The information needed for the PFOS inventory include:

- Production and use of PFOS and PFOS-related substances at the national level
- Presence of products and articles containing PFOS and PFOS-related substances on consumer market
- Stocks stored
- Procedures for the disposal of products and chemicals containing PFOS and PFOS-related substances when they become waste.
- Quantities of generated waste
- Discharges to the environment from dotted sources
- Potentially polluted areas
- Potentially harmful exposure to people and the environment

The PFOS inventory was developed in accordance with the guidelines given in the "Guidance for the inventory of perfluorooctane sulfonic acid (PFOS) and related chemicals listed under the Stockholm Convention on Persistent Organic Pollutants"[22]. Figure 2 schematically illustrates steps in the inventory process of PFOS. The inventory process comprised the following steps: planning (step 1), choosing data collection methodology (step 2), collecting data (step 3), managing and evaluating data (step 4) and preparing inventory reports (step 5).

[22] UNIDO, UNITAR, UNEP, 2017

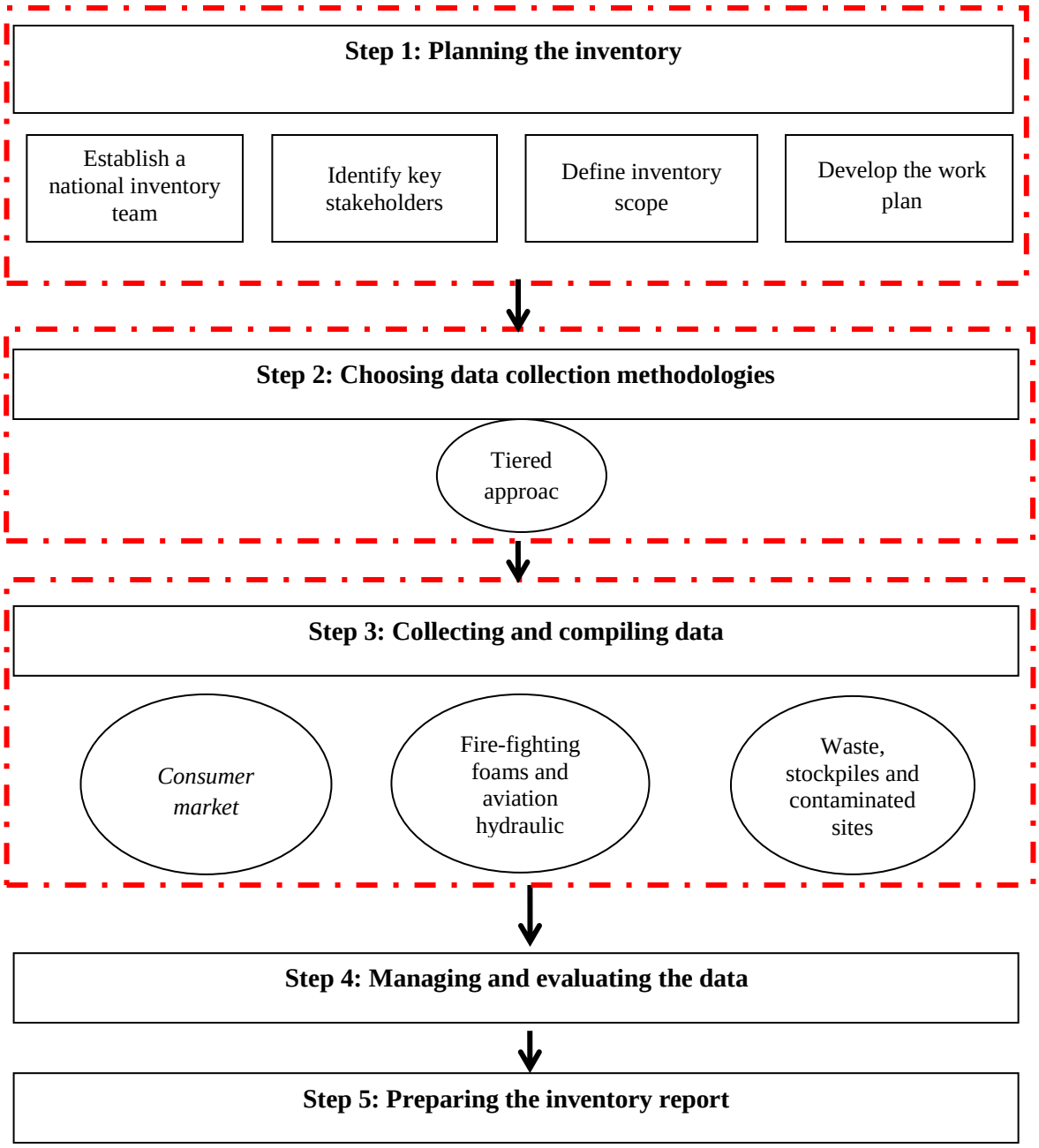


Figure 15. Overview of the national PFOS inventory development process

4.3.2.1. Planning the inventory

As there is no developed industry in Montenegro that can use PFOS chemicals in its production (electronics industry, semiconductor industry, photo industry, textile, paper, leather tanning, carpet production, metal plating industry, chemical industry), the following relevant stakeholders/organizations were chosen for the development of PFOS inventory:

- Fire-fighting organizations (in all municipalities in Montenegro, Army, Aerodromes, Ministry of Interior, Emergency Office, Ports and Marinas, Oil Company Jugopetrol, larger industrial plants)
- Ministry of Finance, Customs Administration
- Statistical Office of Montenegro - MONSTAT
- Agency for Nature and Environment Protection
- Ministry of Health, which can provide information on:

These organizations may provide information on:

- import and use of consumer products that may contain PFOS (textiles, furniture, apparel, leather, various industrial and household products for cleaning, teflon products, paper, packaging);
- use and storage of fire-fighting foam;
- import of PFOS chemicals and its derivatives;
- generation of hazardous waste based on selected waste index numbers.

4.3.3. Results of preliminary inventory of PFOS

4.3.3.1. Results of the preliminary inventory of the presence of PFOS and PFOS-related substances in fire-fighting foams

PFOS and PFOS-related substances were used in the past to produce a wide range of products, including aquatic film-forming foams (AFFF). Foams of this type are used for extinguishing fire of easily flammable liquids and most frequently in petroleum products warehouses, at airports, certain industrial plants. Questionnaires on fire-fighting foams were sent to fire-fighting organizations in all municipalities in Montenegro, to the Aeroports, Ports and Marinas, Jugopetrol Oil Company (the only organization that has larger oil derivatives storages) and larger industrial plants. In total 35 questionnaires were sent to:

1) Civilian fire brigade units (total of 21)
2) Army of Montenegro
3) Airports (Podgorica, Tivat)
4) Large industrial plants (Aluminium Plant Podgorica, Steel Plant Toscelik Niksic, Thermal Power Plant Pljevlja)
5) Jugopetrol Oil Company
6) Port Administration of Bar
7) Porto Montenegro, Tivat

8) Shipyard Bijela
9) Port Administration of Kotor
10) Marina Bar
11) Dukley Marina-Budva

21 organizations answered to the questionnaire, out of which 4 stated that they did not use fire-fighting foam, while the rest stated that the fire-fighting foams they use do not contain PFOS chemicals. None of the fire brigades that responded to the questionnaire have stored old stocks of fire-fighting foams containing PFOS, or data on whether they used to use this type of foam and which were possible use sites.

Data on import of firefighting foams for the period 2006-2016 was obtained from the Customs Administration. Based on the obtained data it can be concluded that in the stated period there wasn't any import of firefighting foams which contained PFOS. In the Table 21 are shown quantitites of imported firefighting foam for the stated period.

Table 21. Import of firefighting foams for the period 2006-2016

Year	Fire fighting foams (kg)
2006	5880
2007	60
2008	87
2009	3040
2010	4400
2011	2472
2012	7400
2013	3400
2014	2600
2015	2000
2016	/

4.3.3.2. Results of the preliminary inventory of the presence of PFOS and PFOS-related substances in aviation hydraulic fluids

Data on the quantities of used and possibly stored hydraulic oils containing PFOS and PFOS-related substances for the period of the past ten years have been requested from the national operator in the civil aviation "Montenegro Airlines" and the Army of Montenegro.

National operator in the civil aviation „Montenegro Airlines“, delivered the data on the used quantities of air hydraulic oil „Skydrol 500-B4“, manufacturer Estman Skydrol, for the period of 2006-2015, which is shown in Table 22. Hidraulic oil „Skydrol 500-B4“ contains small amount of PFOS, which is not listedon safety data sheet.

Amount of PFOS was estimated in accordance with guidelines which are given in the „Guidance for the inventory of perfluorooctane sulfonic acid (PFOS) and related chemicals listed under the Stockholm Convention on Persistent Organic Pollutants, UNIDO, UNITAR, UNEP, 2017“, for the products of this type. In table 22 are shown estimated quantities of PFOS.

Table 22. Import of air hydraulic oil and estimated amount of PFOS

Hydraulic oil	Year	Amount (kg)	PFOS content Approximate values (mg PFOS/kg product)	PFOS quantity (kg) lowest / highest value
Skydrol 500-B4	2006	241	500-1000	0,12-0,24
	2007	482	500-1000	0,24-0,48
	2008	241	500-1000	0,12-0,24
	2009	502	500-1000	0,25-0,50
	2010	502	500-1000	0,25-0,50
	2011	627	500-1000	0,31-0,62
	2012	251	500-1000	0,13-0,23
	2013	246	500-1000	0,12-0,24
	2014	251	500-1000	0,13-0,26
	2015	565	500-1000	0,28-0,52

4.3.3.3. Results of the preliminary inventory of the presence of PFOS and PFOS related substances in waste

The total quantities of generated industrial hazardous waste that can potentially contain PFOS and PFOS-related substances were obtained from the Statistical Office of Montenegro - MONSTAT. In the "Statistical Survey on Industrial Waste Industry" by MONSTAT, the reporting and survey method of data collection was applied, and from the geographical

aspect, it covered business entities that perform their production activities in the entire territory of Montenegro. The survey covered all business entities with 10 or more employees, whose main activity is in the sectors of Mining, Manufacturing, Electricity, Gas and Steam Supply and Water Supply, Waste Water Management, Control of Waste Disposal Processes and similar activities.

For the categorization of waste by groups, the Ordinance on the Catalogue of Waste and Waste Classification ("Official Gazette of Montenegro" No. 64/11) was applied, which is harmonized with the European waste list. Table 5 shows the quantities of generated industrial hazardous waste according to waste catalogue groups, for the period 2011-2016.

Table 23. Generated industrial hazardous waste by the Waste Catalogue groups, which potentially can contain PFOS and PFOS-related substances

Waste group	Waste quantity (t)					
	2011	2012	2013	2014	2015	2016
04 Waste from leather, fur and textile industries	/	0	0	/	/	0
07 Waste from organic chemical processing	/	0	/	/	/	0
08 Waste from the production, preparation, distribution and use of coatings (paints, varnishes and glass glaze), adhesives, seals and printing inks	0.12	0.39	1.99	0	2	1
15 Waste from packaging; absorbents, wiping cloths, filtering materials and protective fabrics, unless otherwise specified	0.41	3.87	11.89	25	81	6
20 Municipal waste (household waste and similar commercial and industrial waste), including separately collected fractions	/	0.20	17.89	4	8	2

By analysing the obtained data it can be concluded that the largest amount of generated hazardous waste that potentially can contain PFOS and PFOS-related substances comes from waste group 15.

Given that there is no index number for waste contaminated with PFOS chemicals, the data on the generated quantities of waste listed in Table 3 are not limited to waste contaminated with PFOS chemicals and, based on the obtained data, it is impossible to accurately determine the amount of waste that potentially contains PFOS .

Data on the collected and exported quantities of hazardous waste that potentially contain PFOS and PFOS-related substances have been obtained from the largest company for the collection, transport, storage and export of waste in Montenegro, "Hemosan" Bar.

Hemosan submitted data on exported waste from group 15. For waste from other groups mentioned above, they did not provide data. According to statistical data, waste from group 15 represents the largest amount of generated hazardous waste in Montenegro that can potentially contain PFOS and PFOS-related substances.

Table 24. Data on collected and exported quantities of hazardous waste from the waste group 15[23]

Year	Collected waste (t)	Exported waste (t)
2013	8.74	0
2014	11.83	14.93
2015	13.36	25.10
2016	13.82	14.42

4.3.3.4. Results of the preliminary inventory of the presence of PFOS and PFOS-related substances in chemicals

Data on imports of chemicals containing PFOS and PFOS-related substances was requested from the Agency for Nature and Environment Protection, the Ministry of Health and the Customs Administration. Based on the obtained data on the import of chemicals for the period 2008-2016, it can be concluded that there were no imports of chemicals containing PFOS and PFOS-like substances during that period in Montenegro.

The Administration for Inspection Affairs, the Department for Environmental Inspection, submitted lists and quantities of stored chemicals that were used in the production processes of factories that are no longer in operation: the Beranka pulp and paper factory in Berane, the Polimka leather and leather goods factory in Berane, and the Dekor paper processing plant in Rozaje. However, from the lists of chemicals supplied (without

[23] The difference that occurs in the amount of collected and exported waste is the amount of waste collected before 2013.

specification or safety data sheets) it can only be assumed that some of the chemicals found in the warehouse of the former pulp and paper factory in Berane (Beranka) and the former paper processing plant in Rozaje (Dekor), as well as a part chemicals from the former leather and leather goods factory in Berane (Polimka) might contain PFOS and its derivatives. CETI has received safety data sheets for a number of chemicals located in the warehouse of Polimka from the current owner of the former factory. Inspection of the delivered safety data sheets showed that the stored chemicals did not contain PFOS and PFOS-related substances.

4.3.3.5. Results of the preliminary inventory of the presence of PFOS and PFOS-related substances in products in the consumer market

A preliminary inventory of the presence of PFOS and PFOS-related substances in surface coatings, paints and varnishes, cleaning agents, waxes and polishes,toner and printing inks, industrial and household cleaning products, coating and impregnation of paper and packaging, synthetic carpets and textiles was made on the basis of data obtained from the Customs Administration. Data on the import of these products was submitted by the Customs Administration by tariffnumbers for the period 2014-2016.

The PFOS amount was estimated in accordance with the "Guidance for the inventory of perfluorooctane sulfonic acid (PFOS) and related chemicals listed under the Stockholm Convention on Persistent Organic Pollutants", UNIDO, UNITAR, UNEP, 2017, for products of this type.

Table 25. Import of consumer products that can contain PFOS and estimated PFOS quantity

Product	Year	Amount (kg)	PFOS content Approximate values (mg PFOS/kg ofarticle)	PFOS quantity (kg) lowest / highest value
Surface coating, paint and varnishes	2014	51962	100	5,2
	2015	31914	100	3,2
	2016	57806	100	5,8
Cleaning agents, waxes and polishes	2014	364645	50-100	18,2-36,4
	2015	322841	50-100	16,1-32,2
	2016	271674	50-100	13,6-27,2
Toner and printing inks	2014	94273	100	9,4
	2015	102522	100	10,3

	2016	**104450**	**100**	**10,4**
Industrial and household cleaning products	**2014**	**309698**	**50-100**	**15,5-31**
	2015	**269053**	**50-100**	**13,4-26,8**
	2016	**218868**	**50-100**	**10,9-21,8**
Coating and impregnation of - paper and packaging	**2014**	**21183**	**500-5000**	**10,6-106**
	2015	**16954**	**500-5000**	**8,5-85**
	2016	**31782**	**500-5000**	**15,9-159**
Coating and impregnation of -synthetic carpets	**2014**	**312613**	**500-5000**	**156,3-1563**
	2015	**373323**	**500-5000**	**186,7-1867**
	2016	**378024**	**500-5000**	**189,0-1890**
Coating and impregnation of -textiles	**2014**	**42289**	**500-5000**	**21,1-211**
	2015	**52887**	**500-5000**	**26,4-264**
	2016	**59604**	**500-5000**	**29,8-298**

Based on the data obtained from the Customs Administration, it can only be assumed that these products contain PFOS and PFOS-related substances, because precise selection of particular products that can potentialy contain PFOS cannot be carried out according to the tariff numbers. **Calculated PFOS quantity is only an approximate quantity in listed products.**

Conclusions:

- In Montenegro, there were no registered production, applications and imports of chemicals containing PFOS and PFOS-related substances in the past 10 years.
- The presence of PFOS is possible in waste, especially in impregnated carpets, textiles, paper packaging, wallpaper, leather, work suits, etc.
- Since there is no index number for waste contaminated with PFOS chemicals, based on statistical data on quantities of waste generated, it is not possible to accurately determine the amount of waste that can potentially contain PFOS.
- Based on data obtained from fire-fighting organizations, it can be concluded that in the past 10 years there have been no use of fire-fighting foams containing PFOS and PFOS related substances and that there are no stored fire-fighting foams containing PFOS in Montenegro.

- Based on the information obtained from the Environmental Inspection Service, it can only be assumed that some of the chemicals found in the warehouse of former pulp and paper production plant, paper processing plant and leather and leather goods plant can contain PFOS and its derivatives. It is necessary to carry out a deeper analysis of the stored chemicals in order to check the possible presence of PFOS and PFOS-related substances in these chemicals.
- Based on the data obtained on imports of various consumer products, it can only be assumed that these products can potentially contain PFOS and PFOS-related substances.
- Since production, placing on the market and use of semi-finished products, products or parts thereof are permitted, if the concentration of PFOS is equal to or less than 0.1% (m/m), safety data sheet is not always a reliable document for determining the content of PFOS in them, since PFOS can be found in quantities less than 0.1%.

4.4. Overview of POP-PBDEs and HBB management

Polybrominated diphenyl ethers (PBDEs: Figure 16) are a group of industrial aromatic organobromine chemicals that have been used since the 1970s as additive flame retardants in a wide range of - mainly - consumer products.

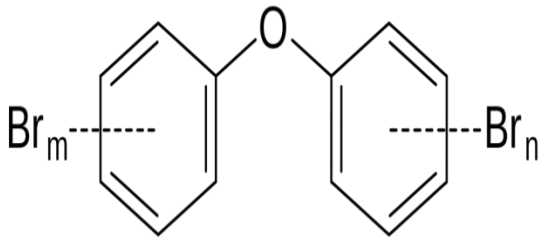


Figure 16: Structure of polybrominated diphenyl ethers (PBDEs)

These chemicals have been widely used in many industrial sectors for the production of various products and items, including consumer goods. For example, POP-PBDEs were used in the electronics industry to produce plastic casings for computer equipment and in the transport industry for the production of foam pads for car seats (Figure 17).

Figure 17:Products and articles containing POP-PBDEs[24]

PBDEs were produced with three different degrees of bromination, and marketed as c-PentaBDE, c-OctaBDE and DecaBDE (c-DecaBDE) commercial mixtures[25]. Although c-DecaBDE has not been found to contain POP-PBDEs, it can form POP-PBDEs by debromination during its life cycle, thus representing an important reservoir of POP-PBDEs[26]. Typical homologue distribution of c-PentaBDE and c-OctaBDE is shown in Table 26 and Table 27.

Table 26: Composition of c-PentaBDE[27]

Categories of PBDE	Tribromodi-phenyl ethers		Tetrabromodi-phenyl ethers	Pentabromodi-phenyl ethers		Hexabromodi-phenyl ethers		Heptabromodi-phenyl ethers
Congener	BDE-17	BDE-28	BDE-47	BDE-99	BDE-100/85	BDE-153	BDE-154	BDE-183
Content	Traces	Traces	Major	Major	Minor	Minor	Traces	Traces
Distribution for calculation*	0.5%**		**33%****	**58%****		**8%****		**0.5%****

[24] Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention
[25] Alaee et al., 2003; Prevedouros et al., 2004; SFT, 2009
[26] UNEP, 2010c; Ross et al., 2009
[27] La Guardia et al., 2006; SFT, 2009; Schlummer et al., 2011

*The homologue distribution in commercial PBDE has a variation depending on producer or production lot. For inventory purposes, a distribution considered as an average distribution of PBDE homologues in products was chosen.
**TriBDE is not listed as a POP and therefore does not need to be included in the inventory.
***The percentage of the PBDE homologues that are POP-PBDEs.

Table 27:Composition of c-OctaBDE[28]

Categories of PBDE	Hexabromo-diphenyl ethers		Heptabromodiphenyl ethers			Octabromodiphenyl ethers			Nonabromodi-phenyl ethers		Decabromodi-phenyl ethers
Congener	BDE-154	BDE-153	BDE-183	BDE-180	BDE-171	BDE-197	BDE-203	BDE-196	BDE-206	BDE-207	BDE-209
Content	Traces	Minor	Major	Traces	Traces	Major	Minor	Minor	Minor	Minor	Traces
Distribution for calculation*	**11%****		**43%****			35%**			10% **		1%**

*The homologue distribution in commercial PBDE has a variation depending on producer or production lot. For inventory purposes a distribution considered as an average distribution of PBDE homologues in products was chosen.
**OctaBDE, nonaBDE and decaBDE are not listed as POPs and therefore do not need to be included in the inventory.
***The percentage of the PBDE homologues that are POP-PBDEs.

4.4.1. POP-PBDEs and HBB and Stockholm Convention

In May 2009, the Conference of the Parties (COP) amended the Stockholm Convention on persistent organic pollutants (POPs) to add certain brominated flame retardants (BFRs) to Annex A:

- Hexabromobiphenyl (HBB);
- Two polybrominated diphenyl ethers (collectively referred to as POP-PBDEs in this document):
  - Hexabromodiphenyl ether and heptabromodiphenyl ether;
  - Tetrabromodiphenyl ether and pentabromodiphenyl ether.

Like all POPs, these chemicals possess toxic properties, resist degradation, and bioaccumulate. They are transported through air, water and migratory species, across

[28] La Guardia, 2006; SFT, 2009; Schlummer 2011

international boundaries and deposited far from their place of release, where they accumulate in terrestrial and aquatic ecosystems. Parties to the Convention, for which the amendments have entered into force, have to meet the obligations under the Convention leading to the elimination of the listed BFRs. Due to the complexity and magnitude of usage of the POP-PBDEs, eliminating them represents a challenge for many Parties.

4.4.2. Production and use

4.4.2.1. Production of PBDEs

C-PentaBDE was produced in China, Israel, Japan, the United States and the European Union (EU)[29]. Production in the EU ceased in 1997. It is assumed that since the late 1990s POP-PBDEs were mainly produced in the United States and to a lesser extent in China and production ended in 2004. C-OctaBDE was produced in the Netherlands, France, the United States, Japan, United Kingdom and Israel. Production stopped in the EU, United States and the Pacific Rim in 2004, and there is no information indicating that it is being produced in developing countries[30].

The compilation of PBDE production data prepared for the POPs Review Committee (POPRC) of the Stockholm Convention estimated the total production of all PBDEs from 1970 to 2005 as between 1.3 million and 1.5 million tonnes[31]. The total amounts of c-PentaBDE and c-OctaBDE used in the world were estimated at around 100,000 tonnes each. The production of c-DecaBDE, was estimated at over 1.1 million tonnes until 2005 (see Table 28). While the production of POPs c-PentaBDE and c-OctaBDE ended in 2004, the production of DecaBDE continues[32].

Table 18: Estimated total production of PBDE commercial mixtures, 1970-2005[33]

Commercial mixture	Tonnes
c-PentaBDE	91,000 to 105,000
c-OctaBDE	102,700 to 118,500
c-DecaBDE	1,100,000 to 1,250,000

[29] UNEP, 2006a, 2010b; Li, 2012; Li et al., 2014
[30] Annex 3; BSEF 2007
[31] Table 3; UNEP, 2010a
[32] 2013, 2014a; Li et al., 2014
[33] UNEP, 2010a; derived from Schenker et al., 2008 and Li et al., 2010

4.4.2.2. Former uses of POP-PBDEs

The main manufacturing sectors that have used POP-PBDEs are as follows: electrical and electronics industry, transport industry, furniture industry; textiles and carpet industry and construction industry; recycling industry.

Former uses of c-PentaBDE

It is considered that between 90% and 95% of the use of c-PentaBDE was for the treatment of polyurethane (PUR) foam. These foams were mainly used in automotive and upholstery applications. Minor uses included textiles, printed circuit boards, insulation foam, cable sheets, conveyer belts, lacquers and possibly drilling oils[34]. The total amount of c-PentaBDE used for these minor uses is estimated to account for 5% or less of the total usage[35]. It is estimated that 85,000 tonnes of c-PentaBDE in total were used in the United States and the remaining 15,000 tonnes in Europe[36]. There may have been production and use in Asia but reliable data are not available.

An approximate distribution of global c-PentaBDE use of 36% in transport, 60% in furniture and a 4% residual in other articles is considered to be reasonable and is generally consistent with the analytical data for different waste streams. Table 29 summarizes the former uses of c-PentaBDE in various materials and applications.

