Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

# National Implementation Plan (NIP) for the Stockholm Convention on Persistent Organic Pollutants

2nd Revision

Vienna, 2022

**Legal notice**

Media owner, publisher, editor:
Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology, Radetzkystraße 2, 1030 Vienna, Austria
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Vienna, 2021. Last updated: 7 April 2022



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## Foreword

Leonore Gewessler

The multilateral Stockholm Convention on persistent organic pollutants (POPs) aims to protect human health and the environment from these hazardous, persistent chemicals as much as possible. For Austria, it entered into force on 17 May 2004. Since 2009, the scope of application has been expanded from the original 12 to 30 substances. The hazardous persistent substances formerly known as the dirty dozen and now as the dirty thirty, which include, for example, dioxins, hexachlorobenzene and brominated flame retardants (BFRs), are to be eliminated worldwide. A contribution toward achieving this goal will be made with appropriate measures, which Austria is establishing in this National Implementation Plan 2021.

The implementation plan contains the entire spectrum of POPs in products, industrial emissions, waterbodies, waste, contaminated sites, pesticides, foods and feeds, including the substances of the Protocol to the Convention of 1979 on Long-Range Transboundary Air Pollution concerning persistent organic pollutants. The Union Regulation on POPs restricts or bans such substances and establishes provisions regarding wastes that consist of, contain, or are contaminated by these chemicals. Data and information on emissions and the monitoring of environmental media are used to verify whether the goals of the Regulation are being achieved.

The measures include monitoring compliance with the bans and restrictions on POPs in substances, mixtures or products, the continuous reduction of POP releases and specifications for environmentally sound recycling. The implementation of the best available technique implies close cooperation in the area of industrial emissions. This National Implementation Plan 2021 is in keeping with our commitment to preventive environment and health protection.

Federal Minister
Leonore Gewessler

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# 1 Introduction

Persistent Organic Pollutants (POPs) constitute a group of chemicals with specific hazardous properties: They are slowly metabolized in the environment; they accumulate in living organisms and are potentially damaging to human health and to the environment. Owing to their properties, these substances are disseminated via the atmosphere and waterways (oceans, rivers), as well as by highly migratory animal species. As a consequence, they are found in remote areas far from their original use and production sites, for example in the Arctic or in mountainous regions such as the Alps, in concentrations that can adversely affect animal and plant life.

Because efficient measures must be implemented against these pollutants, especially at the international level, Austria is actively involved in the further development of the Stockholm Convention on Persistent Organic Pollutants [1] (see the website of the Convention at pops.int). The national measures are currently focusing on monitoring (of soils and biota and in the Alpine regions), and in identifying hotspots. Inspections for ensuring compliance with the bans and restrictions and for reducing the pollutant input in the recycling area occur routinely.

The Stockholm Convention on Persistent Organic Pollutants [1] went into effect in 2004. Austria signed the Convention in 2001 and ratified it in August 2002. The Convention is currently in effect for 184 Parties (status as of September 2021). Since the most recent extensions, 30 hazardous chemicals/chemical groups are covered by the Convention. As a result, production, use and sales are banned or restricted worldwide, and measures have been established for reducing undesired by-products as much as possible and for environmentally sound disposal. Other general or special exceptions notwithstanding, export other than for purposes of disposal in an environmentally sound manner is prohibited.

The Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) is the contact point for the Convention.

Each Party to the Stockholm Convention [1] is obligated to submit a National Implementation Plan (NIP), which describes the implementation of the provisions of the Convention and also drafts strategies and plans for taking any necessary further measures.

After any amendments to the Convention, this plan shall be updated accordingly. The current revised National Implementation Plan 2021 builds on the Austrian NIP 2008 and on its 1st Revision 2012[1] and summarizes measures planned for the 30 substances that are currently regulated under the Convention. Among other things, this includes the amendments from the 9th Conference of the Parties (COP 9), on the basis of which a revision is required by December 2022. Releases of U-POPs, which are the unintentional by-products of industrial processes, are to be identified and reduced as soon as possible, with the ultimate goal of elimination where feasible. In order to achieve a continuous and cost-effective reduction of such releases, all Parties must also draft an updated National Action Plan (NAP[2]) for reducing and eliminating these undesired by-products. This plan shall be updated on a routine basis every five years and submitted to the Secretariat of the Convention.

Austria is also a party to the UNECE Convention on Long-Range Transboundary Air Pollution (LRTAP), the POP protocol [2] of which now regulates 23 substances since a general revision in 2009. The protocol obligates the parties to draft strategies and plans for fulfilling the obligations set forth in the protocol. Since the Stockholm Convention [1] globally covers all substances regulated in the POP protocol except for polycyclic aromatic hydrocarbons (PAH), what remains for the CLRTAP (and its POP protocol) is the cataloguing of POP emissions and measures for reducing the unintentional release of specific POPs (e.g., PAHs during wood combustion).

Regulation (EU) 2019/1021 on Persistent Organic Pollutants [3] (the POPs Regulation) implemented both the Stockholm Convention [1] and the POP Protocol [2] in the EU. The Regulation underwent an extensive revision (recast) in 2019. Article 9 of the Regulation states that, when preparing and updating national implementation plans, the public shall be given early and effective opportunities to participate in this process. When Member States are preparing and updating their implementation plans, the Commission, supported by the European Chemicals Agency (ECHA), and the Member States shall exchange information on the content of these plans, including information on measures taken at national level to identify and assess sites contaminated by POPs, as appropriate.

Because the European Union is also a Party to the Convention, it too must draft an implementation plan. The fundamental implementation plan was submitted to the

[1] bmk.gv.at/themen/klima_umwelt/chemiepolitik/international/pop.html
[2] umweltbundesamt.at/umweltthemen/industrie/nationaleraktionsplan-pops

Secretariat in 2007. Revisions of the EU Implementation Plan (EUIP) were submitted in 2014 and 2019. The current report [4] according to Art. 9 (4) of the POPs Regulation [3] outlines the fundamentals of the upcoming revision. The contents of this report are taken into account as much as possible.

The present document is composed of the revised National Implementation Plan and the 2017 updated version of the National Action Plan. The latter has been available since 2017[3], the next update will be published by the end of 2022.

The draft of the NIP 2021 was made available for online consultation for six weeks (until 2 July 2021), with the opportunity to leave comments and propose changes. These comments were then taken into consideration during the drafting of the final version of the revised National Implementation Plan 2021. The final version must be endorsed by the Austrian Council of Ministers and will then be submitted to the Secretariat of the Stockholm Convention [1] in English translation, in accordance with the relevant obligations of the Convention and of the European Commission.

[3] The 2008, 2012 and 2017 Action Plans can be found under the following link: umweltbundesamt.at/umweltthemen/industrie/nationaleraktionsplan-pops

# 2 Basic Information on Austria

This chapter presents fundamental information on the government and legal system in Austria, on which the implementation of the Stockholm Convention on Persistent Organic Pollutants is based. International and EU legal texts of relevance to the implementation shall also be described.

Austria has set itself ambitious goals in the environmental area. Austria has created an e-government for dealing with challenges such as sustainability, international cooperation and ongoing innovation. This also includes the Austrian Legal Information System (Rechtsinformationssystem, RIS) provided by the public sector, which can be defined as fundamental information of importance in terms of democracy and rule of law. The draft of the revised National Implementation Plan, along with the updated National Action Plan, has been submitted for review on the BMK web pages, where it will be made available to the general public for downloading.

In keeping with the federal state principle, government tasks are divided among the nine Austrian provinces and the federal government. This division of labor comprises legislation and execution of laws, and also financial management. In this context, the provinces contribute to the administration of the federation through indirect federal administration.

The specific responsibilities of the federation and the provinces in terms of legislation and execution can be found in the so-called competence articles of federal constitutional law. They establish, inter alia, whether the federal government and/or the provinces are responsible for legislating and/or execution. Accordingly, the Chemicals Act 1996 [5], the Water Rights Act 1959 [6], the Waste Management Act 2002 [7] and the Food Safety and Consumer Protection Act [8] are implemented through indirect federal administration and the Plant Protection Products Act 2011 [9] is implemented through direct federal administration.

With respect to the geographical situation, reference is made to the corresponding chapter in the NIP 2008. Vast parts of Austria are mountainous. 20% of the Alps are situated in Austrian territory. With an altitude of 3,798 m, the Großglockner is the highest elevation in the nation. The Sonnblick observatory at an altitude of over 3000 m permits

monitoring in the form of measuring extremely low concentrations of trace substances in a clean air environment. Two thirds of the arable land in Austria is used as grass- or pastureland. The site-appropriate management thereof is very important. For monitoring certain POPs, extensively used grasslands without any potential sources of emissions in immediate proximity are chosen as permanent soil observation plots. Air, waterbodies, foods and feeds, and also drinking water are subject to mandatory routine monitoring requirements, which also include POPs.

## 2.1 Political framework

Since Austria joined the European Union on 1 January 1995, its environmental policies, including the protection of the environment and human health from hazardous chemicals, have been determined largely by European environmental policies, and also by international chemical policies. In keeping with the Sustainability Agenda 2030, work is being done on a framework agreement for safe chemical and waste management as a successor to the Global Chemical Strategy SAICM. The cooperation and coordination among the Stockholm Convention [1], the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals in International Trade [10], the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal [11] and the Minimata Convention on Mercury [12], which has already been underscored by the consolidation of the secretariats and Conferences of the Parties (COP) of the first three conventions and the cooperation of the latter with the Minamata Convention [12], is reflected in Austria in the form of an intensive cooperation among waste and chemical authorities.

The Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) has primary responsibility for chemical policy. According to the current version of the Chemicals Act 1996 (ChemG 1996) [5], the Federal Minister for Climate Action, Environment, Energy, Mobility, Innovation and Technology is the acting authority responsible for the POPs Regulation [3]; consensual provisions concerning POPs that are unintentional by-products of industrial processes (unintentional POPs, U-POPs) have been put into place. In the waste management area, the BMK is responsible for the implementation and enforcement of waste-relevant rules of Union law and also serves as the contact point for the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal [11]. The Federal Law on Sustainable Waste

Management (Abfallwirtschaftsgesetz 2002 – AWG 2002 [7]) follows the principle of prevention and sustainability; waste prevention is at the top of the waste hierarchy.

In the pesticides area, the Federal Office for Food Safety (BAES) and the Agency for Health and Food Safety (AGES), in support of the Federal Ministry of Agriculture, Regions and Tourism (BMLRT) handle plant protection products, and the Environment Agency Austria (Umweltbundesamt GmbH), in support of the BMK, handles biocide products as defined by the Federal Law [13] implementing the Ordinance on Biocide Products [14]. On 20 March 1985, the National Council adopted the Environmental Control Act (Umweltkontrollgesetz) [15] and established the Environment Agency Austria (Umweltbundesamt). The Environment Agency Austria has had the legal form of a limited liability company (GmbH) since 1999. In the water management area, the focus regarding POPs is on the quality of surface and groundwater; the responsibility for this lies with the BMLRT. The Austrian Federal Ministry of Labor (BMA) plays a key role in occupational safety and in the use of chemicals at the workplace. Occupational safety is stipulated in the Employee Protection Act [16]. The Austrian Federal Ministry of Digital and Economic Affairs (BMDW), the BMK and the BMLRT are responsible for the implementation of the Industrial Emissions Directive (IED) [17]. A key goal is the prevention, and if this is not possible, the reduction of emissions in air, water and soil and also waste prevention, with the aim of achieving a high level of protection for the environment as a whole, especially through the use of best available techniques (BATs). The emission levels associated with the BATs (BAT AEL-BAT) represent a core element in the conclusions on the best available techniques for specific industrial sectors and waste treatment plants published under the European Commission directive. The authorities may set less stringent emission limit values than the BAT AELs only in special cases, for example because of the geographic location and local environmental conditions of the facility concerned, or because of the technical features of the facility concerned. In Austria, no one has taken advantage of this exemption possibility thus far. As stipulated by the directive, environmental inspections are performed on a routine basis at the large industrial plants and waste treatment plants in Austria. The summary reports on the outcomes of the individual environmental inspections are published centrally on the internet. secure.umweltbundesamt.at/edm_portal/cms.do?get=/portal/informationen/ie-richtlinie-und-ippc-anlagen/inspektionsberichte.main.

At an institutional level, the Environment Agency Austria, in its capacity as a center of scientific expertise, monitors environmental quality and routinely reports on the status of the environment in Austria. The Environment Agency Austria prepares studies on

chemicals in different environmental fields and manages the REACH Helpdesk on behalf of the BMK. The REACH Helpdesk provides support regarding questions about the REACH Regulation [18] and the CLP Regulation [19]. There is also a Biocide Helpdesk. Environment Agency Austria specialists represent Austria as national experts in the technical working groups for preparing BREFs (Best Available Technique Reference Documents) within the framework of the Directive on Industrial Emissions [17]. The Environment Agency Austria has laboratories for analyzing environmental samples, including the well-known dioxins laboratory. Since December 2020, the Environment Agency Austria has also been the national reference laboratory for halogenated persistent organic pollutants (POPs) in foods and feeds.

In the area of official food inspection, the Federal Ministry of Social Affairs, Health, Care and Consumer Protection (BMSGPK) is supported by the Agency for Health and Food Safety (AGES), which performs studies (analyses) and corresponding risk assessments of goods (foods, drinking water, cosmetics and commodities) that are subject to the Austrian Food Safety and Consumer Protection Act (LMSVG) [8]. The BMSGPK, the provincial governors within the framework of indirect federal administration and the food testing centers authorized under the LMSVG [8] (AGES and inspection centers of the provinces) inspect and monitor goods subject to the LMSVG [8] in terms of consumer health protection and consumer fraud protection, also with respect to contaminants. Official food inspection is organized in a tripartite manner. The provincial governors are responsible for carrying out inspections, whereas the AGES and the provincial agencies are responsible for the analysis and assessment of samples. The sampling plan is enacted by the BMSGPK, with consideration given to proposals by the Agency and after consultation with the provinces, and it includes testing for contaminants.

The Federal Office for Food Safety (BAES) and the Agency for Health and Food Safety (AGES) deal with, inter alia, the registration of plant protection products. The BAES monitors the placement thereof on the market. The Austrian Federal Agency for Safety in Healthcare (supported by the AGES medical market surveillance business segment) is responsible for the re-authorization and monitoring of drugs and medical devices that are already on the market. The corresponding register is kept by the Federal Agency for Safety in Healthcare.

The Federal Ministry of European and International Affairs (BMeiA) is responsible for preparing general guidelines for capacity building and technical support. It developed the

"Environment & Development" (Umwelt & Entwicklung)[4] strategic guide jointly with the BMK and non-government organizations (NGOs). A main focus herein is the implementation of multilateral environmental agreements (MEAs). Sustainable chemical and waste management (chemical safety, awareness raising, clean production in agriculture, commerce and industry, sustainable waste management) is one of the thematic fields of action.

Reducing poverty, promoting peace and protecting the environment are the three major concerns of the Austrian Development Agency (ADA)[5]. With the aim of improving living conditions in developing countries, the ADA is currently carrying out projects and conducting programs with a total volume of over 550 million euros. Jointly with the BMEIA, partner countries, public institutions, civic organizations and businesses, the ADA is working on sustainable development in Africa, Asia, and Southeastern and Eastern Europe. The ADA is funded by the BMEIA. However, other Federal Ministries, other sponsors or even the EU use the expertise of the ADA. The Austrian Development Agency has been conducting programs for the European Commission since 2008. The "Economic Partnerships" (Wirtschaftspartnerschaften) financial instrument is used to provide private funds for development cooperation: The ADA sponsors corporate projects in developing and emerging countries if they contribute to improving the life situation of the population of the region. Conformity with the global sustainable development goals (SDGs) and the national development goals of the partner countries is thus immensely important. Specific know-how, capacities and experiences are used accordingly and contribute to the preservation of global public goods (e.g., health, environment) and to climate protection. Along with the cross-sectional topic of environment and climate protection, gender equality is also an important aspect that is considered in all ADA projects and programs. Measures are also reviewed with regard to compliance with social standards.

## 2.2 Legal background

### 2.2.1 International - multilateral and regional conventions

The Stockholm Convention on Persistent Organic Pollutants [1] establishes criteria and procedures for determining which additional substances can be included in the annexes.

[4] entwicklung.at/mediathek/publikationen/strategische-dokumente

[5] entwicklung.at/ada/aktuelles/was-macht-die-oesterreichische-entwicklungszusammenarbeit

Criteria for inclusion are persistence, bioaccumulation in the human body, in animals or plants and that these substances can be transported over long distances in air, water, or via highly migratory animal species and have negative effects on human health or the environment. The scientific subsidiary body pursuant to Article 19 of the Convention, the Persistent Organic Pollutants Review Committee (POPRC), was established by the Parties[6] for the purposes of submitting proposals for inclusion in the annexes to the Conferences of Parties. The Parties decide whether a given substance shall be included in Annexes A, B and C of the Convention. According to Art. 7 of the Convention, the fulfillment of the obligations must be documented no later than two years after the entry into force thereof. Also, the National Implementation Plan shall be reviewed and updated on a routine basis. The most recent amendments by the 9th Conference of Parties (COP 9) are to be implemented by 3 December 2022. As explained in greater detail in Chapter 2.2.2.2.1., these substances have already been included in the POPs Regulation [3]. The exemptions in the Regulation are generally more stringent than the ones in the Convention.

[6] SC-1/7: Establishment of the Persistent Organic Pollutants Review Committee
The Conference of the Parties,
Decides to establish pursuant to paragraph 6 of Article 19 of the Convention a subsidiary body to be called the Persistent Organic Pollutants Review Committee for the purposes of performing the functions assigned to that Committee by the Convention;
Adopts the terms of reference of the Persistent Organic Pollutants Review Committee contained in the annex to the present decision.

Table 1 Substances included in the Stockholm Convention

| Annex | Chemical |
|---|---|
| **A - Elimination** | Aldrin |
| | Chlordane |
| | Chlordecone |
| | Decabromodiphenyl ether (c-DecaBDE) |
| | Dicofol |
| | Dieldrin |
| | Endosulfan |
| | Endrin |
| | Heptachlor |
| | Hexabromobiphenyl |
| | Hexabromocyclododecane (HBCD) |
| | Hexabromodiphenyl ether; heptabromodiphenyl ether |
| | Hexachlorobenzene |
| | Hexachlorobutadiene (HCBD) |
| | Alpha-hexachlorocyclohexane |
| | Beta-hexachlorocyclohexane |
| | Short-chained chlorinated paraffins, SCCP |
| | Lindane (gamma-Hexachlorocyclohexane) |
| | Mirex |
| | Pentachlorobenzene |
| | Pentachlorophenol and its salts and esters (PCP) |
| | Polychlorinated biphenyls |
| | Polychlorinated napthalenes (PCN) |
| | Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds |
| | Tetrabromodiphenyl ether, pentabromodiphenyl ether |
| | Toxaphene |
| **B - Restriction** | DDT |

| Annex | Chemical |
|---|---|
| **C – Unintentionally produced POPs** | Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF) |
| | DDT |
| | Hexachlorobenzene (HCB) |
| | Hexachlorobutadiene (HCBD) |
| | Pentachlorobenzene |
| | Polychlorinated biphenyls (PCB) |
| | Polychlorinated dibenzo-p-dioxins (PCDD) |
| | Polychlorinated dibenzofurans (PCDF) |
| | Polychlorinated naphthalenes |

Source: pops.int

The following chemicals are currently under review by the POP Review Committee (POPRC) for inclusion in the Convention:

- Methoxychlor
- Dechlorane Plus
- UV-238

The POP Review Committee has already made a recommendation to include perfluorohexane sulfonic acid (PFHxS), its salts and related compounds in the Convention. Should the POP Review Committee make further recommendations, these chemicals could therefore be included in the course of the 10th Conference of the Parties, which will presumably be held in June 2022. In its negotiating mandate for the 10th Conference of the Parties, the second part of which is scheduled as a face-to-face meeting for 2022, the EU has already declared itself in favor of a ban on PFHxS, without any exemptions. In 2021, the EU also proposed the pesticide chlorpyrifos as a POP candidate substance[7].

The Geneva Convention on Long-Range Transboundary Air Pollution (CLRTAP[8]) in 1983 was the first regional agreement with the aim of preventing air pollution. It was expanded

[7] Council Decision (EU) 2021/592, OJ no. L 125 of 13 April 2021; p. 52
[8] bmk.gv.at/themen/klima_umwelt/luft/luftguete/clean_air.html

by 8 protocols in the context of the UNECE, the United Nations Economic Commission for Europe. One of these is the POP Protocol [2], to which 33 parties currently belong. During the 27th meeting of the Executive Body in December 2009, it was revised by Decisions 2009/1 and 2009/2 in order to enable the inclusion of new substances.

The substances that were added to the annexes of the protocol were hexachlorobutadiene, octabromodiphenyl ether, pentachlorobenzene, pentabromodiphenyl ether, PFOS, polychlorinated naphthalenes and short-chained chlorinated paraffins. The limit values for dioxin and furan emissions from new facilities were made more stringent. The upper limit value was lowered from 0.2 or 0.5 to 0.1 nanograms per cubic meter. The duty to prepare an emissions inventory henceforth also includes polychlorinated biphenyls. The Parties also adopted modern guidelines for the best available technique for controlling POP emissions.

The revised protocol will enter into force 90 days after ratification of the decisions by two thirds of the 33 Parties. The ratification process is still underway with most of the Parties (including Austria), and the amendments have therefore not yet entered into force. The amendments were approved by the Lower Chamber of the Austrian Parliament on 10 December 2020 and by the Upper Chamber of the Austrian Parliament on 16 December 2020.

### 2.2.2 National/European Union Law

#### 2.2.2.1 Chemicals Act 1996

The most important national legal instrument for dealing with chemicals is the Federal Act on Protection of Human Beings and the Environment from Chemical Substances (Chemicals Act 1996, ChemG 1996) [5].

Article 1(1) of the Chemicals Act states the goal of this federal act as that of preventive protection of human life and health and of the environment from directly or indirectly harmful effects that can occur through the production, marketing, acquisition, use or waste treatment of substances, mixtures or products, especially by averting or preventing the occurrence of harmful effects, or by making them recognizable. In Article 20(1) regarding "Export and import of hazardous chemicals, persistent organic pollutants and mercury", it designates the Federal Minister for Climate Action as the "responsible

authority" for enforcing the POPs Regulation [3]. Under Article 20(2), he/she is responsible for implementing any measures required for documenting releases into air, waterbodies or soils or for action plans or for the National Implementation Plan. Should these measures concern business units pursuant to Article 74 of the Trade and Industry Code 1994 (Gewerbeordnung) [21] or to facilities subject to government supervision under the Mineral Raw Materials Act (Mineralrohstoffgesetz) [22], he/she shall reach an agreement with the Federal Minister of Digital and Economic Affairs or with the Federal Minister of Agriculture, Regions and Tourism, as appropriate.

The provincial governors are responsible for monitoring compliance with the provisions of the Chemicals Act and with the administrative acts based thereon, and also with the relevant European Union legislation. For the monitoring, they shall engage professionally qualified individuals as agents. The enforcement authorities of the so-called chemicals inspectorates must have specific know-how on how to handle chemicals and knowledge of the current legal situation. They are authorized to visit production sites and operations and, inter alia, to verify compliance with the provisions for production, marketing and use on the basis of written records and commercial documents. The surveillance authorities are authorized to take samples, set rules of procedure, temporarily seize and detain goods, and implement temporary enforcement and security measures. Along with general enforcement, the surveillance authorities focus on specific inspection areas in the scope of annually changing priorities for action.

In the context of the annual inspections, in recent years POP-specific investigations have been performed for PFOS in fire-fighting foams and in ski waxes, SCCPs in yoga mats and HBCCD and SCCPs in products made from recycled materials (polystyrene, fall protection mats, etc.). A national coordination network was created to support the enforcement authorities. Along with the surveillance authorities, the specialist department in the BMK responsible for chemical policy and biocides and the experts of the Environment Agency Austria responsible for chemicals and biocides are included in this network, which meets twice a year.

In its capacity as the central European authority for the implementation of the REACH Regulation [18], the European Chemicals Agency (ECHA), with headquarters in Helsinki, administers the registration, assessment, authorization and restriction of chemical substances in order to ensure a uniform procedure within the European Union, the labelling thereof pursuant to the CLP Regulation [19], the export notification procedure

pursuant to the PIC Regulation [20] and the agendas of the POPs Regulation [3][9] assigned to it since 2019. The enforcement bodies collaborate in the FORUM (Forum for Exchange of Information on Enforcement)[10]. The Forum coordinates the network of the authorities of the Member States responsible for enforcing this regulation. The members of the Forum, who are appointed by the Member States, take measures to ensure an appropriate coordination between the tasks of the Form and the work of the responsible authority of their respective Member States. In waste-related matters, the Forum also engages the enforcement authorities of the Member States responsible for waste.

#### 2.2.2.2 POPs and PBTs

##### 2.2.2.2.1 POPs according to the POPs Regulation

The most important legal act for implementing the Stockholm Convention [1] and the UNECE Protocol [2] in the EU is the POPs Regulation [3], which originally entered into force in 2004. The new version of the Regulation has been directly applicable in all Member States since 15 July 2019, even in the ones that are still not Parties to the Convention or to the Protocol.

The POPs Regulation bans the production, marketing and use of intentionally produced POP substances that are listed in the Convention and in the Protocol. General and specific exemptions to these bans are limited to a minimum. All remaining stockpiles that are not authorized for use are to be treated as hazardous wastes. In principle, waste is to be treated in such a way that the POP content is destroyed or irreversibly transformed. Exports of POPs in the case of restrictions are regulated in Annex I of the PIC Regulation [20] or in the case of total bans, forbidden by being listed in Annex V of this Regulation (also see Chapter 2.2.2.3.).

Under the Regulation, the Member States are also obligated to submit and keep comprehensive inventories on releases of POPS that are unintentional by-products of industrial processes (U-POPs) such as dioxins, furans, PCB and polycyclic aromatic hydrocarbons (PAHs), which are listed only in the POP Protocol [2], and send their national action plans regarding the measures for minimizing the overall releases of these

[9] echa.europa.eu/de/understanding-pops
[10] echa.europa.eu/de/about-us/who-we-are/enforcement-forum

substances to the Commission and to the other Member States. The action plan shall also contain measures for promoting the development of modified materials or ones serving as substitutes, and shall also include measures on products and processes that prevent the formation and release of POPs.

Waste producers and holders have a duty to implement measures to prevent wastes from becoming contaminated with POP susbstances. The waste control measures largely correspond to those of the Stockholm Convention [1]; in some aspects they are even more explicit. POP concentration limit values for wastes are listed in Annex IV of the Regulation. In principle, wastes with a POP content above these limit values must be disposed of or recycled in such a way that the POP content is destroyed or irreversibly transformed. The maximum POP concentration limits for wastes that are to be disposed of by means of a process that is preferable from an environmental standpoint (e.g., underground storage in salt domes) rather than destroyed or irreversibly transformed are established in Annex V of the POPs Regulation [3]. The Regulation also contains some general provisions concerning the implementation of the Convention.

The POPs Regulation [3] is revised on a routine basis so that amendments to the Stockholm Convention [1] on POPs and to the POP Protocol [2] can be implemented. However, a substantially revised version was necessary in order to make an adaptation to the provisions of the Treaty of Lisbon with respect to delegated acts and implementing acts pursuant to Articles 290 and 291 TFEU. The European Commission submitted a proposal to this effect on 22 March 2018. The Regulation has been binding throughout Europe since it entered into force on 15 July 2019. It is directly applicable and it establishes detailed restrictions and bans, monitoring, and legal provisions concerning wastes. Article 18 regulates the transfer of power for delegated acts; Article 20 regulates the committee procedure for implementing acts.

The basic structure and the goal (protection of human health and the environment) remain the same, although some important updates and amendments were made:

- Adaptation of the definitions of terms such as substances, mixtures, etc. to the REACH Regulation [18];
- First-time definition of the term "unintentional trace contaminants";
- Flexible procedure for the nomination of POP candidate substances by the EC and the MS; review process for the assessment of materials by the ECHA;
- Traceability of POP wastes;

- Monitoring duties of the ECHA and of the FORUM (technical and scientific expertise for assessing substances, nomination of POP candidates; drafting of technical guidelines as needed, gathering and editing reports, carrying out review processes);
- Amendment of Annexes I, II, III on delegated acts;
- Amendment of Annexes IV and V (waste limit values) on proper legislative procedure.

As a result of the recast, the substance restrictions adopted during the 7th and 8th Conferences of the Parties of the Stockholm Convention [1] have been implemented in the EU. Limit values for unintentional trace contaminants (10 ppm in substances, 500 ppm in mixtures and products as a total value for all BDEs) and precisely defined exemptions for the aircraft and automotive industries were established for DecaBDE, a brominated flame retardant. The provisions concerning PCBs were also made more stringent – by 2025, all technical equipment containing more than 50 ml and more than 0.005% PCBs shall be taken off the market.

The delegated act amending Annex I[11], which contains the restrictions for PFOA on the grounds of the decision during the 9th Conference of the Parties (COP 9) of the Convention, entered into force as of 4 July 2021. A limit value of 0.025 ppm for unintentional trace contaminants was established for PFOA and PFOA-related substances. In addition, PFOA may be used for a limited period in semiconductor production, for photographic coatings, in textiles for worker protection, in invasive and implantable medical devices, and for the production of polytetrafluoroethylene (PTFE) and polyvinylidene fluoride (PVDF) for specific applications in the automotive industry. The Regulation establishes precise conditions for the use of existing stockpiles of PFOA-containing firefighting foams in mobile and fixed systems (see Chapter 3.1.3.)

[11] Commission Delegated Regulation (EU) 2020/784 of 8 April 2020 amending Annex I to Regulation (EU) 2019/1021 of the European Parliament and of the Council as regards the listing of perfluorooctanoic acid (PFOA), its salts and PFOA- related compounds, OJ L 188 I, p.1

Other delegated acts amending Annex I relate to a ban of dicofol[12], to the adaptation of the entry for PFOS[13] and to the establishment of a limit value for pentachlorophenol[14]. These amendments are based on decisions of the 9th Conference of the Parties (COP 9). Nearly all exemptions were cancelled for PFOS. At the present time in the EU, there is only one exemption for the use of PFOS as an antifogging agent for hard chrome plating in closed, fixed systems.

Wastes containing or contaminated with substances listed in Annex IV can be eliminated or recycled in other ways in keeping with relevant European Union laws, provided that the levels of listed substances in the wastes fall below the concentration limit values established in Annex IV. Annexes IV and V establishing limit values for wastes shall be adapted on the basis of a proposal by the Commission, which is expected for the 3rd quarter of 2021.

#### 2.2.2.2.2 Persistent substances according to the REACH Regulation

The REACH Regulation [18] was adopted in December 2006 by the Council and the European Parliament and it has been in force since 6 June 2007. The purpose of the Regulation is to increase the state of knowledge on the properties of chemicals and on the contamination that they cause, as well as to improve risk management in the area of chemical substances.

In the context of the REACH System (Registration, Evaluation, Authorization and Restriction of Chemicals), companies that produce or import more than a ton annually of a chemical substance must get this substance registered in a central database and submit a specific set of basic data on it. The Regulation transferred more responsibility to industry for managing the risks posed by chemicals and for providing safety information on the substances. This information is then passed along the supply chain.

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[12] Commission Delegated Regulation (EU) 2020/1204 of 9 June 2020 amending Annex I to Regulation (EU) 2019/1021 of the European Parliament and of the Council as regards the listing of dicofol, OJ L 270 of 18 August 2020, pp. 4–6

[13] Commission Delegated Regulation (EU) 2020/1203 of 9 June 2020 amending Annex I to Regulation (EU) 2019/1021 of the European Parliament and of the Council as regards the entry for perfluorooctane sulfonic acid and its derivatives (PFOS), OJ L 270 of 18 August 2020, pp. 1–3

[14] Commission Delegated Regulation (EU) 2021/277 16 December 2020 amending Annex I to Regulation (EU) 2019/1021 of the European Parliament and of the Council on persistent organic pollutants as regards pentachlorophenol and its salts and esters, OJ L 62 of 23 February 2021, pp. 1–3

Substances of very high concern (SVHCs) must undergo the authorization procedure. SVHCs include substances having CMR (carcinogenic, mutagenic, teratogenic) properties and PBT/vPvB (persistent, bioaccumulative, toxic/very persistent, very bioaccumulative) properties. The PBT Expert Group, which was established in 2012 by a meeting with authorities responsible for REACH [18] and CLP [19] (CARACAL), has the mandate to provide informal, non-binding recommendations on the identification of PBT/vPvB substances. The Group is coordinated and hosted by the ECHA, with the participation of experts from EU Member States as well as from Norway and NGOs. Austria is a collaborator in this Group and carries out assessments of substances in order to determine if they possess PBT and/or vPvB properties. The substance assessments performed by the expert group can also be used as a basis for compiling dossiers for POP candidates, or the Group can also be commissioned to test substances to determine if they fulfill the POP criteria of the Stockholm Convention [1].

#### 2.2.2.3 Import and export of hazardous chemicals (PIC)

Another important EU legal instrument is the PIC Regulation [20], which implements the Rotterdam Convention [10] on the PIC (Prior Informed Consent) procedure for certain hazardous chemicals and pesticides in international trade. In Annex V, it includes an export ban on POP substances listed in the Stockholm Convention [1], unless numerous exemptions permit the use of the less stringent form of the PIC procedure.

#### 2.2.2.4 Pesticides (plant protection products and biocides)

The EU Regulation concerning the placing of plant protection products on the market [23] divides the EU into three zones in which harmonized authorizations apply. Austria, Belgium, Germany and the Netherlands are assigned to the "Central" zone. The authorization requirements were made more stringent: As a rule, substances deemed especially hazardous shall no longer be re-authorized after expiry of their current authorization. First of all, substances which are demonstrably or very likely carcinogenic, mutagenic or toxic to reproduction under the EU classification scheme are subject to the exclusion criteria. Materials that are potentially harmful to human and animal endocrine system (e.g., POPs) shall likewise not be re-authorized. In principle, a plant protection product can only be authorized if its active substances are approved, except in the case of an emergency situation, i.e., if a "measure proves necessary in the event of a danger that cannot be averted otherwise."

The Biocidal Product Regulation [14] provides for a national approval procedure or Union-wide authorizations for biocidal products according to harmonized standards. The Regulation on the placing on the market and the use of biocidal products applies to numerous different product types, including insecticides, disinfectants and repellents. The regulation also contains provisions concerning treated goods. The rules for excluding highly hazardous biocide active substances from inclusion in an EU list of approved active substances ("Union List", Annex I) have been amended to include environmental criteria (PBT, vPvB, POP properties) in the regulation text as further exclusion criteria.

#### 2.2.2.5 Industrial emissions

The Industrial Emissions Directive[15] (IED) [17]) is especially relevant for U-POPs. Under this directive, the EU Best Available Techniques (BAT) Reference Documents (BREFs) were drafted in the scope of an exchange of information with the European Commission, the Member States, the industry associations and the environmental protection organizations. The "best available techniques" and BAT-associated emission levels (BAT-AELs) derived therefrom are summarized in the BAT conclusions, which the European Commission published as implementing decisions for the individual industry sectors and for certain waste treatment plants. They are to be used as a basis for granting approvals. The Austrian Trade and Industry Code 1994 (Gewerbeordnung 1994) [21] implements the IED [17] for the business premises area. Among other things, it regulates the construction, operation, ongoing review and shutdown of the production facilities used for conducting business (business premises law) and is therefore one of Austria's most important environmental laws relating to production facilities. The Industrial Emissions Directive [17] has also been implemented in numerous different federal and regional laws and regulations, e.g., in the 2002 Waste Management Act [7], the Water Rights Act [6], the Mineral Raw Materials Act [22], the Emission Protection Act for Steam Boilers (Emissionschutzgesetz für Kesselanlagen, EG-K) [24], the Austrian Ambient Air Quality Act (Imissionsschutzgesetz, IG-L) [25], and in individual laws at the provincial level. Sector-specific emission limit values are contained in, for example, the regulations of the Austrian Trade and Industry Code [21], the wastewater discharge regulations based on the Water

[15] ec.europa.eu/environment/industry/stationary/ied/legislation.htm, bmk.gv.at/themen/klima_umwelt/betrieblich_umweltschutz/anlagenbezogen_uws/industrieemissions_rl.html, bmdw.gv.at/Themen/Technik-und-Vermessung/betriebsanlagentechnik/Industrieemissions-Richtlinie.html

Rights Act (WRG), the Emission Protection Act for Steam Boilers (EG-K) [24] and the waste combustion regulation according to the Emission Protection Act for Steam Boilers (EG-K).

The European Pollutant Release and Transfer Register (E-PRTR, prtr.ec.europa.eu/ ) is a publicly accessible electronic database with information on large industrial operations and sewage treatment plants concerning releases of pollutants to air, water and soil, offsite transfer of pollutants contained in wastewater and offsite transfer of hazardous and non-hazardous waste. The PRTR also contains data on diffuse emissions to air. The E-PRTR encompasses all U-POPs listed in the POPs Regulation [3]. (For more on this, also see umweltbundesamt.at/umweltthemen/industrie/daten-industrie/prtr).

A national database on pollutants in surface waters was created in 2009. According to the Emissions Registry Regulation 2017 [26], it encompasses facilities that are wholly or partially dedicated to carrying out one of the industrial activities cited in Appendix I of the IED [17], municipal sewage treatment plants (no less than 2000 EW60[16]) and industrial-scale direct emitters from the food processing sector with a rated value greater than 4000 EW60.

Chapter IV of the IED [17] on waste incinerators encompasses all waste incinerators and thus pertains to an extremely important source of U-POPs. In addition to any applicable BAT conclusions, it establishes minimum limit values for emissions of dioxins/furans in air (0.1 ng I-TEQ/m3) and in water (0.3 mg/l). Furthermore, the BAT conclusions for waste incineration were adopted as a result of the specifications of Chapter II of the directive. Accordingly, an initial inspection is mandatory when using POP wastes, as are additional monitoring obligations for emissions of PCB and PBDD/F in air in the event that wastes containing brominated flame retardants are incinerated.

Directive 2000/53/EC on end-of-life vehicles [27] mandates the removal of hazardous substances from the vehicle before the vehicle body is shredded and proper disposal of the shredder residues. The repealed directives of the European Parliament and of the Council on waste electrical and electronic equipment (Directive 2002/96/EC [28]) and on the restriction of use of certain hazardous substances in electrical and electronic equipment (Directive 2002/95/EC [29]) established the obligatory removal of PCB-

[16] EW60 = population equivalent or unit per capita loading (PE). It refers to the individual pollution load in household sewage produced by one person in 24 hours. One unit equals 60 grams of biochemical oxygen demand (BOD) per day.

containing components in order to ensure the proper disposal thereof and restrict the use of certain hazardous substances in electrical and electronic equipment. The RoHS Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) [30] has as a goal the reduction of the quantity of hazardous substances in electrical and electronic equipment, including PBB and PBDEs[17].

Because PAHs can substantially pollute ambient air as well, under EU legislation they are the only POPs that are subject to target values or limit values in terms of air quality. Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air [31] contributes to the improvement of air quality. In implementation of this directive, the currently valid limit value according to Annex 1a of the Air Pollution Control Act (IG-L) for benzo(a)pyrene is 1 ng/m3 (total content in the PM10 fraction averaged over a calendar year).

On 1 June 2015, the Seveso-III Directive (2012/18/EU) of 4 July 2012 [32] amended and subsequently repealed the Seveso-II Directive (96/82/EG) on the control of major-accident hazards. The immediate cause of this was the adaptation to changes to the classification of hazardous materials according to the CLP Regulation [19]. It is an important EU legal instrument in terms of preventing accident-related releases of hazardous substances from facilities.

#### 2.2.2.6 Waterbodies

Art. 16 of the Water Framework Directive (WFD, Directive 2000/60/EC, [33]) calls for strategies against the pollution of water by individual pollutants or groups of pollutants posing a significant risk to or via the aquatic environment. The list of these priority substances according to the WFD also contains POPs and EU-wide environmental quality standards for the same. The list of priority substances is to be revised and updated every six years. The specifications are implemented in the Austrian Surface Water Quality Ordinance (Qualitätszielverordnung – QZV Chemie OG) [34]. In addition to the EU-wide regulated pollutants, the QZV Chemie OG also contains specifications for nationally regulated pollutants. This list of nationally regulated pollutants also includes POPs.

[17] ec.europa.eu/environment/waste/rohs_eee/index_en.htm

Table 2 Union-wide regulated substances according to the WFD [33] (in the version of Directive 2013/39/EU)

| Parameter | CAS No. | AA-EQS (µg/l) | MAC-EQS (µg/l) | Biota (µg/kg) | PHS |
|---|---|---|---|---|---|
| **Aldrin** | 309-00-2 | Σ 0.01 | n. a. | - | - |
| **Dieldrin** | 60-57-1 | Σ 0,01 | n.a. | - | - |
| **Endrin** | 72-20-7 | Σ 0,01 | n.a. | - | - |
| **Brominated diphenyl ether (pentabromodiphenyl ether)** | 32534-81-9 | - | 0.14 | 0.0085 | X |
| **C10-13 chloroalkanes** | 85535-84-8 | 0.4 | 1.4 | - | X |
| **p,p´-DDT** | 50-29-3 | 0.01 | n. a. | - | - |
| **Total DDT** | - | 0.025 | n. a. | - | - |
| **Dioxins and dioxin-like compounds** | - | - | n. a. | 0.0065 TEQ | X |
| **Endosulfan** | 115-29-7 | 0.005 | 0.01 | - | X |
| **Hexabromocyclododecane (HBCDD)** | - | 0.0016 | 0.5 | 167 | X |
| **Hexachlorobenzene** | 118-74-1 | - | 0.05 | 10 | X |
| **Hexachlorobutadiene** | 87-68-3 | - | 0.6 | 55 | X |
| **Hexachlorocyclohexane** | 608-73-1 | 0.02 | 0.04 | - | X |
| **Heptachlor and heptachlor epoxide** | 76-44-8 1024-57-3 | 0.0000002 | 0.0003 | 0.0067 | X |
| **PAH** | - | 0.00017 - 2.0 | 0.0082 - 130 | 5 | X |
| **Pentachlorobenzene** | 608-93-5 | 0.007 | n. a. | - | X |
| **Pentachlorophenol** | 87-86-5 | 0.4 | 1 | - | - |
| **Perfluorooctane sulfonic acid and its derivatives (PFOS)** | 1763-23-1 | 0.00065 | 36 | 9.1 | X |

Table 3 Nationally relevant substances

| Parameter | CAS No. | AA-EQS (µg/l) |
|---|---|---|
| **Chlordane** | 57-74-9 | 0.002 |

As regards water pollution, Art. 30 of the Water Rights Act WRG 1959 [6], which defines the goals, stipulates that all waterbodies, including groundwater, are to be kept clean and protected in such a way that:

- human and animal health cannot be endangered,
- adverse effects on the landscape and other tangible damage can be avoided,
- a deterioration is avoided, and the condition of aquatic ecosystems and land ecosystems directly dependent thereon and wetlands are protected and improved in terms of their water resources,
- sustainable water use based on long-term protection of the existing resources is promoted,
- an improvement of the aquatic environment is ensured, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of hazardous pollutants.

In particular, groundwater and spring water are to be kept sufficiently clean so that it can be used as drinking water.

The goal of the act is to ensure that Austria does not have to resort to processing groundwater in order to produce drinking water. Comprehensive measures serve to achieve this goal, including:

- Consistent monitoring program for groundwater resources throughout Austria with ca. 2000 sampling points and four samplings per year;
- Regulations as well as consultation in the water protection field;
- Groundwater protection-enhancing renovation work and landfill conditions.

In keeping with the Drinking Water Regulation (Trinkwasserverordnung, TWV) [35] pursuant to the Food Safety and Consumer Protection Act [8], water must be suitable for drinking or use without endangering human health. The water must be in compliance with the established minimum requirements for microbiological and chemical parameters.

Water protection, specifically the testing and assessment of the chemical and ecological state of lakes, waterways and groundwater as well as the monitoring of sewage treatment plants and industrial wastewater, is carried out by the provinces in indirect federal administration.

#### 2.2.2.7 Waste

Austrian waste legislation is governed by the Federal Act on sustainable waste management, the Waste Management Act 2002 (Abfallwirtschaftsgesetz 2002, AWG 2002) [7] and the relevant regulations. EU waste legislation, in particular the Waste Framework Directive [36], is thus implemented in Austria. The act contains general provisions for preventing, collecting and treating waste as well as requirements for treatment plants, and most importantly, specific underlying obligations that must be fulfilled by waste holders as regards the treatment of hazardous waste streams. A principal element is the 5-step waste hierarchy (prevention, preparation for reuse, recycling, other recovery (e.g., energy recovery, disposal).

On 14 June 2018, the amendment to the Waste Framework Agreement [36] was published in the Official Journal of the EU, as part of the Circular Economy Package. The aim of this, inter alia, is to improve the flow of information on substances of very high concern so that these substances can be sorted out prior to recycling and thereby contribute toward pollutant-free material cycles (see the EC website ec.europa.eu/environment/topics/waste-and-recycling/waste-framework-directive_en)

AWG 2002 [7] also contains fundamentals on the collection, coordination, and financing of waste electrical and electronic equipment. Also see Chapter 2.2.2.5 for information on the RoHS Directive [30].

Although POPs are not explicitly mentioned in the Landfill Regulation 2008 (Deponieverordnung 2008 – DVO 2008) [37], they are included in a few sum parameters for organic pollutants. The Waste List Ordinance [38] was announced in the Federal Law Gazette II No. 409/2020. Under the new version, in particular the harmonized hazardous properties for wastes in the European Union were incorporated in the Waste List Ordinance [38], and hazardous properties as yet non-harmonized in the EU were specified on the national level for eluates.

Provisions for the evaluation of hazardous properties as well as the criteria for classifying individual waste types were also adapted accordingly. The provisions concerning the exemption of hazardous wastes were clearly and transparently integrated in the Waste List Ordinance [38] as much as possible.

The ordinance entered into force on 1 October 2020. Annex 1 (Waste list) and Annex 2 (Waste list classification criteria) will enter into force on 1 January 2022.

The Basel Convention [11] and OECD Council Decision C (2001)107 (two-list system, "green and yellow waste list") are implemented in Union law under Regulation (EC) No. 1013/2006 on shipments of wastes [39]. A bilateral "treaty between the government of the Republic of Austria and the government of the Federal Republic of Germany on transboundary movements of wastes according to Article 30 of Regulation (EC) no. 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of wastes" was announced in Federal Gazette III 72/2009. This treaty provides some simplifications for certain waste shipments in the border area of Austria and Germany (cf., for example, the specific situation of Kleinwalsertal), namely for excavated soil, construction debris, waste electrical equipment, etc. (announced in the Federal Law Gazette on 26 June 2009).

Another significant legal instrument is Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT) [40]. This directive aims at the disposal of PCBs and of equipment containing PCBs in order to eliminate them as quickly as possible. For equipment with a PCB filling volume of over 5 dm3, this had to occur before the end of 2010. The conditions for environmentally sound PCB disposal are established in this directive. The Austrian plan for the decontamination and/or disposal of waste equipment containing PCBs according to Art. 11 of Directive 96/59/EC [40] is in Chapter 6.3.5.1 of Federal Waste Management Plan 2017. Art. 16(2) of the Waste Management Act 2002 (AWG 2002) [7] contains the obligation to hand over wastes containing PCBs (total content > 30 ppm) without undue delay to an authorized waste collection facility or waste treatment facility and to thermally dispose of them in facilities approved for that purpose. Alternative methods of disposal are permissible, provided that environmental protection regulations and state of the art equivalent to those of incineration are respected. Furthermore, wastes containing PCBs may not be sorted out from other substances for recycling purposes. Any equipment/components which contain PCBs and which are components of other

equipment shall be removed and collected separately, provided that this is feasible with reasonable effort and expense.

Under the POPs Regulation [3], according to Art. 16 (4) of the Austrian Waste Management Act 2002 [AWG 2002] [7] wastes containing POPs must be incinerated or the POPs in the wastes must be destroyed by an equally effective method. Art. 16(4) of the act also makes provision for the underground storage, according to Annex V Part 2 of the POPs Regulation [3], of hazardous wastes in secure, deep hard rock formations, in salt mines or in landfills. However, this option is not available in Austria at the present time.

The WEEE (waste electrical and electronic equipment) Directive [41] and the RoHS Directive [30] are implemented in the Waste Electrical Equipment Ordinance [42]; the latter also regulates, inter alia, POPs (ban on the marketing of electrical and electronic equipment, including cables and spare parts for repair, containing more than 0.1% PBB or PBDE per homogeneous material).

The Waste Treatment Obligation Ordinance [43] requires that PCB-containing components and plastics with brominated flame retardants be stripped from waste electrical and electronic equipment. Requirements concerning the storage, transport and treatment of wastes containing PCBs (in particular a minimum destruction removal efficiency of 99.999% for PCBs) must also be observed. Furthermore, the ordinance explicitly establishes that recycling of plastic and wooden housings with heavy metal-containing or halogenated additives (which include, inter alia, brominated flame retardants) is only permissible in such cases in which the respective substances or additives have to be added to the new product due to technical requirements (e.g., fire protection), and the adding is not banned under other legislation. In recycling in the electronic industry, there is thus a permissible limit value for total PBDE (including decaBDE) of 0.1%. In the case of recycling options in other areas, the POPs Regulation [3] must be observed and compliance with the use restrictions according to Annex XVII of the REACH Regulation [18] is also required.

In terms of POP levels in plastic recyclates and products produced therefrom, Annex I of the POPs Regulation [3] contains additional and more stringent restrictions for flame retardants that are designated as POPs. Diluting wastes in order to comply with specific limit values such as these is not permissible under the mixing ban pursuant to Art. 15(2) AWG 2002 [7].

Pursuant to the POPs Regulation [3], a limit value of 1000 mg/kg for the destruction or irreversible transformation of POPs applies to hexabromocyclododecane (HBCDD), which was only used in very minor amounts in the electronics industry as a fire retardant.

The EU End-of-Life Vehicle (ELV) Directive [27] was implemented in Austria by the Ordinance on the prevention of waste from, collection and treatment of end-of-life vehicles (End-of-Life Vehicle Ordinance) [44]. Pollutant restrictions and specifications relating to the bioremediation of end-of-life vehicles prior to recycling/shredding were established.

The Recycled Construction Materials Regulation [45] makes provision for, inter alia, a largely mandatory investigation for pollutants and impurities before demolition and is considered a measure for reducing POP releases. Furthermore, provision is made for the sorting of hazardous and non-hazardous wastes during the performance of construction and demolition work.

#### 2.2.2.8 Drinking water, food and feed

The Food Safety and Consumer Protection Act (LMSVG) [8] regulates most importantly the requirements for foods and the responsibility of the entrepreneurs associated therewith. It applies to all production, processing and marketing stages (Art. 1(1). Among other things, it is forbidden to place foods on the market that are not safe, i.e., are harmful to health or unfit for human consumption, or which do not comply with the relevant legal acts of the EU (Art. 5 (1) lines 1+3).

In the EU food law relating to contaminants (Commission Regulation 315/93, Commission Regulation 1881/2006), certain POPs (dioxins, furans, PCB, PAH) are regulated with maximum levels or reference values. Maximum residue limits (Commission Regulation 396/2005) are set for organochlorine pesticides in foods, and in addition there are action values that apply in Austria (decree). The European Commission has also published monitoring recommendations for individual classes of POPs (dioxins, furans, PCB, PFAS, brominated flame retardants), which are directed to the Member States.

In the drinking water area, the European Commission published the recast of the Drinking Water Directive [46] in December 2020. It contains a parameter value of 0.10 µg/l for the combined total of 20 PFAS, which with regard to water are considered to be of concern for human use.

Other relevant, legally-binding texts are:

Decree of the Federal Ministry of Social Affairs, Health, Care and Consumer Protection (BMSGPK) on action values for certain contaminants in foods, verbrauchergesundheit.gv.at/lebensmittel/buch/codex/beschluesse/Aktionswerte_fuer_bestimmte_Kontaminanten_in_Lebensmitteln_7.pdf

Council Regulation (EEC) No. 315/93 of 8 February 1993 laying down community procedures for contaminants in food (consolidated version of 7 August 2009), eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:01993R0315-20090807&from=DE

Commission Regulation (EC) No. 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs (consolidated version of 14 October 2020), eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:02006R1881-20201014&qid=1626778755225&from=DE

Regulation (EG) No. 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on foods and feeds of plant and animal origin and amending Council Directive 91/414/EEC (consolidated version of 9 July 2020), eur-lex.europa.eu/legal-content/DE/TXT/?qid=1598002967093&uri=CELEX:02005R0396-20200709

Commission recommendation of 16 November 2006 on the monitoring of background levels of dioxins, dioxin-like PCBs and non-dioxin-like PCBs in foodstuffs (2006/794/EC), eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32006H0794&from=DE

Commission Recommendation of 17 March 2010 on the monitoring of perfluorinated alkyl substances in foodstuffs (2010/161/EU),eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:068:0022:0023:DE:PDF

Commission Recommendation of 3 March 2014 on the monitoring of traces of brominated flame retardants in foods (2014/118/EU), eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32014H0118&from=DE

According to Commission Recommendation of 3 December 2013 on the reduction of the presence of dioxins, furans and PCBs in feeds and foods (2013/711/EU), amended by Commission Recommendation of 11 September 2014 (2014/663/EU), the Member States

shall monitor for the presence of polychlorinated dioxins and furans, dioxin-like PCBs and non-dioxin-like PCBs by random sampling. Continuous monitoring for dioxins and PCBs (as well as for perfluorinated alkyl substances and brominated flame retardants as required) in foods is therefore carried out in Austria in the scope of an annual campaign.

This continuous monitoring is not only carried out to document the contamination level of Austrian foods, which has remained consistently very low over the years, but also to detect possible regional hot spots (in the context of incidental findings).

Because hexachlorobenzene (HCB) emissions were detected from a cement plant in the Carinthian Görtschitztal in 2014, the scope of testing of the monitoring was expanded to include the organochlorine pesticides listed in the Stockholm Convention [3] starting in 2015. From this point on, locally produced foods were sampled specifically in areas around emitting industrial operations, waste (co-) incineration plants and bulk waste landfills (see additional information in Chapter 3.2.).

The tested foods predominately comprise high-fat products of animal origin, although foods of plant origin are also tested occasionally. From 2010 to 2020, 251 samples were taken from foods produced in Austria, from direct marketers and butchers. The samples of foods of animal origin included meat and meat products, lamb liver, muscle meat of fish, milk and dairy products such as yogurt, cream, cheese and butter, chicken eggs and fat from cattle and pigs, and also honey. From the group of foods of plant origin, vegetable oils and fats, oilseeds, nuts, vegetables and herbs were sampled. The Environment Agency Austria tested all samples for dioxins and PCBs. The analysis for organochlorine pesticides was conducted at the Institute for Food Safety Innsbruck of the Austrian Agency for Health and Food Safety (AGES).

Table 4 gives an overview of all food groups tested from 2012 to 2020 and of the average levels of non-dioxin-like PCBs (NDL-PCB), dioxin-like PCBs (DL-PCB) and polychlorinated dioxins and furans (PCDD/F).

Table 4 Overview of the foods tested during the 2012 – 2020 environmental monitoring and of their average levels of non-dioxin-like PCBs (NDL-PCB), dioxin-like PCBs (DL-PCB) and polychlorinated dioxins and furans (PCDD/F)

| Product group according to Commission Regulation 1881/2006 or EU Recommendation 2014/663/EU | Food | N | Total NDL-PCB (ng/g) | Total DL-PCB (pg/g) | Total PCDD/F (pg/g) | Unit based on |
|---|---|---|---|---|---|---|
| **Meat and meat products (excluding edible by-products of butchering) of** | Cattle and sheep | 43 | 5.17 | 0.77 | 0.49 | fat |
| | Poultry | 7 | 3.80 | 0.22 | 0.32 | fat |
| | Pigs | 31 | 1.89 | 0.09 | 0.28 | fat |
| | Gamebirds | 2 | 5.14 | 0.83 | 0.75 | fat |
| | Pigs and cattle combined | 1 | 1.20 | 0.12 | 0.32 | fat |
| **Lamb liver and products processed therefrom** | Lamb liver | 1 | 4.81 | 0.35 | 1.50 | fresh weight |
| **Muscle meat of fish and fishery products, and products processed therefrom** | Freshwater fish | 12 | 3.14 | 0.17 | 0.23 | fresh weight |
| **Raw milk and dairy products, including butterfat** | Raw milk | 18 | 2.22 | 0.37 | 0.31 | fat |
| | Fermented dairy products | 3 | 7.33 | 0.70 | 0.13 | fat |
| | Cheese | 29 | 4.09 | 0.29 | 0.21 | fat |
| | Butter and clarified butter | 17 | 3.75 | 0.45 | 0.29 | fat |
| **Chicken eggs and egg products** | Chicken eggs | 63 | 4.25 | 0.37 | 0.49 | fat |
| **Fat from** | Cattle | 2 | 2.90 | 0.52 | 0.47 | fat |
| | Pigs | 2 | 0.98 | 0.07 | 0.22 | fat |
| **Vegetable oils and fats** | Cooking oils | 6 | 1.53 | 0.04 | 0.18 | fat |
| **Clays as food supplements** | Mineral powder | 1 | 0.29 | 0.03 | 0.08 | fresh weight |
| **Grains and oilseeds** | Oilseeds | 4 | 0.51 | 0.03 | 0.09 | fresh weight |

| Product group according to Commission Regulation 1881/2006 or EU Recommendation 2014/663/EU | Food | N | Total NDL-PCB (ng/g) | Total DL-PCB (pg/g) | Total PCDD/F (pg/g) | Unit based on |
|---|---|---|---|---|---|---|
| **Fruit and vegetables (including fresh herbs)** | Horseradish, zucchini, marjoram, parsley, apple mint | 7 | 0.79 | 0.04 | 0.05 | fresh weight |
| **Nuts** | Nuts | 1 | 0.08 | 0.02 | 0.05 | fresh weight |
| **Honey** | Honey | 1 | 0.06 | 0.00 | 0.02 | fresh weight |

Out of the 251 samples, the action levels and maximum levels for dioxins and PCBs were within compliance in 248 samples (> 98 %). The maximum level for dioxin of 1.0 pg/g fat was exceeded (1.87 pg/g fat) in one sample of pork bacon, and consequently the maximum level for total dioxins and dioxin-like PCBs of 1.25 pg/g fat was also exceeded. The action level for dioxin-like PCBs in beef of 1.75 pg/g fat was exceeded in one sample of veal and in one sample of beef.

178 samples from the continuous monitoring have also been tested for organochlorine pesticides of the Stockholm Convention since 2015. Hexachlorobenzene was detected in three butter samples, in one clarified butter sample, in two pumpkinseed oil samples and in one bacon sample. The concentrations were below the statutory maximum levels. Nevertheless, the authority was notified to search for possible contamination sources because hexachlorobenzene is normally not detectable in milk and meat and products thereof in Austria.

Regarding drinking water, 259 drinking water samples were taken in 2018 during Campaign 031-18[18] - organic trace substances in drinking water. These samples were tested for 12 different PFAS. The goal was to determine whether drinking water throughout Austria might be contaminated with these organic trace substances. PFAS were found in quantifiable levels, at an average concentration of 22.7 ng/l, in 12% of the samples (30 positive samples). The highest total concentration measured was 99.3 ng/l in one sample, and total concentrations of 50 – 80 ng/l were found in three other samples.

[18] More detailed information on Campaign A-031-18 is available under the following link: https://wissenaktuell.ages.at/organische-spurenstoffe-in-trinkwasser-monitoring/

Out of the group of perfluorinated sulfonic acids, perfluorooctane sulfonic acid (PFOS) as well as the shorter-chain perfluorobutane sulfonic and perfluorohexane sulfonic acids were detected, mostly together. Out of the group of perfluorinated carbonic acids, perfluorooctanoic acid (PFOA) and perfluorohexane acid as well as isolated longer-chain homologues were positively identified. Contaminations were found in nearly all provinces. In 2018, the results were evaluated on the basis of the tolerable daily intakes (TDI) of 150 ng/kg bw per day and 1500 ng/kg bw per day for PFOS and PFOA, respectively, which were established in 2008 by the European Food Safety Authority (EFSA). On the basis of these high tolerable intake levels, no risk could be derived. However, the EFSA derived a significantly lower tolerable weekly intake level for the total of the four PFAS (PFOA, perfluorononanoic acid (PFNA), perfluorohexane sulfonic acid (PFHxS) and PFOS) of only 4.4 ng/kg bw per week [48] in 2020. This lower level was recently reviewed and confirmed by the German Federal Institute for Risk Assessment (BfR) and recommended for assessing risks posed by PFAS [49]. Based on the substances tested at that time, all of the total concentrations in the above-mentioned campaign lie below the parameter value (0.1 µg/l) established by the EU Drinking Water Directive 2020/2184 [46] for the total of the 20 PFAS. The PFAS investigation program for drinking water is also being conducted in 2021.

As for POPs in feeds, the directive on undesired substances in animal feed (Directive 2002/32/EC [50]) covers nearly all listed substances as well as most potential POPs. The Feedstuffs Act 1999 (Federal Act on the production, placing on the market and use of feedstuffs, premixes and additives - FMG 1999 [51] and the Feedstuffs Ordinance 2010 [52] establish corresponding limit values for dioxins and certain pesticides in some feed materials, feed supplements and feeds.

Because the provinces are involved in the sampling process, up to a third of the samples are taken directly on farms.

Among other things, the feed samples are tested primarily for the following:

- illegal substances such as hormones and medications, as well as banned and approved additives such as pesticides;
- PCBs and dioxins;
- heavy metals;
- animal ingredients;
- Salmonella;
- GMOs.

The Austrian Agency for Health and Food Safety (AGES) and the Environment Agency Austria are responsible for the testing of the official samples. The national reference laboratory established under EU Control Regulation [53] for the analysis of dioxins and PCBs as residues in live animals and animal products is also situated in the Environment Agency Austria.

In 2001, the Commission adopted a communication on a Community strategy for dioxins, furans and polychlorinated biphenyls [54] in response to a series of serious incidents involving the contamination of feeds and foods. The aims of this strategy are to assess the status quo of the environment and of the ecosystem, to reduce human exposure to dioxins and PCBs in the short term, to reduce human exposure to a safe level in the mid- and long-term, and to reduce the impacts of dioxin on the environment. The strategy per se forms a Union-wide action plan for reducing and eliminating these POP releases.

The measures for short-term reduction of human exposure include the creation of legislation in which limit values are established for the concentration of dioxins, furans and dioxin-like PCBs in foods and feeds. In order to prevent new releases and to combat the already existing environmental contamination, measures for identifying emitters, for controlling emissions and for controlling environmental quality are proposed in the strategy. The strategy also underscores the need for research, for information transfer to the public and concerning the establishment of a common methodology for continuous monitoring. A further reduction of these hazardous substances is taking place through the identification of unintentional trace contaminants and the lowering of the limit values in POP wastes in the scope of the POPs Regulation [3]. A further reduction of these hazardous substances is being brought about by setting thresholds for unintentional trace contaminants and lowering the limit values in POP wastes in keeping with the POPs Regulation [3].

#### 2.2.2.9 EZA Strategy

In 2001, the European Commission adopted a strategy for integrating the environment in Community economic and development cooperation. This strategy for integrating the environment illustrates how (in the greater context of poverty eradication) Community economic and development cooperation can support partners in developing countries in the best possible manner in overcoming present-day challenges in the environmental area. This includes specific environmental support measures as well as the integration of the “environment” protected object in all existing instruments and programs. At the policy level, this means exploiting the synergies existing between poverty eradication and the environmental area. A more consistent and improved networking with trade, agricultural, fishery, transport and energy policy is crucial. At the operative level, an improved dialog with the partner countries during the program planning in terms of support for the countries and regions offers opportunities for integrating environmental considerations in development cooperation, with the aim of minimizing the risks to human health and to the environment posed by POPs.

# 3 Legal Framework Conditions and Monitoring of the Environmental Status

This chapter describes in detail the measures contained in the Stockholm Convention for reducing POPs and the form in which these provisions and measures for monitoring the environmental status have already been implemented in Austria.

## 3.1 Intentionally produced POPs subject to a ban or a restriction

In Article 3 of the Convention, the production, use, import and export of POPs that are intentionally produced and listed in Annex A of the Convention is generally forbidden.

The substances that are subject to a restriction are listed in Annex B. A production- or use-specific exemption or an acceptable application may apply to a chemical listed in Annex B. DDT and the group of perfluorooctane sulfonates (PFOS and its salts and PFOSF - perfluorooctane sulfonyl fluoride) are listed in Annex B.