Table 29: Former uses of c-PentaPBDE in polymers/resins, the applications and articles [37]

Materials/polymers/resins	Applications	Articles
Polyurethane (PUR)	Cushioning materials, packaging, padding, construction	Furniture, transportation, sound insulation, packaging, padding panels, rigid PUR foam construction
Textiles	Coatings	Back coatings and impregnation for carpets, automotive seating, furniture in homes and official buildings, aircraft, underground
Epoxy resins	Circuit boards, protective coatings	Computers, ship interiors, electronic parts

[34] UNEP, 2007a
[35] SFT, 2009; UNEP, 2010b
[36] Alcock et al. (2003)
[37] UNEP 2009

Rubber	Transportation	Conveyor belts, foamed pipes for insulation
Polyvinylchloride (PVC)	Cable sheets	Wires, cables, floor mats, industrial sheets
Unsaturated (Thermoset) polyesters (UPE)	Circuit boards, coatings	Electrical equipment, coatings for chemical processing plants mouldings, military and marine applications: construction panels
Paints/lacquers	Coatings	Marine and industry lacquers for protection of containers
Hydraulic oils	Drilling oils, hydraulic fluids	Off shore, coal mining

The average content of c-PentaBDE in PUR foam is reported to be around 3-5% (wt %) for upholstery, cushions, mattresses, and carpet padding (Table 30[38]) used in particular in countries with flammability standards for these applications (e.g. United States, United Kingdom). PUR foam in the transport sector might have been used in lower concentrations for applications like seats or arms/head rests at 0.5-1 wt %[39]. Considering the approximately 100,000 tonnes of c-PentaBDE and use of 4% in PUR foam, the historic production of c-PentaBDE treated foam can be conservatively estimated to be approximately 2.5 million tonnes.

Table 30:Usage of pentaPBDE in PUR foam[40]

PUR foam density/use area	PentaBDE in Polymer (wt %)
[a]19 kg/m^3	5.45
[a]24 kg/m^3	4.30
[a]29 kg/m^3	2.77
[b]PUR foam in (US) transport (seating, head/arm rest)	0.5-1
[b]olded carpet padding	2-5
[b]lamination to headliner fabric	Up to 15

C-PentaBDE in reuse, recycling and waste flows

The main uses of c-PentaBDE were in PUR foam used in the transport sector (e.g. cars, buses, trains etc.) and furniture (e.g. couches, seats, cushions etc.), with limited use in mattresses

[38] ENVIRON, 2003; UNEP, 2010a; see
[39] Ludeka, 2011
[40] aCambell, 2010; bLudeka, 2011

and some other uses. Therefore, the reuse and recycling of these major material flows should be addressed in the inventory. Other applications with former minor uses (e.g. insulation in construction, treated rubber, textiles, polyvinylchloride (PVC), epoxy resins in printed circuit/wiring board, etc.; might only be assessed if they appear relevant in a country.

Transport

The lifespan for cars in industrial countries is 10 to 12 years, while buses and trains might have a longer life expectancy. A considerable share of cars and other transport has been and is still being exported from industrial countries to developing countries and countries with economies in transition where the vehicles are often used for a long time before they finally break down. Therefore, a large share of the transport fleet from 1970 to 2004 (cars, buses and possibly trains) containing c-PentaBDE is still in operation today, most likely in developing countries, and will need to be identified in respect of reuse and recycling when these vehicles reach end-of-life. It is therefore reasonable to assume that the transport sector (cars, trucks, buses, trains, ship, and planes) is the largest stockpile for c-PentaBDE in developing countries.

Furniture and mattresses

The use of c-PentaBDE (and other flame retardants) in furniture or mattresses depends on the flammability standards of a country[41].

The lifespan of furniture in industrial countries is estimated at about 10 years. Therefore it is estimated that a considerable share of furniture containing c-PentaBDE in these regions has been deposited or incinerated[42] with a minor share recycled e.g. in carpet rebond (see below).

Textiles and rubber

C-PentaBDE has been used in limited quantities for the treatment of textiles for uses including back-coating, for curtains and for functional textiles[43]. There may be some limited recycling of other c-PentaBDE-containing textiles but it is likely that only relatively small quantities of POP-PBDEs-containing textiles are in use as the application of c-PentaBDE stopped about a decade ago. C-PentaBDE has also been used in rubber for conveyor belts and other minor uses.

Recycling of PUR foam to new articles

In one region PUR foams in furniture, transport, end-of-life vehicles and mattresses are partly recycled into new articles by processes such as carpet rebond and regrinding. Large-

[41] Shaw et al., 2010
[42] ESWI, 2011
[43] UNEP, 2009

scale recycling of PUR foam into carpet padding/rebond is currently practised in the United States and Canada[44].

C-OctaBDEs in reuse, recycling and waste flows

Europe and Japan stopped the use of c-OctaBDE in the 1990s. The production of c-OctaBDE in the United States stopped in 2004[45]. The largest c-OctaBDE content is found in polymers (in particular ABS and HIPS) that are used in EEE and WEEE. The use of c-OctaBDE in polymers in the transport sector was limited[46]. Figure 18 shows the life cycle of c-OctaBDE.

EEE in use, second-hand EEE and WEEE electronic waste

Electronics produced before 2005 may be flame retarded with c-OctaBDE. Main appliances are televisions and computer CRT monitors and heating equipment[47]. Large quantities of old EEE and WEEE were - and in some cases still are - exported from industrial countries/regions (e.g. United States, Europe and Japan) to developing countries for reuse or recycling. Inappropriate recycling technologies for WEEE have resulted in large contaminated areas in developing countries and exposure of recyclers and the general population[48].

Plastics from WEEE recycling and production of articles from recycled plastic

The mechanical recycling of plastic for further use is strongly favoured from a waste hierarchy and life cycle assessment perspective. When plastics are contaminated with POPs and other hazardous materials, however, particular care has to be given to how the waste hierarchy is followed. The recycling of WEEE results in a fraction of flame-retarded plastic, possibly containing POP-PBDEs. Some plastic from WEEE is sent to developing countries such as China and India where it is recycled into new articles. Recent studies have shown that plastics containing POP-PBDEs and other BFRs have been recycled in the production of articles for which no flame retardancy is required including children's toys, coffee cups, household goods and video tapes[49]. This shows that the flows of plastics containing POP-PBDEs and other flame retardants for recycling are not well controlled in some regions and that plastics containing POP-PBDEs are being mixed with non-flame retarded polymers for the production of items with sensitive end uses. Therefore, in some cases, the use of recycled plastic may be significantly more hazardous than the original use (recycling from a printer casing into a toy that may be chewed by a child, for example).

[44] Ludeka, 2011; see chapter 6 of the Draft PBDE BAT/BEP Guidance
[45] UNEP, 2006a, 2010b
[46] Abbasi et al., 2015; UNEP, 2010b
[47] Leslie et al, 2013; Sindiku et al., 2014; Waeger et al., 2010
[48] Wong et al., 2007; UNEP, 2010a, 2010b
[49] Hirai & Sakai, 2007; Chen et al., 2009, 2010; Samsonek & Puype, 2013

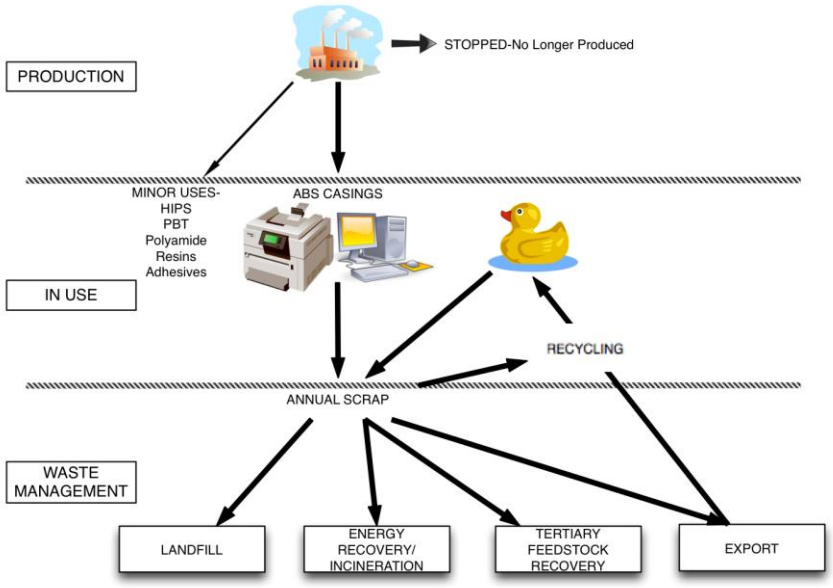


Figure 18: Schematic overview of c-OctaPBDE life cycle and potential for emissions[50]

The main former use of c-OctaBDE was in acrylonitrile-butadiene-styrene (ABS) polymers, accounting for about 95% of c-OctaBDE supplied in the EU. The treated ABS was mainly used for housings/casings of electrical and electronic equipment (EEE), particularly for cathode ray tube (CRT) housings and office equipment such as copying machines and business printers. Other minor uses were high impact polystyrene (HIPS), polybutylene terephthalate (PBT), and polyamide polymers. Although the majority of these polymers were used in electronics, there was also some use in the transport sector.

Other minor uses found in literature include nylon, low density polyethylene, polycarbonate, phenolformaldehyde resins, unsaturated polyesters, adhesives and coatings[51]. Table 31 summarizes the former uses of c-OctaBDE in various materials and applications.

Table 31: Former uses of c-OctaBDE in polymers/materials, the applications and products [52]

Polymers/materials	Application	Articles
Acrylnitrile-Butadiene-Styrene (ABS)	Polymer casings/parts in electric and electronic appliances	Computer- and TV casings (CRTs); office equipment; (other electronic equipment)

[50] Alcock et al., 2003
[51] UNEP, 2010a, 2010b
[52] ESWI 2011

High Impact Polystyrene (HIPS)	Polymer casings/parts in electric and electronic appliances	Computer- and TV casings (CRTs); office equipment
	Cold-resistant layer	Refrigerator
Polybutylen-Terephtalate (PBT)	Polymer casings	Electronic appliances
	Transport sector	Connectors in vehicles
	Household	Iron
Polyamide-Polymers	Textiles	Furniture
	Construction	Pipes and plastic foil

4.4.2. Hexabromobiphenyl (HBB)

4.2.2.1 Former uses of HBB

Included in Annex A, no exceptions, is an industrial chemical used as addition to flame retardants, used the most in 1970. HBB was used as a flame retardant in three main commercial products[53]:

- ABS thermoplastics (plastic for constructing business machine casings and in industrial (e.g. motor casing) and electrical (e. g. radio and TV parts) sectors);
- PUR foam for automotive upholstery;
- Coatings and lacquers.

Approximately 5,400 tonnes of HBB were produced in the US from 1970 to 1976 and for no other country production of HBB has been recorded[54]. Available information suggests that production and use of HBB ceased in most, if not all, countries in the 1970s [55].Due to the small production and limited use, it is likely that most HBB-containing materials were disposed of decades ago. Hence, the chemical is of minor relevance for the inventory process in many countries. Also levels in food (e.g. in European countries that used HBB to some extent in the past) were mostly below detection levels[56].

4.4.2.3. Objectives of the inventory

The main objective of the inventory is to obtain information needed for the implementation of obligations from the Stockholm Convention. More specifically, the objectives are to:

[53] Neufeld et al., 1977; IPCS, 1994; ATSDR, 2004
[54] UNEP, 2006b
[55] UNEP 2006b
[56] EFSA, 2010

- Establish the country baseline and take stock of the country situation in relation to POP-PBDEs and the volume of materials impacted by POP-PBDE;
- Provide the basis for development of a strategy in the NIP (i.e. identify the economic sectors that would be prioritized and the type of actions required for those sectors);
- Gather and assess national information on whether the current recycling of products and waste management meet the requirements of the Convention and identify areas where they do not;
- Identify the need to apply for the specific exemptions provided by the Convention in order to possibly notify the Secretariat;
- Identify areas where the country needs financial or technical support (when resources are limited, to fill the gaps in the inventory/fulfil the obligations of the Convention) and take into account the areas identified when making priorities and planning.

The inventory process followed the tools and techniques contained in the "Guidance for the Inventory of Polybrominated Diphenyl Ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants". So tiered approach was used

4.4.3. Initial assessment (Level I)

Two key sectors using POP-PBDE were identifiedand can be considered relevant:

a) Electrical and Electronic Equipment (EEE) and Waste Electrical and Electronic Equipment (WEEE) sector
b) transport sector and appropriate waste

Inventory of POP-PBDEs in transport sector

The inventory of POP-PBDEs in the transport sector is expected to address the following:

- Vehicles (second-hand) imported (for the inventory year and for the years with relevant vehicle imports as a base for estimating stocks);
- Vehicles in use;
- End-of-life vehicles in the inventory year and those having already reached end-of-life.

As already mentioned, a large percentage of c-PentaBDE use was in the transport sector (car seats, head restraints, carpet ceilings). C-OctaBDE was used to some extent in plastic parts (controls, control panels, etc.)[57].Vehicles in use represent a significant amount of POP-PBDE and the POP-PBDE list is directly relevant to the implementation of the Stockholm Convention.

[57] Abbasi et al., 2015; Ludeka, 2011; UNEP, 2010a, b

Montenegro has no manufacture or assembly of vehicles. The Ministry of the Interior has a relevant database on the number of registered vehicles (by types) by years of manufacture and these data were used for further calculation.
The use of c-OctaBDE commercial mixture in the plastic fraction of vehicles (such as control tables, etc.) is not considered in this inventory because their influence on total c-OktaBDE content in the transport sector is considered minor compared to c-PentaBDE (in PUR foam fraction/textile). Bearing in mind that POP-BDEs were manufactured and used in the period from 1975 to 2004, for the needs of the inventory only the number of vehicles manufactured during this period was taken into account.

4.4.4 Preliminary inventory (Level II)

4.4.4.1. Calculation of POP-PBDEs in imported vehicles

Data on the number of imported vehicleswere obtained from the School of Mechanical Engineering - Motor and Vehicle Centre - which is responsible for confirming compliance of the vehicles under the Traffic Safety Act.

Table 32 shows the number of imported vehiclesin the period 2008 – 2016, by year of manufacture.

Table 32: Number of imported vehiclesin in the period 2008 – 2016

	Year of import								
Year of manufacture	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***
1998	***1***					***1***		***1***	***2***
1999	***39***	***44***	***56***	***60***	***62***	***43***	***33***	***34***	***47***
2000	***800***	***450***	***500***	***600***	***525***	***600***	***425***	***450***	***570***
2001	***1800***	***900***	***1250***	***1500***	***1500***	***1510***	***1400***	***1200***	***1400***
2002	***1400***	***625***	***1000***	***1150***	***1350***	***1425***	***1500***	***1475***	***1600***
2003	***1100***	***450***	***625***	***850***	***1075***	***1325***	***1450***	***1450***	***1780***
2004	***1450***	***475***	***475***	***600***	***875***	***1150***	***1500***	***1600***	***2000***
Total	**6590**	**2944**	**3906**	**4760**	**5387**	**6054**	**6308**	**6210**	**7399**

Figure 19 shows the total number of vehicles manufactured before 2004, imported from 2008 to 2016.

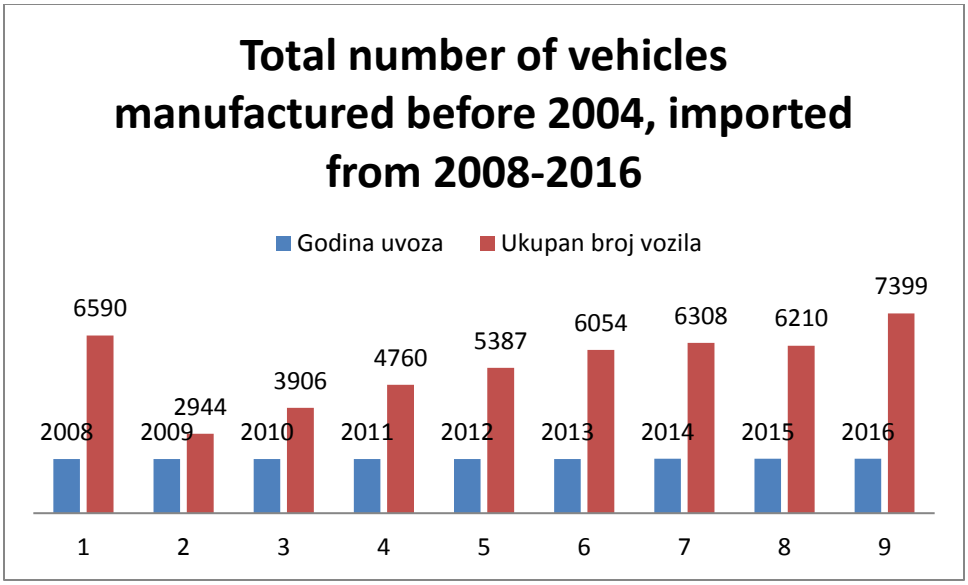


Figure 19: Number of imported vehicles manufactured before 2004

For the calculation of the amount of POP-PBDEs imported via the transport sector, the number of vehicles (produced between 1975 and 2004) imported for the specific inventory year need to be compiled. It is helpful to utilize all available import data (e.g. 1975 to 2010) to calculate the total import of PBDE over the years and to show any trends. Calculation of POP-PBDEs in the import of vehicles can be calculated according to Table 33.

Table 33: Amount of POP-PBDEs in PUR foam of imported vehicles in the inventory year

Number of imported cars/trucks (manufactured in other regions before 2005)	Amount of c-PentaBDE per car/truck	Total amount POP-PBDEs in cars imported in 20XX from regions other than US
8a	160 g per car/truck	**No. of cars and trucks x 016 kg x 0.05*= _____kg POP-PBDEs**

Table 34 shows the content of POP-PBDEs in PUR foam in imported vehicles by years.

Table 34: The content of POP-PBDEs in PUR foam in imported vehicles by years

Year of manufacture	**Total number of imported vehicles**	**Total content of POP-PBDEsin imported vehicles by years**
2008	6590	**53**
2009	2944	**23**
2010	3906	**31**
2011	4760	**38**
2012	5387	**43**

2013	6054	**48**
2014	6308	**50**
2015	6210	**50**
2016	7399	**59**

4.4.4.2. Calculation of POP-PBDEs in vehicles in use

In accordance with the UNEP Guidelines for the Estimation of C-PentaBDE in vehicles in use, the preliminary inventory contains an estimate of the amount of c-PentaBDE in the transport sector depending on the vehicle category and the year of inventory. The number of vehicles older than 2004 registered in the period 2006-2016 were obtained from the Ministry of the Interior (Table 35).

Table 35:Number of vehicles manufactured before 2004, registered in the period 2006-2016

YEAR	TYPE OF VEHICLE	NUMBER OF VEHICLES
2006	Buses	738
2007		991
2008		1000
2009		932
2010		880
2011		834
2012		797
2013		806
2014		743
2015		687
2016		712
TOTAL		9120
2006	Passenger cars	163568
2007		167597
2008		166380
2009		152454
2010		134026
2011		131311
2012		128316
2013		128380
2014		115635
2015		110630
2016		109574
TOTAL		1507871
2006	Cargo vehicles	10075

2007		11205
2008		11147
2009		9695
2010		8818
2011		8308
2012		8124
2013		8057
2014		6786
2015		6474
2016		6463
TOTAL		95152
2006	Special cargo vehicles	1
2007		
2008		
2009		
2010		
2011		1
2012		236
2013		361
2014		463
2015		556
2016		657
TOTAL		2275
2006	Special passenger vehicles	
2007		
2008		
2009		
2010		
2011		1
2012		47
2013		80
2014		99
2015		100
2016		101
TOTAL		428

Calculation of POP-PBDEs in vehicles in current use may be made according to Table36[58]

[58] Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants

Table 36:Amount of POP-PBDEs in PUR foam in vehicles in current use in the inventory year

Number of cars/trucks in use (manufactured in regions other than US before 2005)	Amount of c-PentaBDE per car	Total amount POP-PBDEs in cars in use (manufactured in regions other than US)
	160 g per car	**No. of cars and trucks x 0.16 kg x 0.05*= _____kg**
Number of buses in use (manufactured in regions other than US before 2005)	Amount of c-PentaBDE per bus	Total amount POP-PBDEs in cars in use (manufactured in regions other than US)
	1000 g per bus	**No. of buses x 1 kg x 0.05*= _____kg**
Total c-PentaBDE 20)	-	**Sum of c-PentaBDE: _____kg**

*Factor estimating the share of impacted vehicles in the region of production (1975-2004)

Table 37 gives a preliminary estimate of the amount of c-Penta BDE in vehicles still in use in Montenegro that were manufacture before 2004.

Table 37: Preliminary estimate of the amount of c-Penta BDE in vehicles still in use in Montenegro

YEAR	TYPE OF VEHICLE	NUMBER OF VEHICLES	c-penta BDE (kg)
2006	Buses	738	36.9
2007		991	49.55
2008		1000	50
2009		932	46.6
2010		880	44
2011		834	41.7
2012		797	39.85
2013		806	40.3
2014		743	37.15
2015		687	34.35
2016		712	35.6
TOTAL		9120	
2006	Passenger cars	163568	1308.544
2007		167597	1340.776
2008		166380	1331.04

2009		152454	1219.632
2010		134026	1072.208
2011		131311	1050.488
2012		128316	1026.528
2013		128380	1027.04
2014		115635	925.08
2015		110630	885.04
2016		109574	876.592
TOTAL		1507871	
2006	Cargo vehicles	10075	80.6
2007		11205	89.64
2008		11147	89.176
2009		9695	77.56
2010		8818	70.544
2011		8308	66.464
2012		8124	64.992
2013		8057	64.456
2014		6786	54.288
2015		6474	51.792
2016		6463	51.704
TOTAL		95152	
2006	Special cargo vehicles	1	0.008
2007			0
2008			0
2009			0
2010			0
2011		1	0.008
2012		236	1.888
2013		361	2.888
2014		463	3.704
2015		556	4.448
2016		657	5.256
TOTAL		2275	
2006	Special passenger vehicles		0
2007			0
2008			0
2009			0
2010			0
2011		1	0.008
2012		47	0.376
2013		80	0.64

2014		99	0.792
2015		100	0.8
2016		101	0.808
TOTAL		428	

Considering the c-penta BDE content propotion, the dominant c-penta BDE content is certainly found in cars (90.94%), followed by trucks (5.36%) and buses (3.69%) (Figure 20).

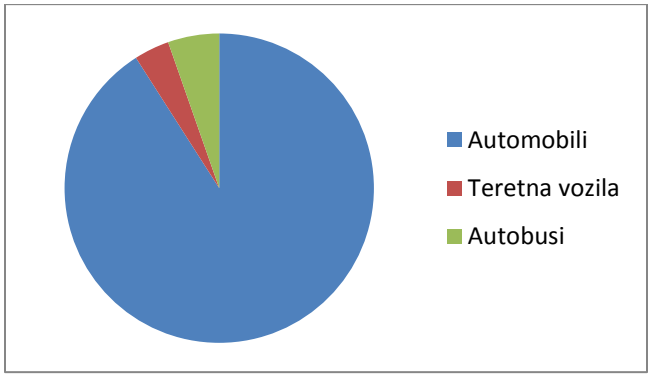


Figure 20: Proportionate C-penta BDE content by vehicle type

4.4.4.3. Calculation of POP-PBDE in vehicles that are not in use/end-of-life vehicles

The Law on Waste Management stipulates the obligation of manufacturers and importers to organize a waste management system for special types of waste themselves. Manufacturers and importers can meet their obligations under extended liability on their own or be included in the extended liability system by engaging another authorized legal entity (the so-called agent for manufacturers' and importers' collective liability in fulfilling the obligations set out in the Law on Waste Management). In any case, it is envisaged that fees for the takeover, collection and processing of special types of waste, which the manufacturers and owners of waste will have to pay, are considerably lower for manufacturers and importers involved in the organized system than for those outside the system, and that the competent authorities will decide on the manner in which these funds will be used in order to fulfill the obligations under manufacturers' extended liability.Table 10 gives an overview of the estimated annual values of the quantity of products/vehicles for which (besides other products) the extended liability of manufacturers and/or importers has been prescribed, as well as the estimated value of the quantity of waste generated from such products. The data originate from the Concession Act for Granting Concessions for the Takeover, Collection and Processing of Special Waste Types in Montenegro and the Report on the Implementation of the National Waste Management Plan for 2013, based on available data in Montenegro as well as the experience of EU member states.

Table 38. Estimated value of quantities of special types of waste in Montenegro and the amount of waste generated, collected, selected and processed (2013)

Proizvod / otpad koji nastaje od tog proizvoda	Količina proizvedenih / uvezenih proizvoda (t)	**Količina generisanog otpada (t)**	Količina sakupljenog otpada (t)	Procenat sakupljanja (%)	Količina selektovanog otpada (t)	Procenat selektovanog otpada (t)	Količina obrađenog otpada (t)	Procenat obrađenog otpada (%)	Cilj u pogledu obrade otpada u CG (%)
Električni i elektronski proizvodi	6.000	**4.200**	–	–	–	–	–	–	50-80
Vozila	15.000	**5.000**	899	17,98	899	17,98	76	1,52	85-95
Baterije i akumulatori	1.277		1.925	100,00	1.925	100,00	1.925	100,00	50-75
Gume	5.000	**3.600**	–	–	–	–	–	–	90
Ambalaža	93.000	**95.935**	7.507	7,80	5.870	6,10	5.052	5,26	15-60
Ulja i tečnosti za podmazivanje	4.000	**890**	118	–	–	–	109	–	–

Regarding the recycling of end-of-life vehicles, Montenegro operates three plants for the dismantling of vehicles out of use and preparation for the reuse and/or recycling of their parts. One is located within the Regional Recycling Centre at the "Livade" Landfill in Podgorica, the second one within the company "Bukumirska Jezera" in Podgorica and the third one within the company "Recycling Centre" d.o.o. from Niksic. In response to the inquiry on processed cars, Deponija d.o.o answered that in the period from 2013 to 2016, 512 end-of-life vehicles were handled in their plant[59] (Table 39).