Nevertheless, the use of the substances in Annexes A and B is possible for certain applications and specific exemptions. However, Parties exercising specific exemptions must register with the Secretariat of the Convention. The exemptions are listed in a special register that is accessible to the public (Register of Specific Exemptions). The exercising of general exemptions must be reported. Pursuant to Part III of Annex B, the production and/or use of PFOS and PFOSF must also be reported to the Secretariat, which lists this information in a public register (Register of Acceptable Purposes). For the EU, the European Commission is responsible for making the entries in both registers. Specific exemptions for deca-DBE for the EU are currently listed in the register. Only one exemption for PFOS is listed for the EU in the register of specific uses (hard chrome plating in closed loop systems).

In addition, the Parties must take measures to prevent the placing on the market of new chemicals with POP properties and, when possible, also chemicals that are currently in use. Both the Plant Protection Products Regulation [23] and the Biocidal Products Regulation [14] establish POP-like properties as exclusion criteria for authorization. Substances with PBT- and vPvB properties are also considered as substances of very high concern in the context of the REACH Regulation [18].

### 3.1.1 Pesticides

As stated in the NIP 2008, the pesticides originally listed in the POP Convention had either already been banned or were no longer in use in Austria before it joined the EU. The biocide pentachlorophenol, which was mainly used as a wood preservative, was listed in Annex A during the 7th Conference of the Parties (COP 7). COP 8 expanded Annex 8 to include the plant protection product dicofol.

Detailed provisions are in effect for the residues of POPs in foods and drinking water. The maximum residue levels are set forth in the Residual Control Ordinance[19] and in the Drinking Water Ordinance [35]. The monitoring of foods, in particular for contamination with dioxins and PCBs, is regulated in the Feedstuffs Act 57 and in the Feedstuffs Ordinance 2010 58. Food monitoring is the responsibility of the Federal Ministry of Social Affairs, Health, Care and Consumer Protection and it is implemented in indirect federal administration by the provincial governments (food inspection authorities of the provinces), with the involvement of the food inspection agencies authorized under the LMSVG [8] (AGES and inspection centers of the provinces). Feed monitoring is the responsibility of the BMLRT in cooperation with the Federal Office for Food Safety (BAES) and the Federal Agency of Health and Food Safety (AGES). The provinces are responsible for feed monitoring at the primary production level. The continuous monitoring of drinking water is the job of the operators of the water supply facilities in the context of self-monitoring. They are supervised and monitored by the official food inspection authorities of the provinces.

[19] Residue Control Ordinance 2006 (Rückstandskontrollverordnung 2006), last amended by the Ordinance of the Federal Minister of Social Affairs, Health, Care and Consumer Protection amending Residue Control Ordinance 2006, Federal Law Gazette II No. 134/2020

### 3.1.2 Industrial chemicals

#### 3.1.2.1 Polybrominated diphenyl ethers (BDEs)

The brominated flame retardant mixtures penta- and octaBDE were included in the Stockholm Convention [1] in 2009, and decaBDE was included in 2017. These substances are primarily used as flame retardants in electronic equipment and in plastics. In Austria, these substances are regulated by the Waste Electronic Equipment Ordinance [42]. One of the key points of the ordinance is a ban on certain environmentally hazardous substances (e.g., lead, mercury, cadmium, certain flame retardants) in the production and in the marketing of electrical and electronic equipment. The POPs Regulation [3] applies a limit value for total BDEs (500 mg/kg in mixtures and products). The exemption for secondary raw materials (recyclates) of the previous version of the POPs Regulation [3] was thus suspended.

The Environment Agency Austria has already conducted several studies on the presence of BDEs in the environment. These data were made available to the POP Review Committee of the Stockholm Convention [1] in 2012.

From 2008 to 2020, 132 electrical devices were examined in Austria in the context of the RoHS Directive [30]. Out of this total, 9 products, articles or parts thereof contained BDEs in excess of 0.1%. It was found that lead and cadmium limit values were exceeded much more often.

#### 3.1.2.2 Hexachlorobenzene (HCB)

An intentional use of hexachlorobenzene is obsolete. The possible use in skyrockets is routinely monitored as part of chemical inspection. See the information box in Chapter 3.2 on HCB in contaminated sites and as an undesired by-product.

#### 3.1.2.3 Polychlorinated biphenyls (PCB)

The Austrian ordinance concerning the ban on halogenated biphenyls, terphenyls napthalenes and diphenyl methanes[20] and the Waste Management Act 2002 (AWG 2002)

[20] Ordinance of the Federal Minister of Environment, Youth and Family concerning the ban on halogenated biphenyls, terphenyls, naphthalenes and diphenyl methanes, Federal Law Gazette No. 210/1993

[7] established a plan for the decontamination and elimination of equipment containing PCBs in the Austrian legal system. According to Art. 16(2) line 2, wastes containing PCBs are to be handed over without undue delay to an authorized waste collection facility or waste treatment facility. According to Art. 2(7) line 4 AWG 2002 [7], the waste to be disposed of may not be stored any longer than one year at the treatment facility.

Art. 16(2) AWG 2002 [7] contains the obligation to thermally dispose of wastes containing PCBs (total content > 30 ppm). Alternative methods of disposal are permissible provided that environmental protection regulations and state of the art equivalent to those of incineration are respected.

Furthermore, waste containing PCBs may not be sorted out from other substances for recycling purposes. Any components/devices which contain PCBs and which are part of other equipment must be removed and collected separately, provided that this is feasible with reasonable effort. The treatment obligations for electrical equipment containing PCBs and other wastes containing PCBs were specified in Arts. 25ff of the Waste Treatment Obligation Ordinance 2004. The regulations were adapted to the state of the art with the revised version of the Waste Treatment Obligation Ordinance [43]. Also included were provisions for other wastes, specifically lithium batteries, flat screens, cooling appliances with hydrocarbons as coolants or propellants, plastics from waste electrical equipment containing brominated flame retardants, and photovoltaic modules.

The rules for the disposal of equipment containing PCBs were made even more stringent in the revised version of the POPs Regulation [3]. Accordingly, technical devices (e.g., transformers, condensers or other containers with fluids in them) that contain PCBs in concentrations > 0.005% and in amounts > 0.05 dm3 are to be identified and taken off the market no later than 31 December 2025.

#### 3.1.2.4 Hexabromocyclododecane

HBCD is a brominated flame retardant that is used in various plastics. The majority of it was used in EPS (expanded polystyrene, “styrofoam”) and in XPS (extruded polystyrene). Although the acute toxicity of HBCD is low, it was classified as toxic to reproduction (Category 2) under the CLP Regulation [19]. HBCD is also toxic to aquatic organisms.

Because HBCD is also relatively persistent (half-life of 210 days in soil – although by comparison, HCB has a half-life of up to 20 years) and bioaccumulating, as of

26 November 2014 stringent restrictions were placed on its use under the Stockholm Convention [1] on persistent organic pollutants. Because of the need for switching to alternatives, the Parties may exercise a specific exemption for the use in insulation (EPS, XPS).

Because of these properties, HBCD was classified within the EU as a substance of very high concern under the REACH Regulation [18]. Two requests for approval for use in insulation materials for buildings were submitted and granted. All other previously existing uses (e.g., in XPS, textiles and shock- and tear-proof polystyrene in electrical and electronic equipment) expired as of 21 August 2015 (“sunset date”).

The POPs Regulation [3] definitively regulates products containing HBCD and POP wastes containing HBCD. The authorization of HBCD under the REACH Regulation [18] is thus superseded. In order to prevent the recycling of HBCD-contaminated materials as defined by the Convention, the amendment also proposes a limit value of 100 ppm for unintentional trace contaminants.

#### 3.1.2.5 Hexachlorobutadiene

Although hexachlorobutadiene was formerly used in lesser quantities as a solvent, a hydraulic fluid and in the production of lubricants, it is primarily generated as an undesired by-product in the production of organochlorine compounds. For this reason, HBCD was included in Annex A as well as in Annex C of the Stockholm Convention [1].

Since 2012, there has been a total ban on the intentional use of HCBD under the POPs Regulation [3] of the EU, as the substance had already been restricted for the UNECE region under the POP Protocol [2] of the LRTAP Convention. HCBD is also listed in Annex III Part B of the POPs Regulation [3].

#### 3.1.2.6 Polychlorinated naphthalenes

Commercial mixtures of PCNs consist of as much as 75 PCNs and by-products. PCNs were used as insulating cable sheaths, wood preservatives, dielectric liquids and plastic additives. Because of their liver toxicity properties, PCNs had already been replaced by other chemicals in Europe during the 1970s and 1980s.

PCNs are formed as unintentional by-products in the presence of chlorine during high-temperature industrial processes. They are therefore listed in both Annex A and Annex C of the Convention.

Since 2012, there has been a total ban on the intentional use of PCNs under the POPs Regulation [3] of the EU, as the substances had already been restricted for the UNECE region under the POP Protocol of the LRTAP Convention. PCNs are also listed in Annex III Part B of the POPs Regulation [3].

#### 3.1.2.7 Short-chained chlorinated paraffins (SCCP)

SCCPs are complex mixtures of polychlorinated alkanes with chain lengths between 10 and 13 carbons and with chlorination degrees ranging from 30 to 70%. They were used as plasticizers in rubber, paints and adhesives, and also as flame-retardant constituents in plastics and as EP (extreme pressure) additives in lubricants.

SCCPs were not listed in Annex A of the Stockholm Convention [1] until 2017. However, they had already been listed before then in Annex I of the POP Regulation [3] because the POP Protocol [2] of the LRTAP Convention had already restricted their use several years earlier. Exemptions for the use as flame retardants in underground conveyor belts and in insulating sealants have been revoked. But because the medium-chain chlorinated paraffins used as substitutes for SCCPs contain SCCPs themselves, content limits of 1% for substances and 0.15% for products have been established. The Regulation stipulates that because these limit values are relatively high, they are not applicable as limit values for unintentional trace contaminants.

#### 3.1.2.8 Perfluorooctanoic acid (PFOA)

PFOA, its salts and PFOA-related substances are widely used in the production of fluoroelastomers and fluoropolymers, and also in the production of non-stick kitchenware. PFOA-related compounds are used as surfactants, impregnating agents for paper, textiles and leather, and also as firefighting foams. PFOA is highly stable chemically and extremely persistent in environmental media such as air, water and soils, as well as sediments. PFOA contaminants have thus been found locally as well as in regions remote from emitters (e.g., the Arctic, Alpine regions). PFOA bioaccumulates terrestrial species, including human beings, although not via fat tissue, which is the usual way for POPs.

Documented harmful effects include elevated cholesterol levels, reduced immune response (after vaccinations, for example), and lower birth weights.

PFOA was listed in Annex A of the Convention in 2019. In the first delegated act of the recast of the POPs Regulation [3], which entered into force on 4 July 2020, PFOA was included in Annex I along with numerous exemptions. A limit value of 0.025 mg/kg (0.0000025 wt%) was established for unintentional trace contaminants (UTC value) in substances, mixtures and products.

There are exemptions for:

1. photolithographic or etching processes in semiconductor production until 4 July 2025;
2. photographic coatings for film until 4 July 2025;
3. oil- and water-repelling textiles for protecting workers from hazardous fluids posing risks to their health and safety until 4 July 2023;
4. invasive and implantable medical devices until 4 July 2025;
5. production of polytetrafluoroethylene (PTFE) and polyvinylidene fluoride (PVDF) for the manufacturing of
    a) high-performance, corrosion-resistant gas filter membranes, water filter membranes and membranes for medical textiles,
    b) industrial heat exchangers,
    c) industrial sealants capable of preventing leakage of volatile organic compounds and PM2,5-particulate matter until 4 July 2023.

In addition, there is an exemption for firefighting foam containing > 0.025 ppm PFOA for combating fumes from liquid fuels and fires from liquid fuels (fire class B) that is already present in (mobile as well as fixed) systems until 4 July 2025. Numerous conditions (no use for training purposes or tests, presence of collection devices as of 1 January 2023) have been established for this exemption. During the 22nd session of the authorities responsible for the POPs Regulation [3], this passage was interpreted to mean that replacement tanks for fixed installations that had already been delivered before 4 July 2020 also came under this exemption. Pursuant to Article 5(2) of the POPs Regulation [3], the holder of such stockpiles of more than 50 kg must inform the responsible authority of the Member State of the nature and size of these stockpiles. This information must be provided within twelve months after the date of entry into force 31, and then annually up until the deadline established for restricted uses in Annex I or II.

Stockpiles that do not come under this exemption are to be disposed of as POP waste in accordance with Article 5(1) of the POPs Regulation [3].

Perfluorooctyl bromide that contains perfluorooctyl iodide may be used for the production of medications until 31 December 2036, provided that routine reviews and assessments are performed by the Commission.

#### 3.1.2.9 PFOS

Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride were mainly used as impregnating agents for textiles, leather and paper, but also in firefighting foams. In addition, they were also used in numerous industrial processes.

The POPs Regulation [3] now makes provision for just one exemption – the use as a mist suppressant for non-decorative hard chromium plating in closed-loop systems. A technical directive concerning the use of PFOS was drafted by the BAT/BEP group of the Stockholm Convention [1]. This directive contains, inter alia, detailed specifications for a closed-loop system in the hard chromium plating field [55].

The following products were analyzed specifically for PFOS:

- Firefighting foams;
- Ski waxes;
- Carpets.

Additional checks were performed on outdoor textiles and furniture in 2021.

In keeping with the obligations of the POPs Regulation [3], the exercising of the exemptions for mist suppressants and electroplating was reported to the EC.

Since PFOS-containing firefighting foams may no longer be used, compliance with the ban is monitored by spot checks. However, there is evidence that foams that do not contain PFOS may contain other fluorinated surfactants instead. These substitutes are likewise either non-degradable or are metabolized into stable PFCs. However, the upshot was that none of these substances could be detected. It is further planned to monitor compliance with the ban in cooperation with the Federal Firefighters' Association and to work on minimizing the use of the substitutes (see also under "PFOA").

Regarding monitoring for PFOS in foods, the European Commission points out in its Recommendation 2010/161/EU that analyses should be conducted for these substances as well. PFOS and PFAS were therefore also included in food testing.

## 3.2 Unintentionally released POPs (U-POP) - Industrial emissions

For this area, reference is made to the detailed National Action Plans, in which existing measures for reducing unintentional emissions of POPs are evaluated and further measures are proposed. The current National Action Plan 2017 can be downloaded at umweltbundesamt.at/fileadmin/site/publikationen/rep0633.pdf.

## 3.3 Stockpiles and wastes

Article 6 of the Convention deals with the reduction or elimination of releases from POP stockpiles and POP wastes. The Parties must ensure that stockpiles and wastes are managed in a manner protective of human health and the environment. Stockpiles and products and articles in use must be identified and handled in a safe, efficient and environmentally sound manner. According to Art.7 (2) of the POPs Regulation [3], wastes consisting of, containing or contaminated by substances listed in Annex IV shall be disposed of or recovered in such a way as to ensure that the POP content is destroyed or irreversibly transformed so that the remaining waste and releases do not exhibit the characteristics of POPs. Other methods of disposal may only be used if the POP content is low or if the destruction does not represent the environmentally preferable option.

In addition to the more general obligations regarding waste management, a provision for destroying POP wastes by incineration in Austria was added with the revision of the Waste Management Act 2002 [7].

With the Waste Framework Directive 2006/12/EC and 2008/98/EC [36] numerous provisions were introduced to ensure that wastes and stockpiles are handled in an environmentally sound manner. Along with other measures, this includes promoting waste prevention, rules for classifying hazardous waste, the obligation to collect, package and label hazardous waste in a traceable manner, to develop waste management plans, to approve disposal and treatment facilities for elimination or recycling and to ban unregulated waste disposal.

Article 5 of the POPs Regulation [3] makes provision such that stockpiles that contain POPs are to be managed as waste. Holders of stockpiles greater than 50 kg and consisting of or containing POPs are obligated to provide the competent authority with information on the nature and size of those stockpiles. The stockpile must be managed in a safe, efficient and

environmentally sound manner. The Member States have a duty to monitor the use and management of reported stockpiles.

Under Austrian legislation, waste stockpiles designated for final disposal must be entirely eliminated within one year.

Although POPs in the construction sector (in particular PCB but also brominated flame retardants in electrical and electronic equipment as well as HBCD-containing polystyrene) represent an important problem for the future, there is hardly any information on stockpiles. The Recycled Construction Materials Ordinance [45], which entered into force in 2015, is an important step towards identifying and properly sorting and disposing of hazardous substances resulting from construction or demolition activities.

Furthermore, it is necessary to implement measures for environmental monitoring and for reducing the POP contents that have already been detected in other waste streams, such as:

- Plastics from waste electrical equipment with halogenated flame retardants,
- PFAS-containing (water repellant) coatings of, for example, plastic or wood surfaces,
- Fire rubble contaminated by POPs (e.g., from extinguishing foams),
- Railway ballast and railway systems contaminated with pesticides,
- Wastes containing tar and
- Other waste groups containing POPs

Regarding waste elimination, Article 7(2) of the POPs Regulation [3] sets forth that the persistent organic pollutant content must be destroyed or irreversibly transformed. According to Annex V of this regulation, the following disposal or recovery measures, as established in Annex IIA and IIB to Directive (EC) 2008/98 on wastes, are allowed for this purpose:

- D9: Physico-chemical treatment;
- D10: Incineration on land, and
- R1: Use principally as a fuel or other means to generate energy, excluding wastes containing PCBs.
- R4: Recycling/reclamation of metals and metal compounds from residues from iron- and steel-making processes such as dusts or sludges from gas treatment or mill scale or zinc-containing filter dusts from steelworks, dusts from gas cleaning systems of

copper smelters and similar wastes and lead-containing leaching residues from non-ferrous metal production. Wastes containing PCBs are excluded.

The processes are restricted to the recovery of iron and iron alloys (blast furnace, shaft furnace and hearth furnace) and non-ferrous metals (Waelz rotary kiln process, bath melting processes using vertical or horizontal furnaces), provided that the facilities concerned meet as minimum requirements the limit values for PCDD and PCDF emissions established in the Industrial Emissions Directive [17].

The POPs Regulation [3] also includes the possibility of treating wastes, under special circumstances, in ways other destroying them or irreversibly transforming the POP content in the waste. This exemption may only be exercised if certain conditions are fulfilled:

- The waste holder has demonstrated to the competent authority that the measure represents the environmentally preferable option over destruction or irreversible transformation of the waste and has submitted information on the POP content of the waste;
- The process is in compliance with the relevant EU legislation;
- The Member State in question has informed the other Member States and the Commission about the authorization granted to it, including the grounds on which it was based.

According to the regulation, the only option under this exemption is permanent storage in secure, deep, underground hard rock formations and salt mines or in landfills for hazardous wastes (for POP wastes below a certain limit value, provided that the wastes are solidified or partially stabilized where technically feasible).

According to Annex V of the POPs Regulation [3], there are concentration limits that constitute a restriction for exercising this exemption (see Table 5). Wastes in which these limit values are exceeded may only be treated by destruction or irreversible transformation of the POP content in the waste and not by means of a process that would be environmentally preferable to the first two methods mentioned. Annexes IV and V of the POPs Regulation [3] are currently being revised. In this process, not only shall existing values be reviewed, but also concentration limits shall be established for newly listed POPs such as PFOA. The revision is being carried out by means of ordinary legislative procedure. A first draft was published by the Commission by the end of 2021.

Table 5 Concentration limits for POP wastes

| Substance | Concentration limits |
|---|---|
| Aldrin | 5 000 mg/kg |
| Chlordane | 5 000 mg/kg |
| Chlordecone | 5 000 mg/kg |
| DDT (1,1,1-trichloro-2,2-bis(4-chlorphenyl)ethane | 5 000 mg/kg |
| Dieldrin | 5 000 mg/kg |
| Endosulfan | 5 000 mg/kg |
| Endrin | 5 000 mg/kg |
| Heptachlor | 5 000 mg/kg |
| Hexabromobiphenyl | 5 000 mg/kg |
| Hexabromocyclododecane | 1 000 mg/kg |
| Hexachlorobenzene | 5 000 mg/kg |
| Hexachlorobutadiene | 1 000 mg/kg |
| Hexachlorocyclohexane, including Lindane | 5 000 mg/kg |
| Mirex | 5 000 mg/kg |
| Pentachlorobenzene | 5 000 mg/kg |
| Toxaphene | 5 000 mg/kg |
| Perfluorooctane sulfonic acid and its derivatives (PFOS) (C8F17SO2X) (X = OH, metallic salts (O-M+), halogenides, amides and other derivatives, including polymers) | 50 mg/kg |
| Polychlorinated biphenyls (PCB) | 50 mg/kg |
| Polychlorinated dibenzo-p-dioxins and dibenzofurans | 5 mg/kg |
| Polychlorinated naphthalenes | 1 000 mg/kg |
| Total of the concentrations of tetrabromodiphenyl ether (C12H6Br4O), pentabromodiphenyl ether (C12H5Br5O), hexabromodiphenyl ether (C12H4Br6O) and heptabromodiphenyl ether (C12H3Br7O) | 10 000 mg/kg |
| Toxaphene | 5 000 mg/kg |

## 3.4 Contaminated sites

Under the provisions of Article 6(1)e of the Convention, the Parties must develop appropriate strategies for identifying sites contaminated by POPs. If remediation of these sites is undertaken, it shall be performed in an environmentally sound manner.

In Article 9(3) of the POPs Regulation [3], it is established that when preparing and updating NIPs, information shall also be exchanged on measures taken to identify and assess sites contaminated by POPs.

The key elements of the Austrian strategy for identifying sites contaminated by POPs are

- a continuous monitoring of the release of POP substances for preventing contaminations, damage to the environment and hazards (see Chapter 2.4.1) by means of
- the application of relevant statutory regulations of the European Union (e.g., Environmental Liability Directive; Industrial Emissions Directive concerning the approval of facilities, reporting duties and environmental inspection),
- the implementation and control of national legal regulations (e.g., Water Rights Act [6], Waste Management Act [7], trade and industry law, fertilizer law)
- the implementation and control of legal provisions of the provinces in the soil protection area
- supportive monitoring programs for air, soils and waterbodies at national and regional levels as well as for large projects,
- a national program for historically contaminated sites, which under the Act on the Clean-up of Hazardous Sites (Altlastensanierungsgesetz, ALSAG) [56] has been in effect since 1 July 1989 (also see Chapter 2.4.2).

The Federal Act on Trade in Fertilizers and other Fertilizer Products (Düngemittelgesetz 2021-DMG 2021), Federal Law Gazette I No. 103/2021, entered into force on 1 October 2021 and governs the authorization, the placing on the market, the labelling and monitoring of fertilizers and other fertilizer products. In terms of general soil protection, fertilizers may only be marketed if they correspond to one of the types listed in the Fertilizer Ordinance or in EC Regulation No. 2003/2003 [57]. If this is not the case, authorization must be requested from the Federal Office for Food Safety (BAES).

The Fertilizer Regulation 2004 [58] sets a limit value of 0.1 mg/kg DM (sum of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS)) for perfluorinated surfactants.

### 3.4.1 Historically contaminated sites

The Act on the Clean-up of Hazardous Sites (Altlastensanierungsgesetz, ALSAG) [56] is the legal basis for funding the remediation of contaminated sites and also makes provision for the coordination of measures for the systematic identification, investigation and assessment of historically contaminated sites.

The results and progress of the measures for systematically identifying and assessing historically contaminated sites are published annually in a report by the Environment Agency Austria, which appears in the Suspected Sites Register and Contaminated Sites Atlas (Verdachtsflächenkataster und den Altlastenatlas) [60].

Under the Contaminated Sites Designation Ordinance (Altlastenatlas-VO) [59], abandoned waste dumps and former industrial sites are made known to the public by the BMK (Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology) as contaminated sites that have been rated as requiring clean-up on the grounds of a risk assessment. Also presented in the Contaminated Sites Designation Ordinance [59] are the classifications of the individual contaminated sites in priority classes, which are used to indicate the degree of risk and the urgency for funding remediation measures. The implementation status of the remediation measures is indicated by the designations “stabilized” or “decontaminated”.

In general, the strategy for implementing the national program for the systematic identification of historically contaminated sites comprises the following complementary elements: (a) registration and initial assessment of former industrial sites and abandoned waste dumps, (b) surveying of sites with investigation needs, (c) risk assessment and (d) remediation and follow-up care.

#### 3.4.1.1 Registration and initial assessment of former industrial sites and abandoned waste dumps

The provincial governors are responsible for identifying and reporting former industrial sites and abandoned waste dumps (landfills and industrial or commercial facilities that

were in operation or abandoned before 1 July 1989). All available information (site, ownership status, site history, possible pollutants, hydrological and geological data) is to be handed over to the BMK and is recorded in a database by the Environment Agency Austria. In the scope of a preliminary examination of the information ("initial assessment"), it is decided whether there may be a substantial risk to the environment or to human health. If the assessment for a former industrial site or abandoned waste dump indicates that substantial hazards are probable, this site is entered in the Suspected Sites Register (Verdachtsflächenkataster). This means that further surveys and investigations are required.

62,400 former industrial sites and 7,388 abandoned waste dumps had been identified in Austria as of 1 January 2021. The total number of abandoned waste dumps and former industrial sites is currently estimated at around 74,130. This means that around 94% have been identified to date. Data obtained thus far and follow-up surveys will be systematically examined in order to improve the coverage.

1,708 sites were classified as suspected sites on the indicated target date.

### 3.4.2 Surveying of sites with investigation needs

Representative investigations are required in order to determine whether contaminations and risks to the environment or human health exist at former industrial sites and abandoned waste dumps.

With site-specific conditions (in particular geology, hydrogeology, development and surface characteristics, use at the site and in the surrounding area) taken into account, it is necessary to set up sampling stations and to take samples. The sampling, measurements and laboratory analyses can include soil, soil air, wastes, landfill gases, plants, fine particulate matter, groundwater, surface water as well as ambient air or the air inside buildings.

Sites are selected for investigations on the basis of a prioritization procedure, which classifies the probability of serious risks at the individual former industrial sites and abandoned waste dumps. Furthermore, the investigations have been regionalized for several years in order to achieve synergy effects in terms of the costs and the time it takes for surveying.

Since 1 January 2021, supplementary investigations have been underway at 3,366 abandoned waste dumps and former industrial sites in Austria.

In the case of former industrial sites and abandoned waste dumps for which there are provable indications of the production, use or handling of POPs, the individual substances relevant to each specific site are identified and considered in the sampling plans of the survey projects.

### 3.4.3 Assessment

When individual sites are evaluated, a global assessment is made on the basis of the results from the investigation in order to determine whether there is a substantial hazard to the environment or human health and whether a site should therefore be included as a "substantially contaminated site with significant risks to the environment and human health" in the Contaminated Sites Atlas Regulation. These sites are then classified according to the urgency/priority of stabilizing or detoxifying them.

If it turns out from the assessment of a site that there is no substantial hazard to the environment or to human health, that site is then deleted from the Suspected Sites Register. The provincial authorities, the communities concerned, and the property owners are informed accordingly.

Thus far, final ratings (risk assessments) have been performed on the basis of investigation results for 1,328 abandoned waste dumps and former industrial sites. 321 contaminated sites had been identified as of 1 January 2021

As regards POPs, substantial contaminations by polycyclic aromatic hydrocarbons (PAH) have been identified at 46 contaminated sites. 6 of these sites were substantially contaminated with other substances (see Table 6).

The PAH-contaminated sites are generally former sites of gas works or tar processing plants, by which the groundwater is contaminated. Because of the physical properties, in particular solubility and tendency to be adsorbed onto particles, low molecular weight substances cause far-spreading contaminant plumes in groundwater. Acenaphthene is often the major lead compound in such cases.

Table 6 POP-contaminated sites in need of clean-up

| Name | Status | Pollutants |
|---|---|---|
| Chemiepark Linz | Survey | Lindane |
| Spattgrube | Stabilized | Lindane, PCDD/F |
| Donau Chemie Brückl | In the process of being stabilized | Hexachlorobenzene, hexachlorobutadiene |
| Kalkdeponie Brückl I/II | In the process of being stabilized | Hexachlorobenzene, hexachlorobutadiene |
| Deponie Metran | Decontaminated | PCDD/F |
| Esse Mitterberghütten | Decontaminated | PCDD/F |

### 3.4.4 Remediation measures

Measures for the remediation of contaminated sites can generally be subdivided into decontamination, stabilization and observation. In specific remediation projects, it very often comes down to a combination of measures, depending upon the results of a variant analysis and the technologies employed.

When decontamination measures are implemented, contaminants of the subsoil are either completely eliminated or the quantity thereof is reduced to the extent that they no longer pose a substantial risk to the environment or to human health. The selection of appropriate technologies must be adapted to the properties of the relevant pollutants in each individual case. Applications directly to the site itself, either in situ (e.g., pollutant fixation) or ex situ (e.g., soil washing), are possible.

When stabilization measures are implemented, further dissemination of pollutants in the environment is prevented. Because the contaminants are not decisively removed, long-term observations (i.e., regular check-ups) are required.

The offices of the provincial governments are responsible for the authorization of remediation projects on historically contaminated sites entered in the Contaminated Sites Designation Ordinance [59]. Depending on the available funds from contaminated sites contributions, subsidies to cover remediation projects may be granted under the Austrian Environmental Support Act (Umweltförderungsgesetz, UFG). The BMK commissioned its

own settlement agent to administer the support program, i.e., the review of grant applications, the review of accounting and payment of subsidies.

Contaminated sites for which it is not possible to hold the originator, a legal successor or a property owner liable fall under Art. 18 ALSAG [30] and are cleaned up by the Austrian federal government or by BALSA GmbH, depending on the available funds.

As of 1 January 2021, 176 contaminated sites out of a total of 321 had been given a positive final review in terms of the progress of the measures. Out of six POP-contaminated sites in need of clean-up (see Table 6), two abandoned waste dumps were remediated (completely decontaminated) and one abandoned waste dump was stabilized. Stabilization measures are being implemented at two other sites. Detailed investigations for priority classification purposes are underway at one site.

## 3.5 Information exchange/informing the public

According to Article 9 of the Convention, each Party shall, within its capabilities, facilitate or undertake the exchange of information relevant to the reduction or elimination of POPs or relevant to alternatives to POPs.

In Article 10 of the Convention, the Parties shall promote awareness raising among the public and provide information on POPs. Each Party shall enable and facilitate the participation of the public. This also includes the creation of opportunities for contributing to the implementation of this Convention.

Consultation and communication with the stakeholder groups and authorities is part of the legislative process in Austria. All legislative material must undergo a public consultation process. Because the NIP 2021 is established in Art. 20 of the Chemicals Act 1996 (ChemG 1996) [5], the draft for the National Implementation Plan was brought to the attention of the competent authorities of the federal government and of the provinces as well as to diverse stakeholders[21] in the scope of the general review process

[21] e.g., economic and business organizations, women's organizations, groups involved in the health of children (see Art. 7(2) of the Stockholm Convention)

up until 2 July 2021. The aforementioned parties were also requested to provide a position statement concerning it.

The BMK also keeps relevant stakeholders up to date on concerns related to the Stockholm Convention [1] through the SAICM Platform. The SAICM Platform takes place 2-4 times per year and informs other departments, social partners and non-governmental organizations on developments in the field of international chemical and waste policy (SAICM, Basel [11], Rotterdam [10] and Stockholm Conventions [1], Minamata Convention [7], OECD). The information was sent by electronic newsletter during the corona lockdown.

Access to environmental information is a fundamental right in Austria, because Austria is a Party to the Aarhus Convention on access to information, public participation in decision-making and access to justice in environmental matters [61]. According to Article 11 of the POPs Regulation [3], the European Commission, ECHA and the Member States shall promote and facilitate awareness programs (in particular for policy- and decision-makers and particularly vulnerable groups), the provision of public information and training in this area. Information on human health and safety and on the environment is considered as non-confidential.

Information on the Stockholm Convention [1] and on the POPs Regulation [3], as well as the results from the POP studies and monitoring projects (e.g., POPMON, AustroPOPs, PureAlps and Human Biomonitoring, Water Quality Monitoring and POPs in grassland soils) is accessible to the public and available for downloading on the corresponding internet sites.

The “Richtig heizen” [proper heating] campaign was launched in 2009 and is still active. A brochure entitled “Richtig heizen mit Holz” [Proper heating with wood] was created in 2010. The flyer provides information on the impacts of emissions from wood stoves on human health and the environment and gives tips on how these emissions can be reduced by the way in which such stoves are operated. The brochure was distributed by chimney sweeps and doctors. An internet site (richtigheizen.at) was also set up. It provides additional information on the proper use of stoves and on legal concerns, and it is regularly updated. Suggestions are thus given on how to deal with problems in the neighborhood resulting from incorrectly operated and high-emitting heating systems.

## 3.6 Monitoring and research/assessment of efficacy

According to Article 11 of the Convention, the Parties shall, through national and international programs and networks, encourage and undertake appropriate monitoring and research pertaining to POPs, their alternatives and candidate POPs. Relevant areas include: sources and releases, presence and levels in the environment, and effects on human health and the environment.

Since the Stockholm Convention [1] entered into force, the BMK has sponsored numerous studies and projects relating to the monitoring of POPs in environmental media and in the human body. These projects were mostly carried out jointly with the Environment Agency Austria, in some cases also in cooperation with the provinces. Accordingly, studies were conducted on the presence of POPs in household dust[22], breastmilk/umbilical cord blood[23], maternal blood[24], grassland soils and metropolitan area soils[25], on pollutants in human beings[26], and on POPs in ambient air[27]. In addition, regional POP monitoring projects were initiated in the provinces. Examples of such include a Vorarlberg study on

[22] Evironment Agency Austria (2004): Uhl, M.; Hohenblum, P. & Scharf, S.: Hausstaub, ein Indikator für die Innenraumbelastung. Reports, vol. BE-258. Evironment Agency Austria, Vienna.
Environment Agency Austria (2008b): Hohenblum, P.; Kundi, M.; Gundacker, C.; Hutter, H.P.; Jansson, M.; Moosmann, L.; Scharf, S.; Tappler, P. & Uhl, M.: LUKI – Luft und Kinder. Einfluss der Innenraumluft auf die Gesundheit von Kindern in Ganztagesschulen. Long version. Reports, vol. REP-0182. Environment Agency Austria, Vienna.

[23] umweltbundesamt.at/fileadmin/site/angebot/analytik/um_muki_broschuere.pdf

[24] Frontiers; Gene Variants Determine Placental Transfer of Perfluoroalkyl Substances (PFAS), Mercury (Hg) and Lead (Pb), and Birth Outcome: Findings From the UmMuKi Bratislava-Vienna Study | Genetics (frontiersin.org)

[25] Environment Agency Austria (2017): Uhl M. & Offenthaler I.: Organische Schadstoffe in Böden von Ballungsräumen REP-0601, Vienna, ISBN: 978-3-99004-415-5.
Environment Agency Austria (2010): Freudenschuß, A. & Offenthaler, I.: Organische Schadstoffe in Grünlandböden – Teil 3. REP-268. Environment Agency Austria, Vienna, ISBN: 978-3-99004-069-0.
Environment Agency Austria (2008): Freudenschuß A., Obersteiner E. & Uhl M.: Organische Schadstoffe in Grünlandböden. Reports, vol. 0158, Environment Agency Austria, Vienna, ISBN: 3-85457-955-1.

[26] Environment Agency Austria (2011): Hohenblum, P.; Hutter, HP.; Schadstoffe im Menschen. Reports, vol. REP-0324. Environment Agency Austria, Vienna.

[27] Environment Agency Austria (2011a): Spangl, W. & Nagl, C.: Jahresbericht der Luftgütemessungen in Österreich 2010. Reports, vol. REP-0326. Environment Agency Austria, Vienna.
Environment Agency Austria Environment Agency Austria (2011b): Spangl, W.; Nagl, C. & Moosmann, L.: Jahresbericht Hintergrundmessnetz Umweltbundesamt 2010. Reports, vol. REP-0325. Environment Agency Austria, Vienna.

PFAS in soils and in sewage sludge[28] and the Salzburg project ORAPOP for identifying organic pollutants in soils[29].

Recently completed projects and projects near completion are presented in more detail in the following.

### 3.6.1 POPs in the Alpine Space (PureAlps and MONARPOP[30])

The Environment Agency Austria had already begun investigating POP levels in remote Austrian Alpine regions during the 1990s. Whereas POP levels in the Arctic have already been well researched, these studies, with which some analysis methods (analyses of POPs and other organic compounds in spruce needles and in topsoil) for this purpose were refined, showed preliminary results for a region in the heart of Europe – the Alps. On the basis of these works, the Environment Agency Austria and the BMK, in collaboration with government agencies and science institutes in Germany, Italy, Slovenia and Switzerland, launched a substantially larger study on this topic. The MONARPOP Project (Monitoring Network in the Alpine Space for POPs and others) was partially funded by the European Regional Development Fund (ERDF) through the "Alpine Space" INTERREG program and partially by the national governments (and also by the provincial governments in Austria) and the individual institutions. MONARPOP was the first monitoring program for investigating the entire Alpine Space. The results of the project are publicly accessible at monarpop.at. After the conclusion of the INTERREG Project 2007, continuous measurements of immissions and depositions were taken on the Zugspitze and Sonnblick until 2017. Under the title "Pure Alps", these measurements and other studies were performed in cooperation with the Environment Agency Austria and the Bavarian State Office for the Environment (LfU) on Alpine fauna from 2018 to 2020. An overview of the diverse publications that came out of these projects is available under

[28] Office of the Provincial Government of Vorarlberg (2016): Clara, M & Scheffknecht, C: Klärschlamm und Boden - Eintrag von Spurenstoffen auf landwirtschaftlich genützte Böden. Report UI-05/2016. Bregenz and Vienna, November 2016

[29] Environment Agency Austria, Province of Salzburg (2018): Organische Schadstoffe in Grünland- und Waldböden. Salzburg. salzburg.gv.at/umweltnaturwasser_/Documents/POP%20in%20Gr%c3%bcnland%20und%20Waldb%c3%b6den.pdf

[30] More details on PureAlps and MONARPOP are also available on the websites lfu.bayern.de/analytik_stoffe/projekte_alpenschutz/purealps/publikationen/index.htm and monarpop.at

lfu.bayern.de/analytik_stoffe/projekte_alpenschutz/purealps/publikationen/index.htm and under umweltbundesamt.at/news210324.

As for results of the monitoring of aerial POP concentrations and POP depositions on Alpine summits (MONARPOP and continuation), there are complete year-long measurements for nearly all POPs from 2006 onwards. The POP monitoring on the Alpine summits thus enables Austria to provide sound information on the significance of the 15-year trend of the input of all POPs.

The multi-year measurements of immisions and depositions on the Sonnblick and Zugspitze mountains are also incorporated in the Global Monitoring Plan of the Stockholm Convention [1]. This plan forms a framework for the collection of comparable monitoring data from all UN regions as well as data on regional and global long-range transport and environmental sample archives pursuant to Decision SC4/31. The Global Coordination Group also researches climate and meteorological trends.

### 3.6.2 AustroPOPs - Monitoring of organic pollutants in Austrian soils[31]

The data situation with organic pollutants, and especially POPs, in Austrian soils is highly heterogeneous. This also applies to the data collection and especially to the analytical methods for measuring these substances. Many of these pollutants such as polycyclic aromatic hydrocarbons (PAH) or hexachlorobenzene (HCB) have been known for some time. In recent years, HCB has been causing quite a stir due to negative impacts on the environment and soils. However, many “new” substances from industry (such as flame retardants and plasticizers), on which increasingly more research has been conducted in recent years, are being found in soils.

The need for current, comprehensive data for diverse issues nationally and internationally is just as evident as the need for harmonized, continuous data collection (“monitoring”) and the coordination of analytical methods and evaluation systems.

The goal of AustroPOPs is that of establishing a coordinated monitoring system for organic pollutants, and in particular POPs, in Austria. This includes closing the gaps in the data situation by the collection, harmonized provision and analysis of existing data as well as

[31] bodeninfo.net/projekte/austropops

the harmonized collection and joint analysis of new data at sites selected for future continuous data recording. Data collection and chiefly the analysis of organic pollutants and POPs will thus be methodically harmonized.

The soil experts in the provinces of Vorarlberg, Tyrol, Salzburg, Styria, Lower Austria, Upper Austria and Carinthia have joined forces with the Federal Ministry for Agriculture, Regions and Tourism (BMLRT) and the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), with the participation of AGES, the BOKU (University of Natural Resources and Life Sciences), BFW (Federal Research and Training Center for Forests, Natural Hazards and Landscaping) and the Environment Agency Austria (project management), for the joint funding and implementation of AustroPOPs in the context of a cooperation between the federal government and the provinces.

AustroPOPs is a project of the DaFNE research platform of the BMLRT. The final report was submitted in mid-2021.

### 3.6.3 POPMON - Risk communication and risk-based monitoring of persistent organic pollutants in different environmental matrices, foods and feeds at potentially contaminated sites in Austria

In the scope of the precursor project “POPMON - Identification of relevant persistent organic pollutants and potentially contaminated regions as a basis for risk-based food monitoring in Austria”, industrial and waste treatment sites, suspected sites and contaminated sites were analyzed on behalf of the BMK and the BMSGPK in terms of potential risks of environmental contamination by persistent organic pollutants (POPs) and consequently food and/or drinking water impurities. On the basis of these results, regions for emissions-based monitoring were identified, in rough scenarios, in the first phase of the ongoing POPMON project. Two scenarios were then further characterized and prepared. Scenario 1 was set in waste management. The following substances were identified as relevant POPs for investigation: polychlorinated dioxins, furans and dioxin-like polychlorinated biphenyls (PCDD/F and dl-PCB), non-dioxin-like polychlorinated biphenyls (ndl-PCB), hexabromocyclododecane (HBCDD), short-chained chlorinated paraffins (SCCP), polybrominated diphenyl ethers (PBDE), tris(1,3-dichloro-2-propyl)-phosphate (TDCPP), polybrominated dioxins, furans and polybrominated biphenyls (PBDD/F; PBB). Air, soil, on-farm feeds and foods of animal origin were investigated at this site. Scenario 2 dealt with a PFAS contamination. The following perfluorinated alkyl

substances are of particular relevance here: perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorohexane sulfonic acid (PFHxS) with their respective salts and related compounds. An explanation of the results for drinking water and groundwater and clarification concerning the originators and contamination paths were proposed here. Further monitoring measures consisted of inspecting locally produced fish and foods.

Another key pillar of the project was that of drawing up recommendations for measures for communicating the risks among the relevant authorities in contamination cases.

The project was concluded by the end of the 2nd quarter of 2021 the report can be downloaded under ages.at/wissen-aktuell/publikationen/popmon.

### 3.6.4 POPs in ambient air

Pursuant to the Austrian Ambient Air Quality Act (Immissionsschutzgesetz-Luft, IG-L) [25], the Offices of the Provincial Governments and the Environment Agency Austria are measuring the concentration of benzo(a)pyrene (B(a)P) in PM10 at 34 measuring stations. In Illmitz, the Environment Agency Austria is also measuring the concentrations of benzo(a)anthracene, benzo(j)fluoranthene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-c,d)pyrene in PM10. The results of the measurements are published in the annual reports of the monitoring network operators as well as in the annual report for all of Austria[32]. The target value of the 4th specific directive [31], or rather the limit value according to IG-L [25] of 1 ng/m³, was only exceeded at one measuring station (Ebenthal Zell in Carinthia) in 2019.

The existing measurement data show in general that Austria south of the Alpine divide, i.e., in regions with unfavorable dissemination conditions, is affected by the highest levels of B(a)P pollution. Furthermore, the level of B(a)P pollution varies greatly spatially with respect to emissions sources and local dissemination conditions.

[32] Environment Agency Austria (2019a): Spangl, W. & Nagl, C.: Jahresbericht der Luftgütemessungen in Österreich 2019 (Annual report on air quality measurements in Austria 2019). Reports, vol. REP-0713. Environment Agency Austria, Vienna. Environment Agency Austria (2019b): Spangl, W.: Luftgütemessungen und meteorologische Messungen - Jahresbericht Hintergrundmessnetz (Air quality measurements and meteorological measurements - Annual report, Background monitoring network) Environment Agency Austria 2019. Reports, vol. REP-0714. Environment Agency Austria, Vienna

Manually operated small-scale furnace systems (wood and coal) for space heating represent the main source of pollution. Smaller contributions come from caloric power plants, automobile traffic and industrial facilities (especially coking plants, gas works and refineries).

The B(a)P concentration exhibits a very clear yearly trend with high concentrations in the winter and very low concentrations in the summer, which is attributable to the interplay between emissions over time (emissions from domestic heating occur exclusively in the winter) and dissemination conditions.

### 3.6.5 Human biomonitoring

Human biomonitoring studies on the exposure of certain population segments to various pollutants have been conducted in Austria since 2005. The data acquired from these studies permit conclusions to be drawn on the efficacy and success of statutory regulations such as restrictions and bans on certain pollutants, including POPs, and they may be able to show where additional measures are needed in order to achieve the goals.

Humans in their daily lives are exposed to a diverse mix of chemicals, which they take up from the environment, in foods, consumer goods, and at the workplace. By analyzing human sample material (e.g., blood, urine, breast milk, hair), human biomonitoring (HBM) makes it possible to determine individual exposure to certain pollutants that are taken up via these different paths and sources.

Serum and placental tissue of mother/child pairs were screened for PFAS and extractable organofluorine (EOF) as part of a current cooperative study of the Medical University Vienna and Örebro University in Sweden. EOF is an indicator of total PFAS exposure, which encompasses the substitutes already identified as POPs as well as new ones[33].

The Human Biomonitoring (HBM) Report to the Austrian National Council introduces the Austrian Human Biomonitoring Program and its members and summarizes the most important Austrian HBM studies in recent years (see bmk.gv.at/themen/klima_umwelt/chemiepolitik/publikationen/biomonitoring.html).

[33] Extractable Organofluorine Analysis in Pooled Human Serum and Placental Tissue Samples from an Austrian Subpopulation—A Mass Balance Analysis Approach

It also introduces the European HBM4EU Project (https://www.hbm4eu.eu/ ), in which 28 European Union (EU) Member States and 3 associated states are participating. The fact that the participating Austrian partners have been able to position themselves well in the HBM4EU network and work together on various subprojects under the coordination of the Environment Agency Austria represents a great success.

An important goal of the HBM4EU Project is that of networking, broadening, and anchoring HBM activities in Europe as a tool of European environmental, chemical and health policy. The aim is to build bridges between science and politics in order to ensure that knowledge is actively passed on to political decision makers so that political measures can be implemented in a targeted manner to reduce the exposure of human beings to pollutants and to assess the efficacy of existing chemical legislation.

### 3.6.6 Breast Milk Monitoring

The WHO/UNEP implemented the second phase of the international breast milk testing program and in 2013 invited Austria to participate. Austria participated in the first phase (1987-1989, 1992-1993). However, Austria did not participate in the subsequent years (2000-2003, 2004-2007, 2008-2012). Austrian samples were collected again from 2014-2016, and the results of the first tests could therefore be compared with more recent data. The study results showed that exposure to dioxins (combustion products) and polychlorinated biphenyls (PCBs), summarized in one parameter known as dioxin toxicity equivalents, decreased by more than 30-fold in the aggregate sample of Austrian mothers during the 1992 to 2016 period. The exposure to organochlorine pesticides could also be reduced significantly. Many of the compounds (Aldrin, Endrin, Endosulfan, Toxaphene, Mirex, hexabromobiphenyl, pentachlorobenzene and chlordecone and numerous other substances) were not detectable in the sample. Other substances were detectable, but they lay in the lower concentration range of European studies. However, new POPs such as PBDE and PFAS are detectable in the samples. The results were submitted to the Ministry in the form of a brief, and an English language publication is pending.

Austria's participation in the global breast milk monitoring program should enable a longer-term monitoring of breast milk. This is being promoted by the BMK and should provide a measurable efficacy indicator in the scope of Health Goal 4 ("sustainably shaping and securing natural foundations for life such as air, water and soil and all of our habitats for present and future generations"). The impact goal of "eliminating, identifying,

observing and, if possible, reducing environmental contaminants having potential adverse effects on health" can thus be assessed.

### 3.6.7 Other monitoring projects

The POP-relevant monitoring activities of the Environment Agency Austria for the industrial emissions area are summarized in the National Action Plan.

The BMK and the Environment Agency Austria are jointly conducting studies and monitoring projects on POPs in waterbodies[34].

The BMK is also co-funding preparatory studies for the revision of BREFs and the participation of the Environment Agency Austria in the HAZBREF project (see syke.fi/projects/hazbref).

The Dioxin Laboratory of the Environment Agency Austria is a business unit of the Accredited Testing Center for Environmental, GMO and Fuel Analytics (Akkreditierte Prüfstelle für Umwelt-, GVO- und Treibstoffanalytik). It specializes in the analysis of organic pollutants and in particular dioxins and dioxin-like PCBs. Its work not only encompasses mere analysis, but also sampling and the development of analysis methods for all environmental media, consumer goods, feeds and foods (for example, the development of active air samplers for the MONARPOP Project). Other POP monitoring programs comprise routine monitoring of air pollutants in larger Austrian cities and at some industrial sites, and also a smaller project on POPs in soil samples. The results of the work of the Dioxin Laboratory have also been incorporated in the "Dioxin Toolkit"[35] (recommendations for measuring and estimating dioxin emissions) for the Stockholm Convention [1]. The group of professionals established in the context of the Stockholm

[34] An overview of the activities of the BMLRT regarding trace substances in groundwater and waterbodies can be found under bmlrt.gv.at/wasser/wasserqualitaet/grundwasser/spurenstoffe_gw_2018.html and bmlrt.gv.at/wasser/wasserqualitaet/fluesse_seen/stobimo-spurenstoffe.html.

[35] The Stockholm Convention obligates the Parties to identify the release sources of unintentional POPs. Not all participating states have the capacity to perform exact measurements for all sources. The "Dioxin Toolkit" gives an overview of methods for estimating the magnitude of potential dioxin sources and thus enables those states to provide comparable lists of sources.

Convention [1] not only deals with the Toolkit but also with recommendations on BAT/BEP (Best Available Techniques/Best Environmental Practices).

The Province of Vorarlberg is performing total deposition measurements on a continuous basis using synthetic resin absorber systems at two sites in Rheintal and in Walgau. PCDD/F, PCB, PAH and selected OCPs such as HCB are checked quarterly. The monitoring is also intended to serve as an early warning system for possible soil and vegetation contamination. In a comprehensive report of the Province of Vorarlberg (Per-and polyfluorinated alkyl substances (PFAS) in Vorarlberg[36]), an attempt was made to consider the topic of PFAS across all media. The report concludes that there is a need for action, especially in terms of soil protection. Experiments with newer methods (bioassays, non-target analytics, cumulative parameters) were also conducted.

The Province of Vorarlberg is working on a list of precautionary values and limit values for selected PFAS, which is to be incorporated in the Vorarlberg Soil Quality Ordinance [62]. Limit values shall also be set for aqueous eluates. There are still major technical problems here, because recovery in the eluate is heavily dependent on the method used to dry the soil. For this reason, further professional inquiries and investigations are currently underway, with support from the State Agency for Nature, Environment and Consumer Protection in North Rhine-Westphalia and the Baden-Wuerttemberg State Institute for the Environment.

The Vorarlberg Soil Quality Ordinance establishes precautionary values for PCDD/PCDF, PCB, PAH, HCB in the soil. Consideration is also given to emissions. Limit values are thus defined for all materials applied to the soil.

## 3.7 Technical assistance

Under Article 12 of the Convention, the Parties are obligated to render timely and appropriate assistance to developing countries and countries with economic systems in transition, and to assist them in developing the capacity to fulfill their obligations under

[36] Per-and polyfluorinated alkyl substances (PFAS) in Vorarlberg, Environmental Institute–Report UI-05/2021, Bregenz 2021

this Convention. With regard to this Convention, the Parties shall provide technical assistance and promote the transfer of technology, where possible via regional centers.

In Austria, the Federal Ministry for European and International Affairs (BMeiA) is responsible for formulating the general policy guidelines for development cooperation. The Austrian Development Agency (ADA) is responsible for practical implementation (project review, allocation of funds).

The topic must be viewed in the context of the Strategic Approach on International Chemicals Management, SAICM[37]). Accordingly, the inclusion of sound chemicals management in the development agenda would also contribute to the implementation of the Stockholm Convention [1].

## 3.8 POP contaminations - HCB in the Görtschitztal example

A case of contamination in southern Austria in 2014 illustrated how pollution with persistent chemicals can have very complex implications. The remediation of a contaminated site by inappropriate means led to a flagrant increase of HCB emissions, contamination of foods and feeds in the vicinity and consequently to elevated HCB values in blood and breast milk in the affected population. In the course of dealing with the case, extensive and complex measurements became necessary in foods and feeds, soil, groundwater and drinking water, as well as in all environmental compartments. Measures to protect the affected population required the disposal of large quantities of feeds and products from agricultural production as well as a ban on consumption, which had substantial adverse impacts on agricultural and tourism businesses in the region.

The following summary is taken from the final report of the Environment Agency Austria – Environment Agency Austria; Görtschitztal Studies on Human Beings and the Environment (Rep 0652, Vienna, 2018, Project management: Alarich Riss). Also see the report of the Higher Federal Teaching and Research Institute Raumberg-Gumpenstein (HBLFA Raumberg-Gumpenstein)] on the control of HCB contamination in agricultural products (Final Report Hexachlorobenzene (HCB) Scientific Monitoring of the HCB Issue in

[37] The main documents of the SAICM are: Ministerial Declaration from Dubai, the Overarching Policy Strategy (OPS) and the Global Plan of Action (GPA). More detailed information on the SAICM can be found on the website chem.unep.ch/saicm.

Carinthian Görtschitztal (Wissenschaftliche Begleitung der HCB-Problematik im Kärntner Görtschitztal), 2016, HBLFA Raumberg-Gumpenstein Report 2016).

In 2014, widespread hexachlorobenzene (HCB) contaminations were discovered in the vicinity of the Wietersdorf cement plant in Görtschitztal/Carinthia. In November 2014, the cause was identified as the inappropriate use of contaminated lime sludge (carbide lime waste, CLW) from Contaminated Site K 20 (Kalkdeponie Brückl I/II) in the cement plant. The lime sludge should have been disposed of in an environmentally sound manner, for the purpose of cleaning up the landfill. Once the cause of the environmental pollution was established, a stop was put to the use of the contaminated lime sludge in the cement plant. After finding out about the environmental pollution caused by hexachlorobenzene in Görtschitztal, the Agency for Health and Food Safety (AGES) conducted a risk assessment in 2014 on locally produced foods. The calculated HCB intakes from the consumption of contaminated foods from the region showed that no immediate hazard to health is to be expected for short-term intake (up to two weeks). However, in the case of longer-term consumption of HCB-contaminated foods (more than one year), the calculated HCB intake was three times the established tolerable daily HCB intake for average consumption of dairy and meat products and ten times the established tolerable daily HCB intake for high consumption. Intake paths other than food (air, soil contact) played a significantly lesser role. In view of these findings, systematic blood testing of the local population was performed in early 2015. The comparison of the HCB concentrations in the blood samples with the expected values calculated by the Environment Agency Austria showed that the level of exposure in the local population was significantly higher. Furthermore, a correlation could be established between the HCB levels in blood and the intake via the consumption of locally produced foods (especially via the consumption of milk and dairy products and meat). The Medical University of Vienna calculated precautionary values in foods for a longer-term intake. These precautionary values were based on the criterion of excretion of HCB from the body outweighing consumption. The Office of the Carinthian Provincial Government published dietary recommendations for the population of Görtschitztal based on these precautionary values. In early 2016, follow-up testing was performed on blood samples from the residents of Görtschitztal. A reduction in HCB levels in comparison to the first test was found in half of the tested members of the high-exposure group. The experiences in Görtschitztal show that a contamination of food and subsequently of human beings is possible in spite of compliance with the legal HCB residue values. In 2016, the European authorities decreed a reduction of the allowable residue contents of HCB in foods, which went into effect on 10 May 2017. According to the assessment of the results by the Medical University of

Vienna Institute of Environmental Hygiene, there was no reason to fear an immediate and acute hazard to health. Although adverse impacts on health with longer-term consumption of contaminated foods (possibly for as long as a year in this specific case) are not to be expected, they cannot be totally ruled out. […]

In the course of the monitoring, the trends for the following pollutant parameters were studied:

Hexachlorobenzene (HCB)

Once the […] HCB contaminations were discovered, HCB emissions were measured at the Wietersdorf cement plant. Two measurements were taken in the fall of 2014. From 2015 on (i.e., after cessation of the carbide lime waste use), a biannual measurement was mandated by decision of the authority.

In the hexachlorobenzene measurements, the sharp decline in the values after cessation of the use of HCB-contaminated carbide lime waste (CLW) was particularly evident. Since 2015, HCB emissions have been several orders of magnitude lower than those during the CLW use period. No limit value is prescribed for HCB. Whether the (low) measurement values of 2015, 2016 and 2017 are indicative of residual amounts of HCB still present in the cement plant or of hexachlorobenzene newly formed during the operation of the cement plant cannot be determined because comparison data are lacking.

# 4 Activities in the Scope of the National Implementation Plan

This chapter builds on the analysis of the measures already implemented and describes further activities needed to help implement the Stockholm Convention on persistent organic pollutants, specifically the most recently restricted POPs. The general strategy thus provides the foundation on which the individual implementation activities are based.

## 4.1 General strategy

Austria plays a proactive role in the negotiations of the Conferences of the Parties to the Stockholm Convention [1] on persistent organic pollutants. However, participation in the specialist groups of the Stockholm Convention [1] (Chemical Review Committee – POPRC and BAT Group (BAT/BEP/Toolkit)), in the scope of which recommendations on the inclusion of new POPs and specifications for practical implementation are formulated, remains an important matter. Austrian experts have made contributions to the Convention in past years. Examples include the evaluation of polychlorinated naphthalenes, hexachlorobutadiene and dechlorane plus and the assessment of alternatives to endosulfan, DDT and PFOS in the POP Review Committee, in the context of the Global Monitoring Plan, and the revision of the Dioxin Toolkit (one of the meetings of experts for reviewing the Toolkit and a meeting of the BAT Group were held in Vienna). In addition, the Environment Agency Austria laboratory was designated by the UNEP (United Nations Environment Program) as the reference laboratory for the Global Monitoring Plan.

In keeping with the precautionary approach, new chemicals which exhibit POP-like properties and which are not yet covered by the Stockholm Convention [1] may not be authorized for production or use. That is the job of the REACH Regulation [18]. The PBT Group has the task of filtering out new POPs at the EU level. Possible POPs and/or PBT substances are to be identified and investigated at an early stage in both products and environmental compartments so that information on their presence can be obtained in a prompt manner. The work of the PBT Group is supported by an Environment Agency Austria expert commissioned by the BMK.

Releases of unintentional POPs have been reduced considerably in recent years. Austria is determined to ensure further reductions in the releases and, in the case of POP-emitting facilities, to mandate reduction measures in keeping with the state of the art or substitution.

Thanks to the results from the monitoring of POP air concentrations and POP depositions on Alpine summits (MONORPOP and the continuation or subsequent project PureAlps), complete annual measurements from 2006 onwards exist for nearly all POPs. With the conclusion of the project, the results for the entire time series (15 years to date) are now being summarized and will be made available to the Secretariat of the Stockholm Convention [1] and to the interested public. The purpose of performing these air and deposition measurements on the Alpine summits was to enable the monitoring of POP inputs and the deduction of future trends, as well as to have a means for checking efficacy pursuant to Article 16 of the Stockholm Convention [1] on POPs. These data are incorporated in the Global Monitoring Plan on a regular basis.

Because the effects of POPs can be felt worldwide and are not just limited to the local level, Austria is committed to supporting developing countries and countries with economic systems in transition by providing technical assistance and exchanging information.

## 4.2 Implementation strategy

The following subchapters are based on the structure of previous chapters, especially Chapter 3, and they present the implementation strategy for fulfilling the obligations under the Stockholm Convention [1] in more detail. Specific steps are described in each individual subchapter.

The Federal Minister for Climate Action is responsible for establishing the measures of the National Implementation Plan and of the National Action Plan. Many of these steps can only be carried out in cooperation with other ministries, the provinces and other contact partners from civil society, social partners and industry. These parties are therefore consulted in the assessment process as well as by the members of the SAICM platform for national coordination. For measures pertaining to business premises according to Art. 74 of the Austrian Trade and Industry Code 1994 (Gewerbeordnung 1994) [21], an agreement shall be reached with the Federal Minister for Digital and Economic Affairs. Measures that

concern mining shall be implemented in consultation with the BMLRT. The BMK, and in particular the National POP Contact Point, is in charge of the coordination aspect.

The BMK, in cooperation with the POP/PBT Group and the SAICM Platform for international chemicals management, is responsible for the coordination of assessment and updating. The SAICM Platform is an interministerial coordination group for providing information to stakeholders and for establishing Austrian positions at environmental conventions in the "chemicals" field, in particular for the Rotterdam [10], Stockholm [1] and Minamata Conventions [12], as well as the SAICM and safe worldwide chemical and waste management.

## 4.3 Intentionally produced POPs

Sampling and examination priorities for products are being broadened to include POPs/PBTs and possible "new" POPs. Studies to check for PFOS and PFOA in outdoor clothing and outdoor furniture are planned for 2021. The enforcement bodies of the chemicals inspectorates will continue focusing on products made from recycled materials. The national measures place emphasis on checking for compliance with the bans and restrictions. Furthermore, the commerce authority shall mandate the use of substitutes for substances/mixtures that contain POPs in the scope of industrial permitting procedures; see the criteria for defining the state of the art in Annex 6 line 2 of the Austrian Trade and Industry Code 1994 (Gewerbeordnung 1994) [21] concerning the use of less hazardous substances.

Another focus will be to provide information, in cooperation with the chemicals inspectorates, on the recirculation (closed loop) process when using PFOS/PFAS-containing antifogging agents. To this end, the Environment Agency Austria is conducting a study in preparation for the revision of the old BREF (as part of the IPPC-BREF process) for the electroplating industry. The state of the art in electroplating in Austria shall be described in this study, on the basis of the German Environment Agency's latest work in this field.

### 4.3.1 Inspected products

- Electroplated kitchen materials and toys (in cooperation with the BMSGPK)
- Outdoor jackets, outdoor furniture

- Ski waxes
- Exercise mats
- Silicone molded parts
- Electronic products made from recycled materials
- Strings of lights

**Cooperation partners**

- BMK
- BMDW
- BMSGPK
- Chemicals inspectorates
- Environment Agency Austria

Another focus will be the cooperation with the fire departments and businesses equipped with fixed installations, with the aim of replacing firefighting foams containing PFOA without undue delay. The information leaflet of the Austrian Federal Fire Service Association (Bundesfeuerwehrverband) will be updated. For example, the strict terms under which PFOA-containing extinguisher foams/concentrates already present in mobile and fixed systems may be used have to be revised. Appropriate communication and possibly monitoring measures need to be elaborated. Existing stockpiles of PFOA-containing foams at local and company fire departments and in companies with fixed installations were to have been reported within twelve months of the entry into force of the PFOA restriction, i.e., by 4 July 2021. Stockpiles for which there is no longer any aithorized use must be disposed of in a manner pursuant to Article 7 of the POPs Regulation [3].

A provincial fire service association, within whose jurisdiction the entire stock of PFOA-containing extinguisher foams had been stored for years for mobile use on demand for a few special firefighting applications, has since stopped using such extinguishing foams for years. A project was started for replacing these centrally stored stocks with products free of perfluoro- and polyfluoroalkyl compounds by 2022. This project also includes proper disposal of the old products as POP waste.

**Cooperation partners**

- BMK
- BMA or Central Labor Inspectorate (ZAI) concerning worker protection
- Chemicals inspectorates
- Federal Fire Service Association
- Provincial fire service associations
- Civil protection departments of the offices of the provincial governments

## 4.4 Unintentionally released POPs (U-POPs)

On the basis of the results documented in the National Action Plan (NAP, 2017) regarding emissions lists, data availability and the already implemented as well as planned measures, it can be concluded that Austria has already fulfilled the provisions of the Stockholm Convention [1] and of the POPs Regulation [3] for the most part. But because the goal of the Stockholm Convention [1] is “the continuous reduction of POP releases”, further efforts are still necessary. Detailed information on this can be found in the list of measures and the summary thereof contained in the Convention (see Annex A).

Furthermore, reference is made to the following provision of Art. 6(3) of the POPs Regulation concerning the prevention of POP Emissions from industrial facilities (business premises and mining facilities): “Member States shall, when considering proposals to construct new facilities or to significantly modify existing facilities using processes that release chemicals listed in Annex III, give priority consideration to alternative processes, techniques or practices that have similar usefulness but which avoid the formation and release of substances listed in Annex III, without prejudice to Directive 2010/75/EU of the European Parliament and of the Council [17].”

In the scope of the industrial permitting procedure, the trade authority shall therefore identify potential releases of POP emissions and consider the use of suitable alternative processes with which the formation and release of POPs is avoided. In any case, appropriate preventive or mitigating measures are to be imposed for relevant releases of POPs. See the criteria for defining the state of the art in Annex 6 line 2 GewO 1994 concerning the use of less hazardous substances.