Table 39. The number of processed vehicles in the dismantling plant Deponija d.o.o.

Year	Number of handled vehicles
2013	105
2014	252
2015	119
2016	36

During 2015, 2016 and 2017, Recycling Centre d.o.o. of Niksic processed 100 vehicles while "Bukumirska Jezera" of Podgorica handled more than 120 end-of-life vehicles in 2016. From the above data it can be concluded that a large number of end-of-life vehicles still end up in places that are not intended for disposal. TheNational Waste Management Plan for Montenegro for the period 2015-2020 mentions unregulated landfills by municipalities where, among other things, decommissioned and end-of-life vehicles are found[60].

As known, the "Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants" suggests the possibility of comparison with the experiences of others (especially by economic development, policies, etc.) from related countries, and in that sense the experiences of regional countryes are used here.The number of end-of-life vehicles on landfills in Montenegro has been calculated by multiplying the number of registered vehicles with a certain factor (for cars by 0.23, for

[59] Data from plant Deponija d.o.o

[60] Table 18, p.60 of the National Waste Management Plan for Montenegro for the period 2015-2020

buses by 0.46, for trucks by 1.89) and multiplying by 0.15. The results of the calculation are given in Table 40.

Table 40: The number of en-of-life vehicles and total number of vehicles in Montenegro

Year	Type of vehicle	Number of end-of-life vehicles	15% of end-of-life vehicles	Total number of vehicles: registered + end-of-life (15%)
2006	Buses	170	25	763
2007		228	34	1025
2008		230	34	1034
2009		214	32	964
2010		202	30	910
2011		192	29	863
2012		183	27	824
2013		185	28	834
2014		171	26	769
2015		158	24	711
2016		164	25	737
2006	Cars	18810	2821	166389
2007		19274	2891	170488
2008		19134	2870	169250
2009		17532	2629	155083
2010		15413	2312	136338
2011		15101	2265	133576
2012		14756	2213	130529
2013		14764	2214	130594
2014		13298	1995	117630
2015		12722	1908	112538
2016		12601	1890	111464
2006	Trucks	9521	1428	11503
2007		10589	1588	12793
2008		10534	1580	12727
2009		9162	1374	11069
2010		8333	1250	10068
2011		7851	1178	9486
2012		7677	1152	9276
2013		7614	1142	9199
2014		6413	962	7748
2015		6118	918	7392
2016		6107	916	7379

POP-PBDE homologues: TetraBDE, pentaBDE, hekaBDE and heptaBDE can be calculated from the estimated amount of c-PentaBDE (or c-OctaBDE) taking into account the percentage of homologues in the commercial mixtures shown in Table 41.

Table 41:Recalculation of POP-PBDEs* present in the transport sector to the listed POP-PBDEs homologues (tetraBDE, pentaBDE, hexaBDE and heptaBDE) for the relevant life cycle stages

2006	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		1426	35	1461
tetraBDE	33%	471	12	482
pentaBDE	58%	827	20	848
hexaBDE	8%	114	3	117
heptaBDE	0.5%	7	0.2	7
2007	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		1480	38	1517
tetraBDE	33%	488	12	501
pentaBDE	58%	858	22	880
hexaBDE	8%	118	3	121
heptaBDE	0.5%	7	0.2	8
2008	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		1470	37	1508
tetraBDE	33%	485	12	497
pentaBDE	58%	853	22	874
hexaBDE	8%	118	3	121
heptaBDE	0.5%	7	0.2	8
2009	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		1344	34	1377
tetraBDE	33%	443	11	455
pentaBDE	58%	779	20	799
hexaBDE	8%	108	3	110

heptaBDE	0.5%	7	0.2	7
2010	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		1187	30	1217
tetraBDE	33%	392	10	402
pentaBDE	58%	688	17	706
hexaBDE	8%	95	2	97
heptaBDE	0.5%	6	0.1	6
2011	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		1159	29	1188
tetraBDE	33%	382	10	392
pentaBDE	58%	672	17	689
hexaBDE	8%	93	2	95
heptaBDE	0.5%	6	0.1	6
2012	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		1134	28	1162
tetraBDE	33%	374	9	383
pentaBDE	58%	658	16	673
hexaBDE	8%	91	2	93
heptaBDE	0.5%	6	0.1	6
2013	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		1135	28	1160
tetraBDE	33%	375	9	383
pentaBDE	58%	658	16	673
hexaBDE	8%	91	2	93
heptaBDE	0.5%	6	0.1	6
2014	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		1021	25	1041

tetraBDE	33%	337	8	344
pentaBDE	58%	592	14	604
hexaBDE	8%	82	2	83
heptaBDE	0.5%	5	0.1	5
2015 godina	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		976	24	995
tetraBDE	33%	322	8	328
pentaBDE	58%	566	14	577
hexaBDE	8%	78	2	80
heptaBDE	0.5%	5	0.1	5
2016	Distribution homologue	POP-PBDEs in registered vehicles(kg)	POP-PBDEs on end-of-life vehicles(kg)	POP-PBDEs in total number of vehicles (kg)
Inventoried POP-PBDE*		970	24	988
tetraBDE	33%	320	8	326
pentaBDE	58%	563	14	573
hexaBDE	8%	78	2	79
heptaBDE	0.5%	5	0.1	5

*c-OctaBDE possibly contained in plastic in vehicles in low levels of 50 ppm (around PCB low POPs content;[61]) are not considered here in the inventory but only if this plastic is recycled.
** For countries with relevant export activities of used cars this sector need also to be calculated.
*** In the respective inventory year; it can be useful to calculate other years with available data (e.g. from 1980 on).

Figure 21 gives the graphical representation of POP-PBDEs in registered vehicles (in kg) in the period 2006-2016 in Montenegro.

[61] Morf et al., 2003

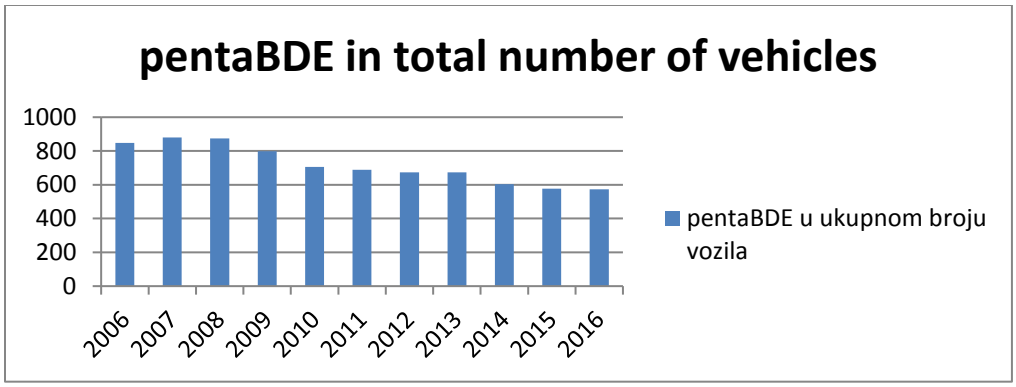


Figure 21: POP-PBDEs in registered vehicles (in kg) in the period 2006-2016 in Montenegro

Figure 22 gives the graphical representation of POP-PBDEs in end-of-life vehicles (in kg) in the period 2006-2016 in Montenegro.

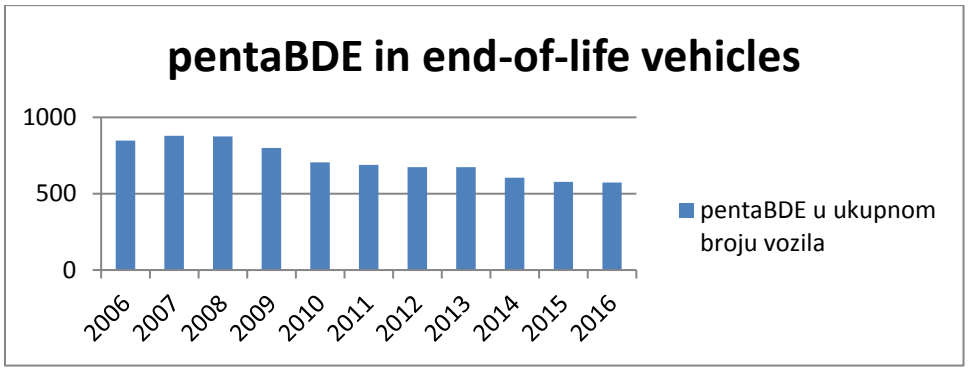


Figure 22: POP-PBDEs in end-of-life vehicles (in kg) in the period 2006-2016 in Montenegro

Figure 23 gives the graphical representation of POP-PBDEs in the total number of vehicles (in kg) in the period 2006-2016 in Montenegro.

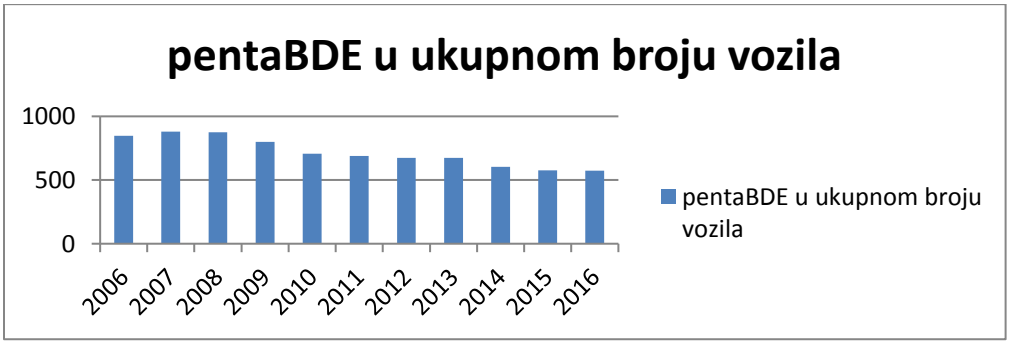


Figure 23: POP-PBDEs in the total number of vehicles (in kg) in the period 2006-2016 in Montenegro

As can be seen from the graphic representations starting from 2010, we can talk about the consistency of the c-pentaBDE quantity in vehicles in Montenegro.

4.4.5. Inventory of POP-PBDE in electrical and electronic equipment (EEE) and related waste (WEEE)

Electrical and electronic equipment is one of the fastest growing material flows of goods, as well as large waste and recycling flows with related management challenges, especially in developing countries (Basel Secretariat of the Convention 2011a, 2011b). This is the largest flow of materials containing c-OctaBDE. The EEE and WEEE inventory is an important step to address the challenges of managing materials that contain c-OctaBDE.

Step 1: Planning inventory and identifying stakeholders

The Working Group members first defined the inventory volume. The POP-PBDE inventory in EEE/WEEE will be based on the data on:

- second-hand EEE that possibly contains POP-PBDEs and that was imported in the inventory year and previous years
- EEE stocks (in use and/or stored in the possession of consumers);
- EEE that enters waste, ie. WEEE
- WEE plastic recycling

Step 2: Selecting a method for data collection

Initial assessment

The objective of the initial assessment is to determine the availability of data for the inventory of EEE and WEEE in the country. In Montenegro, the EEE/WEE inventory has not been implemented. In accordance with the "Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention", the inventory of EEE/WEEE is initiated by an estimate of the minimum content of POP-PBDEs in the CRT in the country. This approach requires an assessment of the national level of entry of products (the number of appliances per capita) analogous to countries of similar economic development and similar consumer behavior, as well as their extrapolation from the number per capita to the state that is the objective of the inventory. Once estimated number of appliances per capita is used along with data on POP-PBDEs content in CRT enclosures (TV and computer monitors) and the following data is used for further calculation:

- number of inhabitants,
- mass of CRTs per device 25 kg/device (estimated average weight of CRT monitors, either TV or PC monitor, Table 12 in the Inventory Guidance);
- the content of the polymer in the CRTcasing: 30% (estimated average, Table 16 in POP-PBDEs Inventory Guidance);

- the range of c-OktaBDE content, 0.87-254 kg/tonne, for polymers used for CRT casings (estimated average, Table 18 in POP-PBDEs Inventory Guidance).

The range of c-OktaBDE content in CRT devices is calculated according to the following equation:
M c-OktaBDE = [number of CRTs/capita] X number of inhabitants X 25 kg (mass of CRT) X 0.3 (polymer content) X [0.00087 to 0.00254] (range of c-OktaBDE content)

Mc-OctaBDE -content of commercial mixture c-OktaBDE (s) (kg) (in polymer (k) used for electrical and electronic equipment (EEE) casings (j))

Due to the above fact that there is no EEE/WEE inventory and the possibilities given in the POP-PBDEs Guidancetomake an estimate by using the experience of a country with similar economic development and similar behaviour of consumers as Montenegro, the estimate of POP PBDE content was based on the experience of regional contry[62].

Import

In the inventory year in Macedonia, there were no imports of used EEE, while according to data obtained from the Montenegrin Customs Administration, starting from 2006-2016, 21 second-hand TVs with cathode ray tube (manufactured before 2004) were imported in Montenegro and 1 cathode ray monitor (manufactured before 2004). The working team is of the opinion that the import of the second-hand equipment for the aforementioned period of 10 years (16 EEE imported in 2007 and 2 EEE in 2016) is not significant. Imports of EEE older than 2004 (not used) are given in Table 42.

Table 42: Overview of imports of CRT TV and CRT monitors for the period 2006-2016[63]

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CRT TVs	2769	30951	34265	13888	12675	3368	1777	2299	144	2	2
CRT monitors	0	3730	2026	1289	2441	153	1619	41	87	36	398

Figure 24 gives a graphical representation of the import of EEE equipment in Montenegro in the period 2006-2016.

[62] Republic of North Macedonia
[63] Data obtained from the Customs Administration

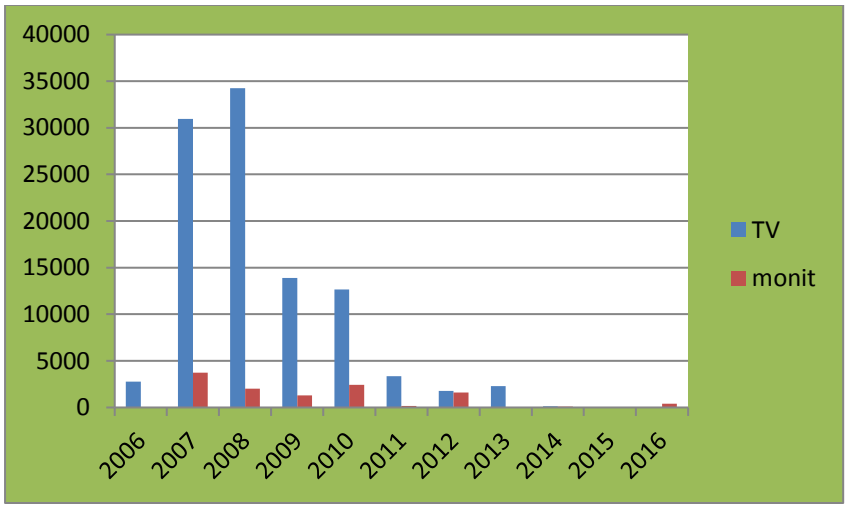


Figure 24: Overview of imports of EEE equipment in Montenegro in the period 2006-2016

EEE in use

The Statistical Office of Montenegro has no data on the number of CRT televisions, CRT monitors per capita. In spite of the possibility to use the experience of countries with similar economic development, etc., a survey was conducted in order to obtain relevant data. A total of 100 households were surveyed in order to obtain data on the number of TVs (black and white) CRT, TV (colour) CRT and CRT monitors. The results of the survey are as follows:

- 88% of respondents answered positively to the question about possession of CRT TV (in colour) (which they do not use)
- 12% of respondents answered negatively to the question about possession of CRT TV (colour)
- 2% of respondents answered positively to the question about possession of a CRT monitor (98% answered negatively to this question)
- 100% of respondents answered a negatively to the question about possession of CRT TV (black and white)

The data obtained by the survey are very similar to the statistical data in the NIP of Macedonia. The data on the number of CRT televisions will be multiplied by 1.5, bearing in mind that the survey included only the households, in order to cover the EEE in institutions, hotels, hospitals, etc.

According to the 2011 census, the population of Montenegro consists of persons living in Montenegro for a year and longer, as well as persons who live less than a year but have the intention to permanently reside in Montenegro. (MONSTAT - Statistical Yearbook 2016-Table 43).

Table 43. The number of inhabitants and households in Montenegro

4 – 1. POVRŠINA, STANOVNIŠTVO I DOMAĆINSTVA, PREMA POPISIMA[1)]

AREA, POPULATION AND HOUSEHOLDS ACCORDING TO CENSUSES[1)]

	Površina u km² Area, km²	Domaćinstva Households	Stanovništvo Population			Stanovnika na km² Population per 1 km²	Broj lica na jedno domaćinstvo Number of persons per 1 household	Broj ženskih na 1000 muških stanovnika Number of females per 1000 males
			ukupno Total	muško Male	žensko Female			
1921	13 812	55 463	311 341	155 301	156 040	22,5	5,6	1 005
1931	13 812	62 836	360 044	179 965	180 279	26,1	5,7	1 003
1948	13 812	83 639	377 189	178 078	199 111	27,3	4,5	1 118
1953	13 812	92 152	419 873	201 718	218 155	30,4	4,6	1 081
1961	13 812	106 569	471 894	229 274	242 620	34,2	4,4	1 058
1971	13 812	121 911	529 604	259 209	270 395	38,3	4,3	1 043
1981	13 812	142 692	584 310	289 739	294 571	42,3	4,1	1 017
1991	13 812	163 274	615 035	305 931	309 104	44,5	3,8	1 010
2003	13 812	180 517	620 145	305 225	314 920	44,9	3,4	1 032
2011	13 812	192 242	620 029	306 236	313 793	44,9	3,2	1 025

[1)] Za upoređivanje broja stanovnika prema Popisima, vidjeti Metodološka objašnjenja.

[1)] For the comparison of number of population with the censuses, look at the Methodological notes.

Taking into account the survey results and estimates, Table 44 presents the inventory of EEE containing PBDE in 2016.

Table 44: EEE stockpiles in Montenegro

EEE category	Households	Households + hotels+ hospitals etc.
Colour TV units (CRT)	169173	253759
PCs	3845	5767

Waste

A company that deals with the collection and export of hazardous waste in Montenegro in accordance with the licenses issued by the Agency for Nature and Environmental Protection is Hemosan doo from Bar. Bearing in mind that more than 90% of EEE waste in Montenegro is processed in this electrical and electronic waste treatment plant, the data we received from this company were considered relevant. Through direct contacts and visits to all significant recycling yards in Montenegro (since the end of 2011,citizens have the opportunity to dispose of certain types of non-hazardous and hazardous waste, generated in their households, in the recycling yards in their cities), as well as questionnaires sent to institutions, we got the information that everybody sends their WEEE to this company for processing. Table 45 shows the collected WEEE collected in Montenegroby years.

Table 45: Overview of the collected WEEE in Montenegro in the period 2014-2016

WEE by category	**2014**	**2015**	**2016**
Number of CRT TVs	756	668	1223
Number of CRT monitors	75015	66273	121102
Total	75771	66941	122325

The total polymer fraction in the relevant EEE

The relevant EEE/WEEE relating to POP-PBDE include only (individual) product types and categories ofWEEE with an average POP-PBDE concentration around or above the RoHS MCV (Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment). The corresponding data for the total polymer fraction are listed in Table 46.

Table 46: Total polymer fraction in the relevant EEE/WEEE in Europe. Printed wiring boards and cables are not included[64]

Category/Article		Total polymer fraction $f_{Polymer}$ [in % by weight]		
		Minimum	Maximum	Mean
3	ICT equipment without monitors	26%	58%	**42%**
4	Consumer equipment without monitors	21%	26%	**24%**
3	CRT monitors	13%	38%	**30%**
4	CRT-TVs	15%	38%	**30%**

To complete the inventory of the POP-PBDEs in EEE, data about their concentration in the total polymer fraction of the relevant EEE are needed ($C_{PBDE(i);Polymer(k)}$).

According to a study that analysed the concentrations of RoHS substances in mixed plastics from WEEE in Europe, the average concentration of c-OctaBDE exceeds the RoHS' MCV in certain product types in WEEE categories 3 and 4[65]. In all cases, the polymer containing those concentrations was ABS.

Table 47. provides the concentration of c-OctaBDE in the total polymer fraction used in the relevant EEE. It should be noted that the provided data were derived from mixed polymer fractions from different WEEE recycling plants in Europe in 2010[66]. The sampling procedure is described in detail in the study.[67]

Table 47:c-OctaBDE content in total (mixed) polymer fractions of different WEEE in Europe [68]

Category/Article	c-OctaBDE content in total polymer fractions in [kg/ metric tonne] * ($C_{OctaBDE;Polymer}$)

[64] Waeger et al., 2008
[65] Waeger et al., 2010
[66] Waeger et al., 2010
[67] http://ewasteguide.info/files/Waeger_2010_Empa-WEEEForum.pdf
[68] concentration ranges in European WEEE Forum countries as described in Waeger et al., 2010

		Minimum	Maximum	Mean
3	ICT equipment w/o monitors	0.05	0.4	**0.225**
3	CRT monitors	0.14	10.6	**2.54**
4	Consumer equipment w/o monitors (1 composite sample)	-	-	**0.15**
4	TV CRT monitors	0.05	3.54	**0.87**

* RoHS limit for c-OctaBDE is 0.1% or 1 kg/metric ton; CRT casings treated with c-OctaBDE contain approximately 15% c-OctaBDE including about 10% POP-PBDEs (hexaBDE and heptaBDE).

The initial inventory of c-OctaBDE and the appropriate congeners (hepta-, hexa- and octa-BDE) was carried out on the basis of comparisons with other countries, developing countries, be using the guidance for new industrial chemicals and on the basis of the national team's assumptions. The most important input data for POP-PBDEs originating from EEE and WEEE based on data on CRTs per capita were:

a) population of Montenegro,
b) average mass of CRTmonitor,
c) average content of polymers in CRT monitor,
d) average content of c-OctaBDE which is incorporated in a polymer for the enhancement of polymer properties, and
e) the number of CRT monitors used in households, public institutions, administration, business sector, hotels and other institutions, older than 2005.

Waste from electrical and electronic equipment was not taken into account because there was no available information at this stage of the project. It is calculated in "Tier 2". Table 48 gives data for the preliminary inventory of POP PBDE in the EEE in Montenegro.

Table 48: Data for the preliminary inventory of POP PBDE in the EEE in Montenegro

Input data for estimating the amount of C-octave PBDE in EEE in use in Montenegro	Unit
Number of inhabitants of Montenegro in 2016 (2011 census)	620029
Number of CRTs older than 2004 in use for 2016	259526
CRT/number of inhabitants	0.42

Weight CRT (kg / equipment) as the average weight of a CRT monitor, (or TV or monitor)	25 kg
The content of polymers in the CRT (estimated mean value)	30%
The average C-Octa PBDE of these polymers in the CRT monitor	0.15%

The initial estimation of the quantity of the POP PBDE chemical, ie c-oct of BDE, in the EEE in 2016 in Montenegro based on the number of inhabitants is given in Table 49.

Table 49: Preliminary estimate of EEE inventory in 2016

Number of CRT/capita		Population		Weight of CRT monitor (kg)		Polymer content in CRT monitors (30%)		Average C-octa BDE content in polymers (0.15%)		Amount of C-octaBDE in kg
0.42	**X**	**620029**	**X**	**25**	**X**	**0.3**	**X**	**0.0015**	**=**	**2929**

The mean amount of c-octaBDE in the household in Montenegro in 2016 is given in Table 50.

Table 50: Mean amount of C-octaBDE in EEE in Montenegro for households in 2016.

Households					
Monitors	**Number**	**Weight (kg)**	**Weight (t)**	**The amount of plastic in monitors (30%)**	**The mean amount of C-octaBDE**
CRT PC monitor	54214	96125	96	29	74
CRT TV	169173	5345866	5346	1603	1395
Total	**223387**	**5441991**	**5442**	**1632**	**1469**

Table 51 shows the mean amount of C-octaBDE in WEEE in Montenegro in 2016.

Table 51: Mean C-octaBDE content in WEEE in Montenegro in 2016

WEE					
Monitors	**Number**	**Weight (kg)**	**Weight (t)**	**The amount of plastic in monitors (30%)**	**The mean amount of C-octaBDE**
CRT PC monitor	1223	17244	17	5	13
CRT TV	121102	3826823	3826	1147	790
Total	**122325**	**3844067**	**3843**	**1152**	**803**

Table 52 shows the mean amount of C-octaBDE in imported EEE in 2016.

Table 52: The mean amount of C-octaBDE in imported EEE in 2016

Import					
Monitors	**Number**	**Weight (kg)**	**Weight (t)**	**The amount of plastic in monitors (30%)**	**The mean amount of C-octaBDE**
CRT PC monitor	398	5612	5	1.5	4
CRT TV	2	63	0.063	0.019	0.016
Total	**400**	**5675**	**5.063**	**1.519**	**4**

For the final inventory, hexaBDE and heptaBDE (from c-OctaBDE) must be calculated from the c-octaBDE total quantity. The average c-octaBDE consists of 43% of heptaBDE homologs and 11% of hexaBDE homologues (see Table 53).