### 4.4.1 Specific steps

- Providing the regional administrative authorities with targeted information on the mandatory monitoring measures for POPs, especially the POPs that are currently listed in the Convention
- Providing the regional administrative authorities with targeted information on the verification of POP emissions or the prevention thereof in the scope of authorization processes (for new facilities or major alterations to facilities)
- In the scope of the revision of the Directive on Industrial Emissions [17], Austria will continue advocating for greater consideration being given to POPs in the BAT reference documents (with the help of experts of the Environment Agency Austria in the technical working group)

**Cooperation partners**

- BMK (Dept. V/5, Dept. V/11)
- BMDW
- BMLRT
- Environment Agency Austria
- Chemicals inspectorates

## 4.5 Stockpiles and wastes (Article 6)

### 4.5.1 PCBs

It is furthermore necessary to ensure that waste electrical equipment such as lamps, microwaves and washing machines are disposed of in an environmentally sound manner and in keeping with the specifications of the Waste Treatment Obligation Ordinance [43] and the Waste Management Act [7].

In terms of the deadline of 2025 established in the Convention for the final disposal of transformers containing PCBs, the limit value of the PCB content was reduced further in the POPs Regulation [3]. The original inventory of transformers shall be checked in

cooperation with the enforcement bodies of the chemicals inspectorates in order to rule out the possibility of the limit value being exceeded.

As far as PCB-containing demolition material is concerned, it must be ensured that the subject of PCBs and the proper disposal thereof are covered in demolition inspection training.

As far as existing buildings are concerned, taking a building inventory to check for the presence of PCBs in public buildings is recommended.

**Cooperation partners**

- BMK (Dept. V/5, Dept. V/7)
- Chemicals inspectorates
- ÖWAV (Austrian Water and Waste Management Association)
- Demolition inspection training institutes

### 4.5.2 HBCDD

The measures must focus on the area of deconstruction and waste disposal and waste recycling. Polystyrene wastes from building insulation prior to 2015/2016 very likely contain HBCDD. It must be ensured that such wastes are properly sorted and disposed of. Recycling in the form of lightweight concrete aggregates or packaging material is to be avoided in any case.

The brochure on treatment issued by the Provincial Government of Upper Austria in collaboration with the BMK shall be kept up to date and brought to the attention of the competent authorities and waste disposers.

### 4.5.3 PBDEs

The revised version (recast) of the POPs Regulation [3] establishes a lower total value of 500 mg/kg for PBDEs. This means that inspections must be performed on equipment on the market (see Chapter 4.3.), and that proper disposal and sorting of products at end of life are to be monitored. In view of the Stockholm Convention [1] ban on the recycling of POPs, the removal of POP contaminants must be considered a priority.

The information for waste disposers on the proper sorting of bromine-containing plastics pursuant to the Waste Treatment Obligation Ordinance [43] shall be kept up to date.

**Cooperation partners**

- BMK (Dept. V/5, Dept. V/7, Moser, Löw)
- Provincial authorities
- Chemicals inspectorates
- ÖWAV (Austrian Water and Waste Management Association)
- Demolition inspection training institutes

## 4.6 Foods and feeds

The BMSGPK and the AGES, as well as the inspection centers in the provinces, are responsible for monitoring and checking POP levels in foods. The BMLRT and the BAES are responsible for doing the same in feeds. It must be ensured that action values and limit values are also established for POPs that were recently included or will be included in the next few years in the Convention.

### 4.6.1 Specific steps

- Revision and updating of the action values established in the Austrian Food Code
- In the context of the Food Safety and Consumer Protection Act (LMSVG), it is recommended that the obligations to provide information pursuant to Art. 42 be expanded
- Monitoring of foods and drinking water with particular emphasis on new POPs (PBDEs, PFAS)

**Cooperation partners**

- BMK
- BMSGPK
- BMLRT
- Provincial authorities

- Food inspection establishments
- Environment Agency Austria
- AGES

## 4.7 Water Quality

With regard to one of the key goals of the Water Rights Act 1959 [6], namely that of protecting groundwater or keeping it clean so that it can eventually be used as drinking water, it was established that the contamination of groundwater with POPs is due to anthropogenic inputs.

From the study results it is known that effluents from sewage treatment plants and sewage sludges are contaminated with POPs. It is therefore proposed that these effluents be tested for such substances and that any discharges of contaminated water be regulated. Such paths of entry into surface waters would thus have to be controlled or eliminated. It is furthermore recommended that sewage sludges also be analyzed for POPs if they are to be used in composting facilities, as spreading the resulting contaminated compost would further disseminate the POPs. It is also proposed that landfill leachates be tested for POPs. From a technical perspective, these measures are required in order to prevent further contamination of soils, surface waters and ultimately groundwater.

POPs are regulated to a degree in the EU Drinking Water Directive [46]. In order to fulfill the quality requirements for drinking water set forth in this directive in the future, national statutory regulations are needed. These regulations must include stringent control of persistent organic pollutants in groundwater. The POPs of relevance and classified as hazardous to health should be included in the Austrian Groundwater Quality Ordinance (Qualitätszielverordnung Chemie Grundwasser) [34] in the form of threshold values and subsequently in the surveillance monitoring of groundwater pursuant to the Water Condition Monitoring Ordinance [63].

Comprehensive analyses of water with regard to persistent organic pollutants will be necessary in order to get an overview of the current situation. Countermeasures are to be taken in the event of positive results.

### 4.7.1 Specific steps

- Investigation of the origin and probability of occurrence of the POPs regulated under the new EU Drinking Water Directive [46], after national implementation
- Verification of inclusion in the Austrian Groundwater Quality Ordinance [34]

**Cooperation partners**

- BMK
- BMSGPK
- BMLRT
- Provincial authorities
- Environment Agency Austria
- AGES

## 4.8 Contaminated sites

As a rule, contaminated sites and suspected areas in Austria are promptly logged and managed. However, more attention needs to be given to the logging and assessment of the POPs that have been included in the Convention in recent years such as brominated flame retardants and perfluorinated alkyl substances (PFOS and PFOA; eventually also PFHxS). Another goal should be that of facilitating access to information on POP-contaminated sites for both authorities and stakeholders in the name of transparency. In the execution of the ALSAG [30], POPs are not addressed as a specific pollutant group. Because the investigation and assessment of historically contaminated sites is a long-term program with a temporal target horizon of 2050, and new contaminations have not been centrally logged since 1989, the representativeness of the information on the sites contaminated with POPs must be classified as limited at the present time. In contrast, it should be noted that in principle, the existing legal framework conditions and the currently implemented processes for implementation enable sites contaminated by POPs to be identified to a large extent.

Concerning soil protection in general, the sewage sludge and compost ordinances of the soil protection acts of the provinces would require a routine evaluation of the limit values. Establishing target values for organic pollutants (including polybrominated diphenyl

ethers, perfluorinated surfactants and pesticides) in order to reduce soil contamination would be worthwhile.

### 4.8.1 Specific steps

- Identification of POPs as a separate pollutant group in the database pursuant to ALSAG [30] and public access to the contaminated sites portal (altlasten.gv.at)
- Application of the technical directives of the Basel Convention [11] concerning the treatment of wastes containing POPs in remediation cases
- Annual group reports from the provinces on current/new pollution events (enforcement regarding the European IED [17] as well as the Water Rights Act (WRG) [6] and the Waste Management Act (AWG) [7]) contributing to significant contamination of the soil or waterways
- Continuation of the POPMON Project for detecting POP hotspots in Austria
- Compilation and creation of a georeferenced database of sites at which PFAS-containing fire extinguishing foams have been used to a large extent (e.g., firefighter training centers, airports, major fires)
- Establishing target values for organic pollutants (including polybrominated diphenyl ethers, perfluorinated surfactants and pesticides) in order to reduce soil contamination would be worthwhile.

**Cooperation partners**

- BMK (Dept. V/5, Dept. V/3)
- Environment Agency Austria

## 4.9 Reporting

The ECHA is currently working on the specifications of the recast version of the POPs Regulation [3] and an updated format for reporting POP data. This should simplify and streamline reporting for the Convention as well as in the context of the POPs Regulation [3]. In the scope of this project, the reporting systems of the Convention, of the POP Protocol [2] and of the POPs Regulation [3] are to be standardized as much as possible so as to avoid duplication of the necessary data collection. With regard to the recording of emissions from facilities that are subject to official supervision under the Austrian Trade

and Industry Code [21] or the Mineral Raw Materials Act [22], under Art. 20(3) ChemG 1996 [5] the BMDW and the BMLRT shall send data collected on and measures concerning these facilities pursuant to Art. 6(3) of the POPs Regulation to the BMK. Both the BMDW and the BMLRT are thus cooperation partners.

### 4.9.1 Specific steps

- Appointment of a working group for POP reporting
- Recording of existing data and data sources
- Harmonization of specifications on reporting from the Convention, the Protocol and the POPs Regulation
- Closing existing data gaps (e.g., in the area of newer POPs and for calculating U-POP emissions)
- Implementation of a reporting system encompassing all environmental compartments and which is also accessible to the public

**Cooperation partners**

- BMK
- BMLRT
- BMDW
- Environment Agency Austria
- AGES

## 4.10 Information exchange/informing the public

The information exchange required under the Convention will continue to be the responsibility of the National Contact Point in the BMK. The Environmental Information Act (Umweltinformationsgesetz – UIG) [64] regulates greater public access to environmental information and the dissemination of such information. Information on POPs contributes to raising awareness of the environment, to enabling a free exchange of views, to more effective public participation in decision making processes regarding environmental issues, and ultimately to improving environmental protection. With information as an aspect of communication, fears and prejudices can be eliminated and trust can be developed between administration and citizens. A free flow of information

promotes peace under the law, reduces the potential for conflicts and is a key component in the solution of environmental problems and in the constructive designing of environmentally relevant areas from a sociopolitical perspective.

General information on current developments in the scope of the Stockholm Convention [1] and the POPs Regulation [3] is provided on the Austrian SAICM Platform, which comprises competent authorities, stakeholders and NGOs.

Enabling the exchange of information among the competent authorities and the specialists involved with POPs is necessary. The job of the Austrian Contact Point is to forward any requests for information coming from other Parties to the respective specialists/experts. The Austrian POP/PBT Group, in which the heads of different departments of the BMK and the heads of different specialist departments of the Environment Agency Austria and AGES participate, strives to permit meaningful and efficient cooperation among all individuals who deal with POPs and PBTs.

### 4.10.1 Specific steps

Regular meetings of the POP/PBT Group (after the Conferences of the Parties and the meetings of the POP Review Committee of the Stockholm Convention [1])

Continuation of the POP homepage in the “Environment” area of the BMK website (bmk.gv.at/themen/klima_umwelt/chemiepolitik/international/pop.htm) with current information on the Stockholm Convention [1] and information for the group of consumers on environmental pollutants such as individual POP/PBTs (bmk.gv.at/themen/klima_umwelt/chemiepolitik/umweltschadstoffe.html)

Information on the Environment Agency Austria (umweltbundesamt.at/umweltthemen/luft/luftschadstoffe/pops) or AGES homepage (ages.at/themen/rueckstaende-kontaminanten/dioxin) concerning technical details

## 4.11 Monitoring and research/assessment of efficacy

The MONARPOP/Pure Alps Project was the largest monitoring project concerning POPs that was conducted in recent years. In addition, the POPMON and AustroPOPs projects were conducted in 2018-2021. POPs were also detected in the scope of the human

biomonitoring studies of the BMK. The focus of the next projects in the monitoring and research area will be on new POPs such as brominated flame retardants (HBCDD, PBDEs) and PFAS. The BMK will continue collaborating with the Environment Agency Austria (laboratory) and AGES in actively contributing to the work of the POP Review Committee, to the BAT/BEP guidelines and to efficacy assessment.

### 4.11.1 Specific steps

- Providing the public with information on MONARPOP/PureAlps results (closing event, information brochure for the interested public)
- Continuation of the POPMON project in order to identify regional POP hotspots in Austria
- Implementation of the monitoring and risk communication recommendations (in particular with respect to a risk communication center) from the POPMON project in cooperation with the BMSGPK
- Possible participation in the Horizon 2020 Project Catch PFAS
- AustroPOPs: integration of the results in the BORIS database, appropriate publication of the results for the interested public
- Drafting of a PFAS action plan

## 4.12 Technical assistance

When setting goals for development cooperation, the theme of capacity development, technical assistance and transfer of technology must not be taken out of the context of the implementation of the Strategic Approach to International Chemicals Management (SAICM) in Austria and the inclusion of sound chemical management.

### 4.12.1 Specific steps

Continuous observation of the progress in multilateral funding of the chemical and waste cluster (keyword: FOCW and synergies).

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pesticides (OJ L 309 of 24 November 2009), last amended by Regulation (EU) 2019/1243 of the European Parliament and of the Council of 20 June 2019

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[28] Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment, OJ L 37, 13.2.2003, S. 24.

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[33] Directive 2000/60/EG of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ L 327, 22 December 2000, p.1

[34] Ordinance of the Federal Minister of Agriculture and Forestry, Environment and Water Management concerning the establishment of quality targets for surface water (Surface Water Quality Ordinance (Qualitätszielverordnung – QZV Chemie OG)), Federal Law Gazette II No. 96/2006, last amended by Federal Law Gazette II No. 128/2019

[35] Ordinance of the Federal Minister of Social Security and Generations concerning the quality of water for human consumption (Drinking Water Ordinance (Trinkwasserverordnung - TWV)) Federal Law Gazette II No. 304/2001, last amended by Federal Law Gazette II No. 362/2017

[36] Directive 2008/98/EC on waste and repealing certain directives, OJ L 312 of 22 November 2008, pp. 3–30, last amended by Directive (EU) 2018/851, OJ L 150 of 14 June 2018, pp. 109–140.

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[38] Ordinance of the Federal Minister of Climate Action, Environment, Energy, Mobility and Technology concerning a waste list (Waste List Ordinance 2020 (Abfallverzeichnisverordnung 2020)), Federal Law Gazette II No.

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[44] Regulation of the Federal Minister of Agriculture, Forestry, Environment and Water Management on the Prevention of Waste from, Collection and Treatment of End-of-Life Vehicles (End-of-Life Vehicle Regulation), Federal Law Gazette II No. 407/2002, last amended by Federal Law Gazette II No. 489/2020

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[51] Federal Act on the Production, Placing on the Market and Use of Feeds, Premixes and Additives (Feedstuffs Act 1999 (Futtermittelgesetz 1999 – FMG 1999), Federal Law Gazette I No. 139/1999, last amended by Federal Law Gazette I No. 92/2020

[52] Ordinance of the Federal Minister of Agriculture, Forestry, Environment and Water Management decreeing the provisions implementing the Feedstuffs Act 1999, Federal Law Gazette 216/2010, last amended by Federal Law Gazette II No. 267/2017

[53] Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products, OJ L 95, 7.4.2017, p. 1–142

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[63] Ordinance of the Federal Minister of Agriculture, Forestry, Environment and Water Management on monitoring the condition waterbodies (Water Condition Monitoring Ordinance (Gewässerzustandsüberwachungsverordnung – GZÜV)), Federal Law Gazette II No. 479/2006, last amended by Federal Law Gazette II No. 128/2019

[64] Federal Act concerning access to information on the environment (Environment Information Act (Umweltinformationsgesetz – UIG)), Federal Law Gazette No. 495/1993, last amended by Federal Law Gazette I No. 74/2018

## Abbrevations

| | |
|---|---|
| AA-EQS | Annual Average Environmental Quality Standards |
| ADA | Austrian Development Agency |
| AGES | Austrian Agency for Health and Food Safety (Österreichische Agentur für Gesundheit und Ernährungssicherheit) |
| AWG | Waste Management Act (Abfallwirtschaftsgesetz) |
| BAES | Austrian Federal Office for Food Safety (Bundesamt für Ernährungssicherheit) |
| BAT | Best Available Technique |
| BAT-AEL | With the best available techniques (BAT) associated emission levels |
| BEP | Best Environmental Practice |
| BMA | Austrian Federal Ministry of Labor (Bundesministerium für Arbeit) |
| BMDW | Austrian Federal Ministry for Digital and Economic Affairs (Bundesministerium für Digitalisierung und Wirtschaftsstandort) |
| BMEIA | Austrian Federal Ministry for European and International Affairs (Bundesministerium für europäische und internationale Angelegenheiten) |
| BMK | Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie) |

| | |
|---|---|
| BMLRT | Austrian Federal Ministry for Agriculture, Regions and Tourism (Bundesministerium für Landwirtschaft, Regionen und Tourismus) |
| BMSGPK | Austrian Federal Ministry for Social Affairs, Health, Care and Consumer Protection (Bundesministerium für Soziales, Gesundheit, Pflege und Konsumentenschutz) |
| BREF | Best Available Techniques Reference Document |
| BWPL | Federal Waste Management Plan (Bundesabfallwirtschaftsplan) |
| CARACAL | Competent Authorities for REACH and CLP |
| CAS No.: | Chemical Abstracts Service Number |
| CLP | Classification, Labelling and Packaging |
| CLRTAP | Convention on Long-Range Transboundary Air Pollution |
| COP | Conference of Parties |
| DDE | Dichloro-diphenyl-dichloroethylene (primary metabolite of DDT) |
| DDT | Dichloro-diphenyl-trichloroethane |
| ECHA | European Chemicals Agency |
| EUIP | European Union Implementation Plan |
| EW60 | Population equivalent or unit per capita loading (PE) = the individual pollution load in household sewage produced by one person in 24 hours. One unit equals 60 grams of biochemical oxygen demand (BOD) per day |

| | |
|---|---|
| FMG | Feedstuffs Act (Futtermittelgesetz) |
| FORUM | Forum for Exchange of Information on Enforcement |
| HBCDD | Hexabromocyclodecane |
| HCBD | Hexachlorobutadiene |
| HCB | Hexachlorobenzene |
| HCH | Hexachlorocyclohexane |
| IPPC | Integrated Pollution and Prevention Control |
| LMSVG | Food Safety and Consumer Protection Act (Lebensmittelsicherheits- und Verbraucherschutzgesetz) |
| LRTAP | Long-Range Transboundary Air Pollution |
| MAC-EQS | Maximum allowable concentration Environmental Quality Standards |
| NIP | National Implementation Plan |
| NGO | Non-Governmental Organization |
| PAH | Polyaromatic hydrocarbons |
| PIC | Prior Informed Consent |
| PBT | Persistent, bioaccumulative and toxic substances |
| PBB | Polybrominated biphenyls |
| PBDEs | Polybrominated diphenyl ethers |

| | |
|---|---|
| PCB | Polychlorinated biphenyls |
| PCN | Polychlorinated naphthalenes |
| PCT | Polychlorinated terphenyls |
| PeCB | Pentachlorobenzene |
| PFAS | Per- and polyfluorinated alkyl sulfonates |
| PFOA | Perfluorooctanoic acid |
| PFOS | Perfluorooctane sulfonic acid |
| PFOSF | Perfluorooctane sulfonyl fluoride |
| PHS | Priority hazardous substance |
| POP | Persistent Organic Pollutants |
| POPRC | POP Review Committee |
| PTFE | Polytetrafluorethylene |
| PVDF | Polyvinylidene fluoride |
| QZV | Austrian Quality Target Ordinance (Qualitätszielverordnung) |
| REACH | Registration, Evaluation, Authorization and Restriction of Chemicals |
| RIS | Legal Information System of the Republic of Austria (Rechtsinformationssystem des Bundeskanzleramtes) |
| SAICM | Strategic Approach to International Chemicals Management |

| | |
|---|---|
| SDGs | Sustainable Development Goals (of the United Nations) |
| SVHC | Substances of very high concern |
| TWV | Drinking Water Ordinance (Trinkwasserverordnung) |
| UNECE | United Nations Economic Commission for Europe |
| UNEP | United Nations Environment Program |
| UNIDO | United Nations Industrial Development Organization |
| U-POP | Unintentional POPs, POPs that are unintentional by-products of industrial processes |
| vPvB | Very persistent, very bioaccumulative substances |
| WFD | Water Framework Directive |

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ENVIRONMENT AGENCY AUSTRIA **umweltbundesamt**

# National Action Plan pursuant to Article 5 of the Stockholm Convention on POPs and Article 6 of the EU-POP Regulation


Second Review, 2017

MINISTERIUM FÜR EIN LEBENSWERTES ÖSTERREICH

ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

# NATIONAL ACTION PLAN PURSUANT TO ARTICLE 5 OF THE STOCKHOLM CONVENTION ON POPS AND ARTICLE 6 OF THE EU-POP REGULATION

Second review, 2017

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REPORT
REP-0633

lebensministerium.at

Wien 2017

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The second review of the National Action Plan is part of the National Implementation Plan on POPs which has been published by the Federal Ministry of Agriculture, Forestry, Environment and Water Management.

For further information about the publications of the Umweltbundesamt please go to: http://www.umweltbundesamt.at/

## Imprint

Owner and Editor: Umweltbundesamt GmbH
Spittelauer Lände 5, 1090 Vienna/Austria

*Printed on $CO_2$-neutral 100%recycled paper*.


ISBN 978-3-99004-450-6

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# EXECUTIVE SUMMARY

## A Introduction

This report covers the second review of the National Action Plan for POPs which was published in 2008. Article 5 of the Stockholm Convention requires Parties to develop an Action Plan to identify, characterise and address the release of chemicals listed in Annex C. Article 5 further requires a review of the National Action Plan every five years, including the strategies and their success in meeting the relevant obligations.

Currently listed in Annex C are polychlorinated dibenzo(p)dioxins (PCDD), polychlorinated dibenzofurans (PCDF), hexachlorobenzene (HCB), polychlorinated biphenyls (PCB) and pentachlorobenzene (PeCB) when produced unintentionally. Polychlorinated Naphthalenes (PCN) have been part of Annex C since the end of 2016.

In line with the European POP Regulation (850/2004) polyaromatic hydrocarbons (namely the substances benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene) shall be included in the Action Plan as well.

The definition of the term “release” includes emissions of POPs into air, water and soil as well as releases via residues and waste and releases via products.

The Action Plan is part of the Party’s National Implementation Plan as specified in Article 7 of the Convention and includes strategies for meeting obligations to reduce or eliminate releases of chemicals listed in Annex C of the Stockholm Convention (including PAH as an additional requirement under the EU POP Regulation), and a schedule for the Action Plan. The Plan identifies priorities for action and includes those source categories that provide the most cost-effective opportunities for release reduction or elimination. It also includes an inventory of the releases of chemicals listed in Annex C.

For the second review of the National Action Plan the inventory (2004, 2009 and 2014) of POP releases has been updated. Based on this inventory instruments and measures aiming at the reduction of POP releases are described. In particular, the effectiveness of national legal regulations is assessed and the report examines whether Best Available Techniques (BAT) in combination with Best Environmental Practices (BEP) have already been applied in the source categories defined by the Stockholm Convention. If applicable, recommendations on how BAT and BEP can be implemented are given. In addition, data gaps are identified and proposals for the improvement of data quality elaborated.

Concerning emissions into air, the data are of sufficient quality for establishing an inventory for the POPs PCDD/F, PAH, HCB, PCB and PeCB (in descending order by data quality). However, due to a general lack of data, this could not be achieved in the case of PCN.

Whereas data on environmental concentrations (e.g. air) is available for most of the substances of concern, fewer data are available on releases into water and waste. For the latter, a plausible estimation of releases has been made for PCDD/F and PeCB.

Direct releases of POPs into soil arise from the source category ”open burning of waste, including burning of landfill sites” (this includes the burning of straw and stubble as well). However, if residues and waste from processes are released into the environment, releases of POPs may also occur indirectly (e.g. when using ashes from small scale residential combustion sources or biomass plants for fertilising purposes).

There are some data available in the literature on concentrations of POPs in cement and pulp and paper which are presented in this report.

In 2011 the Environment Agency Austria conducted analyses of cardboard boxes produced from waste paper (possibly contaminated with PCDD/F from printer’s ink). The results did not show a PCDD/F contamination of the printer’s ink.

The Action Plan will be reviewed and updated on a periodic basis.

## B Inventory of emissions into air

### Trends in POP emissions into air

PCDD/F and PAH emissions of major (industrial) sources decreased steadily in the years 1990-2014 with a significant drop between the years 1990 and 1994. Emissions of PCB declined significantly from 1990 to 1993, then increased slowly from 1994 to 2014 and at 180 kg/a they are now 7% lower than in 1990 (but 11% higher than in 1995). Emissions of HCB declined from 1990 to 2011, and then increased strongly in the years 2012, 2013 and 2014. This increase is due to an unintentional release of HCB in an Austrian cement installation which was caused by the input of HCB containing waste and incomplete destruction of HCB.

In 2009 emissions of PAH, HCB and PCDD/F dropped significantly due to reduced economic activity.

### Dioxins and furans (PCDD/F, I-TEQ)

In the year 2014 a total of 31.05 g PCDD/F (I-TEQ) was emitted in Austria from the source categories according to the Stockholm Convention. In the Austrian Air Emissions Inventory (OLI) PCDD/F emissions into air were calculated to be 31.61 g (I-TEQ, 2009). The difference can be explained by the fact that the OLI is more comprehensive (i.e. more activities are covered). On the other hand, some emission factors have been updated for this report (see description of source categories).

Only a few source categories contribute significantly to the total emissions of dioxins and furans, the most important being residential combustion sources with a share of 58% and thermal processes in the metallurgical sector with a share of 17%. Other sources are motor vehicles with 7%, biomass combustion (13%) and fossil fuel use in industry (3%) (see figure A and tables A and B).

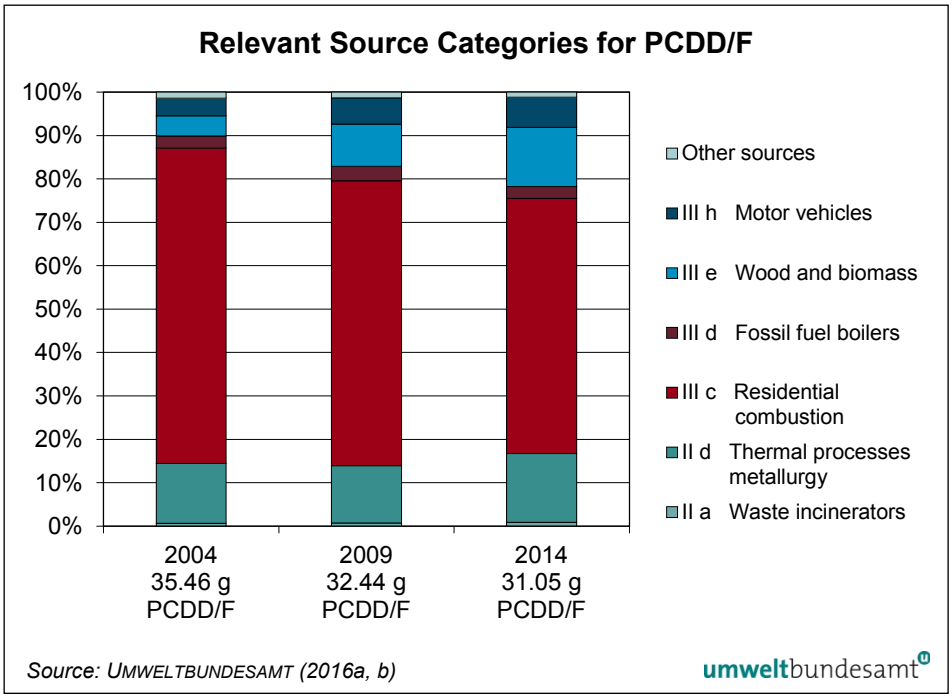


*Figure A: Relevant source categories for PCDD/F.*

*Table A: PCDD/F emissions from source categories part II for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| **Source Category Part II** | **2004 [g I-TEQ]** | **2009 [g I-TEQ]** | **2014 [g I-TEQ]** |
|---|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 0.230 | 0.229 | 0.267 |
| Cement kilns firing hazardous waste[1] | 0.119 | 0.131 | 0.121 |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2] | IE | IE | IE |
| The following thermal processes in the metallurgical industry | | | |
| (i) Secondary copper production | 0.279 | 0.279 | 0.279 |
| (ii) Sinter plants in the iron and steel industry | 3.106 | 2.538 | 3.353 |
| (iii) Secondary aluminium production | 1.309 | 1.282 | 1.256 |
| (iv) Secondary zinc production | NO | NO | NO |
| **Total (Part II)** | **5.043** | **4.459** | **5.275** |

[1] *figures represent total emissions from cement kilns*

[2] *only process emissions are covered here; PCDD/F emissions from combustion processes are included in fossil fuel fired utility and industrial boilers, and in firing installations for wood and other biomass fuels.*

*NO: not occurring*

*IE: included elsewhere*

*Table B: PCDD/F emissions from source categories part III for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| Source Category Part III | 2004 [g I-TEQ] | 2009 [g I-TEQ] | 2014 [g I-TEQ] |
|---|---|---|---|
| Open burning of waste* | 0.223 | 0.132 | 0.069 |
| Thermal processes in the metallurgical industry not mentioned in Part II | 0.204 | 0.191 | 0.213 |
| Residential combustion sources | 25.748 | 21.295 | 18.127 |
| Fossil fuel-fired utility and industrial boilers | 0.989 | 1.079 | 0.856 |
| Firing installations for wood and other biomass fuels | 1.644 | 3.147 | 4.192 |
| Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil | NA | NA | NA |
| Crematoria | 0.154 | 0.164 | 0.164 |
| Motor vehicles, particularly those burning leaded gasoline | 1.451 | 1.972 | 2.155 |
| Destruction of animal carcasses | NA | NA | NA |
| Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) | NA | NA | NA |
| Shredder plants for treatment of end of life vehicles | NE | NE | NE |
| Smouldering of copper cables | NO | NO | NO |
| Waste oil refineries | NO | NO | NO |
| **Total (Part III)** | **30.414** | **27.980** | **25.776** |

* *without burning of landfill sites and accidental fires*

*NA: not applicable*

*NO: not occurring*

*NE: not estimated*

### Hexachlorobenzene (HCB)

In Austria only a few source categories contribute significantly to the total emissions of HCB. In the year 2014, 140.92 kg were emitted in total (see Table C, D and Figure B). Cement kilns sources had the lion's share (76.5%) while residential combustion sources accounted for 19%. Thermal processes in the metallurgical industries emitted 3.4% of the total emissions. All other sources were well below 1%. The situation is totally different than in the years 2004 and 2009 when the lion's share of HCB came from residential combustion sources. The increase in 2014 is due to an unintentional release of HCB in an Austrian cement plant.

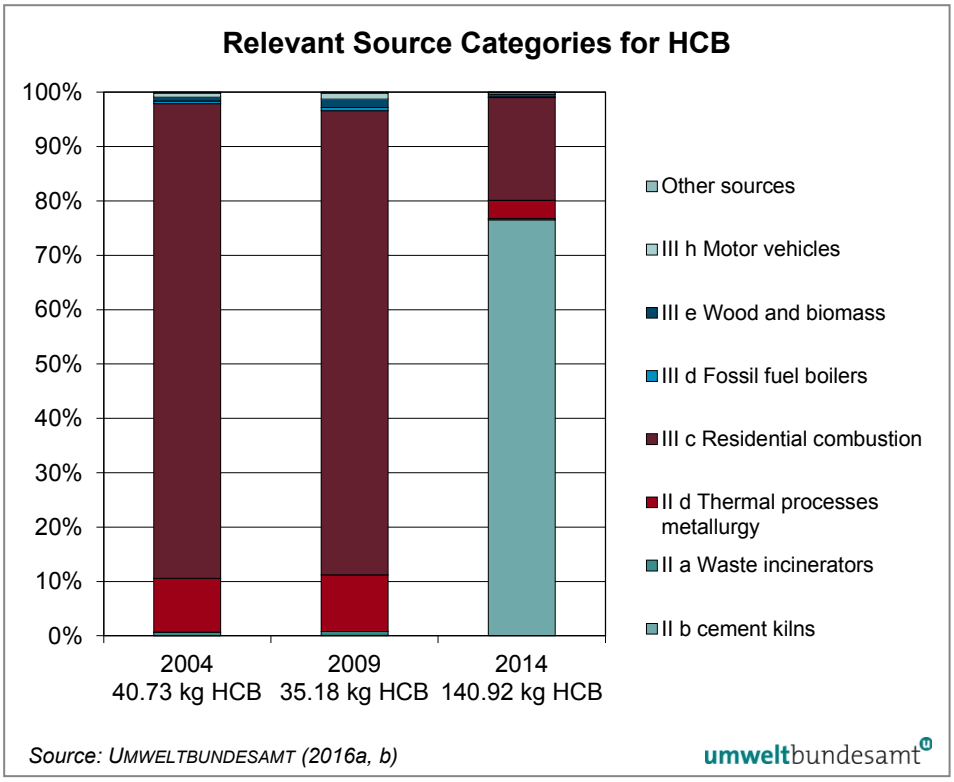


*Figure B: Relevant source categories for HCB.*

*Table C: HCB emissions from source categories part II for 2004, 2009 and 2014 (Umweltbundesamt 2016a, b).*

| **Source Category Part II** | **2004 [kg HCB]** | **2009 [kg HCB]** | **2014 [kg HCB]** |
|---|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 0.253 | 0.262 | 0.301 |
| Cement kilns firing hazardous waste[1] | 0.018 | 0.020 | 107.851 |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2] | IE | IE | IE |
| The following thermal processes in the metallurgical industry | | | |
| (i) Secondary copper production | 0.091 | 0.091 | 0.091 |
| (ii) Sinter plants in the iron and steel industry | 3.261 | 2.926 | 4.031 |
| (iii) Secondary aluminium production | 0.654 | 0.641 | 0.628 |
| (iv) Secondary zinc production | NO | NO | NO |
| **Total (Part II)** | **4.277** | **3.939** | **112.902** |

[1] *figures represent total emissions from cement kilns*

[2] *only process emissions are covered here; HCB emissions from combustion processes are included in fossil fuel fired utility and industrial boilers, and in firing installations for wood and other biomass fuels.*

*NO: not occurring*

*IE: included elsewhere.*

*Table D: HCB emissions from source categories part III for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| Source Category Part III | 2004 [kg HCB] | 2009 [kg HCB] | 2014 [kg HCB] |
|---|---|---|---|
| Open burning of waste* | 0.045 | 0.026 | 0.014 |
| Thermal processes in the metallurgical industry not mentioned in Part II | 0.016 | 0.014 | 0.017 |
| Residential combustion sources | 35.586 | 30.032 | 26.657 |
| Fossil fuel-fired utility and industrial boilers | 0.197 | 0.195 | 0.152 |
| Firing installations for wood and other biomass fuels | 0.287 | 0.543 | 0.715 |
| Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil | NA | NA | NA |
| Crematoria | 0.031 | 0.033 | 0.033 |
| Motor vehicles, particularly those burning leaded gasoline | 0.290 | 0.394 | 0.431 |
| Destruction of animal carcasses | NA | NA | NA |
| Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) | NA | NA | NA |
| Shredder plants for treatment of end of life vehicles | NE | NE | NE |
| Smouldering of copper cables | NO | NO | NO |
| Waste oil refineries | NO | NO | NO |
| **Total (Part III)** | **36.451** | **31.238** | **28.019** |

** without burning of landfill sites and accidental fires*

*NA: not applicable, NE: not estimated, NO: not occurring*

### Polycyclic aromatic hydrocarbons (PAH)

In the year 2014, 4,845 kg PAH were emitted in Austria. PAH emissions are mainly caused by two source categories (see Figure C, Table E and F). Residential combustion sources accounted for 79% and mobile vehicles for 11%. Other notable sources were firing installations for wood and biomass (2.7%) and sinter plants (4%).

*Figure C: Relevant source categories for PAH.*

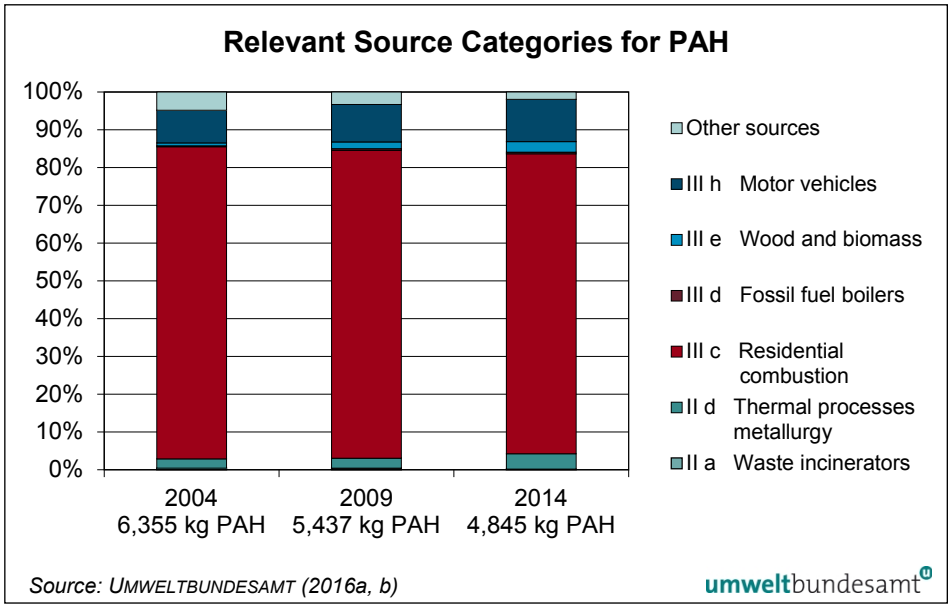

*Table E: PAH emissions from source categories part II for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016 a, b).*

| Source Category Part II | 2004 [kg PAH] | 2009 [kg PAH] | 2014 [kg PAH] |
|---|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 24.066 | 24.095 | 9.443 |
| Cement kilns firing hazardous waste[1] | 3.332 | 3.663 | 3.385 |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2] | IE | IE | IE |
| The following thermal processes in the metallurgical industry | | | |
| (i) Secondary copper production | NE | NE | NE |
| (ii) Sinter plants in the iron and steel industry | 156.484 | 140.891 | 193.647 |
| (iii) Secondary aluminium production | NE | NE | NE |
| (iv) Secondary zinc production | NO | NO | NO |
| **Total (Part II)** | **183.872** | **168.649** | **206.476** |

*1 figures represent total emissions from cement kilns*

*2 only process emissions are covered here; PAH emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.*

*NO: not occurring; NE: not estimated; IE: included elsewhere.*

*Table F: PAH emissions from source categories part III for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016 a, b).*

| Source Category Part III | 2004 [kg PAH] | 2009 [kg PAH] | 2014 [kg PAH] |
|---|---|---|---|
| Open burning of waste* | 305.551 | 178.625 | 90.885 |
| Thermal processes in the metallurgical industry not mentioned in Part II | 2.909 | 2.763 | 3.250 |
| Residential combustion sources | 5,250.076 | 4428.292 | 3,846.067 |
| Fossil fuel-fired utility and industrial boilers | 16.925 | 25.973 | 20.121 |
| Firing installations for wood and other biomass fuels | 46.961 | 96.496 | 133.194 |
| Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil | NA | NA | NA |
| Crematoria | 0.007 | 0.008 | 0.008 |
| Motor vehicles, particularly those burning leaded gasoline | 548.220 | 536.494 | 545.0025 |
| Destruction of animal carcasses | NA | NA | NA |
| Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) | NA | NA | NA |
| Shredder plants for treatment of end of life vehicles | NE | NE | NE |
| Smouldering of copper cables | NO | NO | NO |
| Waste oil refineries | NO | NO | NO |
| **Total (Part III)** | **6,170.651** | **5,268.651** | **4,638.550** |

*NA: not applicable*

*NE: not estimated*

*NO: not occurring*

**Pentachlorobenzene (PeCB)**

In the year 2014, a total of 23.2 kg of PeCB was emitted in Austria from the source categories according to the Stockholm Convention.

PeCB emissions are not available from the Austrian inventory but have been calculated using default emission factors from the literature and given activity data. Therefore, there are some uncertainties in the calculated PeCB emissions.

*Figure D: Relevant source categories for PeCB.*

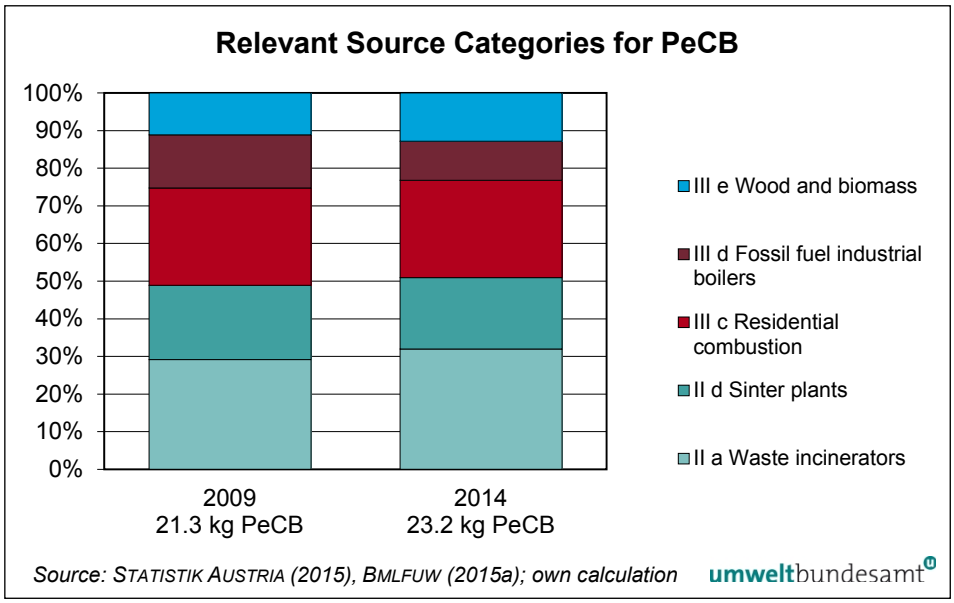


*Table G: PeCB emissions from source categories part II for 2009 and 2014 (STATISTIK AUSTRIA 2015, BMLFUW 2015a, own calculation).*

| Source Category Part II | 2009 [kg PeCB] | 2014 [kg PeCB] |
|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 6.21 | 7.42 |
| Cement kilns firing hazardous waste | NA | NA |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching | NA | NA |
| The following thermal processes in the metallurgical industry | | |
| (i) Secondary copper production | NA | NA |
| (ii) Sinter plants in the iron and steel industry | 4.2 | 4.4 |
| (iii) Secondary aluminium production | NA | NA |
| (iv) Secondary zinc production | NO | NO |
| **Total (Part II)** | **10.41** | **11.82** |

*NO: not occurring*

*NA: not applicable.*

| Source Category Part III | 2009 [kg PeCB] | 2014 [kg PeCB] |
|---|---|---|
| Open burning of waste, including burning of landfill sites | NA | NA |
| Thermal processes in the metallurgical industry not mentioned in Part II | NA | NA |
| Residential combustion sources | 5.5 | 6.0 |
| Fossil fuel-fired utility and industrial boilers | 3.00 | 2.4 |
| Firing installations for wood and other biomass fuels | 2.37 | 2.98 |
| Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil | NA | NA |
| Crematoria | NA | NA |
| Motor vehicles, particularly those burning leaded gasoline | NA | NA |
| Destruction of animal carcasses | NA | NA |
| Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) | NA | NA |
| Shredder plants for treatment of end of life vehicles | NA | NA |
| Smouldering of copper cables | NO | NO |
| Waste oil refineries | NO | NO |
| **Total (Part III)** | **10.87** | **11.38** |

*NA: not applicable.*

*NO: not occurring*

*Table H: PeCB emissions from source categories part III for 2009 and 2014 (STATISTIK AUSTRIA 2015, BMLFUW 2015a; own calculation).*

### Polychlorinated bipenyls (PCB)

In Austria only a few source categories contribute significantly to the total emissions of PCB. In the year 2014, 116.87 kg were emitted in total. Thermal processes in the metallurgical industry had the lion's share (99%). All other sources were well below 1%.

*Figurae E: Relevant source categories for PCB.*

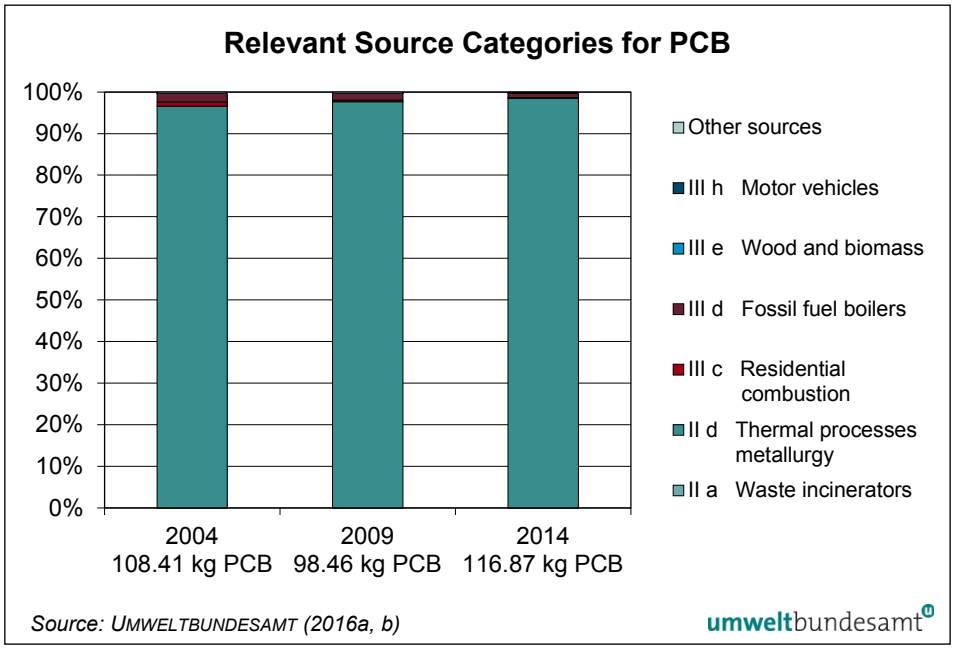


*Table I: PCB emissions from source categories Part II for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| **Source Category Part II** | **2004 [g PCB]** | **2009 [g PCB]** | **2014 [g PCB]** |
|---|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 0.065 | 0.068 | 0.053 |
| Cement kilns firing hazardous waste[1] | 331.949 | 353.098 | 323.780 |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2] | IE | IE | IE |
| The following thermal processes in the metallurgical industry | | | |
| (i) Secondary copper production | NA | NA | NA |
| (ii) Sinter plants in the iron and steel industry | 26,903.600 | 23,633.234 | 33,000.000 |
| (iii) Secondary aluminium production | NA | NA | NA |
| (iv) Secondary zinc production | NO | NO | NO |
| **Total (Part II)** | **27,235.614** | **23,986.401** | **33,323.833** |

[1] *figures represent total emissions from cement kilns*

[2] *only process emissions are covered here; PCB emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.*

*NA: not applicable*

*NO: not occurring*

*IE: included elsewhere*

*Table J: PCB emissions from source categories Part III for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| Source Category Part III | 2004 [g PCB] | 2009 [g PCB] | 2014 [g PCB] |
|---|---|---|---|
| Open burning of waste* | NA | NA | NA |
| Thermal processes in the metallurgical industry not mentioned in Part II | 77,779.105 | 72,499.525 | 82,162.70 |
| Residential combustion sources | 1,091.570 | 426.201 | 190.817 |
| Fossil fuel-fired utility and industrial boilers | 2,298.303 | 1,547.341 | 1,196.029 |
| Firing installations for wood and other biomass fuels | 0.128 | 0.261 | 0.351 |
| Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil | NA | NA | NA |
| Crematoria | NA | NA | NA |
| Motor vehicles, particularly those burning leaded gasoline | 0.924 | 0.841 | 0.508 |
| Destruction of animal carcasses | NA | NA | NA |
| Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) | NA | NA | NA |
| Shredder plants for treatment of end of life vehicles | NE | NE | NE |
| Smouldering of copper cables | NO | NO | NO |
| Waste oil refineries | NO | NO | NO |
| **Total (Part III)** | **81,170.031** | **74,474.169** | **83,550.405** |

** without burning of landfills sites and accidential fires*

*NA: not applicable*

*NO: not occurring*

*NE: not estimated*

**Polychlorinated naphthales (PCN)**

Due to the limited availability of qualified data, releases of PCN have not been calculated.

## C Inventory of emissions into water

Data on sources for POPs releases into water are held in two registers in Austria:

In principle, point sources and emissions to water for all POPs are included in the European Pollutant Release and Transfer Register (PRTR). In practice, a reporting obligation to PRTR exists (for most industrial sectors) only for facilities exceeding a certain production capacity threshold and for emissions which exceed a pollutant release threshold. For Austria, approximately 70 facilities with emissions to water or waste water are listed in the PRTR. None of these facilities have reported emissions to water for the pollutants HCB, PeCB and PCB. Two PRTR facilities reported PCDD/PCDF emissions to water; one PRTR-facility reported PAH emissions to water. So far, no data on diffuse sources of POPs have been entered in the PRTR.

Additional information on POP releases was gathered as part of a project undertaken to set up the national emissions inventory in 2007/2008. Some 70 substances were analysed at the inlet and outlet of 15 urban waste water treatment plants with different capacities, purification technologies and waste water composition. The analytical programme comprised the priority substances and certain other substances listed in the daughter Directive 2008/105/EC of the Water Framework Directive and pollutants of national relevance regulated in the Austrian Ordinance on Quality Standards for Surface Waters. DDT, chlordane, aldrin, dieldrin, endrin, heptachlor, hexachlorobenzene and pentachlorobenzene could not be detected in untreatedwaste water. With the exception of one facility, PAHs were only detectable in untreatedwaste water. Only polybrominated diphenylethers were detected in effluents in the sub-ng/l range and hexachlorcyclohexane (lindane) in the ng/l range. The use of lindane had been allowed for some selected minor applications until January 1st 2008.

In 2009 a national inventory on pollutant emissions to surface waters was established. This national register comprises emissions of the following point sources: PRTR facilities, urban waste water treatment plants with a capacity from 2,000 population equivalents upwards and waste incineration facilities with a capacity of more than 2 tonnes of waste per hour. There is no release threshold for reporting. The lower release limit is determined by the limit of quantification of the specified analytical method and the waste water discharge. The first reporting cycle (for the data for 2009) covered only basic waste water parameters. Since 2010 discharges have been reported for a number of substances including POPs. The emissions are reported as annual load data.

By 2014, the remediation of a historical landfill had to be stopped as off-site thermal treatment of HCB-contaminated lime sludge from a cement kiln caused unintended releases to air. As a new tender for ex-situ treatment of sludges failed, a containment system to minimise pollutant releases from the abandoned landfill is now being installed.

It can be concluded that underground pollution by PAHs causes local impacts on soil and groundwater. Nevertheless, it should be pointed out that, depending on the site-specific situation and whether sensitive land uses are concerned, an analysis of the risks to human health or ecosystems is required.

Whereas underground pollution by PAH is a well known problem, available information on sites contaminated by PCDD/F, HCB and PCB is scarce.

## D Inventory of releases via residues and waste

An inventory of releases via residues and waste can be established for PCDD/F and PeCB. In the case of the other POPs, qualified data are not available.

### Dioxins and furans (PCDD/F)

In the year 2014 a total of 302.7 g PCDD/F I-TEQ was emitted, which is approximately ten times as much as for the emissions to air. Solid waste from waste incineration contributed most (63%) of the overall releases. Waste from residential sources was responsible for another significant release (25%). Other releases arose from thermal processes in the metallurgical sector and from fossil fuel and biomass combustion (see Figure F, Table K).

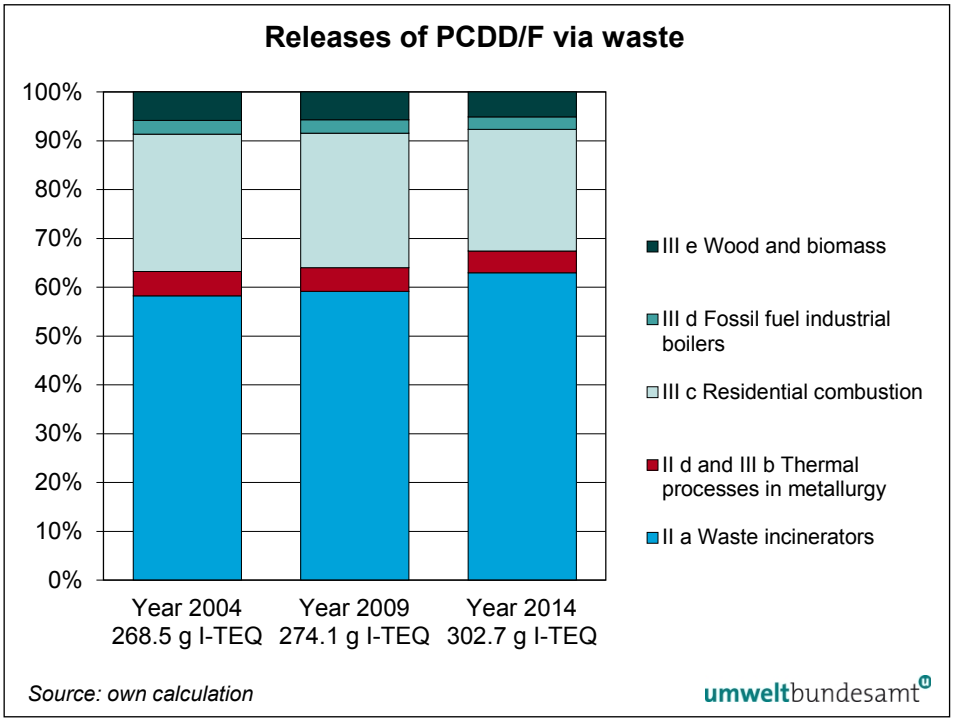


*Figure F: Releases (though hardly bio-available) of PCDD/F via waste.*

*Note: Total releases may be higher since for many source categories (e.g. the metallurgical sector) with a potential for POPs releases via waste qualified emission factors are not available.*

*Table K: Releases of PCDD/F via waste (own calculation).*

| Source Category | 2004<br>g I-TEQ | 2009<br>g I-TEQ | 2014<br>g I-TEQ |
|---|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 156.37 | 162.1 | 190.7 |
| Thermal processes in the metallurgical industry | 13.3 | 13.3 | 13.3 |
| Residential combustion | 75.5 | 75.5 | 75.5 |
| Fossil fuel industrial boilers | 7.7 | 7.7 | 7.7 |
| Wood and biomass | 15.6 | 15.6 | 15.6 |
| **Total** | **268.5** | **274.1** | **302.7** |

However, there are **distinct differences** to other releases with regard to uptake by organisms and impact on human health: Many waste types are disposed of in landfills and thus removed from regular material flows and are **no longer bio-available**, provided that the landfills are correctly designed and operated:

Waste from waste incinerators is generally disposed of in landfills (landfills for residual waste, mass waste or underground disposal). 87% of the PCDD/F releases occur via fly ash, which is often sent to underground disposal.

Very high PCDD/F concentrations were found in soot from small scale combustion sources. It is not known in detail how this type of waste is treated, but it is assumed that the major part is disposed of via the typical municipal solid waste routes. Where municipal solid waste undergoes thermal treatment, POPs are either oxidised or – if captured in the ashes – sent to landfill. In the case of mechanical-biological treatment, soot accumulates in the fraction which is usually sent to landfill.

Waste from metallurgical processes – which is contaminated to some extent– is either returned to the process or sent to external treatment and/or disposal. There are major data gaps with respect to POP concentrations and the treatment of POP containing waste types.

Fly ash from thermal power plants is used in the cement and construction industry, whereas fly ash from biomass plants has to be disposed of in landfills.

Releases of POPs into the environment via waste can occur when POP containing waste types end up in the environment. This can be the case when ash from small scale firing installations (which can contain considerable high concentrations of POPs) is used for “fertilising” purposes or used as an agent for sanding the pavement during the winter season. Coarse ashes from biomass plants are used as additional material for preparing compost. In general, there are also major data gaps concerning the concentrations of POPs in ashes from residential combustion sources. Release estimates are associated with great uncertainties. The reasons for these uncertainties are (among others) the many different types and varieties in the quality of the fuels (and waste types) used (e.g. water content, ash content, calorific value, chlorine content), the wide variety of firing systems with different conditions of combustion and the wide variety of “local” factors (such as manual loading of the firing system, co-incineration of waste).

These releases are relevant when a certain part of the waste is used in the environment (e.g. when using ash as “fertiliser” in private gardens).

**Pentachlorobenzene (PeCB)**

In the year 2014 a total of 3.51 kg PeCB was emitted. Solid waste from waste incineration contributed most (81%) of the overall releases. Other releases came from thermal processes in the metallurgical sector and from fossil fuel and biomass combustion. It should be mentioned that the data available were scarce.

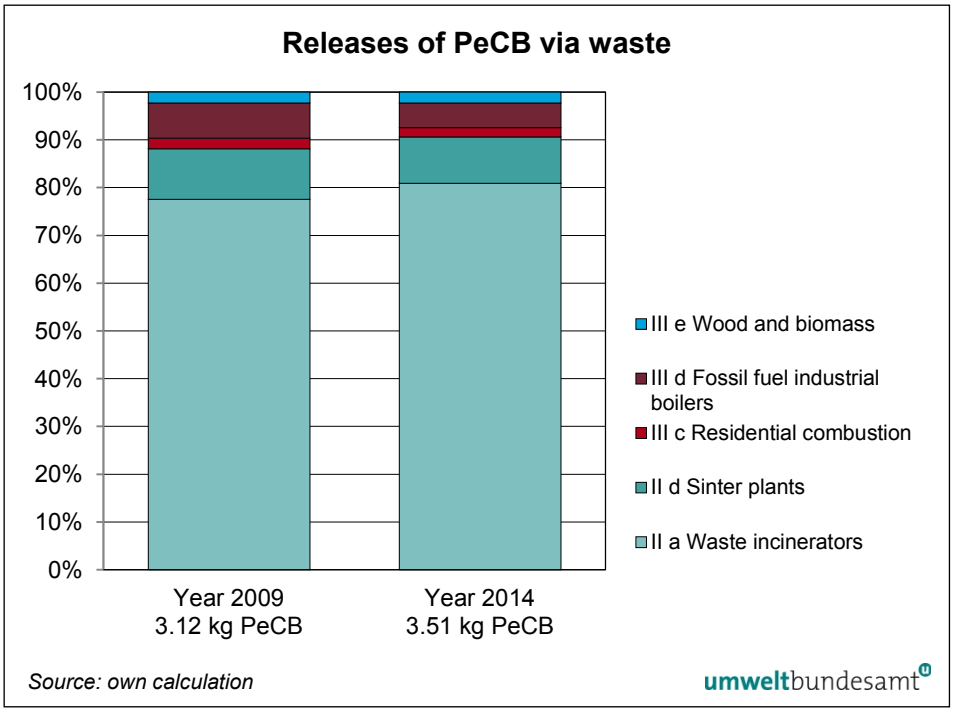


*Figure G: Releases (though hardly bio-available) of PeCB via waste.*

| Source Category | 2009 [kg PeCB] | 2014 [kg PeCB] |
|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 2.42 | 2.84 |
| The following thermal processes in the metallurgical industry | | |
| (ii) Sinter plants in the iron and steel industry | 0.33 | 0.34 |
| Residential combustion sources | 0.07 | 0.07 |
| Fossil fuel-fired utility and industrial boilers | 0.23 | 0.18 |
| Firing installations for wood and other biomass fuels | 0.07 | 0.08 |
| **Total** | **3.12** | **3.51** |

*Table L: Releases of PeCB via waste for 2009 and 2014 (own calculation)*

## E Releases via products

Action on POPs in products is specified in Annex C Part V A (g) of Stockholm the Convention ("minimization of these chemicals as contaminants in products"). Some data can be found in the literature relating to concentrations of PCDD/F in sold cement, pulp and paper products (see Table M). No data are available on the other POPs described in this report.

However, for most source categories there are no relevant product releases.

*Table M: PCDD/F-releases via the products cement and pulp and paper – calculations were based on data from literature (KARSTENSEN 2006, UNEP 2013, GRUBER 1996).*

| | Release (g I-TEQ/a) |
|---|---|
| Cement | 4.04 |
| Paper | 4.46 |

*Releases via pulp which is not exported are included in the value given for paper.*

PCDD/F releases via cement, pulp and paper products in 2014 were almost the same as in 2009 and 2004 since there were no significant changes in production.

Concentrations of PCDD/F in cement are considered to be low and can be explained by the fact that filter dust from the clinker process (average PCDD/F concentration: 6.7 ng I-TEQ/kg) is added to the product and that secondary raw materials (e.g. fly ash, gypsum from flue gas desulphurisation) are used. Consequently, the cement is contaminated with low concentrations of PCDD/F (average: 0.91 ng I-TEQ/kg cement) (KARSTENSEN 2006).

It should be mentioned that the bio-availability of POPs in cement has been greatly reduced.

Austria participated in the revision of the Dioxin Toolkit (UNEP 2013). UNEP 2013 states under “mineral products”: ”This section summarises high-temperature processes in the mineral industry. Raw materials or fuels that contain chlorides may potentially cause the formation of PCDD/PCDF at various steps of the processes, e.g. during the cooling phase of the gases or in the heat zone. Due to the long residence time in kilns and the high temperatures needed for the product, emissions of PCDD/PCDF are generally low in these processes.”

Cement kilns firing hazardous waste are a source covered in Annex C Part II (b) of the Convention concerning emissions of PCDD/F, HCB, PAH, PCB and PeCB. Therefore, the quantification of these POPs in environmental media, as well as in residues and products, is desirable.

In pulp and paper production PCDD/F is introduced into the products mainly via bleached (Kraft-)pulp and recycled papers.

In Austria, total pulp production (reference year 2014) amounted to 1,571 kt (2009: 1,514 kt; 2004: 1,509 kt) with bleached pulp having a share of 36%, unbleached pulp 35% and textile pulp 28% (AUSTROPAPIER 2015).

The releases from pulp were calculated based on emission factors of 0.5 µg/t (bleached Kraft-pulp) and 0.1 µg/t (other pulp) (UNEP 2013). Thus, the total releases via pulp amounted to 0.39 g in the year 2014.

Relevant raw materials for paper production are pulp (both from national production and from imports), wood pulp and recovered paper (both de-inked and not de-inked).

In addition to pulp produced in Austria (see above), imported pulp has to be taken into account: In 2014 about 662,330 t of bleached (Kraft-)pulp were imported. Part of the imported pulp came from countries where chlorine is still used as a bleaching agent. For the calculation of the PCDD/F content it is as-

sumed that the emission factor is 0.5 µg/t for 10% of the imported pulp, whereas the other imported pulp is less contaminated (0.1 µg/t). This leads to a total of 0.093 g I-TEQ imported via pulp.

Input of PCDD/F via wood-pulp has been calculated using an emission factor of 0.1 µg/t (UNEP 2013; total input: 0.037 g I-TEQ).

On the other hand, PCDD/F is introduced via recycled paper and more specifically via impurities in used inks. Where de-inking is applied (about 40% of recovered paper is de-inked in Austria), the PCDD/F content is reduced by a factor of 3 (GRUBER 1996). Comparably high concentrations (up to 2 ng/kg) were found in packaging papers and paper board in the early 1990s. In general, there was a sharp decline in average concentrations between 1989 and 1994 whereas concentrations have been decreasing slowly since 1994 (GRUBER 1996).

Based on the information above and on data given in the Dioxin Toolkit (UNEP 2013), it has been assumed that the PCDD/F concentration in recovered paper is 3 µg/t (without de-inking) and 0.99 µg/t (with de-inking). These assumptions result in an average emission factor of 2.18 µg/t (for de-inked and non de-inked paper). Thus the total release of PCDD/F via paper amounts to 4.46 g (reference year: 2014).

Publications in the scientific literature give some indication that waste paper could be contaminated by printing inks containing significant residues of PCDD/F, e.g. through pigments. In 2011 the Environment Agency Austria conducted a survey assessing the PCDD/F content of cardboard boxes known to be produced from waste paper as the predominant raw material. Comparing the PCDD/F content of brand-new non printed cardboard boxes with used cardboard boxes imprinted to a large extent this limited study did not show any indication of PCDD/F input via printing inks. The cardboard box samples analysed for this study showed PCDD/F contents in a range of 1.2 to 1.9 ng TEQ/kg (UMWELTBUNDESAMT 2011c).

In 2010 Austropapier, the Association of the Austrian Paper Industry, submitted new data on the PCDD/F content of selected paper products in order to refine calculations based on the emissions factors taken from the Dioxin Toolkit (UNEP 2005). The emission factors derived from the new data indicate a reduction in the overall PCDD/F release via paper products by a factor of three.