Table 53: Distribution of HexaBDE, heptaBDE and OctaBDE homologues in EEE and in WEEE

Homologues	**Distribution of c-OctaBDE homologues**	**POP-PBDEs in import for inventory year**	**POP-PBDEs in stocks for inventory year**	**POP-PBDEs entering the waste stream**
Inventoried c-OctaBDE		**Σc-OctaBDE 4**	**Σc-OctaBDE 2929**	**Σc-OctaBDE 803**
HexaBDE	**11%**	**0.44**	**322**	**88**

HeptaBDE	**43%**	**1.72**	**1529**	**345**
OctaBDE**	**35%**	**1.4**	**1025**	**281**

Photodocumentation for some of the visited yards is presented in Figures 25-27.

Figure 25. Recycling yard in Husinskih Rudara Street, Konik, Podgorica

Figure 26. Recycling yard in Mihaila Lalica Boulevard, Tolosi, Podgorica

Figure 27. Recycling yard in Iva Vizina Street, Zabjelo, Podgorica

As mentioned earlier, the waste from the recycling yard is sent to Hemosan d.o.o. for processing. (Figure 28)

Figure 28: Hemosan d.o.o Bar – Visiting, measuring and recording

4.5. Polychlorinated biphenyls (PCBs)

Polychlorinated biphenyls (PCB) are organochlorinated synthetic compounds tha tbelong to the group of industrial persistent pollutants, presented in Annex A, Part II ofthe Stockholm Convention. PCBs are aromatic compounds formed in such a manner that the hydrogen atoms on the biphenyl molecule (two benzene rings bonded together by a single carbon-carbon bond) may be replaced by up to 10 chlorine atoms (Figure 29). In theory there are 209 congeners, although only about 130 congeners have actually been found in commercial chemical formulations[69]. Typically, four to six of the 10 possible substitution sites are occupied by a chlorine atom[70]. The more highly chlorinated PCB congeners are virtually insoluble in water and highly resistant to degradation. PCBs include 12 congeners for which the World Health Organization has assigned toxicity equivalency factors because they exhibit dioxin-like toxicity.Depending on the reaction conditions, the degree of chlorination can vary between 21 and 68% (w/w). The yield is always a mixture of different compounds and congeners.

[69] Holoubek, 2000

[70] Environment Canada, 1988

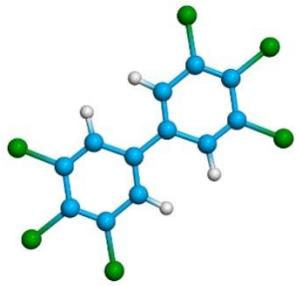


Figure 29. Polychlorinated biphenyl (PCB) Chemical structure

4.5.1. Use of PCBs

PCBs were used in a very wide variety of industrial and consumer applications. The uses were categorized by the World Health Organization as completely closed, nominally closed and open-ended[71]. The uses included:

- Completely closed systems: Electrical transformers; Electrical capacitors (including lamp ballasts); Electrical switches, relays and other; Electrical cables; Electric motors and magnets (very small amounts);
- Nominally closed systems: Hydraulic systems; Heat transfer systems (heaters, heat exchangers);
- (Open-ended systems:Plasticizer in polyvinyl chloride, neoprene and other artificial rubbers;Ingredient in paint and other coatings;Ingredient in ink and carbonless copy paper;Ingredient in adhesives;Pesticide extender;Ingredient in lubricants, sealants and caulking material;Fire retardant in fabrics, carpets, polyurethane foam, etc.;Lubricants (microscope oils, brake linings, cutting oils, other lubricants).

Although electrical transformers containing PCBs are defined as a "completely closed" application, industrial practices caused these PCBs to be transferred to other types of equipment, thus creating additional points of contact with the environment. A common practice was to top up or recharge non-PCB (mineral oil) transformers with PCBs when no other fluid was available. PCB oils were also added to or disposed of with non-PCB fluids such as heating or cooling fluid, hydraulic fluid, brake fluid, engine oil and off-specification fuels. There are numerous anecdotal reports of employees in electrical utilities using PCB fluids to wash their hands and taking PCB fluids home for use in home heaters, hydraulic systems and motors (as a lubricant). Since most fluorescent lamp ballasts made before PCBs were banned contained PCBs, many homes and businesses that installed fluorescent lamps unknowingly acquired PCBs. All these PCB applications could be found in the areas presented in the Table 54.

[71] IPCS, 1992

Table 54. PCB Applications by Location

Possible target locations	Common PCB-containing applications
Electric Utilities (including distribution networks)	Transformers Large Capacitors Small Capacitors Switches Voltage Regulators Liquid Filled Electrical Cables Circuit Breakers Lighting Ballasts
Industrial Facilities (including aluminium, copper, iron and steel, cement, chemicals, plastics, synthetics, and petroleum refining industries)	Transformers Large Capacitors Small Capacitors Heat Transfer Fluids Hydraulic Fluids (equipment) Voltage Regulators Circuit Breakers Lighting Ballasts
Rail Road Systems	Transformers Large Capacitors Voltage Regulators Circuit Breakers
Underground Mining Operation	Hydraulic Fluids (equipment) Earthing Coils
Military Installation	Transformers Large Capacitors Small Capacitors Hydraulic Fluids (equipment) Voltage Regulators Circuit Breakers
Residential/Commercial Buildings	Small Capacitors (in washing machines, hair dryers, neon tubes, dishwashers, power supply units, etc.) Circuit Breakers Lighting Ballasts
Research Laboratories	Vacuum pumps Fluorescent Light Ballasts Small Capacitors Circuit Breakers
Electronics Manufacturing	Vacuum pumps
Plants	Lighting Ballasts Small Capacitors Circuit Breakers

Waste waters Discharge Facilities	Vacuum pumps Well Motors
Automobile Service Stations	Re-used oil
Landfills (including industrial and municipal waste sites)	Decommissioned Equipment Building Demolition Fluff Spills

The following countries have been the main manufacturers of PCBs: United States, Germany, former Soviet Union, former Czechoslovakia, United Kingdom, China, France, Italy, Japan, Spain, Korea (DPR), and Poland. The cumulative worldwide production of PCBs has been estimated up to 1.5 million tons.[72] The Table 55 provides a list of the many trade names and synonyms commonly given to PCB mixtures.

Table 55: Trade names for PCBs[73]

Abestol (t, c)	DP 3, 4, 5, 6.5	Phenoclor (t, c) (France)
Abuntol (USA)	Ducanol	Phenoclor DP6 (France)
Aceclor (t) (France, Belgium)	Duconal (Great Britain)	Phyralene (France)
Acooclor (Belgium)	Duconol (c)	Physalen
Adkarel	Dykanol (t, c) (USA)	Plastivar (Great Britain)
ALC	Dyknol (USA)	Polychlorinated biphenyl
Apirolio (t, c)	E(d)ucaral (USA)	Polychlorobiphenyl
Arclor B (c)	EEC-18 (t)	Pryoclar (Great Britain)
Areclor (t)	EEC-IS (USA)	Pydraul (USA)
Aroclor (t, c) (USA)	Elaol (Germany)	Pydraul 1 (USA)
Aroclor 1016 (t, c)	Electrophenyl (France)	Pydraul 11Y (USA) (h)
Aroclor 1221 (t, c)	Electrophenyl T-60	Pydraul A, AC, F, 135, 230
Aroclor 1232 (t, c)	Elemex (t, c) (USA)	Pyralene (t, c) (France)
Aroclor 1242 (t, c)	Elexem (USA)	Pyralene 1460, 1500, 1501 (F)
Aroclor 1254 (t, c)	Eucarel (USA) (c)	Pyralene 3010, 3011 (France)
Aroclor 1260 (t, c)	Fenchlor 42, 54, 70 (t, c) (Italy)	Pyralene T1, T2, T3 (France)
Aroclor 1262 (t, c)	Hexol (Russian federation)	Pyramol (USA)
Aroclor 1268 (t, c)	Hivar (c)	Pyranol (t, c) (USA)
Arubren	Hydol (t, c)	Pyrochlor
Asbestol (t, c)	Hydrol	Pyroclar (Great Britain)
ASK	Hyvol (c)	Pyroclor (t) (USA)

[72] UNEP, "Preliminary Assessment" 19

[73] UNEP, "Guidance for the Identification of PCBs" 26

Askarel (t, c) (USA)	Hywol (Italy/USA)	Pyromal (USA)
Auxol (USA)	Inclar (Italy)	Pyronal (Great Britain)
Bakola	Inclor (Italy)	Pysanol
Bakola 131 (t, c)	Inerteen 300, 400, 600 (t, c)	Saf(e)-T-Kuhl (t, c) (USA)
Bakolo (6) (USA)	Kanechlor (KC) (t, c) (Japan)	Safe T America
Biclor (c)	Kanechor	Saf-T-Khul (t)
Capacitor 21 (c)	Kaneclor (t,c)	Sanlogol
Chlorextol (t)	Kaneclor 400	Sant(h)osafe (Japan)
Chlorinated Diphenyl	Kaneclor 500	Sant(h)othera (Japan)
Chlorinol (USA)	Keneclor	Sant(h)othern FR (Japan)
Chlorintol (USA)	Kennechlor (t)	Santosol
Chlorobiphenyl	Leromoli	Santoterm
Chloroecxtol (USA)	Leromoll	Santotherm (Nippon) (t)
Chorextol	Leronoll	Santotherm FR (t)
Clophen (t, c) (Germany)	Magvar	Santovac
ClophenApirorlio	Man(e)c(h)lor (KC) 200,600	Santovac 1
Clophen-A30	Manechlor (Nippon)	Santovac 2
Clophen-A50	MCS 1489 (c)	Santovec (USA)
Clophen-A60	Montar (USA)	Santowax
Cloresil	Monsanto FR-1 (he)	Santvacki (USA)
Clorinol	Nepolin (USA) (t)	Saut(h)otherm (Japan)
Clorphen (t,c)	Niren	Siclonyl (c)
DBBT	No-Famol	Solvol (t, c) (Russian Federation)
Delorene	NoFlamol	Sorol (Russian Federation)
Delor (Czech Republic)	No-Flamol (t, c) (USA)	Sovol (Russian Federation)
DI 3,4,5,6,5	No-flanol (t,c) (USA)	Sovtol (Russian Federation)
Diachlor (t,c)	Nonflammable liquid	Terpenylchlore (France)
Diaclor (t, c)	Non-flammableliquid (t,c)	Therainol FR (HT) (USA)
Diaconal	Orophen (Former East Germany)	Therminol (USA)
Dialor (c)	PCB	Therminol FR
Diconal	Pheneclor	Therpanylchlore (France)
Disconon (c)	Phenochlor	Turbinol 153 (h)
Dk (t, c) (decachlorodiphenyl)	Phenochlor DP6	Ugilec 141, 121, 21
Dl(a)conal	Phenoclar DP6 (Germany)	

t- transformers, c- capacitors

4.5.2. PCB-containing waste

Although the manufacture, processing and use of PCBs are widely prohibited, there still exist a host of different activities that generate PCB wastes, including: exemptions given to certain uses of PCBs; the incidental production of PCBs; recycling operations and quantities held within equipment still in service[74]. Some specific examples of activities that generate PCB waste are presented in Table 56.

Table 56: PCB waste generating activities[75]

Activities	Description
PCBs in Used Oil	Because PCBs were widely used in equipment that is still in service today, waste oil collected from this equipment frequently contains detectable PCB concentrations. PCB-contaminated used oil comes principally from industrial and automotive sources and electrical equipment. Industrial sources are typically plants and factories where used oil is used as a fluid in hydraulic and heat transfer systems. Used PCB transformer oil has often been mixed with used mineral oil in oil recycling operations, such that low concentrations of PCBs are often found in recycled oil used in trucks and automobiles. Automotive sources are generally gasoline stations and commercial vehicle fleets that collect oil from engine crankcases, transmissions, radiators and other vehicle-related systems. In addition, the condensate in natural gas pipelines can become contaminated with PCBs by contacting PCB containing oils used in the compressors of such pipelines.
Navigational Dredging of PCB-Contaminated Waters and Sediments	Over the years, large quantities of PCBs have been discharged into aquatic environments including rivers, lakes, and estuarine systems. PCBs tend to adsorb strongly to sediments. Dredging of the bottom to allow ship navigation can therefore generate waste sediments contaminated with PCB levels above 50 ppm. PCBs were used in hydraulic fluids in mining equipment and this use was one of the major sources of PCBs that have settled in river water and river sediments.

[74] UNEP, "Guidance for the Identification of PCBs" 11-12
[75] UNEP, "Guidance for the Identification of PCBs" 11-12

Repair and Decommissioning of Equipment.	The repair and maintenance of PCB-containing equipment is a source of toxic waste. For example, in the event of a breakdown, transformers are repaired either by the manufacturer or, more often, in repair shops which creates PCB-containing wastes at these locations. Additional significant sources of PCBs may include waste materials generated by clean-up of dielectric fluid leaks at industrial facilities and the explosion or overheating of transformers and capacitors. Furthermore, the decommissioning of PCB-containing equipment may introduce (formerly contained) PCBs into the environment, often in the form of fluff (waste including upholstery, padding and insulation materials derived from the shredding of cars and electrical appliances). Given that transformers and electrical capacitors tend to have relatively long service lives (~ 40 years).
Building Demolition	In general, large amounts of waste are produced through the demolition of buildings. Of this waste, PCBs are to be found in filling material for joints of concrete structures, flame-retardant coatings on ceiling boards (or tiles), fluorescent light ballasts, coatings on furnishings, surface treatments for textiles, adhesives for waterproof wall coatings, paints, insulating materials, sealant putties, and large and small capacitors (found in appliances and electrical devices).
Volatilization and Leaching from Landfills	Of the PCBs that have already been disposed, most have likely been deposited in landfills, including municipal, industrial, and sewage sludge landfills. However, PCBs may be released from these landfills by volatilization into the atmosphere and leaching into groundwater. It is likely that much of the PCBs distributed in the waste was originally enclosed in containers, such as capacitors, or was in plasticized resins and will not be released to the environment until the containing medium decays or is damaged. Thus, the diffusion of PCBs from landfills is likely to be slow.
Recycling Operations	Through various recycling operations, PCBs have found their way back into the commercial stream. For example, waste paper supplies (carbonless copy paper) may have been recycled into paper and board used as food packaging materials.

	Another major pathway of PCB environmental exposure is through scrap and waste oil recycling. Additionally, recycled PCB-containing mixtures have been detected in formulations for pesticides and soft soap.
Incinerators	Emissions of PCBs may occur during the incineration of industrial and municipal waste (e.g., refuse and sewage sludge incinerators). Most municipal incinerators are not effective in destroying PCBs. It is recommended that destruction of PCB-contaminated waste should be carefully controlled, especially with regard to the burning temperature (above 1100°C), residence time, and turbulence.
Inadvertent Production by Organic Chemical Manufacturing and Use Industries	There are a number of industrial processes in the organic pigment, pesticide, chemical, and aluminium refining industries that inadvertently produce PCB-laden materials. PCBs can be produced when chlorine, hydrocarbon, and elevated temperatures (or catalysts) are present together. Approximately 90 percent of this production is expected to contain less than 50 ppm of PCBs, and approximately 5 – 10 percent may contain between 50 and 500 ppm of PCBs.

4.5.3. Impacts of PCBs on health and the environment (Bio-accumulation of PCBs in the organism)

Bio-accumulation of PCBs in the organism

Laboratory experiments on animals have shown that:

- PCBs are easily absorbed through all exposed areas and remain for the most part in fattytissue, where they tend to accumulate;
- More than 90% of ingested PCBs cross the intestinal walls and are retained in the organism;
- The organ favored by PCBs is the liver, which stores them.

Actual toxicity of PCBs

Anomalies have been observed in the children of women who, during pregnancy, have consumed PCB-contaminated oil. These anomalies are primarily found on the skin, in mucous membrane and the epidermis. Occupational exposure can cause irritations of the skin and the mucous membrane (eyes and respiratory system), chloracne and, with stronger concentrations, liver disorders. High concentrations of PCBs cause: Acne, skin irritations,

hyperpigmentation; Hypersecretion of the tear glands, conjunctivitis; Liver disorders (hypertrophy et enzymatic changes); Blood disorders (anaemia et hyperleucytosis); Reproductive effects: changes in the epidermis (hair loss) and the skin (acne, œdema) are observed among the off-spring of exposed mothers, as well as low birth weight and bone abnormalities. In mice, the lethal dose 50 at eight days (i.e., the lethal dose for 50% of the population at the end of eight days) is only 0.7 g of PCB per kg of the 'animal.

Carcinogenicity of PCBs

Epidemiological studies have shown no significant increase in the incidence of cancer among people exposed to PCBs. Skin, digestive and liver tumours, and also instances of leukaemia have been attested, however, but scientific analyses have failed to establish a link between increased skin and pancreatic cancer rates and occupational exposure of the victims to PCBs. The International Agency for Research on Cancer (IARC), which is part of the World Health Organization (WHO), measures the carcinogenic risk of various chemicals and PCBs and places them in group 2 B: probably carcinogenic to humans with evidence “less well established”.

4.5.4. Toxicity of products resulting from the breakdown of PCBs

When PCBs are broken down by heat, they produce – first and foremost – chlorine, hydrochloric gas and carbon monoxide. Hydrochloric gas vapours can cause serious irritation of the respiratory tracts, exposed skin areas, the mucous membrane (particularly of the eyes), resulting in pharyngitis, laryngitis, bronchitis and inflammation of the eyes. In strong concentrations, there is a risk of acute pulmonary oedema. Therefore, a transformer which has been damaged should never be sniffed. In the event of fire or decomposition, PCBs also produce, where oxygen is present, small quantities of toxic compounds which belong to the family of furans and dioxins.

4.5.5. Environmental contamination

PCBs are identified as persistent, bioaccumulative and toxic (PBT) substances. Because of their persistence , PCB continue to be found in the environment and contamination from legacy sources remains a problem. PCB concentrations of less than 50ppm are considered to be “PCB free”. Like many organochlorine compounds, many of the congeners are highly persistent and accumulate within food chains. Investigations in many parts of the world have revealed widespread distribution of the PVBs in the environment. The universal distribution of PCBs throughout the world, suggest that PCBs are transported in air. The ability of PCBs to co-distil, volatilize from landfills into the atmosphere (adsorption to aerosols with a particle size of <0.05-20μm), and resist degradation at low incinerating temperatures, makes atmospheric transport the primary mode of global distribution.

4.5.6. Environmentally sound management of PCBs

ESM may be defined as taking all practicable steps to ensure that used and/or end-of-life products and wastes are managed in a manner which will protect human health and the environment. This definition is consistent with the definitions of ESM as agreed upon through the Basel Convention (Article 2) and the Basel Mobile Phone Partnership Initiative and compatible with the Organization for Economic Cooperation and Development (OECD) working definition. Based on the actual and updated inventory PCB contaminated equipment and waste according to ESM procedures must be maintained and stored in a sound manner. Equipment that is still in use should be replaced to avoid possible contamination, temporarily stored and further disposed according to established procedures.

4.5.7. "Comprehensive Environmentally Sound Management of PCBs in Montenegro "project– UNDP GEF ID 5562 (GEF ID 9045)

Ministry for Sustainable Development and Tourism of Montenegro in cooperation with United nations development programme (UNDP) office in Montenegro currently implementing project "Comprehensive Environmentally Sound Management of PCBs in Montenegro ".

The project intends to support the country with the necessary technical and financial assistance to ensure that all the remaining PCBs in the country (estimated in not less than 900 t of PCB contaminated equipment and waste) are identified and disposed of. The project will be implemented side by side with the relevant institutional and industrial stakeholders, i.e. the Ministry for Sustainable Development and Tourism, EPCG, CEDIS, UNIPROM DOO Podgorica (ex KAP), RudnikugljaPljevljaand other holders of PCB containing equipment. Although the project expects to solve all remaining PCBs issues in the country, it will also ensure that enough capacity for the sound management of PCBs would have been built for the management of any further such hazardous waste identified in time after project's closure.

The project consiststhe following four components which are:

Component 1. Capacity strengthening on PCB management;
Component 2. PCB Inventory, planning and establishment of public-private partnership;
Component 3. Environmentally Sound Management (ESM) of PCBs, and
Component 4. Monitoring, Learning, Adaptive Feedback and Evaluation.

The Inventory phase of the project (Component 2) will cover at least 4,000 pieces of equipment that should be sampled, in addition to 220 already sampled equipment followed by developed online data base. Trough established ESM procedures appropriate decontamination technologies according to BAT will be selected. The equipment and PCB waste declared as dangerous waste with high PCB content will be safely managed and disposed of/decontaminated by the end of the project (Component 3.). The project further plans to address the currently found obstacles in Montenegro in aligning the country's PCB

regulation (Component 1. And Component 4.) with basic international benchmarks which are also in line with the EU regulation on PCBs and POPs, namely:

- Lack of inventories of the existing PCB equipment;
- Unavailability of data on storage and removal of the obsolete equipment and waste oils containing PCB;
- Lack of consistent instructions for identification, decontamination, use, transport, storage and disposal of PCB equipment or products;
- Need of particular efforts for the safe disposal of the PCB containing equipment.

At the PPF (project preparation phase) stage of the project it is identified amount of 517.686 tons of PCB contaminated equipment and waste. This project will last until the end of 2021.

Table 57: amount of PCB contaminated equipment and waste in Montenegro listed at PIF stage[76]

Type of PCB oil contained in online equipment	No. of equipment	Oil weight (t)	Equipment or waste weight (t)
Online transformers	37	35.4	106.2
Online capacitors	325	28.5	85.5
Other equipment	2	4.8	14.4
PCB oil (stored)			12.1
Silicone oil contaminated by PCB			17
Mineral oil contaminated by PCB			0.8
Transformers contaminated by PCB (in use)			22
Capacitors contaminated by PCB (in use)			29.89
Barrels and containers contaminated by PCB			13.15
Other PCB contaminated material			0.646
Sludge			2.9
Soil contaminated with PCBs (in barrels)			9.1
Alumina contaminated by PCB oil			4
Soil and infrastructures contaminated by PCB (estimated) based on site visit observations (in December 2014)			200
Total amount of PCB contaminated equipment and PCB waste (t)			517.686

[76] Project identification form

4.5.8. Permits for storage, decontamination (disposal/reuse, recycle) and transboundary movement of PCB waste

Legislation and legal requirements for waste storage (including PCB waste) are in place to ensure that waste is properly stored in such a manner as to protect human health and the environment. Requirements should provide for proper storage in containers, tanks, drip pads or containment buildings. The main legal acts are Waste management law (OGM 64/11, 39/16), Decree on the method and conditions of the waste storage (OGM, 33/13, 66/15), Rulebook on classification of waste and catalogue of waste (OGM, no. 59/13, 83/16). In accordance with information provided by NEPA as well as above mentioned legislation and permitting procedure for waste collection, transport and temporally storage, there are two permitted companies in Montenegro: "Hemosan" L.L.C. Bar, and "Cezar Montenegro" DOO Nikšić.

4.5.9. Disposal

There are no installations for PCB-disposal (no operations D8, D9, D10, D12 or D15) in Montenegro. In accordance with Waste Management Law, separation of PCB from equipment, PCB treatment and decontamination of equipment can be done by a company or entrepreneur who has the appropriate equipment, facility for temporary storage of PCB and the required number of employees, based on a permit for the removal of hazardous waste. In additional, owner of a waste treatment plant is required to keep records on the waste management, the origin of waste and location of waste treatment facilities .

In accordance with information provided by NEPA, "Hemosan" L.L.C. Bar, address: Stara raskrsnica bb Bar is permitted company for decontamination of transformers, with code 16 02 09* - *transformers and capacitors containing PCBs, for recovery operations R12, R13.*

4.5.10. Transboundary movement

Control system that governs **transboundary movements** (imports, exports and transit) of hazardous wastes and other wastes including PCB wastes are consist of:

- Waste management law(OGM 64/11, 39/16),
- Rulebook on the content of the documentation to be submitted with the application for a permit to import, export and transit of waste, the waste classification list and content and manner of management of the register of issued permits (OGM 83/16 of 31.12.2016),
- Law on Transport of Dangerous Substances (OGM 83/16),
- Law on Inspection Control (OGM, 39/03, 76/09, 57/11, 18/14, 11/15, 52/16),
- Law on Ratification of Basel Convention on the Control of the Trans-boundary Movements of Hazardous Waste and their Disposal (Official Gazette of the Federal Republic of Yugoslavia, International Treaties, 2/99).

Permitting of waste management (e.g. transboundary movement of waste as well as permits for the treatment and/or disposal of waste) is the responsibility of the NEPA - Permitting Department. *Import, export and transit of waste can be carried out only with a permit which,*

at the request of the waste management company, is issued by the NEPA (which keeps a register of all permits issued).

Montenegro is a party to the Basel Convention and Ban Amendment since October 2006. Pursuant to Basel Convention and national legislation, transboundary movements of hazardous and other wastes can be carried out only with the previous written notification of authorized state organs and according to the license issued by the competent bodies approving such waste shipments. All waste movements must be supplemented with a consigning document having its unique ordinal numeral. This document is only issued upon the approval of the recipient state and the transit states.