A new calculation was performed in 2011:

*Table N: Releases of PCDD/F via products (calculation on the basis of the output of Austropapier and the results of analysis).*

| Product | Production (t/a) | Emission factor (µg TEQ/t) | Releases (g PCDD/F TEQ/a) | Percentage (%) |
|---|---|---|---|---|
| Newspaper printing paper | 299,205 | 0.068 | 0.02 | 1.2 |
| Printing and writing paper | | | | |
| • deinked | 902,421 | 0.068 | 0.06 | 3.7 |
| • from pulp | 1,346,070 | 0.050 | 0.07 | 4.0 |
| Folding box cardboard | 487,214 | 0.723 | 0.35 | 21.1 |
| Packaging paper | 676,177 | 1.141 | 0.77 | 46.2 |
| Kraft paper | | | | 0.0 |
| • with recovered paper | 374,855 | 0.858 | 0.32 | 19.3 |
| • only from pulp | 250,743 | 0.050 | 0.01 | 0.8 |
| Thin- and special papers | | | | 0.0 |
| Sanitary paper | 128,660 | 0.068 | 0.01 | 0.5 |
| Others | 126,896 | 0.050 | 0.01 | 0.4 |
| Packing and spezial board | 13,299 | 0.858 | 0.01 | 0.7 |
| Market pulp exported | 95,471 | 0.070 | 0.01 | 0.4 |
| Market pulp (ECF) | 313,818 | 0.090 | 0.03 | 1.7 |
| **Total** | **5,014,829** | | **1.67** | **100.0** |

## F Evaluation of the efficacy of national laws and policies and strategies for meeting the obligations of the Stockholm Convention and the EU POP Regulation

Considering the findings of this report for POPs release inventories, availability of data, measures already implemented or planned, it can be concluded that Austria complies to a great extent with the provisions of the Stockholm Convention and the EU POP Regulation. Nevertheless, as one of the goals of the Convention is the “continuous reduction of POP releases”, further efforts are necessary.

PCDD/F and PAH emissions of major (industrial) sources decreased steadily in the years 1990-2014 with a significant drop between the years 1990 and 1994. Emissions of PCB declined significantly from 1990 to 1993, then increased slowly from 1994 to 2014 and, at 180 kg/a, are now 7% lower than in 1990 (but 11% higher than in 1995). Emissions of HCB declined from 1990 to 2011, and then increased strongly in the years 2012, 2013 and 2014. This increase was due to an unintentional release of HCB in an Austrian cement installation which was caused by the input of HCB containing waste and incomplete destruction of HCB.

If there are changes in the best available techniques allowing for lower or zero emissions from relevant sources, policy makers have to react and to adapt the relevant legal provisions accordingly (e.g. by laying down stricter emission limit values).

The NAPs 2008 and 2012 identify small residential combustion plants as an important target area. In 2014 they still are responsible for 58% of the PCDD/F emissions, 79% of the PAH emissions and 26% of the PeCB emissions into air. All possible measures have to be investigated and explored to reduce POP emissions from these sources.

PCDD/F emissions from biomass combustion have more than doubled from 2004 to 2014 and are responsible for 13% of the overall PCDD/F emissions. PAH emissions from biomass combustion almost tripled from 2004 to 2014, but are still only responsible for 3% of the overall PAH emissions.

It should be mentioned that in order to comply with certain national and international obligations a variety of comprehensive and to some extent cross-sectoral measures and instruments are being developed in Austria. These measures are aimed at the reduction of greenhouse gases, $NO_x$ and (fine) particulate matter. Some of these measures (described e.g. in the Climate Strategy 2007 or in the Programme of the Federal Government (FEDERAL GOVERNMENT 2007)) will lead to an indirect reduction of POPs releases (e.g. by reducing energy consumption or by prescribing stricter air emission limit values for dust), others (such as the increased use of biomass in small scale firing installations) will lead to an increase in POP releases.

Moreover, it is important to gain more in-depth knowledge in fields where reliable data are limited or missing. Specific studies e.g. of POP concentrations in certain wastes as well as further POP related monitoring activities are formulated below.

**Evaluation of Measures proposed in NAP 2012 (according to § 20 (2) Chemicals Act 1996)**

NAP 2008 and NAP 2012 list a variety of measures which help to lower POPs emissions from relevant sources on the one hand, and would improve the availability of data on POP in the environment on the other hand.

**Releases of POPs from source categories**

The following table gives an overview of measures proposed in the NAP 2012 and implemented in the period 2012-2016.

| National legislation | Contents relating to POPs | Measures proposed in NAP 2012 | Current status |
|---|---|---|---|
| Industrial Code 1994 and specific ordinances according to § 82 para 1 | ELV for various air pollutants, eg dust, PCDD/F | Continuous evaluation with regard to BAT | Amendment of Iron and Steel Ordinance (Fed. Law Gaz. II No. 54/2016)<br>Repeal of ordinance for Sinter Plants (Fed. Law Gaz. II No. 303/2014)<br>Ordinance on Foundries (Fed. Law Gaz. II No. 264/2014) |
| Ordinance on combustion plants (Fed. Law Gaz. II No. 331/1997) | ELVs for dust, CO, Corg, $NO_x$ | Adaptation to BAT necessary (stricter ELVs for dust) | The process of implementation of the MCPD into national law is currently (2017) under way (amending the ordinance on combustion plants). |
| Waste incineration ordinance (Fed. Law Gaz. II No. 2002/389) | ELVs for dust, CO, Corg, $NO_x$, heavy metals, PCDD/F | Stricter ELVs for dust for co-incineration plants | Revised ordinance (Fed. Law Gaz. II No. 135/2013) |
| Austrian Water Act and specific Ordinances: | ELVs for AOX and POX in the sector specific ordinances | | |
| Ordinance on the limitation of waste water emissions from flue gas treatment (Fed. Law Gaz. II No. 271/2003) | ELVs for PCDD/F | Continuous evaluation with regard to BAT | Amendment (Fed. Law Gaz. II No. 201/2014) |
| Ordinance on the limitation of waste water emissions from processing of coal (Fed. Law Gaz. II No. 346/1997) | ELVs for PAHs | Continuous evaluation with regard to BAT | Amendment in preparation |
| Ordinance on the limitation of waste water emissions from the production of plant protecting agents and crop sprayings (Fed. Law Gaz. No. 668/1996) | ELVs for AOX and specific POPs | Continuous evaluation with regard to BAT | None |
| Ordinance on the determination of the target state for surface waters (Fed. Law Gaz. II No. 96/2006) | Environmental quality standard for HCB | For PAHs: community environmental quality standards determined (in 2008) | Ordinance was amended in 2010 according to Directive 2008/105/EC (Fed. Law Gaz. II No. 461/2010) and in 2016 (Fed. Law Gaz. II No. 363/2016) |
| Ordinance on landfills (Fed. Law Gaz. II No. 39/2008) | Limit values for the content of PAH in wastes | | Amended by Fed. Law Gaz. II No. 291/2016 |
| Compost ordinance (Fed. Law Gaz. II No. 292/2001) | Limit values for the content of POPs in composts | Continuous evaluation of the limit values necessary | None |

| Other relevant legal provisions | Contents relating to POPs | Measures proposed in NAP 2012 | Current status |
|---|---|---|---|
| BAT Conclusions, already published in the Official Journal of the European Commission | Limit values for POPs | New measure | Implementation in national law (ordinances, permits) |
| Cement, lime and magnesia | ELV for POPs | New measure | Implemented via waste incineration ordinance (Fed. Law Gaz. II No. 135/2013) |
| Non ferrous metals | ELV for POPs | New measure | Implementation for air-emissions in non ferrous metals ordinance (Fed. Law Gaz. II No. 86/2008), for water emissions in AEV non ferrous metals (Fed. Law Gaz. II No. 889/1995) and/or in individual permits required by 30 June 2020 |
| Iron and steel | ELV for POPs | New measure | Implemented for air emissions with amendment to iron and steel ordinance (Fed. Law Gaz. II No. 54/2016) and for water emissions with amendment to AEV iron metal industry (Fed. Law Gaz. II No. 202/2014) |
| Ordinances on sewage sludge and compost of the Federal Provinces | Limit values for POP | Continuous evaluation of the limit values necessary | Some Austrian provinces limit POPs in sewage sludge |
| Ambient Air Quality Act (IG-L) | § 21 IG-L: Legal basis for an ordinance | Evaluation whether generally binding ELVs for crematoria are necessary in an ordinance according to § 21 IG-L | Not implemented, no general binding rule for crematoria |
| Laws of the Federal Provinces concerning residential combustion sources | PM emission thresholds for new installation of small scale combustion equipment | Agreement pursuant to Art. 15a Federal Constitution Law concerning the placing on the market and the inspection of combustion installations, rapid transposition of the requirements of this agreement into the law of the federal provinces | Signed by governors of federal provinces governors of the federal provinces in 2011<br>Amended by Federal provinces individually by ordinance or law starting from 2012 |
| Act on Air Pollution Prevention (Fed. Law Gaz. I No. 137/2002, as amended (Fed. Law Gaz. I No. 50/2012)) | Prohibiting the burning of biogenic materials, many exemptions possible | Evaluation with respect to exemptions | Prohibition integrated in Act on Air Pollution Prevention |
| Permitting process | Content relating to POPs | Comments/Specific Steps | Ongoing |
| Landfill sites | Fire protection requirements | Implementation of effective fire protection requirements for landfills and intermediate storage sites for waste | No new information |

**Implemented measures for residential combustion plants**

Standard eco-design emission requirements for the placing on the market and putting into service of solid fuel local space heaters[1] and solid fuel boilers[2] will enter into force on 1 January 2020 (2015/1189) and on 1 January 2022 (2015/1185) and gradually repeal the current national standard emission requirements (Article 15a Agreement).

However, the Austrian Ecolabel N°37 on biomass heating[3] sets more ambitious PM emission thresholds for new installations, as well as defining other environment-friendly criteria. The Ecolabel is a mandatory requirement for new installations with biomass combustion systems if they are supported by funding programmes promoting the exchange of old fossil-fuel based heating systems.

Another set of measures is concerned with awareness raising to encourage low-emission incineration in wood stoves in households or the use of ashes from these stoves for fertilising purposes.

An initiative of Federal Ministry of Agriculture and Forestry, Environment and Water Management entitled “Richtig heizen” (“Proper Heating”) was launched in 2009 and is still running in 2017. An important output is a booklet published in 2010 containing information on the effects of emissions from household stoves on human health and the environment as well as tips and advice on how heating with low emissions can be achieved by simple measures (e.g. light from above). The booklet has been distributed to the public by doctors and chimney sweepers.

Furthermore, an internet site has been created where the proper use of household wood stoves as well as legal considerations are described. The internet site was further developed in 2013 by adding an interactive online calculator that allows users to calculate their energy demand, PM emissions and solid fuel used for heating. Subsequently, it gives advice on possible measures for reducing energy consumption and emissions (wood drying, thermal insulation, exchange of heating system). Information on Ecodesign provisions and PM filter systems for small scale heating appliances will be added in 2017.

**Proposed measures for residential combustion plants and biomass plants**

- Effective financial funding for the replacement of coal-fired small scale combustion systems and old (probably high emission) biomass heating systems with modern, low emission biomass heating systems, district heating or renewable energy systems.
- Periodic reviews and improvements of the criteria for the funding of biomass plants (including biomass plants operated in the agricultural sector) with respect to operating conditions, energy efficiency (including district heating systems), quality of fuels and emission limit values for dust.

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[1] Commission Regulation (EU) 2015/1185 of 24 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel local space heaters.

[2] Commission Regulation (EU) 2015/1189 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel boilers.

[3] Österreichisches Umweltzeichen Richtlinie UZ 37 Holzheizungen, Version 6.0 vom 1. Jänner 2017

- Providing further information (awareness raising) concerning the prevention of co-incineration of waste in small scale firing installations.
- Providing further information (awareness raising) concerning the final disposal of ashes/soot from small scale firing installations.
- Emission behaviour of small scale combustion installations (esp. in case of firing cereals): → still partly unknown for POPs, a literature study is currently underway.

**Data availability on POP releases into the environment**

For the following sources the availability of data is still limited or missing. Therefore, to assess whether releases of POPs are relevant and to improve and complete Austrian inventories on POPs, the following specific steps are desirable/necessary to improve data quality. However, the implementation of these measures often depends on available budget resources.

- Improvement of data quality with respect to releases of HCB, PCB, PeCB and, if feasible, PCN into air (e.g. by planning and carrying out measurement programmes for sources with a high priority, such as residential combustion sources, industrial processes).
- Verification of the emission factor for PCB in the source category Part III "thermal processes in the metallurgical industry" (especially for the sector secondary lead production).
- Establishment of emission monitoring programmes in the neighbourhood of POP relevant emitters: identification of relevant sites for sampling and measurements campaigns (winter/summer).
- Continuation of ambient air and deposition monitoring for POPs.
- Continuation of monitoring programmes in food (meat, milk,..).
- Food and Feed Monitoring in the neighbourhood of POP relevant emitters, identification of relevant sites for sampling.
- Implementation of a national monitoring programme to investigate the distribution of deposited POPs.
- Continuation of monitoring programmes in soil and bioindicators (Norway spruce needles and/or grass) close to POP sources.
- Improvement of data quality with respect to releases of POPs from landfills and abandoned industrial sites and known contaminated sites (e.g. PAH content of landfill gases).
- Determination of POP concentrations in waste streams from small scale combustion installations in the sectors residential combustion, services and agriculture which have a high probability of being released into the environment (e.g. bottom ash and fly ash).
- Determination of POP concentrations in waste streams from fossil fuel fired utilities and industrial boilers (including co-incineration of waste) which are recovered in other production processes or which have a high probability of being released into the environment (e.g. fly ash from co-incineration plants).
- Determination of POP concentrations in waste streams from biomass fired combustion installations which are recovered in other production processes or which have a high probability of being released into the environment (e.g. bottom ash).

- Quantification of POP emissions (esp. PCDD/F and PCB) from Platformer 3 of the OMV refinery in Schwechat.
- Measurement of emissions from motor vehicles and update of emission factors to improve the quality of forecasts.

  → The Handbook on Emission Factors for Road Transport (HBEFA) provides emission factors for all current vehicle categories (PC, LDV, HGV, urban buses, coaches and motor cycles), each divided into different categories, for a wide variety of traffic situations. Emission factors for all regulated (and the most important non-regulated) pollutants as well as fuel consumption and $CO_2$ are included. The latest HBEFA version 3.2 was updated in 2014. All emission factors have been recalculated (based on a broader set of emission data, new measurements of motor vehicle emissions; and new emission factor models have been applied). For calibrating the model, a broad set of emission measurements up to Euro 6 has been used.

**Proposed measures with regard to industrial plants**

- Limitation of POP contaminated waste/residues in co-incineration plants and industrial plants. Representative sampling of individual batches of POP contaminated waste/residues is necessary before using them as input material.
- Avoid/prohibit highly contaminated waste/residues in co-incineration plants.
- Before treating POP contaminated waste/residues in industrial plants, test runs (including monitoring of POP emissions) have to be conducted.
- If POP contaminated waste/residues are used as input materials in industrial plants, regular/continuous monitoring of POP emissions is necessary. If a destruction of these POPs cannot be ensured in the industrial plant, the POP residues/waste must not be used as input material.
- If there are any changes in the process involving POP contaminated waste/residues, test runs (including monitoring of POP emissions) have to be conducted.

**Proposed other measures**

- Successive reduction of diesel powered vehicles through increased market penetration of electrically vehicles.

| | | |
|---|---|---|
| Soil Protection Laws of the Federal Provinces:<br>Burgenländisches Bodenschutzgesetz (LGBl. Nr. 87/1990)<br>Niederösterreichisches Bodenschutzgesetz (LGBl. Nr. 6160-0)<br>Oberösterreichisches Bodenschutzgesetz (LGBl. Nr. 63/1997)<br>Bodenschutzgesetz Salzburg (LGBl Nr. 80/2001)<br>Steiermärkisches landwirtschaftliches Bodenschutzgesetz (LGBl. Nr. 66/1987) | Setting of target values for organic pollutants (including polybrominated diphenylethers, perfluorinated tensides and pesticides) with the aim to reduce pollution of soils | AustroPOPs project aiming at implementing a national soil POP monitoring system is under discusssion |

# ZUSAMMENFASSUNG

## A Einleitung

## A Einleitung

Dieser Bericht ist der 2. Review des Nationalen Aktionsplans POPs, der 2008 veröffentlicht wurde. Artikel 5 des Stockholmer Übereinkommens verpflichtet die Vertragsparteien zur Erarbeitung eines Aktionsplanes, der unbeabsichtigt freigesetzte POPs (laut Anhang C) beschreibt und näher behandelt. Artikel 5 sieht darüber hinaus alle 5 Jahre eine regelmäßige Überprüfung (Revision) des Aktionsplanes und der erfolgreichen Umsetzung der Verpflichtungen des Übereinkommens vor.

In Anhang C sind derzeit folgende unbeabsichtigt freigesetzte Chemikalien enthalten: polychlorierte Dibenzo(p)dioxine (PCDD), polychlorierte Dibenzofurane (PCDF), Hexachlorbenzol (HCB), polychlorierte Biphenyle (PCBs) und Pentachlorbenzol (PeCB). Polychlorierte Naphthaline (PCN) sind seit Ende 2016 Teil des Anhangs.

Ferner behandelt der Nationale Aktionsplan auch die Freisetzung von polyzyklischen aromatischen Kohlenwasserstoffen (Benzo(a)pyren, Benzo(b)fluoranthen, Benzo(k)fluoranthen und Indeno(1,2,3-cd)pyren), da diese in der EU POP-Verordnung ((EG) Nr. 850/2004) genannt sind.

Die Bezeichnung „Freisetzung" umfasst POP-Emissionen in Luft, Wasser und Boden sowie Freisetzungen aus Abfällen, Rückständen und Produkten.

Der Nationale Aktionsplan ist Teil des Nationalen Durchführungsplans gemäß Artikel 7 des Übereinkommens und beinhaltet Strategien zur Verminderung oder Eliminierung der Freisetzung der in Anhang C genannten Chemikalien (einschließlich PAHs) sowie einen Zeitplan. Der Plan identifiziert Handlungsprioritäten, unter anderem für diejenigen Quellkategorien, die eine möglichst kosteneffiziente Verminderung oder Eliminierung von Freisetzungen versprechen. Zudem enthält er Freisetzungsinventare für die in Anhang C gelisteten Chemikalien.

Der 2. Review des Nationalen Aktionsplanes enthält eine Aktualisierung der Quellverzeichnisse und der Emissionsabschätzungen (2004, 2009 und 2014). Auf deren Grundlage werden Instrumente und Maßnahmen vorgeschlagen, die zur Reduzierung von POP-Freisetzungen führen sollen. Insbesondere werden die Wirksamkeit der bisherigen gesetzlichen Regelungen und auch die Anwendung von BAT (Best Available Techniques – Beste Verfügbare Techniken) und BEP (Best Environmental Practice – Beste Umweltschutzpraktiken) in den Quellkategorien des Stockholmer Übereinkommens (laut Anhang C) überprüft. Zudem werden Empfehlungen gegeben, wie BAT und BEP einzusetzen sind. Des Weiteren werden noch bestehende Datenlücken identifiziert und Vorschläge zur Verbesserung der Datenqualität ausgearbeitet.

Ein Quellverzeichnis kann für folgende POP-Emissionen in die Luft erstellt werden: PCDD/F, PAHs, HCB, PCB und PeCB. Für PCN ist dies aufgrund mangelnder Daten jedoch nicht möglich.

Zum Eintrag von POPs in Gewässer und zur Freisetzung aus Abfällen existieren wenige Daten. In Bezug auf Abfälle kann lediglich für PCDD/F und PeCB eine Abschätzung getroffen werden.

Eine direkte Kontamination von Böden erfolgt durch die Quellkategorie “offene Verbrennung von Abfällen, einschließlich Verbrennung auf Deponien“ (dies beinhaltet auch die offene Verbrennung biogener Materialien wie etwa Stroh). Jedoch können auch POPs in den Boden eingetragen werden, wenn Prozessrückstände wieder in die Umwelt gelangen (z. B. Verwendung von Asche aus Kleinfeuerungsanlagen für Düngezwecke).

Der Nationale Aktionsplan enthält außerdem einige Literaturdaten zu Gehalten von POPs in den Produkten Zement, Zellstoff und Papier.

Das Umweltbundesamt untersuchte im Jahr 2011 Kartonagen aus recycliertem Papier auf eine mögliche Kontamination mit PCDD/F durch Druckfarben. Es konnten keine Verunreinigung nachgewiesen werden.

Der Nationale Aktionsplan wird periodisch überarbeitet.

## B Emissionsverzeichnis Luft

### Trends für POP-Emissionen in die Luft

PCDD/F und PAH-Emissionen aus industriellen Prozessen sind von 1990 bis 2014 stetig – mit einer signifikaten Reduktion zwichen 1990 und 1994 – gesunken. PCB-Emissionen nahmen zwischen 1990 und 1993 signifikant ab, erhöhten sich von 1994 bis 2014 jedoch langsam. Mit 180 kg/a liegt ihr Wert nun um 7 % unter jenem von 1990, jedoch um 11 % höher als 1995.

Die HCB-Emissionen sanken von 1990 bis 2011. In den Jahren 2012, 2013 und 2014 kam es aufgrund einer unbeabsichtigten Freisetzung von HCB in einer österreichischen Zementanlage zu einem starken Anstieg. Die Emission wurde durch den Einsatz von HCB-haltigem Abfall und eine unvollständige Zerstörung von HCB verursacht.

Durch die verringerte Wirtschaftstätigkeit im Krisenjahr 2009 fielen die PAH-, HCB- und PCDD/F-Emissionen in signifikantem Ausmaß.

### Dioxine und Furane (PCDD/F; I-TEQ)

Im Jahr 2014 wurden 31,05 g PCDD/F (I-TEQ) aus den in Anhang C des Stockholmer Übereinkommens angeführten Quellkategorien emittiert. Gemäß der Österreichischen Luftschadstoffinventur (OLI) betrugen die PCDD/F-Emissionen in die Luft im Jahr 2014 31,61 g (I-TEQ). Diese Differenz ergibt sich einerseits durch den breiteren Anwendungsbereich der OLI, andererseits durch teilweise adaptierte Emissionsfaktoren, die für diesen Bericht verwendet wurden.

Einen wesentlichen Beitrag zur Emission von Dioxinen und Furanen liefern nur einige wenige Quellkategorien. Am größten sind hierbei die Anteile der Kleinfeuerungsanlagen (häusliche Quellen) mit 58 % und jene der thermischen Prozesse in der metallurgischen Industrie mit 17 %. Andere Verursacher sind Kraft-

fahrzeuge (7 %), die Verbrennung von Biomasse (13 %) und der Einsatz von fossilen Brennstoffen in der Industrie (3 %) (siehe Abbildung A und Tabellen A und B).

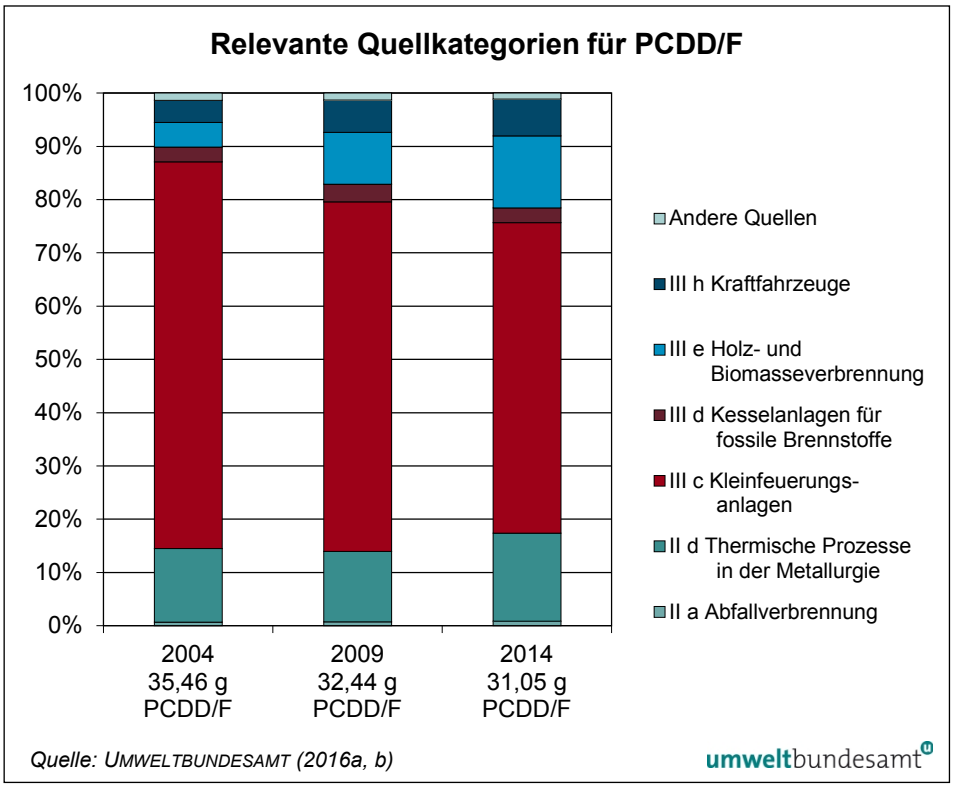



*Abbildung A: Relevante Quellkategorien für PCDD/F.*

*Tabelle A: PCDD/F-Emissionen aus Quellkategorien Teil II für 2004, 2009 und 2014 (UMWELTBUNDESAMT 2016 a, b).*

| **Quellkategorien Teil II** | **2004 [g I-TEQ]** | **2009 [g I-TEQ]** | **2014 [g I-TEQ]** |
|---|---|---|---|
| Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm | 0,230 | 0,229 | 0,267 |
| mit gefährlichen Abfällen befeuerte Zementöfen[1] | 0,119 | 0,131 | 0,121 |
| Zellstoffproduktion unter Verwendung von elementarem Chlor oder von Chemikalien, bei denen elementares Chlor erzeugt wird, für Bleichzwecke[2] | IE | IE | IE |
| folgende thermische Prozesse in der metallurgischen Industrie: | | | |
| (i) Sekundärkupferproduktion | 0,279 | 0,279 | 0,279 |
| (ii) Sinteranlagen in der Eisen- und Stahlindustrie | 3,106 | 2,538 | 3,353 |
| (iii) Sekundäraluminiumproduktion | 1,309 | 1,282 | 1,256 |
| (iv) Sekundärzinkproduktion | NO | NO | NO |
| **Gesamt (Teil II)** | **5,043** | **4,459** | **5,275** |

[1] *gesamte PCDD/F-Emissionen der österreichischen Zementöfen*

[2] *nur Prozessemissionen; PCDD/F-Emissionen aus Verbrennungsprozessen werden bei den relevanten Quellkategorien des Teil III betrachtet.*

*IE: inkludiert in anderer Emissionsquelle*

*NO: not occurring (Emissionsquelle in Österreich nicht vorhanden)*

*Tabelle B: PCDD/F-Emissionen aus Quellkategorien Teil III für 2004, 2009 und 2014 (UMWELTBUNDESAMT 2016a, b).*

| Quellkategorien Teil III | 2004 [g I-TEQ] | 2009 [g I-TEQ] | 2014 [g I-TEQ] |
|---|---|---|---|
| offene Verbrennung von Abfall, einschließlich Verbrennung auf Deponien* | 0,223 | 0,132 | 0,069 |
| in Teil II nicht genannte thermische Prozesse in der metallurgischen Industrie | 0,204 | 0,191 | 0,213 |
| häusliche Verbrennungsquellen | 25,748 | 21,295 | 18,127 |
| mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen | 0,989 | 1,079 | 0,856 |
| Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe | 1,644 | 3,147 | 4,192 |
| spezifische chemische Produktionsprozesse, bei denen unbeabsichtigt gebildete persistente organische Schadstoffe freigesetzt werden, insbesondere bei der Produktion von Chlorphenolen und Chloranil | NA | NA | NA |
| Krematorien | 0,154 | 0,164 | 0,164 |
| Kraftfahrzeuge, insbesondere bei Verbrennung von verbleitem Ottokraftstoff | 1,451 | 1,972 | 2,155 |
| Tierkörperbeseitigung | NA | NA | NA |
| Färben (mit Chloranil) und Endbehandlung (durch alkalische Extraktion) von Textilien und Leder | NA | NA | NA |
| Shredderanlagen zur Behandlung von Altfahrzeugen | NE | NE | NE |
| Kupferkabelverschwelung | NO | NO | NO |
| Altölaufbereitungsanlagen | NO | NO | NO |
| **Gesamt (Teil III)** | **30,414** | **27,980** | **25,776** |

* *ohne Brände (einschließlich Deponiebrände)*

*NA: not applicable – als vernachlässigbar betrachtet.*

*NE: not estimated – nicht abgeschätzt*

*NO: not occurring – Emissionsquelle in Österreich nicht vorhanden*

### Hexachlorbenzol (HCB)

In Österreich tragen nur wenige Quellkategorien signifikant zu den Gesamtemissionen an HCB bei. Im Jahr 2014 wurden 140,92 kg HCB emittiert (siehe Tabellen C, D und Abbildung B). Hauptverantwortliche Quellkategorien sind die Zementöfen mit 76,5 % und die Kleinfeuerungsanlagen mit 19 %.Thermische Prozesse in der metallurgischen Industrie trugen mit 3,4 % zu den Gesamtemissionen bei. Der Anteil aller anderen Quellkategorien betrug unter 1 %. Die Situation ist völlig anders als in den Jahren 2004 und 2009 – damals waren Kleinfeuerungsanlagen die hauptverantwortliche Quellkategorie für HCB-Emissionen. Die Zunahme der HCB-Emissionen erfolgte aufgrund einer unbeabsichtigten Freisetzung von HCB in einer österreichischen Zementanlage.

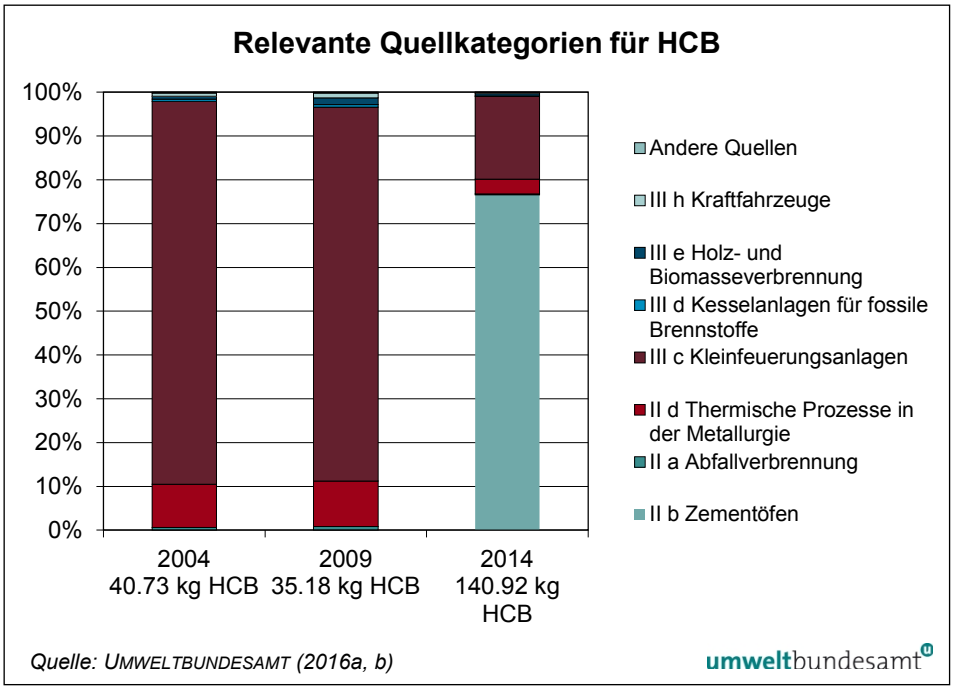



*Abbildung B: Relevante Quellkategorien für HCB.*

*Tabelle C: HCB-Emissionen aus Quellkategorien Teil II für 2004, 2009 und 2014 (UMWELTBUNDESAMT 2016a, b).*

| **Quellkategorien Teil II** | **2004 [kg HCB]** | **2009 [kg HCB]** | **2014 [kg HCB]** |
|---|---|---|---|
| Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm | 0,253 | 0,262 | 0,301 |
| mit gefährlichen Abfällen befeuerte Zementöfen[1] | 0,018 | 0,020 | 107,851 |
| Zellstoffproduktion unter Verwendung von elementarem Chlor oder von Chemikalien, bei denen elementares Chlor erzeugt wird, für Bleichzwecke[2] | IE | IE | IE |
| folgende thermische Prozesse in der metallurgischen Industrie: | | | |
| (i) Sekundärkupferproduktion | 0,091 | 0,091 | 0,091 |
| (ii) Sinteranlagen in der Eisen- und Stahlindustrie | 3,261 | 2,926 | 4,031 |
| (iii) Sekundäraluminiumproduktion | 0,654 | 0,641 | 0,628 |
| (iv) Sekundärzinkproduktion | NO | NO | NO |
| **Gesamt (Teil II)** | **4,277** | **3,939** | **112,902** |

[1] *gesamte HCB-Emissionen der österreichischen Zementöfen*

[2] *nur Prozessemissionen; HCB-Emissionen aus Verbrennungsprozessen werden bei den relevanten Quellkategorien des Teil III betrachtet.*

*IE: inkludiert in anderer Emissionsquelle*

*NO: not occurring (Emissionsquelle in Österreich nicht vorhanden)*

*Tabelle D: HCB-Emissionen aus Quellkategorien Teil III für 2004, 2009 und 2014 (UMWELTBUNDESAMT 2016a, b).*

| Source Category Part III | 2004 [kg HCB] | 2009 [kg HCB] | 2014 [kg HCB] |
|---|---|---|---|
| offene Verbrennung von Abfall, einschl. Verbrennung auf Deponien* | 0,045 | 0,026 | 0,014 |
| in Teil II nicht genannte thermische Prozesse in der metallurg. Industrie | 0,016 | 0,014 | 0,017 |
| häusliche Verbrennungsquellen | 35,586 | 30,032 | 26,657 |
| mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen | 0,197 | 0,195 | 0,152 |
| Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe | 0,287 | 0,543 | 0,715 |
| spezifische chemische Produktionsprozesse, bei denen unbeabsichtigt gebildete persistente organische Schadstoffe freigesetzt werden, insbesondere bei der Produktion von Chlorphenolen und Chloranil | NA | NA | NA |
| Krematorien | 0,031 | 0,033 | 0,033 |
| Kraftfahrzeuge, insbes. bei Verbrennung von verbleitem Ottokraftstoff | 0,290 | 0,394 | 0,431 |
| Tierkörperbeseitigung | NA | NA | NA |
| Färben (mit Chloranil) und Endbehandlung (durch alkalische Extraktion) von Textilien und Leder | NA | NA | NA |
| Shredderanlagen zur Behandlung von Altfahrzeugen | NE | NE | NE |
| Kupferkabelverschwelung | NO | NO | NO |
| Altölaufbereitungsanlagen | NO | NO | NO |
| **Gesamt (Teil III)** | **36,451** | **31,238** | **28,019** |

** ohne Brände (einschließlich Deponiebrände)*

*NA: not applicable – als vernachlässigbar betrachte*

*NE: not estimated – nicht abgeschätzt*

*NO: not occurring – Emissionsquelle in Österreich nicht vorhanden*

### Polyzyklische aromatische Kohlenwasserstoffe (PAH)

Im Jahr 2014 wurden 4.845 kg PAHs in Österreich emittiert. Hauptverantwortlich für die PAH-Emissionen sind v. a. die Kleinfeuerungsanlagen mit einem Anteil von 79 % sowie Kraftfahrzeuge mit einem Beitrag von 11 % an den Gesamtemissionen (siehe Abbildung C, Tabellen E and F). Andere nennenswerte Verursacher sind Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe (2,7 %) sowie Sinteranlagen (4 %).