In accordance with Art.6, point 9 of Basel Convention, Montenegro requires that each person who takes charge of a transboundary movement of hazardous wastes or other wastes sign the movement document either upon delivery or receipt of the wastes in question. Montenegro also requires that the disposer inform both the exporter and the competent authority of the State of export of receipt by the disposer of the wastes in question and, in due course, of the completion of disposal as specified in the notification.

There are no recorded exports of PCB waste from Montenegro in last 4 years (2013, 2014, 2015 and 2016) including this year. Namely, NEPA didn't have any request for export in this period.

4.5.12. Quantities of PCB waste and PCB contaminated equipment in use in Montenegro [77]

UNIPROM DOO Podgorica (ex Aluminum Plant Podgorica JSC)

In the complex of former plant "Aluminum Plant Podgorica JSC" now UNIPROM DOO Podgorica, there is a large quantity of transformers and capacitors that are assumed to contain PCBs due to their year of production. According to the data from the Comprehensive Environmentally Sound Management of PCBs in Montenegro" project, the quantities are as follows:

- 36 operational transformers contaminated with PCB
- 43 operational transformers washed but suspected on PCBs contamination (out of which 9 were analyzed and proved as PCB contaminated)
- 3 deposited transformers contaminated with PCB (out of 7 in total)
- 305 operational capacitors contaminated with PCB
- 445 capacitors deposited and suspected on PCB

[77] The quantites will be updated throught project "Comprehensive Environmentally Sound Management of PCBs in Montenegro"

UNIPOM DOO Podgorica has PCB warehouse with PCB contaminated mineral oil in amount of 18.000 liters and 12,100 liters of pirelin oil stored. There is around 30 tons of PCB contaminated soil and other material used.

POLITROPUS ALTERNATIVE – TIVAT

The former "Prerada" company (part of the Aluminium Plant Podgorica) now Politropus Alternative has transformers and capacitors contaminated with PCB. According to the name of the manufacturer and year of production there are 14 operational transformers contaminated with PCB. 82 PCB contaminated capacitors now belong to the company Nexan DOO NIkšić.

HEMOSAN LLC BAR

Waste transformer that contains oil with PCBs with the total mass of 5795 kg. In the storage of the LLC "Hemosan" there are 10.800 litres of oil collected fromother legal entities, which is according to the certificate on categorisation issuedby LLC CETI categorised as insulating oil and heat transfer containing PCBs withthe code from the Waste Catalogue 13 03 01*.Hemosan LLC Bar is authorized company for decontamination of the PCB contaminated transformers with the code from the Waste Catalogue 16 02 09*. according to permit issued by Agency for Nature and Environmental Protection (UPI – 1660/3). The company is licensed for processing of 100 tons of the PCB contaminated waste annually.

MONTENEGRIN ELECTRO DISTRIBUTIVE SYSTEM- CEDIS

Under the possession of this legal entity there are great quantities of equipment thatwill be subject to testing to the presence of piralen, which is in use, as well as theequipment not in use, but is suspicious to contain PCBs.Project preparation phase (PPF) of the project "Comprehensive Environmentally Sound Management of PCBs in Montenegro "included analyzes of 220 transformers out of which 16 % were PCB contaminated. CEDIS has within FC Distribution a lot of equipment, in use, spare and deposited as waste, that will be subject to inventorying and testing to the presence of piralen in the coming period mainly through inventory phase of the above mentioned project. According to data from the "Waste management plan" issued in March 2017., Montenegrin electro distributive system has 4887 transformers still not subjected to PCB analysis. 122 transformers and 27 low oil disconnectors are classified as a waste according to mentioned document. Estimated amount of produced electrical waste (transformers, capacitors and low oil disconnectors) by company is 66.000 kgannually. Deposited capacitors not in use are inthe quantity of 26 160 kg (674 pieces). The supervision of environmental inspection hasestablished that on the deposited capacitors there are plates placed by the manufacturerwith the information that the insulating oil does not contain PCBs (label "NO PCB′S").On some capacitors there were no plates with the information on the type of insulatingoil, thus the checking by authorized

laboratory will be performed during implementation of the“Comprehensive Environmentally Sound Management of PCBs in Montenegro”project.

ELEKTROPRIVREDA CRNE GORE A.D.NIKŠIĆ (POWER PLANT OF MONTENEGRO JSC NIKŠIĆ)

HPP “Perućica” has in operation 24 power transformers, 90 measurementtransformers and 1 power transformers and 21 measurement transformers thatserve as spare ones. Identified PCB contaminated equipment are deposited and stored by authorized company (Hemosan LLC Bar).

HPP “Piva” has 9 power transformers in operation. The subject transformerscontain around 120 tons of oil. Transformers were tested to PCBsby accredited laboratory showing no presence of contamination. HPP“Piva” has 3 measurement transformers in operation and 1 transformer as a spare one.All analyzed transformers are PCB free.

TPP “Pljevlja” has in operation 17 power transformers of which 7 transformers are tested to PCB showing absence of contamination. 10 power transformers are relatively new (produced in Germany 2009) with no PCB technology produced. 8 low-oil disconnectors are classified as a waste and analyzed to PCB showing no contamination.

TOSCELIK SPECIAL STEEL (STEEL PLANT NIKŠIĆ)

Toscelik special steel currently has 82 operational transformers tested to PCB showing no contamination. Previously deposited capacitors inthe quantities of 686 pieces are delivered to Hemosan LLC Bar. The company authorities declared no presence of transformer’s oil contaminated with PCB owned by the company.

ŽELJEZNIČKA INFRASTRUKTURA CRNE GORE A.D. (RAILWAY INFRASTRUCTURE OF MONTENEGRO JSC)

Railway Infrastructure of Montenegro JSC possesses 6 waste transformers with the massof 27.5 tons each (in total 110 tons) of which 9 tons are transformer oil (total 36 tons). Inthe process of determining the character of this waste in oil, the presence of PCBs hasbeen identified by 4 transformers, but the concentration is less than 50 mg/litre. Two transformers are operational and they will be tested on PCB contamination.

ADRIATIC SHIPYARD “BIJELA”

Adriatic Shipyard “Bijela” possesses 20 transformers and 104 capacitors. Out of total 20transformers 9 have been subject to analysis in view of establishing if the insulating oil iscontaminated with PCBs and the results show that in three transformers there is oil withPCBs, and in the remaining 6, the PCB concentration in oil has been below the limitvalue.

The remaining 11 transformers will be tested in an accredited laboratory in thecoming period in view of determining if they contain PCBs.

ELECTRO-INDUSTRY "OBOD" under bankruptcy

In the halls of Electro-industry "Obod" were 12 transformers in total, of whichaccording to the data of bankruptcy administration 3 have piralen oil. Production hasceased in the plant and transformershave not been used for a long period.

COAL MINE PLJEVLJA

Coal Mine Pljevlja has 63 transformers, 209 capacitors and 82 low-level disconnectorsthat could contain oil with PCBs. Environmental inspection has passed a decision toorder the subject of the supervision to carry out categorization of the subject equipment.

LUKA BAR (PORT OF BAR)

On the area of Luka Bar there are 4 transformers highly suspected on PCB contamination. 32 capacitors with oilcontaining PCBs as well as 3transformers that were not operational and were placed in a temporary stockpile are handed over to the Hemosan LLC Bar in accordance to the procedure.

PLANTAŽE JSC "13. JUL

In this industrial complex, there are 28 transformers and 8 oil disconnectors installed.The subject equipment is operational. Through "Comprehensive Environmentally Sound Management of PCBs in Montenegro "project it is planned to carry out analyses in view of establishing the characterof this equipment.

4.6. Assessment of releases of unintentionally produced POPs from Annex C (PCDD/PCDF, HCB and PCB) of the Stockholm Convention

This part provides an overview of emissions unintentionally produced Long-lasting Polluting Organic Pollutants, PCDD/PCDF due to various activities taking place in the territory of Montenegro and grouped into different sectoral categories. For this purpose, an Inventory of Unintentionally Produced POPs under the Stockholm Convention for the period 2006-2016 has been updated. The Inventory points to the most significant sources of pollution, their characterization and quantification, but cannot provide a precise picture of the impact of the emissions considered on the degree of exposure of the population and the ecosystem. Based on the level of the estimated emissions, it is possible to define the measures that must be implemented in order to prevent the generation of the substances under consideration and to reduce or completely prevent the transmission of unintentionally produced POPs.

4.6.1 Application of the UNEP methodology for the national inventory of releases of PCDD/PCDF

Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs issued by UNEP in January 2013(UNEP, 2013) (hereinafter: the UNEP Toolkit) was used for the preparation and compiling the inventory of releases of PCDD/PCDF. This publication contains a thoroughly developed methodology with the aim of assisting the signatories of the Stockholm Convention in establishing inventories of unintentionally released POPs at the national or regional level. The use of the UNEP Toolkit is facilitated by the use of the accompanying Excel software tool (UNEP-POPs-TOOLKIT-PCDD-PCDF-EfsEn.xls), which simplifies the budget and contains predefined emission factors for all categories and sub-categories that may represent sources of unintentionally produced POPs in accordance with the UNEP Toolkit. The UNEP methodology proposes five basic steps in the process of preparing an inventory of dioxins and furans:

- Identification of the main categories of PCDD/PCDF release sources
- Identification of sub-categories, existing activities and potential ways of spreading PCDD/PCDF in the environment
- Collection of data on specific processes
- Quantification of PCDD/PCDF release sources and calculation of release values using release factor data and
- Review of the prepared inventory.

The final annual releases are calculated by multiplying the appropriate release factor with the data that define the intensity of the considered activity. For this purpose, only defaultemission factors (included in the methodology) are used, as there are no developed national emission factors for either of the considered inventory sub-categories. The main task in preparing the inventory was to obtain the necessary data on the intensity of particular activities from the corresponding sub-categories and accordingly assign the release factor which characterizes best this type of activity/production/technology. The correctness of the POPs Inventory depends on the quality and accuracy of these inputs.

The releases of dioxins and furans are expressed in International Toxicity Equivalents (TEQs). The annual releases of PCDD/PCDF are given in g/TEQ per year.

The first national inventory of unintentionally produced POPs (PCDD/PCDF, HCB and PCB) submitted to the Convention Secretariat under the National Plan for the Implementation of the Stockholm Convention for the period 2014-2021 in 2013 was prepared according to the EMEP/EEA Air Pollution Emission Inventory Guidebook 2009 and the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The first POPs national inventory contains separate data on releases of unintentionally produced POPs (hexachlorobenzene, polychlorinated biphenyls, polychlorinated dibenzo dioxin and polychlorinated dibenzofuran and polycyclic aromatic hydrocarbons) in the air from the National Inventory of Pollutant Emissions in Air that is being prepared for reporting purposes in accordance with the Convention on Long Range Transboundary Air Pollution (CLRTAP).

The Stockholm Convention Secretariat allows signatories to prepare and submit national inventories of unintentionally produced POPs in accordance with EMEP/EEA methodology, but the signatory countries are encouraged to use the UNEP methodology and the accompanying software tool for the following reasons:

- The assessments of unintentionally produced POPs are easily comparable;
- National and global release assessment reports can be easily prepared;
- In addition to air emissions, the amount of dioxins and furans discharged into water and soil is assessed, the quantities that come into the product through various mechanisms, as well as the quantities in waste or residues resulting from different production or processing activities;
- It includes new potential sub-categories of release sources and updated emission factors in accordance with new scientific knowledge;
- Time trends can be easily elaborated for the purpose of assessing the effectiveness of Article 16 of the Convention.

POPs inventory prepared under the project: "Revision and update of the National Implementation Plan for POPs in Montenegro", according to UNEP's methodology, is a good basis for preparing and updating all subsequent national inventories in accordance with the requirements of the Stockholm Convention. The year 2006 has been retained as a reference year for observing the release trends of POPs substances.

4.6.2. Assessment of releases of unintentionally produced POPs (PCDD/PCDF, HCB and PCB) for the period 2006-2016

Emissions of PCDDs and PCDFs are accompanied by emissions of other unintentionally produced POPs, which can be reduced or eliminated by implementing the same measures as for PCDD and PCDF releases. The UNEP Toolkit recommends that, for practical reasons, inventory of unintentionally produced POPs be focused on PCDD/PCDF, as they are indicative of the presence of other unintentionally produced POPs. They are considered to be a sufficient basis for identifying the sources and prioritizing as well as for determining control measures and assessing their effectiveness for all POPs listed in Annex C of the Stockholm Convention. In addition to the PCDD and PCDF calculations, the calculated amounts of hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs) are also presented in this report, on the basis of the appropriate emission factors from the UNEP Toolkit. The national inventory of pollutant emissions in the air gives an overview of PAHs and was last updated in 2011. An overview of PAHs for 2011 was given in the First National Inventory of Unintentionally Produced POPs in 2013. When making inventories, all available information and data on significant countrywide activities and major emission sources was used. The main source of data for the observed period 2006-2016 was the annual statistical report of the Statistical Office of Montenegro - MONSTAT (MONSTAT). Other data were obtained directly from the operators, by using national inventory data (EMEP/EEA, IPCC), World Health Organization WHO, strategic national documents, European Statistics EUROSTAT and others. In the chapters addressing PCDD/PCDF releases from major categories and sub-categories, the data sources are precisely specified. In accordance with

the methodology recommended by UNEP, the review and updating of PCDD/PCDF inventory was carried out in nine main categories:

- Waste incineration;
- Ferrous and non-ferrous metal production;
- Heat and power generation;
- Production of mineral products;
- Transportation;
- Open burningprocesses;
- Production of chemicals and consumer goods;
- Miscellaneous;
- Waste disposal.

The PCDD/PCDF release categories defined in the UNEP programming tool are divided into ten groups, each of which is further subdivided into several subgroups.

4.6.3. Total assessed releases of unintentionally produced POPs (PCDD/PCDF) for the period 2006 -2016

Total national annual releases of dioxins and furans (PCDD/PCDF) for the period 2006-2016 are shown in Table 58 and Chart 1. Depending on the intensity of the activities generating POPs, the values of total annual releases varied.

Table 58 - Total annual releases of dioxins and furans (PCDD/PCDF), 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PCDD/PCDF, gTEQ	89	91	73	75	71	69	45	32	40	43	44

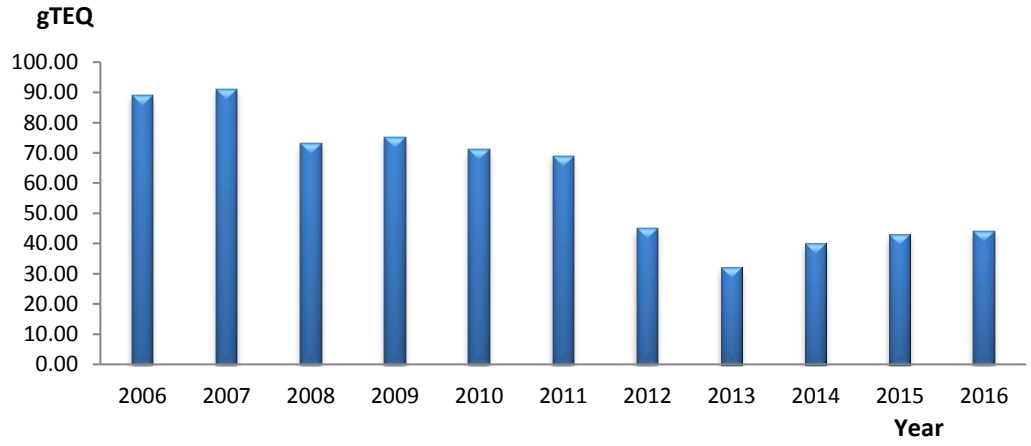


Chart 1 - Total annual releases of dioxins and furans (PCDD/PCDF), 2006-2016 (gTEQ)

The total POPs releases in each medium individually are assessed as recommended by the UNEP methodology. Total POPs annual releases into air, water, land, products and residues

from the processes are shown in Table 59 and Chart 2. It is noted that most POPs releases are airborne.

Table 59 - Total annual releases of dioxins and furans (PCDD/PCDF) into air, water, land, products and residues from production processes, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	70.51	70.04	53.48	56.32	54.53	53.09	30.67	18.54	24.60	26.65	27.16
Water	0.14	0.15	0.14	0.15	0.14	0.13	0.13	0.13	0.14	0.15	0.15
Land	2.25	2.25	1.66	1.80	1.77	1.72	1.03	0.58	0.78	0.85	0.86
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	16.53	18.29	17.65	16.29	14.70	14.31	13.51	13.20	14.81	15.61	15.70

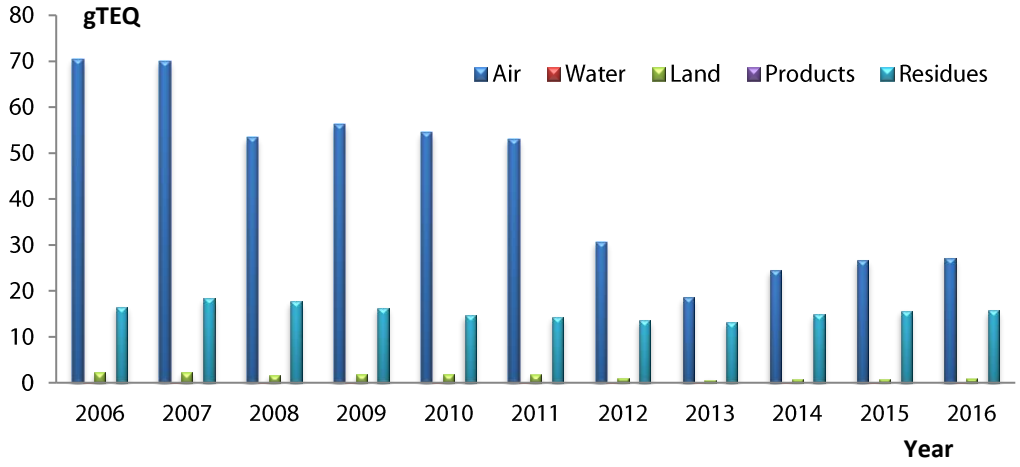


Chart 2 - Total annual releases of dioxins and furans (PCDD/PCDF) into air, water, land, products and residues from production processes, 2006-2016 (gTEQ)

4.6.4. Assessment of releases of unintentionally produced POPs (PCDD/PCDF) to air for the period 2006 -2016

POPs emissions in the air largely result from open burning processes and, to a lesser extent, from ferrous and non-ferrous metal production, heat and power generation, and production of mineral products (Table 60, Chart 3). Other activities do not result in significant POPs releases to air.

Table 60 - Annual releases of dioxins and furans (PCDD/PCDF) to air, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Waste incineration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Ferrous and non-ferrous metal production	1.8	2.0	2.2	1.2	0.3	0.4	0.2	0.1	0.2	0.2	0.1
Heat and power generation	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.1	1.2	1.4
Production of mineral products	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transportation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open burning processes	67.5	66.8	50.0	54.0	53.0	51.4	29.2	17.2	23.3	25.2	25.6
Production of chemicals and consumer goods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste disposal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potential hot spots	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

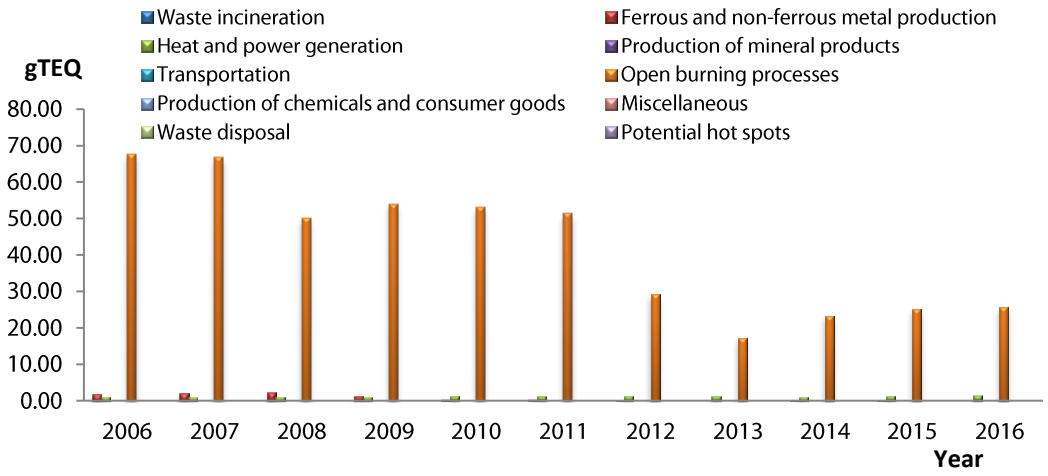


Chart 3 - Annual releases of dioxins and furans (PCDD/PCDF) to air, 2006-2016(gTEQ)

4.6.5. Assessment of releases of unintentionally produced POP (PCDD/PCDF) to water for the period 2006 -2016

Waste disposal is the only activity that releases POPs into water (Table 61, Chart 4). Other activities are not registered as sources of these releases.

Table 61 - Annual releases of dioxins and furans (PCDD/PCDF) to water, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Waste incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous and non-ferrous metal production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heat and power generation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production of mineral products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transportation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Open burning processes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production of chemicals and consumer goods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Miscellaneous	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Waste disposal	0.00	0.15	0.14	0.15	0.14	0.13	0.13	0.13	0.14	0.15	0.15
Potential hot spots	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

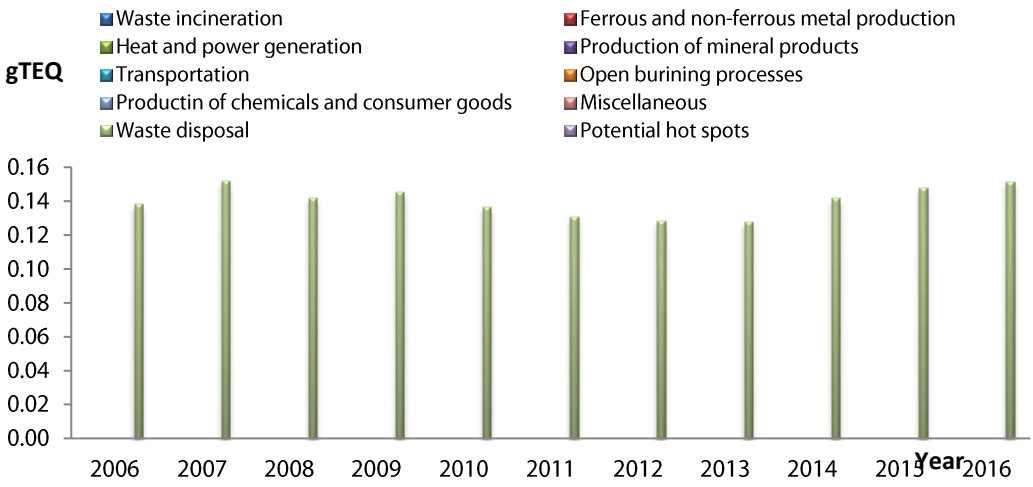


Chart 3 - Annual releases of dioxins and furans (PCDD/PCDF) to water, 2006-2016 (gTEQ)

4.6.6. Assessment of releases of unintentionally produced POPs (PCDD/PCDF) to land for the period 2006 -2016

The main sources of POPs releases to land are open burning processes (Table 62, Chart 5).

Table 62 - Annual releases of dioxins and furans (PCDD/PCDF) to land, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Waste incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous and non-ferrous metal production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heat and power generation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production of mineral products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transportation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Open burning processes	2.20	2.20	1.80	1.80	1.80	1.70	1.00	0.60	0.80	0.80	0.80
Production of chemicals and consumer goods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Miscellaneous	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Waste disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potential hot spots	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

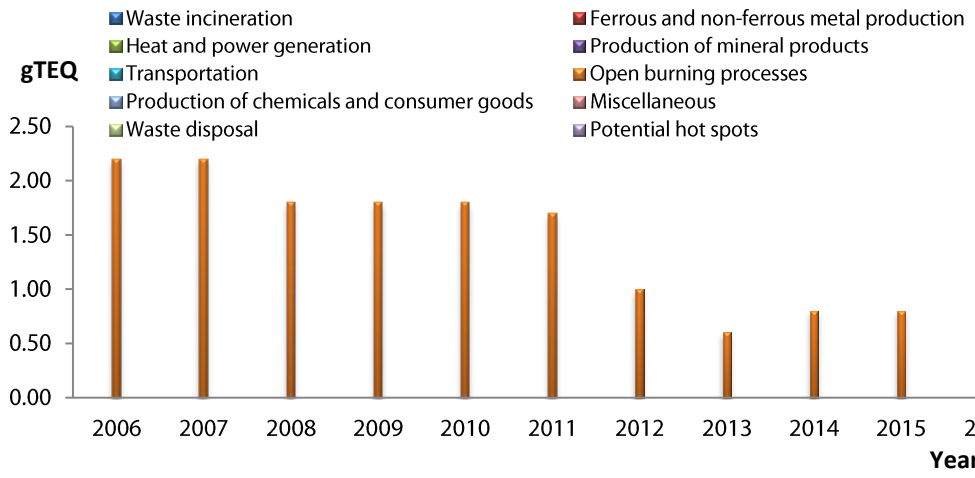


Chart 5 - Annual releases of dioxins and furans (PCDD/PCDF) to land, 2006-2016 (gTEQ)

4.6.7 Assessment of releases of unintentionally produced POPs (PCDD/PCDF) in products for the period 2006 -2016

It is estimated that there are no releases of unintentionally produced POPs (PCDD/PCDF) from products in Montenegro.

4.6.8. Assessment of releases of unintentionally produced POPs (PCDD/PCDF) in residues from production processes for the period 2006 -2016

POPs in residues from production processes largely came from waste disposal, and to a lesser extent from ferrous and non-ferrous metal production and heat and power generation (Table 63, Chart 5).

Table 63 - Annual releases of dioxins and furans (PCDD/PCDF) in residues from production processes, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Waste incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous and non-ferrous	2.90	3.20	3.40	1.90	1.10	1.30	0.70	0.50	0.60	0.80	0.50

metal production											
Heat and power generation	0.30	0.20	0.30	0.20	0.40	0.40	0.30	0.30	0.30	0.30	0.30
Production of mineral products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transportation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Open burning processes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production of chemicals and consumer goods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Miscellaneous	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Waste disposal	13.30	14.80	13.90	14.20	13.20	12.60	12.40	12.40	13.90	15.60	14.90
Potential hot spots	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

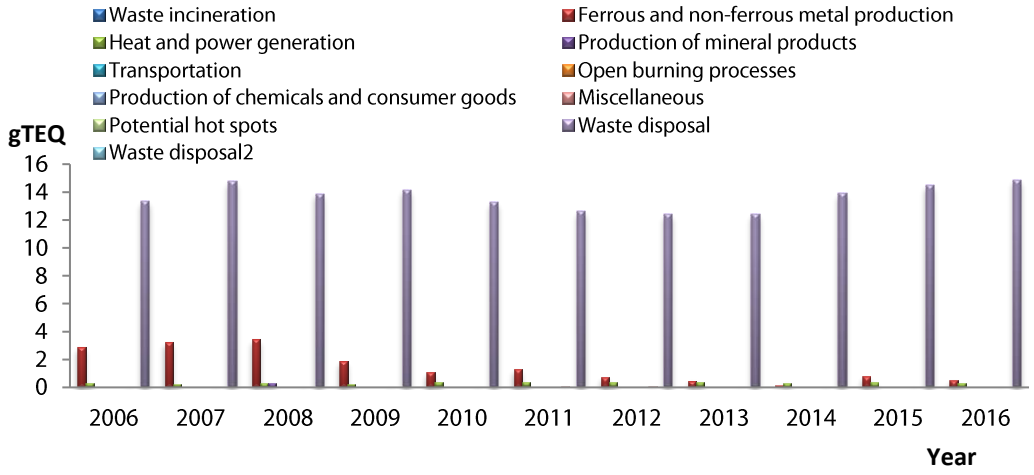


Chart 5- Annual releases of dioxins and furans (PCDD/PCDF) in residues from production processes, 2006-2016ar (gTEQ)

4.6.9. Assessment of releases of unintentionally produced POPs (PCDD/PCDF) by main categories for the period 2006 - 2016

Within each category for all major activities, the active data used and the resulting releases for the period 2006-2016 are shown in tables. The activities shown have a key contribution to total releases.

Category 1. Waste incineration

There are no waste incinerators in Montenegro, and generated waste is disposed of on sanitary landfills and untreated waste dumps. Hazardous wastes from the industry are either disposed of at appropriate locations or collected and possibly exported. Medical waste is collected, processed and sterilized at two sites (Podgorica and Berane) in autoclaves that belong to BAT technique,i.e. during the waste treatment there is no formation and release of the substances listed in Annex C of the Convention.

Category 2. Ferrous and non-ferrous metal production

In ferrous and non-ferrous metal production in Montenegro, two plants are operating: Steel Plant Niksic (Toscelik) and Aluminium Plant Podgorica.

In Steel Plant Niksic, steel is produced by melting of steel waste in the electric arc furnace. The operation of this plant in the period after 2006 is characterized by a constant drop in output as well as the reconstruction and modernization of steelworks in 2011, within which a new dedusting system was installed (the old filtering system was out of function). Based on these facts, the emissions of dioxins and furans for the period 2006-2011 were calculated using an emission factor of 10 µg TEQ/t. For the period after 2011, the emission factor of 3µg TEQ/t was used for the calculation. Steel production data were downloaded from the official national statistics (Statistical Office of Montenegro - MONSTAT) while technical and technological data were obtained from the plant operator. It is noted that POPs are mainly emitted in production residues and partly to air, and emission levels depend directly on annual output.

Table 64 - Total annual releases of POPs (PCDD/PCDF) from steel production plans, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	1.61	1.74	2.02	1.04	0.15	0.18	0.08	0.06	/	0.11	0
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	2.42	2.61	3.03	1.55	0.72	0.92	0.42	0.29	/	0.55	0.39

Table 65 - Annual production in the steel and iron casting plant, 2006-2016, (t)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016

Iron and steel production (t)	161333	173913	201690	103479	48272	61164	28161	19723	/	36602	26246

The Aluminium Plant Podgorica has an operational facility for aluminium production from secondary raw materials (Silumina Plant). It is a plant of outdated technology, with a low-efficiency, waste-gas filtering facility installed. For this reason, a higher emission factor of 10 µgTEQ/t was used for the consideration of dioxin and furan emissions. The dioxin and furan emissions show a decreasing trend compared to the baseline year due to a significant decrease in the output of the plant. Production data were obtained from plant operators. It is noted that most POPs are released air and in residues from production.

Table 66 - Total annual releases of POPs (PCDD/PCDF) from the facility for the production of aluminium from secondary raw materials,2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.23	0.31	0.21	0.15	0.17	0.18	0.15	0.08	0.07	0.10	0.06
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.50	0.60	0.40	0.30	0.34	0.36	0.29	0.17	0.15	0.21	0.12

Table 67 - Total annual releases of POPs (PCDD/PCDF) from the facility for the production of aluminium from secondary raw materials, 2006-2016(gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Aluminium production (t)	2282	3068	2057	1511	1690	1797	1457	832	732	1041	581

Category 3. Heat and power generation

Heat and power generation is an important category in the national inventory from the standpoint of contributions to total national emissions to air of unintentionally produced/ released PCDD/PCDF. Lignite, as a type of coal, is the fuel most consumed in Montenegro due to the operation of a large power plant (TPP Pljevlja). However, from the aspect of intensity of dioxin and furan emissions, wood biomass consumption is more important because of higher emission factors for wood biomass (50 to 100 µgTEQ/TJ) compared to the emission factor for coal burning (10 µgTEQ/TJ). The consumption of liquid fuels at national level is not a significant source of POPs due to relatively low consumption and low emission factors

for heavy oil and light fuel oil. All active data for the period 2006-2016 were taken from the national energy balances (Statistical Office of Montenegro - MONSTAT) while the data on the thermal power of fossil fuels and biomass were used to translate the mass of spent fuel into the energy unit under IPCC 2006 methodology. Tables 68 and 69 show the assessed POPs emissions and the lignite consumption. In the case of combustion of lignite, the POPs were mostly emitted to air and in residues from production processes.

Table 68 - Total annual releases of POPs (PCDD/PCDF) due to coal combustion, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.14	0.11	0.16	0.08	0.179	0.18	0.16	0.16	0.15	0.16	0.13
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.19	0.15	0.23	0.12	0.250	0.255	0.23	0.22	0.21	0.22	0.17

Table 69 - Total coal consumption, 2006-2016 (TJ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Burnt coal (TJ)	14017	11146	16045	8824	17870	18193	16469	15583	15017	15839	12534

Emissions from biomass consumption include emissions from heat plants driven by clean biomass and the consumption of heating wood in households. The total consumption of biomass is shown in Table 71. It is assessed that most POPsare, due to biomass combustion, released to air and in residues from production.

Table 70 - Total annual releases of POPs (PCDD/PCDF) due to biomass burning, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.31	0.31	0.32	0.33	0.34	0.33	0.33	0.37	0.35	0.36	0.36
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Table 71 - Total consumption of biomass, 2006-2016 (TJ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016

Biomass burnt (TJ)	6126	6126	6383	6678	6741	6513	6614	7338	7088	7284	7247

Category 4. Production of mineral products

Brick production in Montenegro was suspended in 2006. Lime production, according to national statistics, ranged from 8118 tonnes in 2006 (producing air emissions of 0.081 g TEQ/yr) to 3500 tonnes in 2010. The production was discontinued in 2011. Emissions of unintentionally produced or released PCDD/PCDF from asphalt production were calculated but are negligible due to the low emission factor (0.007 µg TEQ/t asphalt). For the analysis and assessment of the POPs releases, data of the Statistical Office of Montenegro - MONSTAT were used.

Category 5. Transportation

National statistics on fuel consumption in road traffic recognize gasoline and diesel consumption only. There is no historical individual data on the consumption of unleaded gasoline whose use was prohibited by law in 2011. UNEP's methodology provides two emission factors for the consumption of unleaded gasoline: for vehicles manufactured before 1996 and for vehicles manufactured after 1996. The difference in emission factors is due to the fact that vehicles manufactured after 1996 were assumed to be made under EURO 2 and higher ecological standards, i.e.t hey have a mandatory built-in catalytic converter that reduces PCDD/PCDF emissions by two decimals compared to vehicles that do not have the EURO 2 standard.

Since the inventory preparation team was not in position to collect more precise data on vehicle types and year of manufacture, the obligation remains to make a recalculation with the data that will be available after the establishment of a new database of the Montenegrin Ministry of the Interior. Since there is no available data on the amount of unleaded gasoline consumed in two-stroke machines, all emissions were allocated to four-stroke engines with internal combustion. No heavy oil consumption data for large ships is available.

Tables 72-77 show POPs emissions due to the burning of leaded and unleaded gasoline and diesel as well as their annual consumption. For all three types of fuel, POPs emissions have been registered only to the air. The emission level is directly dependent on fuel consumption.

Table 72 - Total annual releases of POPs (PCDD/PCDF) due to burning of leaded and unleaded gasoline, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.01	0.01	0.01	0.01	0.01	0.004	0.00	0.00	0.00	0.00	0.00
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 73 - Total consumption of leaded and unleaded gasoline, 2006-2016 (t)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
leaded and unleaded gasoline(t)	54000	54000	50000	64000	57000	42000	36000	21000	33400	34000	36700

Table 74 - Total annual releases of POPs (PCDD/PCDF) due to burning of unleaded gasoline, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	/	/	/	/	/	0.004	0.00	0.00	0.00	0.00	0.00
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 75 - Total consumption of unleaded gasoline, 2006-2016 (t)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Unleaded gasoline (t)	/	/	/	/	/	42000	36000	21000	33400	34000	36700

Table 76 - Total annual releases of POPs (PCDD/PCDF) due to diesel combustion, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.01	0.02
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 77 - Total diesel consumption, 2006-2016 (t)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Diesel (t)	76900	106800	134130	150700	130100	160000	156000	157600	120300	136500	204700

Category 6. Open burning processes

Uncontrolled combustion processes represent the dominant category in the national inventory because this category is used to calculate emissions of unintentionally produced PCDDs/PCDFs due to fire at open dumps (unregulated dumping sites). In addition to this sub-category, emissions from agricultural residue combustion and forest fires have been calculated. For other sub-categories listed in the UNEP Toolkit, there is either no activity data (accidental fires on cars, accidental fires on houses, factories) or they do not appear in Montenegro. It is assumed that there is no practice of separating agricultural residues treated with chlorinated pesticides from untreated agricultural residues, and higher emission factors (30 µg TEQ/t for air and 10 µg TEQ/t for soil) were used. Based on statistical data, the amount of burned agricultural residues has a stable trend for the observed time period and the PCDD/ PCDF emissions to air are about 0.013 g TEQ/year or about 0.004 g TEQ/year. Sources of data on the amount of agricultural biomass burnt are the Statistical Office of Montenegro - MONSTAT, and United Nations Food and Agriculture Organization – FAO.

Fires in Montenegro are characteristic for the summer dry season and, based on official statistics, fires that would be statistically recorded were not reported only in 2009.Data of the Forest Management Directorate of Montenegro were used. Tables 78 and 79 show the levels of air emissions of POPs and the quantity of burnt forest material (dry matter) for the observed period.

Table 78 - Total annual releases of POPs (PCDD/PCDF) from forest fires, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.003	0.003	0.002	/	0.035	0.028	0.500	0.00	0.00	0.041	0.022
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 79 - Quantity of burnt forest material in state-owned forests(dry matter), 2006-2016 (t)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Burnt forest material (t)	3162	3162	1692	/	35466	28236	498507	270	30	41348	21817

In order to estimate data on the quantities of waste that are burning due to uncontrolled fire on unregulated waste dumps, official data on the quantities of total disposed waste were used as well as data from the "Annual Report on the Status of Water Supply, and Solid Waste and Wastewater Management, and implementation of priority activitiesin utility activities in 2014, with a proposal for priority projects for the construction of utility infrastructure in 2016 and proposed measures", which specified the 2013 quantities of waste disposed of on sanitary landfills, the quantities of waste disposed on unregulated dumps, the quantities recycled and the quantities temporarily stored. To assess the emissions for the observed time series, precise data on the amount of municipal waste disposed of on two existing sanitary landfills (Deponija doo Podgorica "Livade" and Deponija doo "Mozura") were used. For the assessment of municipal waste that is burned in households, data from the Proposed National Waste Management Plan for Montenegro of 2015 on the amount of waste collected by utility companies were used. It is important to point out that the new methodology described in Annex 43 of the UNEP Toolkit of 2013 makes it easier to calculate emissions from this sub-category. In the absence of more accurate data, the mentioned data was used to assess the waste disposed of at open dumps on an annual basis for the entire period. The inventory team believes that, due to the unreliability of data on the amount of waste that is burntat open dumps, the calculated emissions are probably overestimated, but due to the fact that fires on unregulated dumps are quite common, it is important to identify and quantify this source.

The total annual POPs emissions due to open burning of waste for the observed period are shown in Table 80, while the amounts of the burnt waste are shown in Table 81.

Table 80 - Total annual releases of POPs (PCDD/PCDF) due to open burning of waste, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	66.48	65.66	49.27	53.16	52.15	50.65	28.28	16.889	22.92	24.81	25.24
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	2.22	2.19	1.64	1.77	1.74	1.69	0.94	0.56	0.76	0.83	0.84
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 81 - Open burning of waste, 2006-2016 (t)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Open burning waste (t)	221586	218853	164229	177203	173824	168828	94258	56296	76402	82705	84126

The total annual POPs emissions due to waste combustion in households for the observed period are shown in Table 82, while the amounts of the burnt waste are shown in Table 83.

Total annual releases of POPs (PCDD/PCDF) due to burning waste in households, 2006-2016 (gTEQ)Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.985	0.973	0.730	0.788	0.773	0.750	0.419	0.250	0.340	0.368	0.374
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	0.025	0.024	0.018	0.020	0.019	0.019	0.010	0.006	0.008	0.009	0.009
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 83 - Waste burnt in households, 2006-2016 (t)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Waste burnt in households (t)	24621	24317	18248	19689	19314	18759	10473	6255	8489	9189	9347

Category 7. Production of chemicals and consumer goods

There are no activities that result in PCDD/PCDF emission within the Production of Chemicals and Consumer Goods. The pulp and paper manufacturing plant that was located in Berane stopped production before the baseline year 2006.

Category 8. Miscellaneous

Within this category, POPs emissions due to smoking of dried meat and fish and cigarette consumption were considered. For activities within other sub-categories, it is estimated that they do not appear in Montenegro or appear as negligible potential sources of POPs. (e.g. dry, chemical cleaning). For sub-category – SmokeHouses, official data on the quantities of dried meat are available after 2011, so that estimate was made for the period before 2011. Fish drying data are not available. Total quantity of unintentionally produced/released PCDD/PCDFs in category 8 – Miscellaneous for 2016 is 0.009 g TEQ/year, or in products 0.027 g TEQ/year.[78]The data of the World Lung Association, Cigarette Consumption 2014 Tobacco Atlas, were used as a source of data for cigarette consumption, according to which Montenegro isthe largest consumer of cigarettes per capita at world level, with an estimated consumption of 4124 cigarettes per capita. If national statistical data are produced, the emissions will be recalculated.

Category 9. Waste disposal

In Montenegro, municipal waste is disposed of on two sanitary landfills, Livade landfill near Podgorica, which is in operation since 2007, and Mozura landfill near Bar, which is operation since 2012. In the territory of the country, there are 155 unregulated waste dumps with a volume of<100 m^3, 68 with a volume of 100-1000 m^3 and 50 with a volume of >1000 m^3. According to the Report on the Implementation of the National Waste Management Plan in 2013, of the total amount of waste generated on an annual level, about 30% of waste ends on regulated, and about 30% on unregulated landfills. The total amount of recycled waste, according to the official data for 2013, is negligible (between 2 and 3% of the total quantity), so that the total amount of waste generated is assigned to sub-category Mixed Municipal Waste.

Tables 84 and 85 show the total annual POP emissions due to the disposal of mixed municipal waste for the observed period as well as the amount of disposed waste.

Table 84 - Total annual releases of POPs (PCDD/PCDF) from mixed municipal waste disposal, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water	0.13	0.15	0.14	0.14	0.13	0.13	0.12	0.12	0.14	0.14	0.15
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	13.16	14.61	13.69	14.01	13.08	12.46	12.25	12.21	13.61	14.20	14.59

Table 85 - Quantity of disposed mixed municipal solid waste,2006-2016 (t)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016

[78] Data source is Statistical Office of Montenegro.

Mixed municipal solid waste (t)	263235	292245	273798	280207	261542	249252	244957	244191	272190	284032	291756

National statistics on the annual level show the total amount of generated wastewater. Given that a certain amount of wastewater produced is treated in wastewater collection and treatment systems, resulting in the formation of sewage sludge, the data from the "Annual Report on the Status of Water Supply, and Solid Waste and Wastewater Management, and implementation of priority activities in utility activities in 2014, with a proposal for priority projects for the construction of utility infrastructure in 2016 in Montenegro" were used. In the mentioned 2014 report, the quantities of wastewater treated and the amount of sewage sludge produced in four plants, in the cities of Podgorica, Budva, Mojkovac and Zabljak, were given. The data were used to calculate and estimate the missing data per years, taking into account the initial year of operation of individual plants (the plant in Budva started in 2014). The wastewater treatment plant for Tivat and Kotor was opened in mid-2016, with a capacity of 72,000 population equivalents, which was not included in the estimate for 2016. The calculation can be taken as accurate having in mind that the quantities of treated wastewater were constant over the considered period of time.

Tables 86 and 87 show the total annual POP emissions due to the discharge of wastewater with sludge removal and the quantities of wastewater discharged without sludge for the observed period.

Table 86 - Total annual releases of POPs (PCDD/PCDF) due to the discharge of wastewater with sludge removal, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 87 - Quantities of discharged wastewater with sludge removal, 2006-2016 (m^3)

Year	2006	2007	2008	2009	2010	2011
Quantity of discharged wastewater w/o sewage sludge (m^3)	5303308086	5303308086	5303308086	5303308086	5303308086	5303308086

Year	2012	2013	2014	2015	2016
Quantity of released wastewater w/o sewage sludge (m^3)	5303308086	5303308086	9250649353	9250649353	9250649353

Tables 88 and 89 show the total annual POPs emissions due to the formation of sewage sludge and the amount of formed sludge.

Table 88 - Total annual releases of POPs (PCDD/PCDF) due to formed sewage sludge, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.164	0.163	0.164	0.164	0.164	0.164	0.164	0.164	0.285	0.285	0.285

Table 89 - Quantities of formed sewage sludge, 2006-2016 (t)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sewage sludge (t)	8182	8182	8182	8182	8182	8182	8182	8182	14272	14272	14272

Tables 90 and 91 show the total annual POPs emissions due to the discharge of municipal wastewater and the quantities of municipal wastewater discharged.

Table 90 - Total annual releases of POPs (PCDD/PCDF) due to the discharge of municipal wastewater, 2006-2016 (gTEQ)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Air	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water	0.005	0.005	0.004	0.004	0.005	0.004	0.005	0.005	0.004	0.004	0.004
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 91 - Quantities of discharged wastewater, 2006-2016 (m^3)

Year	2006	2007	2008	2009	2010	2011

Municipal wastewater(m^3)	25259522	23765666	19521104	20400386	23006584	22415950
Year	2012	2013	2014	2015	2016	
Municipal wastewater (m^3)	23006584	23006584	19059423	18793813	18665833	

4.6.10. Total assessed releases of unintentionally produced POPs (PCB and HCB) for the period 2006 – 2016

Emissions of hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs) were assessed by using emission factors from the UNEP Toolkit. The main sources of unintentionally produced PCBs and HCBs in Montenegro, by categories, are:

- Category 2. Ferrous and non-ferrous metal production (production of steel and aluminium);
- Category 3. Heat and power generation (biomass combustion);
- Category 7. Open burning processes (fires at open landfills).

The most significant emission source of unintentionally released HCB to the air is steel production with a share in total emissions of 86.8% for 2006 and 50.4% in 2016. The biomass combustion contributed to total HCB emissions from 13.0% in 2006 to 49.3% in 2016. Production of aluminium from secondary raw materials contributed less than 1% over the entire time period. The main source of unintentionally released PCBs were uncontrolled burning processes at open dumps. Table 92 shows the total annual HCB and PCB emissions (g/year) for the period 2006-2016.

Table 92 - Total annual releases of HCB and PCB, 2006-2016(g)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
HCB (g)	464,73	497,05	565,99	323,26	188,15	222,20	140,39	117,41	132,36	156,23	130,11
PCB (g)	6,79	6,74	5,05	5,42	5,32	5,17	2,91	1,73	2,34	2,54	2,57

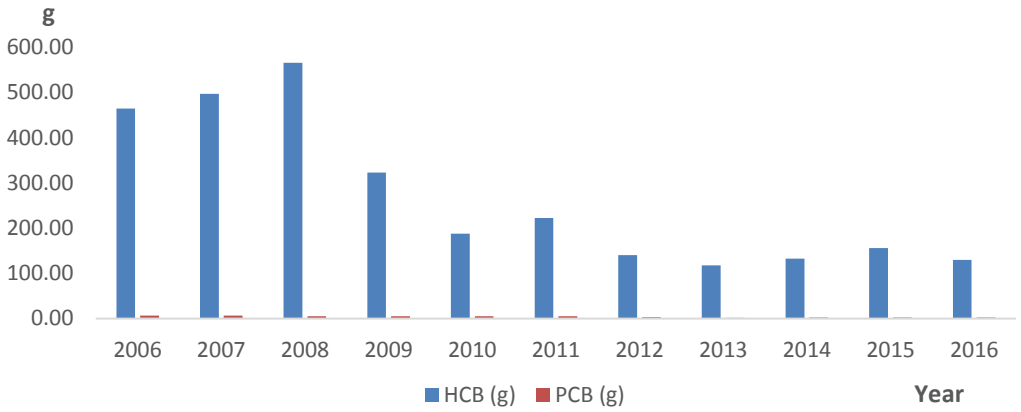


Chart 6 - Total annual releases of HCB and PCB, 2006-2016 (g)

V. HEALTH IMPACT OF POPs CHEMICALS IN MONTENEGRO

POPs chemicals represent persistent organic pollutants or organic compounds that are toxic to humans and other living world, bioaccumulative and persistent in the environment. These compounds are resistant to photolytic, chemical and biological degradation, which allows them to remain unchanged for a long time in the environment. POPs have low solubility in water and high solubility in fats, which allows them to accumulate in the fat tissues of living organisms. POPs are transported in an environment in low concentrations by movement mainly through surface waters. They represent semi-volatile compounds, which enables them to move at great distances and in the atmosphere, leading to wide distribution across the globe, including regions in which they have never been used. Thus, people and animals around the world are exposed to POPs at low levels over a longer period of time.

Exposure of population to POPs can occur as unprofessional and professional exposure through multiple exposure routes: oral, dermal, by inhalation, by exposure in the environment (water, air, soil) as well as through food. Studies show that more than 90% of the total population exposure to these compounds occurs through intake of food, such as fish, meat and dairy products, and there is increasing evidence that other exposure routes may be significant, for example, inhalation and swallowing dust containing brominated flame retardants in households as well as through drinking water in the case of perfluorinated compounds.

In humans and animals, there are known harmful effects on health in case of exposure to high POPs concentrations, which are expressed in the form of hormone-dependent cancer, nerve system damage, disorders of the reproductive or immune system. There is growing concern that chronic exposure to low levels of POPs can also lead to illnesses including an increased incidence of breast cancer and other forms of cancer, learning and behavioural difficulties, and other neuro-developmental and reproductive problems. Research has revealed a number of potential links between this exposure to POPs and various metabolic

disorders (including type 2 diabetes), obesity and neurological effects, such as effects on the coefficient of intelligence or autism. Since they can be present everywhere, exposure to POPs can begin even before conception when these chemicals affect sperm and egg cells as well as during pregnancy when chemicals are mobilized from the fat tissue of the mother and reach the fetus through placenta. All studies show that the placenta does not ensure defence against harmful chemicals, as previously thought. Persistent and bio-accumulated chemicals remain in the human body long after exposure and can be transferred from the mother to the baby, in the uterus and through breast milk, and they go beyond the blood-brain barrier that can affect the central nervous system of the child and its development. Some harmful effects of POPs can be manifested only after a latency period, during adolescence or adulthood when it is difficult to attribute them to POPs exposure due to the long period that has elapsed since exposure. Children are at greater risk of health damage due to exposure to toxic chemicals, because their rapid development and dynamic growth periods (that can be affected by exposure to chemicals) increase their physiological sensitivity. Fetal exposure in critical periods can have harmful effects that become apparent only at school, in puberty, or in adulthood. Small children can more efficiently absorb chemicals and excrete them more slowly, which leads to more pollution with toxic pollutants. In addition, the child's input of a proportionally larger amount of these environmental pollutants through water, air and food (relative to body size) further increases the risk. Determining the exposure time, or determining whether the exposure occurred during the developmental period of the highest vulnerability, is considered a crucial factor in determining the nature of the health impact.

Given the proven diversity of exposure to POPs chemicals and limited information on the sources of exposure that exist in Montenegro, as well as the limited information that can be obtained from health statistics, the need has arisen to develop an epidemiological study on the risk assessment of these chemicals for health. Considering the importance of early exposure to these chemicals, pregnant women as a vulnerable category of the population, especially those living near industry-contaminated areas and unregulated landfills, would be in the focus of interest in this kind of study. In phases of life such as pregnancy, lactation and menopause, women's bodies undergo rapid physiological changes that can increase their vulnerability to health-related harms caused by toxic chemicals.

Necessary forms of education in POPs chemicals have not been developed sufficiently in Montenegro, which results in a low level of knowledge about these chemicals. Health workers in general, even those who care about men and women in reproductive age, are not fully aware of POPs and their potential effects on children's health, growth and development. There is therefore a need to raise awareness in the health sector about low level exposure to these chemicals and their effects on health. It is necessary to achieve improvements in the health system in terms of a more precise registration of disease episodes, which would allow the implementation of long-term studies, as well as to encourage interdisciplinary cooperation. It is also necessary to begin to carry out studies based on human biomonitoring programs that should be linked to data on average annual consumption of certain types of foods per inhabitant and data on the population exposure to polluting substances in the environment by air, water and land.

Creating and maintaining a healthy environment should therefore be a priority of the primary prevention. The change in the perception of the environment as a basic element of health care and its adequate preservation is of great benefit to human health towards making a lasting contribution to reducing the global burden of diseases attributable to environmental factors.

VI. OVERVIEW OF TECHNICAL INFRASTRUCTURE FOR ASSESSMENT OF POPS CHEMICALS, TESTING AND MEASUREMENT

Capacities of professional organizations for testing POPs chemicals

Examination of POPs chemicals in Montenegro is carried out by authorized and / or accredited professional organizations. Authorization for the analysis of POPs chemicals is issued by the Agency for Nature and Environmental Protection for testing POPs chemicals in the environmental segments (air, soil, seawater, waste), the Food Safety Authority if the matrix is food or animal feed. In Montenegro, there are two laboratories with technical capacities for testing organic chemicals: Institute of Public Health and Center for Ecotoxicological Research.

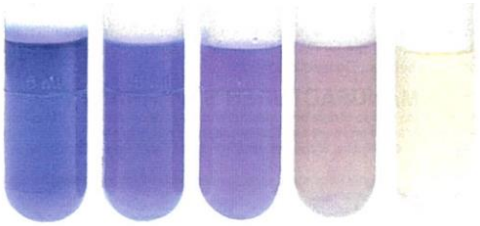
Only the Center for Ecotoxicological Research has the authority to test POPs in all segments of the environment and feed in accordance with its scope of accreditation. The Accreditation Body of Montenegro is in charge of accrediting the laboratory in Montenegro in accordance with the MEST ISO / IEC 17025. The list of accredited laboratories and the scope of accreditation of all testing laboratories is available on the website: http://www.akreditacija.me/reg.php#

Methods for analyzing PCBs in insulating liquids

In the Laboratory, a gas chromatograph with an electron capture detector is used to determine the content of PCBs in insulating liquids. Gas chromatography is a confirmatory method. The screening method is used in the field. This is a quick test method (eg Cloro-N-OIL and chloro-N-SOIL test kits). Complete scanning of all insulating liquids in equipment in Montenegro is performed by the Center for Ecotoxicological Research using PCB Screening Kit CLOR-N-OIL® 50.

The Clor-N-Oil Test Kit works on the principle of chlorine determination. Since PCBs are chlorine-based materials, the test kit is able to detect them. However, the test cannot distinguish between any other chlorine-containing compounds such as trichlorobenzene which may also be found in transformer oil. These compounds may cause a result known as a “false positive”, i.e., the ol will indicate the presence of over 50 ppm PCBs, but when analyzed by gas chromatography will show a value less than 50 ppm. The test works on the

principle of chloride detection. Therefore, contamination by salt (sodium chloride), sea water, perspiration,etc., will give a false positive result and further testing in a laboratory will be necessary.



|----below 50 ppm---------- | above 50 ppm

VII APPLYING GENDER SENSITIVE APPROACH IN NIP UPDATE

During the update of NIP gender sensitive approach was used which includes collecting od data classified by gender and identification of differences of exposure of women and men. Also this gender sensitive approach enabled that policies and principles of gender equality would be applied in activities of NIP update as well as during its implementation. It is important to understand that numerous social and biological factors determine the level of exposure to toxic chemicals, as well as the resulting impacts on human health. Also there is important connection between gender aspect and impact of chemicals, and in this part it is particularly analyzed impact on women, men and children. Women are especially vulnerable category when impact of these toxic chemicals is in question, because of the structure of their reproductive system, and they are particularly vulnerable in certain periods of life such as during pregnancy, lactation etc. Men are also exposed to harmful impact of POPs chemicals in certain branches of industry so it is also necessary to analyze that aspect.

Women and men are exposed to different levels of toxic chemicals and have different biological features that determine the different susceptibility to the hazardous health effects of the chemicals. Because of that it is needed to take into account gender implications during the creation of policies and programs that are related to quality management of chemicals.

In order to apply gender equality in Montenegro, international conventions are adopted, especially UN Convention on elimination of all forms of discrimination against women. Also Law on gender equality (2007) and Law on prohibition of discrimination (2010) are adopted, as well as Plan of activities for achievement gender equality in Montenegro.
Law on gender equality enables equal participation of women and men in all areas of public and private sector, equal position and equal opportunities for the realization of all rights and freedoms and the use of personal knowledge and skills for the development of society, as well as achieving equal benefits from the results of work.

Gender sensitive approach in update of NIP included gathering of data about position of men and women in Montenegro, data about participation of women and men in management of

chemicals and enviromental protection in Montenegro, representation of men and women in different categories professionals or population potentially exposed to POPs chemicals (professionals in industry, recyclers, households, agriculture sector and other...), as well as institutions and organizations that are responsible for implementation of NIP. After gathering and analysis of data conclusions were made:

- Men are less included comparing to women in institutional activities which are concerned about management of chemicals and environmental protection, so it is necessary to include more men in organizations and institutions that deal with this question
- It is necessary to collect gender sensitive data because current data that is collected from different institutions is not gender sensitive, and it is needed to include gender aspect in scientific and other researches
- In sectors of agriculture, transport and industry men are more exposed to POPs chemicals while women are more exposed in health sector (nurses, pharmacists)
- In general population, because of the job distribution in households women are more exposed so it is necessary to organize campaigns with aim to raise awareness
- In agriculture men are more exposed to harmful chemicals during application of pesticides, while women are more exposed during planting and harvesting.

Based on the collected data measures will be implemented in action plans with accent on gender sensitiviti and equal involvment of women and men. It is necessary to inform government officials about gender sensitiviti with aim to build capacity in government and other institutions, as well as keeping gender sensitive statistics in all relevant institutions.

VIII STRATEGIC AND OPERATIONAL GOALS WITH ACCOMPANYING PERFORMANCE INDICATORS AND ACTIVITIES

The National Implementation Plan for the Stockholm Convention sets out two strategic goals:

- **Elimination or restriction of the production and use of POPs;**
- **POPs waste management in a safe, efficient and environmentally sound manner.**

Elimination or restriction of the production and use of POPs will be ensured by achieving the following *operational* goals with accompanying performance indicators specified in Table 93.

Table 93 – Operational goals set out by the National Implementation Plan for the Stockholm Convention

Operational goal	Performance indicator
GOAL 1. Proper management of products containing PBDEs, HBB and HBCDD, in accordance with guidelines set out in the Stockholm Convention	Functioning IT tools for efficient keeping of the database and for statistical data processing • Baseline value: database is not kept; • Interim value: activities initiated to set up the register, deadline 2021; • Target value: Software solution is specifically adapted to the needs of keeping the database, supported by an appropriate hardware, deadline: 2023.
	Competent authorities and operators are educated about PBDEs, HBB and HBCDD, as well as about products containing these chemicals • Baseline value: There are no activities focused on raising public awareness; • Interim value: 2 informative materials developed (brochures, flyers or instructions) and 1 round table held; • Target value: 3 informative materials developed (brochures, flyers or instructions) and 3 round tables held;
GOAL 2. Safe removal of products containing PFOS from the market	Products and parts of products containing PFOS are identified: • Baseline value: Inventory compiled in 2018; • Interim value: Inventory updated in 2021; • Target value: Updating inventories every 3 years, and 3 training courses delivered for all the stakeholders regarding safe management of products containing PFOS.
GOAL 3: Monitoring POPs in all segments of the environment and in food	Monitoring POPs in environmental matrices and in food: • Baseline value: Monitoring programme includes "old" POPs; • Interim value: 4 "new" POPs added, 2021; • Target value: Improvement of monitoring with the "new" POPs.

	Improved national capacities for scientific-research development in the area of POPs • Baseline value: There is no database of scientific and educational institutions, and of the projects dealing with POPs • Interim value: Cooperation established among all the relevant institutions for the purpose of creating database and projects dealing with POPs • Target value: Publicly accessible database
GOAL 4. Improving accessibility of the information on POPs and public awareness raising	Activities to raise public awareness on POPs implemented with participation of scientific-research institutions • Baseline value: There are no activities focused on raising public awareness about POPs; • Interim value: Memorandum on Cooperation signed between the NEPA and scientific-research institutions which will, amongst other things, also include awareness raising activities, deadline 2020; • Target value: Minimum 3 informative campaigns conducted with the aim of raising public awareness about chemicals, deadline 2022;
	Improved knowledge of professional users (managers and employees working in positions with an increased risk of exposure to POPs, professional associations, trade unions etc.) and of general population about risks posed by POPs • Baseline value: There are no activities focused on raising public awareness about POPs; • Interim value: Minimum 1 informative campaign held with the aim of raising public awareness about POPs; • Target value: Minimum 2 informative campaigns held with the aim of raising public awareness about POPs
GOAL 5: Reducing emission and release of unintentionally produced POPs into the environment	Regular update of inventory of unintentionally produced POPs and establishment of the system for control of the activities causing emissions • Baseline value: Inventory made in 2018, there are no informative public campaigns aimed at reducing activities which cause emissions;

	• Interim value: Inspection control increased for the purpose of reducing activities which cause emissions, deadline 2021; • Target value: Inventory updated in 2021 and every year, starting from 2020, minimum one informative campaign conducted
GOAL 6: Proper management of POPs pesticides	Degree of harmonisation increased and staff working at competent authorities and external experts are trained: • Baseline value: Legal framework established, training courses necessary for all the relevant stakeholders; • Improving legal framework and 1 training course held, deadline 2021; • Target value: Full harmonisation with the EU law achieved and 2 training courses held by 2023.

Management of POPs waste in a safe, efficient and environmentally sound manner will be achieved by reaching the following operational goals with accompanying indicators specified in Table 94.

Table 94 – Operational goals of the National Implementation Plan for the Stockholm Convention

Operational goal	Performance indicator
GOAL 1. Proper management of waste containing PBDEs, HBB and HBCDD, in accordance with guidelines set out by the Basel Convention	Functioning IT tools for efficient keeping the database, and for statistical data processing • Baseline value: Database is not kept. • Interim value: Activities to set up the register initiated under the project „Industrial Waste Management and Clean-up“, deadline 2021; • Target value: Software solution specially adapted to the needs of keeping the database, supported by an appropriate hardware, deadline 2023.
	Competent authorities and operators educated about waste containing PBDEs, HBB and HBCDD, with strong focus on substances produced in the process of recycling such waste • Baseline value: There are no activities focused on raising public awareness.

	• Interim value: 2 informative materials developed (brochures, flyers or instructions) and 1 round table held • Target value: 3 informative materials developed (brochures, flyers or instructions) and 3 round tables held
GOAL 2. Treatment of waste containing PFOS	Waste generated from products containing PFOS identified: • Baseline value: Inventory made in 2018; • Interim value: Training conducted for all the stakeholders about proper collection and treatment of the waste containing PFOS, deadline 2021; • Target value: Updating inventory every 3 years.
GOAL 3. Use of PCB fluids in devices is identified and eliminated	Devices containing PCB >50 ppm are identified and labelled; PCB waste identified; complete database of PCB devices created; mechanisms for controlling these processes established. • Baseline value: Inventory making in progress and 3 training courses for operators held; • Interim value: Final inventory made, 2 training courses held, deadline 2021; • Target value: organise minimum 5 training courses by 2020.
GOAL 4. Remediation of identified sites contaminated with POPs	Permanent disposal of waste containing PCB • Baseline value: Around 700 tons of equipment and contaminated soil containing PCB are located in Montenegro; • Interim value: Certain quantities of equipment and contaminated soil exported, deadline 2021; • Target value: Certain quantities of waste containing PCB exported from Montenegro for the purpose of permanent disposal are identified, deadline 2022.
	Sites contaminated with the new POPs identified and prioritised by 2023. • Baseline value: Sites contaminated with the new POPs not identified.

	• Interim value: Results of the programme for monitoring and examination of sites under the project „Comprehensive Environmentally Sound Management of PCBs in Montenegro “ • Target value: Inventory of potentially contaminated sites.

Detailed description of activities needed to achieve operational goals, as well as the deadlines, implementing entities, performance indicators and financial estimate/sources of funding are specified in the Action Plan in Chapter IX of the Plan.

8. 1. Monitoring Implementation of the Plan and Reporting

In order to monitor achievement of the goals set out by the Plan, it is necessary to regularly monitor implementation of specific activities, meeting of deadlines and indicators. Reporting on implementation will be carried out at the end of every second calendar year within the period the strategy refers to. The two-year report will summarise results that have been achieved and proposals will be given regarding potential improvements to the implementation in the course of strategy execution.

In that regard, in order to ensure proper monitoring and coordination of all the implementing entities involved in implementation of the Action Plan, it is recommended that the working group set up to develop strategy also is in charge of monitoring its implementation, including any potential amendments to the articles, should that prove necessary. The working group tasked with monitoring should include representatives of competent authorities who are identified as those implementing certain activities set out in the Action Plan.

Activities that concern monitoring of the Plan implementation will be coordinated by the Ministry of Sustainable Development and Tourism (MSDT). Each implementing activity indicated in the Action Plan is obligated, at the end of the calendar year and where necessary even more frequently, to submit data to the MSDT regarding implementation of activities set out by the Action Plan. The MSDT is responsible for integration of the data and writing of the Report on Plan Implementation, based on data it possesses as the competent authority which is primarily responsible for chemical management, in line with its competences. The report is posted on website of the MSDT.

The MSDT will be responsible for submitting the two-year report to the Government via Secretariat-General, while data needed for reporting on the degree on implementation of the measures within its competences will be provided by the entities which implement activities i.e. representatives of competent authorities within the working group: Ministry of Sustainable Development and Tourism (MSDT), Nature and Environment Protection Agency

of Montenegro (NEPA), Administration for Inspection Affairs (AIA), Ministry of Agriculture and Rural Development (MARD)/Administration for Food Safety, Veterinary and Phytosanitary Affairs (AFSVPA), Ministry of Labour and Social Welfare (MLSW), Ministry of Health (MH), Ministry of Economy (ME), Ministry of Interior (MoI), University of Montenegro (UoM) and Centre for Eco-toxicological Research (CETR). The report is posted on website of the MSDT.

8.1.1 Evaluation and Final Reporting

Upon finalisation of the period that the National Implementation Plan for the Stockholm Convention refers to, it is necessary to carry out *ex post* evaluation of implementation of the Plan, i.e. analysis of effects of all the implemented activities and of the degree of achievement of goals upon implementation of the Plan in order to draw conclusions and give recommendations for the coming period.

The fundamental principle of evaluation will be to ensure independence and objectivity in the analysis of relevance, efficiency, effectiveness and sustainability of activities and programmes in the field of POPs management, with the aim of giving clear guidelines on how to make further improvements to the chemicals management system.

Evaluation of implementation of this Plan will be carried out by an independent evaluator, which will ensure greater degree of objectivity, while funds for his/her hiring will be planned in the budget for 2024, i.e. final year of Plan implementation, while the amount of such funds is EUR 4,000.

Evaluation is carried out after the end of the period that the strategic document refers to and it constitutes an integral part of the Final Report on Plan Implementation. In addition to the evaluation of effects and degree of achievement of the goals set out in the Plan for the implementation period, the Final Report will also include data on implemented activities, remarks concerning difficulties that emerged during implementation and proposals for their elimination and explanations as to why certain activities have not been implemented. Evaluation process will be coordinated by the MSDT which will also be responsible for submitting Final Report to the Government via Secretariat General of the Government, while data needed for evaluation of the implemented activities falling under its competences will be provided by representatives of the competent authorities within the working group (MSDT, NEPA, AIA, MARD/AFSVPA, MLSW, MH, ME, MoI, UoM and CETR). Final report will be posted on website of the MSDT.

Since this is the second National Implementation Plan for the Stockholm Convention and since this convention is supplemented every two/four years, under Article 7 of the Convention Montenegro is obligated to update NIP, particularly after the new POPs have been added to the Convention list. All the activities defined for the purpose of fulfilling recommendations given in the evaluation will be taken into account in the next update to the

NIP. NIP Action Plan covers the period 2019-2023, after which time the “NIP update“ project will be planned, which will ensure sufficient time after expiry of the NIP to analyse results of the evaluation in order to make use of them in drafting the next NIP.

IX ACTION PLAN

Elimination or Restriction of Production and Use of POPs;

ACTION PLAN FOR PRODUCTS CONTAINING PBDEs, HBB AND HBCDD

OPERATIONAL GOAL 1			**Proper management of products containing PBDEs, HBB and HBCDD, in accordance with guidelines set out by the Stockholm Convention**					
PERFORMANCE INDICATOR			**Functioning IT tools for efficient keeping of the database and for statistical data processing**					
Baseline value (2019)			Interim value (2021)			Target value (2023)		
Database is not kept			Activities to set up register initiated, deadline 2021			Software solution is specifically adapted to the needs of keeping the database, supported by an appropriate hardware, deadline: 2023.		
Activity	Implementing entity	Deadline	Performance indicator	Control of activity implementation	Base for cost calculation	Activity cost, in EUR	NIP cost, in EUR	Potential sources of NIP funding

Creating and updating an integrated database of products which contain these chemicals (data collection -2020, IT tools installed 2022, register available in electronic form 2023)	NEPA;	2021-2023	IT tool and register available	2021 and 2024		EUR 150,000	EUR 150,000	Funds will be obtained through the project which will be submitted to the donors
Capacity building for the purpose of supplementing inventory of PBDEs, HBB and HBCDD, and of products containing these chemicals (starting from 2020, conduct minimum one	NEPA; CETR;	Continuously	Number of participants exceeds 20 X 4 training courses	2021 and 2024		Funds not allocated in the budget	Funds not allocated in the budget	TAIEX

training every year)								
Regular reporting on identified products which contain PBDEs, HBB and HBCDD	NEPA; MSTD; CA	Continuously	Annual report on the generated waste	2021 and 2024	Part of regular work duties/activities	EUR 280	EUR 280	State budget
PERFORMANCE INDICATOR	**Competent authorities and operators educated about PBDEs, HBB and HBCDD, as well as about products containing these chemicals**							
Baseline value (2019)	Interim value (2021)				Target value: (2023)			
There are no activities focused on raising public awareness	2 informative materials developed (brochures, flyers or instructions) and 1 round table held				3 informative materials developed (brochures, flyers or instructions) and 3 round tables held			

Raising awareness and familiarising operators/owners (legal persons) with the risks posed by handling products containing PBDEs, HBB and HBCDD and undertaking activities regarding occupational health and safety, while taking into account gender equality	NEPA, MLSW	2020-2023	Number of participants exceeds 30 X 3 round tables, and developing brochures, flyers, instructions	2021-2024		EUR 10,000 (per year)	EUR 40,000	State budget
Study visit on EU principles of control for the purpose of strengthening inspection	AIA	2022	Number of participants exceeds 10	2023		Funds not allocated in the budget	Funds not allocated in the budget	TAIEX

control of products containing PBDEs, HBB and HBCDD								

As a result of implementation of 5 activities set out by the Action Plan in respect of the products containing PBDEs, HBB and HBCDD, the system for proper management of the products containing these chemicals will be established, in the period 2019-2023. A total of EUR 190,280 need to be allocated for implementation of the activities mentioned above, out of which EUR 150.000 are planned to be obtained through the project for which application will be submitted to the donors, in order to borrow funds. The remaining EUR 40,280 are allocated in the budget of Montenegro, i.e. EUR 280 are salaries of employees whose regular work duties include implementation of the activities mentioned above, while EUR 40,000 need to be allocated for awareness raising (EUR 10,000 each year, respectively).

ACTION PLAN FOR PRODUCTS CONTAINING PFOS

OPERATIONAL GOAL 2			**Safe removal of products containing PFOS from the market**					
PERFORMANCE INDICATOR			**Products and parts of products containing PFOS are identified**					
Baseline value (2019)			Interim value (2021)			Target value: (2023)		
Inventory made			Inventory updated			Continuously update the inventory, 3 training courses		
Activity	Implementing entity	Deadline	Control of activity	Performance indicator	Base for cost calculation	Activity cost, in EUR	NIP cost, in EUR	Potential sources of

			implementation					NIP funding
Deliver training courses in order to supplement the existing inventory of products that potentially contain PFOS	MSDT; NEPA, CA; AIA, waste generators	2020-2023	2020-2023	Number of participants exceeds 20 X 3 training courses		Funds not allocated in the budget	Funds not allocated in the budget	TAIEX
Carry out more intensive inspection control of the products containing PFOS	AIA; AFSVPA	2020-2023	2020-2023	Number of decisions	Part of regular work duties/activities, 2 inspectors X 10 working days	EUR 560 X 5 years	EUR 2,800	State budget
Awareness raising and familiarising	NEPA MSDT	2020-2023	2020-2023	Minimum one training		EUR 10.000	EUR 40.000	State budget

operators with the risks posed by handling products containing PFOS and undertaking activities regarding occupational health and safety (taking into account gender analysis in terms of equal protection of men and women in line with their biological differences)	MLSW			course held every year, number of participants exceeds 30		(per year) *Common budget line item as in the case of training courses related to PBDEs, HBB and HBCDD*		

As a result of implementation of 3 activities set out by the Action Plan in respect of PFOS, the system for safe removal of products containing PFOS from the market will be established, in the period 2020-2023. A total of EUR 42,240 need to be allocated for implementation of the activities mentioned above, and these funds are planned in the budget of Montenegro, while EUR 2,520 are salaries of employees whose regular work duties include performance of the activities mentioned above, and EUR 40.000 need to be allocated for awareness raising. These EUR 40,000 are common budget line item as in the case of training courses related to PBDEs, HBB and HBCDD, i.e. **no additional EUR 40,000 will be allocated.**

ACTION PLAN FOR MONITORING AND RESEARCH OF POPs

OPERATIONAL GOAL 3		**Monitoring POPs in all segments of the environment and in food**						
PERFORMANCE INDICATOR		**Monitoring POPs in environmental matrices and in food**						
Baseline value (2019)		Interim value (2021)				Target value: (2023)		
Monitoring programme includes the “old“ POPs;		4 “new“ POPs added				Improving monitoring with “new“ POPs		
Activity	Implementing entity	Deadline	Control of activity implementation	Performance indicator	Base for cost calculation	Activity cost, in EUR	NIP cost, in EUR	Potential sources of NIP funding
Continuation of the process of taking over the prescribed and recommende	ISME, MSDT, MARD	2019-2023	2019-2023	Number of MEST standards that were taken over	Part of regular work duties (2 employees X 10 days)	EUR 560 x 5 years	EUR 2,800	State budget, as well as the budget of the Institute for Standardization

d EU standards for measuring POPs, particularly new ones, in segments of the environment and in food, as MEST standards								
Continuation of establishing annual programme for post-registration control of the plant protection products	AFSVPA	2019-2023	2019-2023	Programme adopted	Part of regular work duties /activities (2 employees X 20 days)	EUR 1,120 X 5 years	EUR 5,600	State budget
Development of the programme	NEPA MSDT	2021-2023	2021-2023	Programme adopted				Funds approved through GEF

for monitoring new POPs in the marine ecosystem and its integration into the programme for monitoring marine environment								Adriatic, IPA project (MARD and MSDT)[79]
Building administrative and professional capacities for implementation of the	NEPA, MSDT, MARD	2020-2021	2020-2021	2 training courses attended by more than 10 participant		Funds not allocated in the budget	Funds not allocated in the budget	TAIEX

[79] The activity mentioned above is partly implemented through the sub-regional two-year project "Implementation of the Ecosystem Approach (EcAp) in the Adriatic Sea through Marine Spatial Planning". The project will enable introduction of ecosystem approach into the national system for monitoring state of the marine environment and will contribute to development of the marine spatial plan. The new approach to monitoring state of the marine environment requires a comprehensive monitoring of the state of marine environment by applying a complex set of indicators in line with obligations of Montenegro in the framework of implementation of ecosystem approach, in compatibility with requirements set out by the EU Marine Strategy Framework Convention (MSFD). The project is implemented by the Mediterranean Action Plan within UNEP and its Priority Actions Programme / Regional Activity Centre in Split (PAP/RAC) with GEF's financial resources amounting to USD 1,700,000.

programme for monitoring POPs in the environment and in food for humans and animals, while taking into account gender equality				s (one each year)				
Including larger number of POPs into the programme for monitoring environment and food and transparent reporting on the results	NEPA; Institute for Hydrometeorology and Seismology (IHS); MARD	2019-2023	2019-2023	Report on the state of the environment	As part of the Monitoring Programme	EUR 20,000	EUR 100,000	Funds approved through GEF Adriatic project

Control of whether reference laboratories meet requirements	NEPA	2019-2023	2019-2023			Funds not allocated in the budget	Funds not allocated in the budget	NA
Improving the work done by professional organisations (laboratories) engaged in measuring POPs, particularly new ones, through accreditation of methods, procurement of laboratory equipment, professional advancement of laboratory employees)	NEPA; IHS; Accreditation Authority of Montenegro; accredited laboratories	2020-2023	2020-2023	Procurement of equipment		EUR 50,000	EUR 50,000	Funds approved from donor projects, IPA, GEF Adriatic project

PERFORMANCE INDICATOR		**Improved national capacities for scientific-research development in the field of POPs**						
Baseline value (2019)		Interim value (2021)			Target value: (2023)			
There is no database of scientific and educational institutions and of projects dealing with POPs		Cooperation established among all the relevant institutions for the purpose of creating database and projects dealing with POPs			Publicly accessible database			
Creation and regular updating of the national database of scientific and educational institutions, as well as of the projects dealing with POPs which will be publicly accessible.	MS, MSDT, MARD	2020-2023	2020-2023	Database created	Part of regular work duties /activities (2 employees X 2 days)	EUR 112	EUR 560	State budget
Preparation and implementati	MS, MH, MARD	2021-2023	2023	Project approved		N/A	100,000	Funds will be obtained through the

on of projects for measuring POPs and their metabolites in segments of the environment and in food, biological material, products and waste								project for which application will be submitted to the donors

As a result of implementation of 9 activities set out by the Action Plan in respect of monitoring and research of POPs, decision-makers, citizens and international organisations will be informed about presence of POPs in the environment through proper monitoring and organised system of collecting information and reporting, in the period 2019-2023. A total of EUR 260,640 need to be allocated for implementation of the activities mentioned above, of which EUR 250,000 are planned to be obtained from donations[80], while EUR 8960 are necessary for salaries of employees, as part of regular work duties.

[80] It is necessary to apply for EUR 100,000, whereas EUR 150,000 are obtained through IPA, GEF Adriatic project

ACTION PLAN FOR IMPLEMENTATION OF THE STRATEGY FOR COMMUNICATION, AWARANESS RAISING AND EDUCATION ON POPs

OPERATIONAL GOAL 4		**Improving accessibility of information on POPs and raising public awareness**						
PERFORMANCE INDICATOR		**Activities to raise public awareness on POPs implemented with the participation of scientific-research institutions**						
Baseline value (2019)		Interim value (2021)			Target value: (2023)			
There are no activities focused on raising public awareness about POPs		Memorandum on Cooperation signed between the NEPA and scientific-research institutions which will, amongst other things, also include awareness raising activities			Minimum 3 informative campaigns conducted with the aim of raising public awareness about POPs			
Measure	Implementing entity	Deadline	Control of activity implementation	Performance indicator	Base for cost calculation	Activity cost, in EUR	NIP cost, in EUR	Potential sources of NIP funding
Development of educational material on POPs adapted to specific target groups	NEPA	2021-2022	2021-2022	Material prepared	10 brochures X 10 pages X 3 years	EUR 10,000	EUR 30,000	Project application for funding will be submitted through SAICM

Delivery of training courses for representatives of the institutions competent and authorised for the performance of activities involving occupational health and safety, as well as for the professionals responsible for occupational health and safety, labour inspectors, NGO, laboratories and designing the system of	MSDT, MH, MLSW, laboratories	2020-2022	2020-2022	Training courses held	3 training courses for more than 30 participants (one each year)	Funds not allocated in the budget	Funds not allocated in the budget	TAIEX

gender sensitive indicators and databases								
Delivery of training courses for civil society organisations and associations (associations of consumers, NGOs active in the field of environment, women' s organisations and others), representatives of print and electronic media, journalists, representatives of journalists'	NGO, MSDT, NEPA	2021	2022	Training courses held	2 training courses for more than 30 participants	EUR 10,000	EUR 20,000	Project application for funding will be submitted through SAICM

associations and defining the forms of cooperation and partnership in execution of the NIP								
PERFORMANCE INDICATOR		**Improved knowledge of professional users (managers and employees working in the positions with an increased risk of exposure to POPs, professional associations, trade unions etc.) and of general population about risks posed by POPs**						
Baseline value (2019)		Interim value (2021)				Target value: (2023)		
There are no activities focused on raising public awareness about POPs		Minimum 1 informative campaign held with the aim of raising public awareness about POPs				Minimum 2 informative campaigns held with the aim of raising public awareness about POPs		
Organise training courses for the purpose of informing journalists, operators, recyclers and	NEPA, NGO, MSDT	2021-2022	2022-2023	Training courses held	2 training courses for more than 30 participants	EUR 10,000 (per year)	EUR 20,000	Project application for funding will be submitted

informal collectors of waste about risks posed by handling POPs and undertaking activities in respect of occupational health and safety, while taking into account gender equality.								through SAICM
Preparation of informative contents on POPs adapted to specific target groups	NEPA	2021-2022	2021-2022	Flyers and brochures developed	2 consulting days X 3 years, design and print	EUR 2,000	EUR 6,0000	Project application for funding will be submitted through SAICM

Holding periodic press conferences (once in two years) to present implemented activities and achieved results	MSDT, NEPA, MARD	2022/2024	2022/2024	Press release	Part of regular work duties /activities 2 employees X 1 day	EUR 56	EUR 224	State budget

As a result of implementation of 6 activities set out by the Action Plan in respect of implementing strategy for communication, awareness raising and education on POPs, the level of information and knowledge among stakeholders and general public on the risks posed by POPs to human health and environment will be improved. A total of EUR 76,224 need to be allocated for implementation of the activities mentioned above, of which EUR 76,000 are planned through the project which the MSDT plans to apply for funding under the Strategic Approach to International Chemicals Management (SAICM QSP). The remaining EUR 224 will be allocated from the budget for holding the press conference, as part of regular work activities.

ACTION PLAN FOR UNINTENTIONALYLY PRODUCED POPs

OPERATIONAL GOAL 5	**Reducing emission and release of unintentionally produced POPs into the environment**
PERFORMANCE INDICATOR	**Regular update of inventory of unintentionally produced POPs and establishing system for the control of activities causing emissions**

Baseline value (2019)		Interim value (2021)			Target value: (2023)			
Inventory made in 2018, there are no informative public campaigns for the purpose of reducing activities which cause emissions		Increased inspection control in order to reduce activities that cause emissions			Inventory updated every year starting from 2020, minimum one informative campaign conducted			
Activity	Implementing entity	Deadline	Control of activity implementation	Base for cost calculation	Performance indicator	Activity cost, in EUR	NIP cost, in EUR	Potential sources of NIP funding
Continuation of the work on supplementing and completing the existing inventory of emissions of unintentionally produced POPs released into the environment by collecting data on quantities of the collected	NEPA; MTMA, MSDT – Waste Management Directorate; waste generators in timber industry; operators dealing with waste	2020-2023	2020-2023	Part of regular work duties/activities (3 employees X 180 days)	Inventory made	EUR 12,420 X 4 years	EUR 49,680	State budget

/incinerated industrial wood waste, oil consumption in boat traffic, classification of vehicles in road transport by the type of vehicle and year of manufacturing, consumption of cigarettes at the annual level) for the purpose of ensuring completeness of the inventory. Setting up quality control (QC) of active data	management; MONSTAT							
Carrying out control of implementation of the regulations	AIA; municipal police	2021-2023	2021-2023	Part of regular work duties/activities (2 inspectors	Number of decisions,	EUR 4,200	EUR 4,200	State budget and budget of municipal inspection

governing waste management				X 15 days X 5 years)	permits			
Revision of the existing legislation and standards for the release of unintentionally produced POPs (n-POPs)	MSDT, NEPA; MH, MARD, ISME	2021/2022	2021/2022	Part of regular work duties/activities (2 employees X 15 days X 2 years)	Regulations amended, standards taken over	EUR 840	EUR 840	State budget

Raising awareness of citizens, rural population, employees at the landfills, at the industrial facilities, and in agricultural facilities, as well as the awareness of individual agricultural producers about risks posed by exposure to unintentionally produced POPs, and particularly awareness of vulnerable groups – informal collectors, while taking into account gender equality	NEPA, MSDT, MLSW, MH	2020-2023	2019-2023	4 training courses for more than 30 participants	Training courses held	EUR 10,000	EUR 10,000	State budget

Informative campaign about benefits of replacing heating with fossil fuel and raw wood biomass by alternative heating systems	ME, MSDT	2020-2021	2020-2021		Campaign conducted	EUR 5,000	EUR 5,000	State budget

Improving control and measurement of emissions and release, and improving monitoring of concentrations in food and in the environment	Accredited laboratories, operators, NEPA, ISME	2020-2023	2019-2022		Reports Sampling and analysis	EUR 50,000	EUR 50,000	Donation/distribution of generated revenue into fixed assets needed for improvement of the control and measurement of emissions and release, and for the improvement of monitoring of concentrations in food and in the environment
Calculation of national emission factors separately for metal industry and small facilities that burn wood biomass.	Accredited laboratories, MSDT, NEPA	2023	2023		National emission factors	200,000	EUR 200,000	Funds will be obtained through the project for which application will be submitted to the donors

As a result of implementation of 8 measures set out by the Action Plan in respect of unintentionally produced POPs, a proper system for the reduction of emissions and release of unintentionally produced POPs into the environment will be established, in the period 2019-2023. A total of EUR 319.720 need to be allocated for implementation of the activities mentioned above, of which EUR 250,000 are planned to be obtained through donations, while EUR 69.720 will be allocated in the budget for salaries for employees who implement the activities mentioned above as regular activities.

ACTION PLAN FOR POPs PESTICIDES

OPERATIONAL GOAL 6	**Proper management of POPs pesticides**							
PERFORMANCE INDICATOR:	**Degree of harmonisation increased and staff working at competent authorities and external experts trained**							
Baseline value (2019)	Interim value (2021)				Target value: (2023)			
Legal framework established, necessary training for all the relevant parties	Improvement of legal framework and 1 training course held				Full harmonisation with EU law achieved and 2 training courses held			
Activity	Implementing entity	Deadline	Control of activity implementation	Base for cost calculation	Performance indicator	Activity cost, in EUR	NIP cost, in EUR	Potential sources of NIP funding
Improvement of legal framework and administrative capacities for pesticide management (from the production phase, to the import and disposal as a hazardous waste), and capacities for making inventory of POPs pesticides and other abandoned pesticides	MARD, AFSVPA	2019-2022	2019-2022	Part of regular work duties/activities (3 employees X 90 days X 4 years)	Report on implementation	EUR 30,240	EUR 30,240	State budget

Delivery of training and development of operational plans for making inventory of POPs and other abandoned pesticides and making an inventory	MARD, AFSVPA	2019-2022	2019-2023	In the training of users and persons authorised to sell plant protection products, participants will be informed about POPs and abandoned pesticides	(7 training courses per year envisaged for 20 participants)	Funds not allocated in the budget	Funds not allocated in the budget	TAIEX
Familiarising operators with the risks posed by handling waste that contains POPs pesticides and undertaking activities related to occupational health and safety, while taking into account gender equality	MARD, AFSVPA	2020-2022	2020-2022	In the training of users and persons authorised to sell plant protection products, participants will be informed about POPs and	(7 training courses per year envisaged for 20 participants) flyers, brochures – 3 years	30,000	30,000	Budget

				abandoned pesticides				

As a result of implementation of 3 measures set out by the Action Plan in respect of POPs pesticides, proper functioning of the system for management of POPs pesticides will be established, in the period 2019-2013. A total of EUR 60,240 need to be allocated in the budget of Montenegro for implementation of the activities mentioned above, of which EUR 30,240 will be allocated for employees' salaries and EUR 30,000 for awareness raising.

Management of POPs Waste in a Safe, Efficient and Environmentally Sound Manner

ACTION PLAN FOR WASTE CONTAINING PBDEs, HBB and HBCDD

OPERATIONAL GOAL 1	**Proper management of waste containing PBDEs, HBB and HBCDD chemicals, in accordance with guidelines set out in the Basel Convention**	
PERFORMANCE INDICATOR	**Functioning IT tools for efficient keeping the database, as well as for statistical data processing**	
Baseline value (2019)	Interim value (2021)	Target value (2023)
Database is not kept	Activities to set up register initiated, deadline 2021	Software solution is specifically adapted to the needs of keeping the database, supported by an appropriate hardware, deadline: 2023.

Activity	Implementing entity	Deadline	Performance indicator	Control of activity implementation	Base for cost calculation	Activity cost, in EUR	NIP cost, in EUR	Potential sources of NIP funding
Creating and updating an integrated database of waste which contains these chemicals, particularly substances produced in the waste recycling process.	NEPA;	2020-2023	IT tool and register available	2021 and 2024				Funds obtained through borrowing from the bank (Loan Agreement with the World Bank) through the project "Industrial Waste Management and Clean-up"
Capacity building for the purpose of supplementing	NEPA; CETR;	Continuously	Number of participants exceeds 20 X 4	2021 and 2024		Funds not allocated in the budget	Funds not allocate	TAIEX

inventory of waste which contains PBDEs, HBB and HBCDD, with particular focus on substances produced in the process of recycling such waste (starting from 2020, every year deliver minimum one training course)			training courses				d in the budget	
Regular reporting on generated waste which contains PBDEs, HBB and HBCDD	MSDT; CA; NEPA	Continuously	Annual report on generated waste	2021 and 2024	Part of regular work duties/activities	EUR 280	EUR 280	State budget
PERFORMANCE INDICATOR			**Competent authorities and operators educated about waste containing PBDEs, HBB and HBCDD, with strong focus on substances produced in the process of recycling such waste**					

Baseline value (2019)			Interim value (2021)			Target value: (2023)		
There are no activities focused on raising public awareness			2 informative materials developed (brochures, flyers or instructions) and 1 round table held			3 informative materials developed (brochures, flyers or instructions) and 3 round tables held		
Raising awareness and familiarising operators/owners (legal persons) and recyclers with the risks posed by handling products containing PBDEs, HBB and HBCDD and undertaking activities regarding occupational health and safety, while taking into	NEPA, MLSW	2020-2023	Number of participants exceeds 30 X 3 round tables, and development of brochures, flyers and instructions	2021-2024		EUR 10,000 (per year)	EUR 40,000	State budget

account gender equality								
Study visit on EU principles of control for the purpose of strengthening inspection control of products containing PBDEs, HBB and HBCDD	AIA	2022	Number of participants exceeds 10	2023		Funds not allocated in the budget	Funds not allocated in the budget	TAIEX

As a result of implementation of 5 activities set out by the Action Plan in respect of waste containing PBDEs, HBB and HBCDD, the system for proper functioning will be put in place, in the period 2019-2023. A total of EUR 40,280 need to be allocated in the budget of Montenegro for implementation of the activities mentioned above, while EUR 280 are salaries of employees whose regular duties include implementation of the activities mentioned above, and EUR 40,000[81] need to be allocated for public awareness raising (EUR 10,000, each year respectively).

[81] Common budget line item as in the case of training courses for products containing PBDES, HBB and HBCDD.

ACTION PLAN FOR THE WASTE CONTAINING PFOS

OPERATIONAL GOAL 2	**Treatment of waste containing PFOS**	
PERFORMANCE INDICATOR	**Waste generated from products containing PFOS identified**	
Baseline value (2019)	Interim value (2021)	Target value: (2023)
Inventory made	Inventory updated	Continuously update inventory, 3 training courses

Activity	Implementing entity	Deadline	Control of activity implementation	Performance indicator	Base for cost calculation	Activity cost, in EUR	NIP cost, in EUR	Potential sources of NIP funding
Delivery of training courses with the aim of supplementing the existing inventory of waste contaminated with PFOS	MSDT; CA; AIA; NEPA; waste generators;	2019-2023	2019-2023	Number of participants exceeds 20 X 3 training courses		Funds not allocated in the budget	Funds not allocated in the budget	TAIEX

Carry out more intensive inspection supervision of products and waste generated from products	AIA; AFSVPA	2020-2023	2019-2023	Number of decisions	Part of regular work duties/activities, 2 inspectors X 10 working days	EUR 560 X 5 years	EUR 2,240	State budget
Adoption of legal provisions which will contribute to the resolution of the issue of collecting and final treatment / destruction of the waste containing PFOS	MSDT;	2020/2021	2020-2021	Law on Waste Management and a piece of secondary legislation on the basis of it		Part of regular work duties/activities	EUR 280	EUR 280

Awareness raising and familiarising operators with the risks posed by handling waste containing PFOS and undertaking activities regarding occupational health and safety (taking into account gender analysis in terms of equal protection of men and women in line with their	NEPA MSDT MLSW	2020-2023	2020-2023	Every year minimum one training course held, number of participants exceeds 30		EUR 10,000 (per year) *Common budget line item as in the case of training courses related to PBDEs, HBB and HBCDD.*	EUR 40,000	State budget

biological differences).								

As a result of implementation of 4 activities set out by the Action Plan in respect of waste containing PFOS, the system for adequate treatment of waste containing PFOS will be established, in the period 2020-2023. A total of EUR 42,240 need to be allocated in the budget of Montenegro for implementation of the activities mentioned above, EUR 2.240 are salaries of employees whose regular duties include performance of the activities mentioned above, while EUR 40,000 need to be allocated for awareness raising. These EUR 40,000 are common budget line item as in the case of training courses related to PBDEs, HBB and HBCDD, i.e. **no additional EUR 40,000 will be allocated.**

ACTION PLAN FOR THE USE OF PCB FLUIDS IN DEVICES

OPERATIONAL GOAL 3	**Use of PCB fluids in devices is identified and eliminated**							
PERFORMANCE INDICATOR:	**Devices containing PCB >50 ppm are identified and labelled; PCB waste identified; complete database of PCB devices created; mechanisms for controlling these processes established.**							
Baseline value (2019)	Interim value (2021)				Target value: (2022)			
Inventory making is in progress and 3 training courses for operators are held	Final inventory made, 2 training courses held				Hold minimum 5 training courses by 2022			
Activity	Implementing entity	Deadline	Control of activity implementation	Base for cost calculation	Performance indicator	Activity cost, in EUR	NIP cost, in EUR	Potential sources of NIP funding
Continuation of the work on supplementing the existing inventory of equipment which contains PCB >50	MSDT; owners of PCB devices; temporary owners of PCB devices)	2019 2020	2019-2020		Inventory	EUR 230,000	EUR 230,000 €	Funds obtained from GEF' s donation under the project "Comprehensiv

ppm and labelling the identified PCB devices.								e Environmentally Sound Management of PCBs in Montenegro"
Awareness raising, gaining knowledge and familiarising operators with the risks posed by handling PCB waste and PCB devices and undertaking activities regarding occupational health and safety, while taking into account gender equality.	MSDT, NEPA;	2019-2021	2019-2021		Number of training courses exceeds 5, number of participants exceeds 30	EUR 120,000	EUR 120,000	Funds obtained from GEF' s donation under the project "Comprehensive Environmentally Sound Management of PCBs in Montenegro"
Permanent disposal of PCB contaminated equipment and waste in accordance with national legislation and requirements set out by international conventions	Owners of PCB waste	2019-2021	2019-2021		Tons of exported waste	1,600,000	1,600,000	Funds obtained from GEF' s donation under the project "Comprehensive Environmentally Sound Management of PCBs in Montenegro"

As a result of implementation of 3 measures set out by the Action Plan in respect of PCB, the use of PCB fluids in devices will be identified and eliminated by 2025; proper disposal of PCB waste will be ensured as well (liquids with PCB and equipment containing PCB). A total of EUR 1,950,000 need to be allocated for implementation of the activities mentioned above, and these funds are obtained from GEF' s donation under the project "Comprehensive Environmentally Sound Management of PCBs in Montenegro".

ACTION PLAN FOR CONTAMINATED SITES

OPERATIONAL GOAL 4	**Remediation of identified sites contaminated with POPs**	
PERFORMANCE INDICATOR	**Permanent disposal of waste containing PCB**	
Baseline value (2019)	Interim value (2021)	Target value: (2023)
Around 700 tons of equipment and contaminated soil containing PCB are located in Montenegro	Certain quantities of equipment and contaminated soil are exported	Quantities of waste containing PCB exported from Montenegro for the purpose of permanent disposal are identified

Activity	Implementing entity	Deadline	Control of activity implementation	Performance indicator	Base for cost calculation	Activity cost, in EUR	NIP cost, in EUR	Potential sources of NIP funding
Adoption of regulations in the field of soil protection/remediation	MARD	2021	2022	Law on Soil Protection adopted	Part of regular work duties/activities / 10 representatives of state	EUR 25,200 X 2 years	EUR 50,400	State budget

					authorities and administrative bodies X days			
Preparation of technical documentation needed for conducting remediation of the site within KAP (linking to the WB project)	MSDT; NEPA	2019-2020	2019-2020	Documentation prepared		EUR 1 million	EUR 1 million	Borrowing from the bank (Loan Agreement with the World Bank) project "Industrial Waste Management and Clean-up"
Development of the spatial planning documentation. Environmental Impact Study for the project, Feasibility Study and technical	MSDT; NEPA; accredited laboratories	2019-2022	2019-2022	Remediation of sites	Project PCB and KAP	EUR 250,000	EUR 250,000	Funds obtained from GEF donation under the project "Comprehensive Environment

documentation needed for remediation of the sites contaminated with POPs								ally Sound Management of PCBs in Montenegro"
Delivery of training courses for employees at the authority competent for environment and for other local experts regarding selection and assessment of efficiency of remediation procedures	MSDT; NEPA	Continuously	2020-2023	Number of participants exceeds 20 x 4 training courses (one each year)		Funds not allocated in the budget	Funds not allocated in the budget	TAIEX etc.
PERFORMANCE INDICATOR	**Sites contaminated with new POPs identified and prioritised by 2023**							
Baseline value (2019)	Interim value (2021)				Target value: (2023)			
Sites contaminated with new POPs not identified	Results of the programme for monitoring and examination of sites under the project "Comprehensive Environmentally Sound Management of PCBs in Montenegro"				Inventory of potentially contaminated sites			

Conducting preliminary and detailed research of the areas potentially contaminated with new POPs	NEPA	2020-2022	2020-2022	Reports, studies		EUR 5,000	15,000	State budget, in framework of monitoring state of the environment. Funds also obtained from GEF' s donation under the project "Comprehensive Environmentally Sound Management of PCBs in Montenegro" "[82] and partly from the budget through the

[82] Budget shown for the project "Comprehensive Environmentally Sound Management of PCBs in Montenegro" refers to the period from this year and onward, however the indicated funds have already been spent to a certain extent during the previous 2 years of project implementation. This mainly refers to making of inventory and disposal of PCB.

								Monitoring Programme
Development of a comprehensive inventory of sites contaminated with new POPs.	MSDT; NEPA	2022	2022	Inventory of sites		EUR 50,000	EUR 50,000	Funds will be obtained through the project for which application will be submitted to the donors

As a result of implementation of 6 activities set out by the Action Plan in respect of contaminated sites, environmental pollution will be reduced through the remediation of identified sites contaminated with POPs, in the period 2019-2023. A total of EUR 1,365,000 need to be allocated for implementation of the activities mentioned above, of which 1 million is already obtained by borrowing from the World Bank, EUR 250,000 are also obtained from GEF' s donation under the project "Comprehensive Environmentally Sound Management of PCBs in Montenegro", whereas EUR 50,000 needed for making a comprehensive inventory of sites contaminated with POPs will be obtained from the donation. EUR 15,000 are allocated in the budget of Montenegro for monitoring POPs under the Programme for Monitoring the state of the environment, EUR 50,400 are allocated for salaries of 10 representatives of state authorities and administrative authorities (90 days x 2 years) as part of regular work duties/activities.

Action plans include a total of 53 activities which will be implemented in the period 2019-2023, with precisely set deadlines, implementing entities, verification indicators and estimated funds. Funds needed for their implementation in the period 2019-2023, which have already been obtained through implementation of projects amount to EUR 3,500,000, whereas project applications are planned to be prepared and submitted to the donors in order to obtain EUR 626,000. EUR 100,000 are planned to be allocated in the budget of Montenegro, mainly for raising awareness about the harm and impact of POPs on the

environment and human health. In line with the guidelines set out by the Stockholm Convention, the document shows funds referring to salaries of the employees working in the positions in this field, however it is worth noting that EUR 149,864 do not represent a separate allocation in the budget since these are salaries of the current employees who also perform other tasks, in addition to the activities specified in the Action Plan.