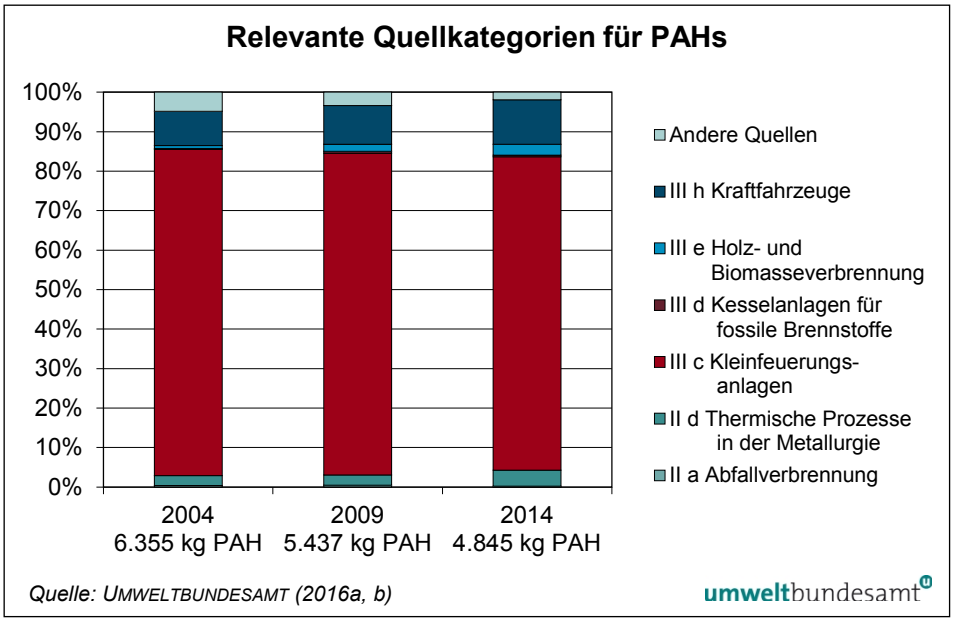



*Abbildung C: Relevante Quellkategorien für PAHs.*

*Tabelle E: PAH-Emissionen aus Quellkategorien Teil II für 2004, 2009 und 2014 (UMWELTBUNDESAMT 2016a, b).*

| **Quellkategorien Teil II** | **2004 [kg PAH]** | **2009 [kg PAH]** | **2014 [kg PAH]** |
|---|---|---|---|
| Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm | 24,066 | 24,095 | 9,443 |
| mit gefährlichen Abfällen befeuerte Zementöfen[1] | 3,332 | 3,663 | 3,385 |
| Zellstoffproduktion unter Verwendung von elementarem Chlor oder von Chemikalien, bei denen elementares Chlor erzeugt wird, für Bleichzwecke[2] | IE | IE | IE |
| folgende thermische Prozesse in der metallurgischen Industrie: | | | |
| (i) Sekundärkupferproduktion | NE | NE | NE |
| (ii) Sinteranlagen in der Eisen- und Stahlindustrie | 156,484 | 140,891 | 193,647 |
| (iii) Sekundäraluminiumproduktion | NE | NE | NE |
| (iv) Sekundärzinkproduktion | NO | NO | NO |
| **Gesamt (Teil II)** | **183,872** | **168,649** | **206,476** |

[1] *gesamte PAH-Emissionen der österreichischen Zementöfen*

[2] *nur Prozessemissionen; PAH-Emissionen aus Verbrennungsprozessen werden bei den relevanten Quellkategorien des Teil III betrachtet.*

*IE: inkludiert in anderer Emissionsquelle*
*NO: not occurring (Emissionsquelle in Österreich nicht vorhanden)*
*NE: not estimated - nicht abgeschätzt*

*Tabelle F: PAH-Emissionen aus Quellkategorien Teil III für 2004, 2009 und 2014 (UMWELTBUNDESAMT 2016a, b).*

| Quellkategorien Teil III | 2004 [kg PAH] | 2009 [kg PAH] | 2014 [kg PAH] |
|---|---|---|---|
| offene Verbrennung von Abfall, einschl. Verbrennung auf Deponien* | 305,551 | 178,625 | 90,885 |
| in Teil II nicht genannte thermische Prozesse in der metallurg. Industrie | 2,909 | 2,763 | 3,250 |
| häusliche Verbrennungsquellen | 5.250,076 | 4428,292 | 3.846,067 |
| mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen | 16,925 | 25,973 | 20,121 |
| Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe | 46,961 | 96,496 | 133,194 |
| spezifische chemische Produktionsprozesse, bei denen unbeabsichtigt gebildete persistente organische Schadstoffe freigesetzt werden, insbesondere bei der Produktion von Chlorphenolen und Chloranil | NA | NA | NA |
| Krematorien | 0,007 | 0,008 | 0,008 |
| Kraftfahrzeuge, insbes. bei Verbrennung von verbleitem Ottokraftstoff | 548,220 | 536,494 | 545,0025 |
| Tierkörperbeseitigung | NA | NA | NA |
| Färben (mit Chloranil) und Endbehandlung (durch alkalische Extraktion) von Textilien und Leder | NA | NA | NA |
| Shredderanlagen zur Behandlung von Altfahrzeugen | NE | NE | NE |
| Kupferkabelverschwelung | NO | NO | NO |
| Altölaufbereitungsanlagen | NO | NO | NO |
| **Gesamt (Teil III)** | **6.170,651** | **5.268,651** | **4.638,550** |

** ohne Brände (einschließlich Deponiebrände)*

*NA: not applicable – als vernachlässigbar betrachtet.*

*NE: not estimated – nicht abgeschätzt*

*NO: Not occurring – Emissionsquelle in Österreich nicht vorhanden*

### Pentachlorbenzol (PeCB)

Im Jahr 2009 wurden 23,2 kg an PeCB aus den Quellkategorien emittiert. PeCB-Emissionen werden nicht in der österreichischen Inventur angeführt. Die Emissionen wurden mittels Default-Emissionsfaktoren aus der Literatur und gegebenen Aktivitätszahlen berechnet. Daher beinhalten die berechneten PeCB-Emissionen einige Unsicherheiten.

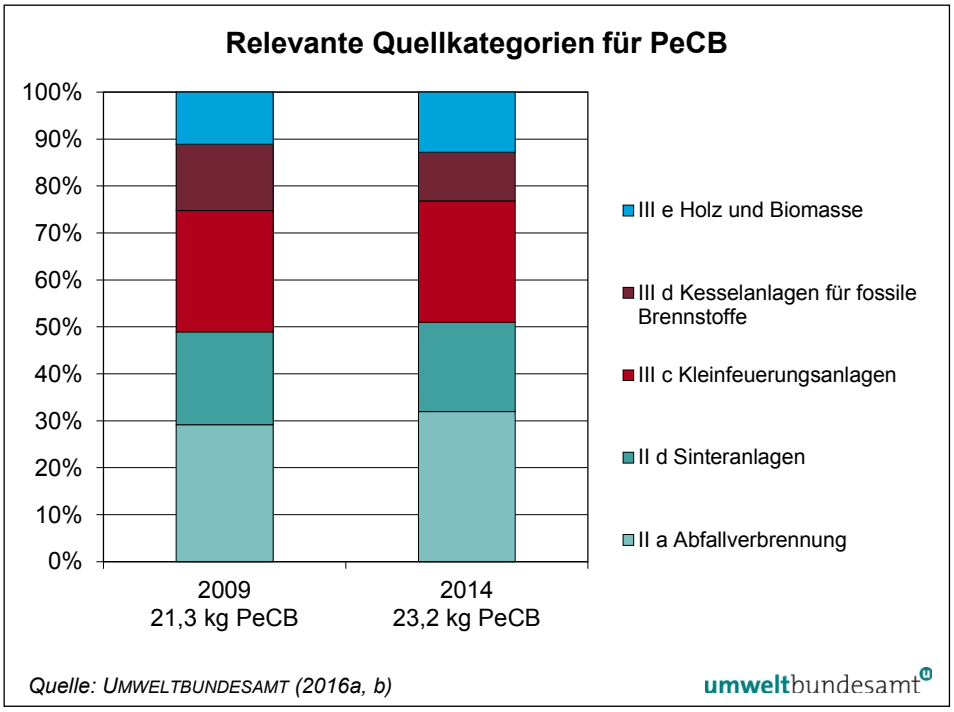



*Abbildung D: Relevante Quellkategorien für PeCB.*

*Tabelle G: PeCB-Emissionen aus Quellkategorien Teil II für 2009 und 2014 (STATISTIK AUSTRIA 2015, BMLFUW 2015a; eigene Berechnung).*

| **Quellkategorien Teil II** | **2009 [kg PeCB]** | **2014 [kg PeCB]** |
|---|---|---|
| Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm | 6,21 | 7,42 |
| mit gefährlichen Abfällen befeuerte Zementöfen | NA | NA |
| Zellstoffproduktion unter Verwendung von elementarem Chlor oder von Chemikalien, bei denen elementares Chlor erzeugt wird, für Bleichzwecke | NA | NA |
| folgende thermische Prozesse in der metallurgischen Industrie: | | |
| (i) Sekundärkupferproduktion | NA | NA |
| (ii) Sinteranlagen in der Eisen- und Stahlindustrie | 4,2 | 4,4 |
| (iii) Sekundäraluminiumproduktion | NA | NA |
| (iv) Sekundärzinkproduktion | NO | NO |
| **Gesamt (Teil II)** | **10,41** | **11,82** |

*NA: not applicable – als vernachlässigbar betrachtet*

*NO: not occurring – Emissionsquelle in Österreich nicht vorhanden*

*Tabelle H: PeCB-Emissionen aus Quellkategorien Teil III für 2009 und 2014 (STATISTIK AUSTRIA 2015, BMLFUW 2015a; eigene Berechnung).*

| **Quellkategorien Teil III** | **2009 [kg PeCB]** | **2014 [kg PeCB]** |
|---|---|---|
| offene Verbrennung von Abfall, einschließlich Verbrennung auf Deponien* | NA | NA |
| in Teil II nicht genannte thermische Prozesse in der metallurgischen Industrie | NA | NA |
| häusliche Verbrennungsquellen | 5,5 | 6,0 |
| mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen | 3,00 | 2,4 |
| Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe | 2,37 | 2,98 |
| spezifische chemische Produktionsprozesse, bei denen unbeabsichtigt gebildete persistente organische Schadstoffe freigesetzt werden, insbesondere bei der Produktion von Chlorphenolen und Chloranil | NA | NA |
| Krematorien | NA | NA |
| Kraftfahrzeuge, insbesondere bei Verbrennung von verbleitem Ottokraftstoff | NA | NA |
| Tierkörperbeseitigung | NA | NA |
| Färben (mit Chloranil) und Endbehandlung (durch alkalische Extraktion) von Textilien und Leder | NA | NA |
| Shredderanlagen zur Behandlung von Altfahrzeugen | NA | NA |
| Kupferkabelverschwelung | NO | NO |
| Altölaufbereitungsanlagen | NO | NO |
| **Gesamt (Teil III)** | **10,87** | **11,38** |

** ohne Brände (einschließlich Deponiebrände)*

*NA: not applicable – als vernachlässigbar betrachtet.*

*NO: not occurring – Emissionsquelle in Österreich nicht vorhanden*

### Polychlorierte Biphenyle (PCB)

Nur wenige Quellkategorien tragen significant zu den PCB-Gesamtemissionen in Österreich bei. 2014 wurden 116,87 kg PCB emittiert. Hauptverantwortlich waren die thermischen Prozesse in der metallurgischen Industrie mit einem Anteil von 99 %. Der Anteil aller anderen Quellkategorien betrug unter 1 %.

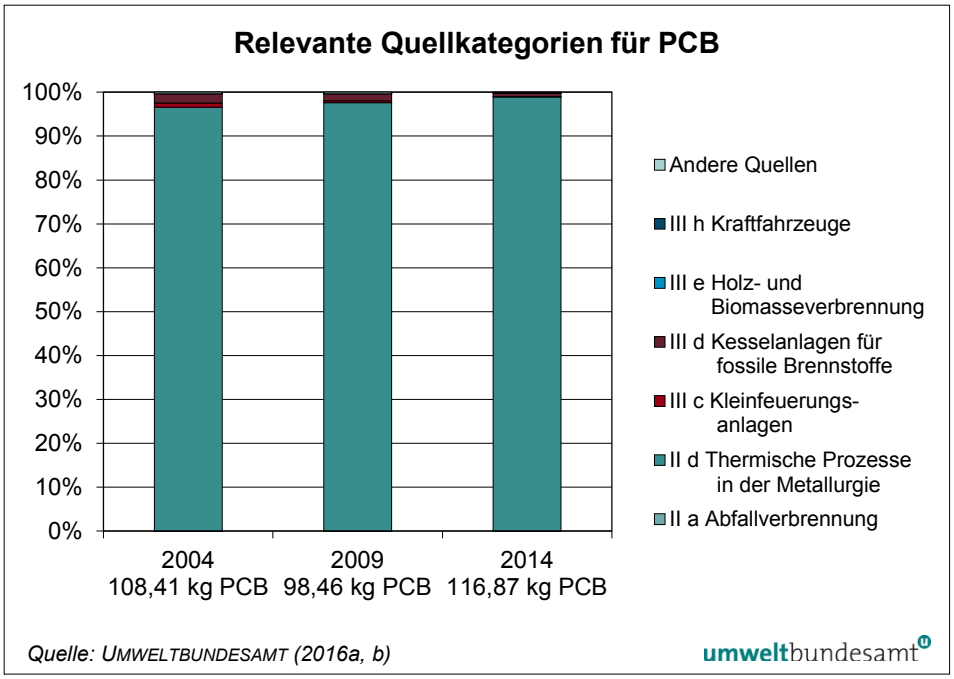



*Abbildung E: Relevante Quellkategorien für PCB.*

*Tabelle I: PCB-Emissionen aus Quellkategorien Teil II für 2004, 2009 und 2014 (UMWELTBUNDESAMT 2016a, b).*

| **Quellkategorien Teil II** | **2004 [g PCB]** | **2009 [g PCB]** | **2014 [g PCB]** |
|---|---|---|---|
| Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm | 0,065 | 0,068 | 0,053 |
| mit gefährlichen Abfällen befeuerte Zementöfen[1] | 331,949 | 353,098 | 323,780 |
| Zellstoffproduktion unter Verwendung von elementarem Chlor oder von Chemikalien, bei denen elementares Chlor erzeugt wird, für Bleichzwecke[2] | IE | IE | IE |
| folgende thermische Prozesse in der metallurgischen Industrie: | | | |
| (i) Sekundärkupferproduktion | NA | NA | NA |
| (ii) Sinteranlagen in der Eisen- und Stahlindustrie | 26.903,600 | 23.633,234 | 33.000,000 |
| (iii) Sekundäraluminiumproduktion | NA | NA | NA |
| (iv) Sekundärzinkproduktion | NO | NO | NO |
| **Gesamt (Teil II)** | **27.235,614** | **23.986,401** | **33.323,833** |

[1] *gesamte PCB-Emissionen der österreichischen Zementöfen*

[2] *nur Prozessemissionen; PCB-Emissionen aus Verbrennungsprozessen werden bei den relevanten Quellkategorien des Teil III betrachtet.*

*IE: inkludiert in anderer Emissionsquelle*

*NA: not applicable – als vernachlässigbar betrachtet*

*NO: not occurring (Emissionsquelle in Österreich nicht vorhanden)*

*Tablle J: PCB-Emissionen aus Quellkategorien Teil III für 2004, 2009 und 2014 (UMWELTBUNDESAMT 2016a, b).*

| Quellkategorien Teil III | 2004 [g PCB] | 2009 [g PCB] | 2014 [g PCB] |
|---|---|---|---|
| offene Verbrennung von Abfall, einschließlich Verbrennung auf Deponien* | NA | NA | NA |
| in Teil II nicht genannte thermische Prozesse in der metallurgischen Industrie | 77.779,105 | 72.499,525 | 82.162,70 |
| häusliche Verbrennungsquellen | 1.091,570 | 426,201 | 190,817 |
| mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen | 2.298,303 | 1.547,341 | 1.196,029 |
| Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe | 0,128 | 0,261 | 0,351 |
| spezifische chemische Produktionsprozesse, bei denen unbeabsichtigt gebildete persistente organische Schadstoffe freigesetzt werden, insbesondere bei der Produktion von Chlorphenolen und Chloranil | NA | NA | NA |
| Krematorien | NA | NA | NA |
| Kraftfahrzeuge, insbesondere bei Verbrennung von verbleitem Ottokraftstoff | 0,924 | 0,841 | 0,508 |
| Tierkörperbeseitigung | NA | NA | NA |
| Färben (mit Chloranil) und Endbehandlung (durch alkalische Extraktion) von Textilien und Leder | NA | NA | NA |
| Shredderanlagen zur Behandlung von Altfahrzeugen | NE | NE | NE |
| Kupferkabelverschwelung | NO | NO | NO |
| Altölaufbereitungsanlagen | NO | NO | NO |
| **Gesamt (Teil III)** | **81.170,031** | **74.474,169** | **83.550,405** |

** ohne Brände (einschließlich Deponiebrände)*

*NA: not applicable – als vernachlässigbar betrachtet*

*NE: not estimated – nicht abgeschätzt*

*NO: not occurring – Emissionsquelle in Österreich nicht vorhanden*

**Polychlorierte Naphthaline (PCN)**

Aufgrund der beschränkten Verfügbarkeit an Daten konnte für diese Stoffgruppe kein Freisetzungsinventar erstellt werden.

## C Emissionsverzeichnis Wasser

In Österreich werden Freisetzungen von POPs in zwei verschiedenen Registern erfasst:

Im Europäischen Schadstofffreisetzungs- und Verbringungsregister (Pollutant Release and Transfer Register – PRTR) werden prinzipiell für alle POPs Punktquellen und deren Emissionen in Gewässer erfasst. In der Praxis unterliegen allerdings die meisten Industriezweige nur dann einer Berichtspflicht, wenn bestimmte Produktionskapazitäten oder Emissionsschwellen überschritten werden. Es sind ungefähr 70 Anlagen mit Freisetzungen in Wasser oder Abwasser im PRTR gelistet. Keine dieser Anlagen meldete HCB-, PeCB- und PCB-Emissionen in Gewässer. Zwei PRTR-Anlagen gaben PCDD/F-Emissionen bekannt, eine Anlage PAH-Emissionen. Derzeit sind noch keine Daten über diffuse Quellen verfügbar.

In den Jahren 2007 und 2008 wurden im Rahmen der Erstellung eines nationalen Emissionsinventars zusätzliche Daten zu POP-Freisetzungen in Gewässer erhoben. Einlauf und Abfluss von 15 städtischen Abwasserreinigungsanlagen mit verschiedener Kapazität, unterschiedlichen Reinigungsverfahren und unterschiedlicher Abwasserzusammensetzung wurden auf ca. 70 Stoffe hin untersucht. Das Analyseprogramm umfasste prioritäre Stoffe und bestimmte andere Stoffe gemäß der Tochterrichtlinie 2008/105/EG der Wasserrahmenrichtlinie, aber auch national relevante Schadstoffe gemäß der österreichischen Qualitätszielverordnung Chemie. DDT, Chlordan, Aldrin, Dieldrin, Endrin, Heptachlor, Hexachlorbenzol und Pentachlorbenzol wurden im Rohabwasser nicht gefunden. PAHs wurden mit einer Ausnahme nur im Rohabwasser gefunden. Im Abwasserauslauf konnten nur PBDEs (< ng/l) und Lindan ($\gamma$-Hexachlorcyclohexan – ng/l) analysiert werden. Die Verwendung von Lindan war für einige Verwendungen im pharmazeutischen Bereich bis 1. Jänner 2008 zugelassen.

Im Jahr 2009 wurde ein nationales Emissionsverzeichnis (Oberflächengewässer) eingerichtet. Dieses Verzeichnis umfasst Emissionen folgender Punktquellen: Anlagen gemäß PRTR, städtische Wasseraufbereitungsanlagen mit einer Kapazität von mehr als 2.000 Einwohnergleichwerten (EGW) und Abfallverbrennungsanlagen mit einer Kapazität von mehr als 2 Tonnen Abfall pro Stunde. Es gibt keine Freisetzungsschwellen für die Berichtspflicht. Die untere Grenze ergibt sich allerdings in der Praxis aus der Bestimmungsgrenze der jeweiligen Analysemethode und aus der Ablaufmenge des Abwassers. Im ersten Berichtszeitraum (2009) wurden nur grundlegende Abwasserparameter erfasst. Seit 2010 werden Freisetzungen für eine Vielzahl von Substanzen inkl. POPs berichtet. Die Emissionen werden als Jahresfrachten berichtet.

Im Jahr 2014 musste die Sanierung einer Altlast, die HCB-haltigen Kalkschlamm enthielt, eingestellt werden. Bei dessen thermischer Behandlung in einer Zementanlage kam es zu unkontrollierten Emissionen von HCB in die Luft. Eine neue Ausschreibung für eine ex-situ Behandlung des Kalkschlammes scheiterte. In Folge wurde ein umfassendes Sicherungskonzept entwickelt. Zur Vermeidung weiterer Emissionen durch die aufgelassene Deponie wird aktuell u. a. eine Oberflächenabdichtung errichtet.

Freisetzungen von PAHs auf kontaminierten Flächen können zu lokalen Beeinträchtigungen des Bodens und des Grundwassers führen. Abhängig von der spezifischen Situation und der Frage, auf welche Weise das betroffene Gebiet genutzt wird, müssen mögliche Risiken für die menschliche Gesundheit und das Ökosystem untersucht und sodann hintangehalten werden.

Während Freisetzungen von PAHs in Boden und Grundwasser ein bekanntes Problem sind, sind nur sehr wenige Informationen zu Altlasten verfügbar, die mit den Schadstoffen PCDD/F, HCB und PCB kontaminiert sind.

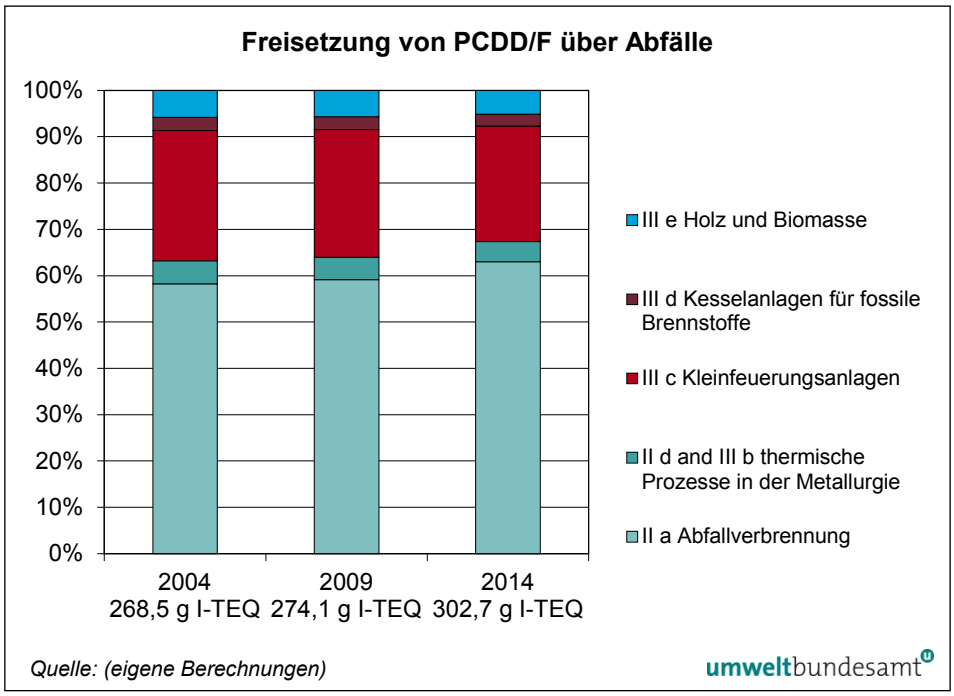
## D Emissionen aus Abfällen und Rückständen

Ein entsprechendes Emissionsverzeichnis kann nur für PCDD/F und PeCB erstellt werden. Für die weiteren POPs sind keine qualifizierten Daten verfügbar.

### Dioxine und Furane (PCDD/F)

Im Jahr 2014 wurden insgesamt 302,7 g PCDD/F I-TEQ emittiert, ein Zehnfaches der Emissionen in die Luft. Der Anteil fester Abfälle aus der Abfallverbrennung ist hierbei mit 63 % am größten, erheblich ist auch der Anteil von Abfällen aus Kleinfeuerungsanlagen (25 %). Andere Quellen sind Abfälle aus thermischen Prozessen der metallurgischen Industrie sowie aus dem Einsatz fossiler Brennstoffe und Biomasse (siehe Abbildung F, Tabelle K).

*Abbildung F: Freisetzungen (jedoch überwiegend nicht bioverfügbar) von PCDD/F über Abfälle (eigene Berechnungen).*




*Anmerkung: Die Gesamt-Emissionen können höher sein, da für viele Quellkategorien (z. B. metallurgischer Sektor), die potenziell POPs aus Abfällen freisetzen könnten, keine qualifizierten Emissionsfaktoren vorhanden sind.*

*Tabelle K: PCDD/F-Freisetzung aus Abfällen für 2004, 2009 und 2014 (eigene Berechnungen).*

| **Quellkategorien** | **2004** | **2009** | **2014** |
|---|---|---|---|
| | **g I-TEQ** | **g I-TEQ** | **g I-TEQ** |
| Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm | 156,37 | 162,1 | 190,7 |
| thermische Prozesse in der metallurgischen Industrie | 13,3 | 13,3 | 13,3 |
| Kleinfeuerungsanlagen | 75,5 | 75,5 | 75,5 |
| Kesselanlagen für fossile Brennstoffe | 7,7 | 7,7 | 7,7 |
| Holz und Biomasse | 15,6 | 15,6 | 15,6 |
| **Gesamt** | **268,5** | **274,1** | **302,7** |

Es muss hervorgehoben werden, dass POP-Freisetzungen über Abfälle grundsätzlich anders zu betrachten sind als Emissionen in die Medien Luft und Wasser: Die überwiegende Mehrheit der Abfälle wird auf Deponien abgelagert. Eine

Bioverfügbarkeit der möglicherweise enthaltenen POPs ist dadurch nicht mehr gegeben, vorausgesetzt die Deponien wurden und werden ordnungsgemäß errichtet und betrieben.

Rückstände aus der Abfallverbrennung werden im Allgemeinen auf Deponien entsorgt (Restmülldeponien oder Untertagedeponien). Die Flugasche, in der 87 % der PCDD/F enthalten sind, wird oft einer Untertagedeponie zugeführt.

Sehr hohe PCDD/F-Konzentrationen finden sich in Ruß aus Kleinfeuerungsanlagen. Vermutlich wird ein Großteil des Rußes über den Hausmüll entsorgt. Bei der thermischen Behandlung dieses Hausmülls werden die POPs entweder oxidiert oder mit der Asche auf Deponien entsorgt. Auch im Fall einer mechanisch-biologischen Behandlung des Hausmülls gelangen die POPs letztendlich in jene Fraktion, die auf der Deponie endgelagert wird.

Abfälle aus der metallurgischen Industrie, die zu einem gewissen Ausmaß kontaminiert sein können, werden entweder wieder in den Prozess zurückgeführt oder einer externen Behandlung/Entsorgung zugeführt. Diesbezüglich bestehen jedoch noch Unklarheiten über die Höhe der POP-Konzentrationen und die in Österreich praktizierte Behandlung der Abfälle.

Die Flugasche aus Kraftwerken wird in der Zement- und Baustoffindustrie weiterverwendet, Flugasche aus der Verbrennung von Biomasse muss jedoch über Deponien entsorgt werden.

Auch Abfälle, die absichtlich in die Umwelt eingetragen werden, können zur Freisetzung von POPs führen. Beispiele dafür sind die Verwendung von Aschen aus Kleinfeuerungsanlagen (die beträchtliche Mengen an POPs enthalten können) zur Düngung bzw. für Streuzwecke im Winter oder die Verwendung grober Aschen aus Biomasseverbrennungsanlagen als Zusatzstoffe für Kompost. Da große Datenlücken hinsichtlich der Höhe der POP-Konzentrationen in Aschen existieren, sind Freisetzungsabschätzungen generell mit hohen Unsicherheiten behaftet. Ausschlaggebend für die Höhe der POP-Konzentrationen in Aschen sind insbesondere die unterschiedliche Art und Qualität des Brennstoffes (Feuchtegehalt, Aschegehalt, Heizwert, Chlorgehalt), das verwendete Feuerungssystem sowie die Menge mitverbrannter Abfälle.

Diese Freisetzungen sind jedoch relevant, da ein Teil der Rückstände/Abfälle in die Umwelt rückgeführt wird (z. B. Verwendung von Asche als Dünger in Privatgärten).

**Pentachlorbenzol (PeCB)**

Im Jahr 2014 wurden insgesamt 3,51 kg PeCB emittiert. Der Anteil fester Abfälle aus der Abfallverbrennung ist hierbei mit 81 % am größten. Abfälle aus thermischen Prozessen der metallurgischen Industrie, aus Kleinfeuerungsanlagen sowie aus dem Einsatz fossiler Brennstoffe und Biomasse tragen zu einem geringeren Anteil zu den Emissionen bei. Es ist allerdings anzumerken, dass für Freisetzungen an PeCB nur wenige Daten verfügbar sind.

*Abbildung G: Freisetzungen von PeCB (jedoch überwiegend nicht bioverfügbar) aus Abfällen (eigene Berechnungen).*

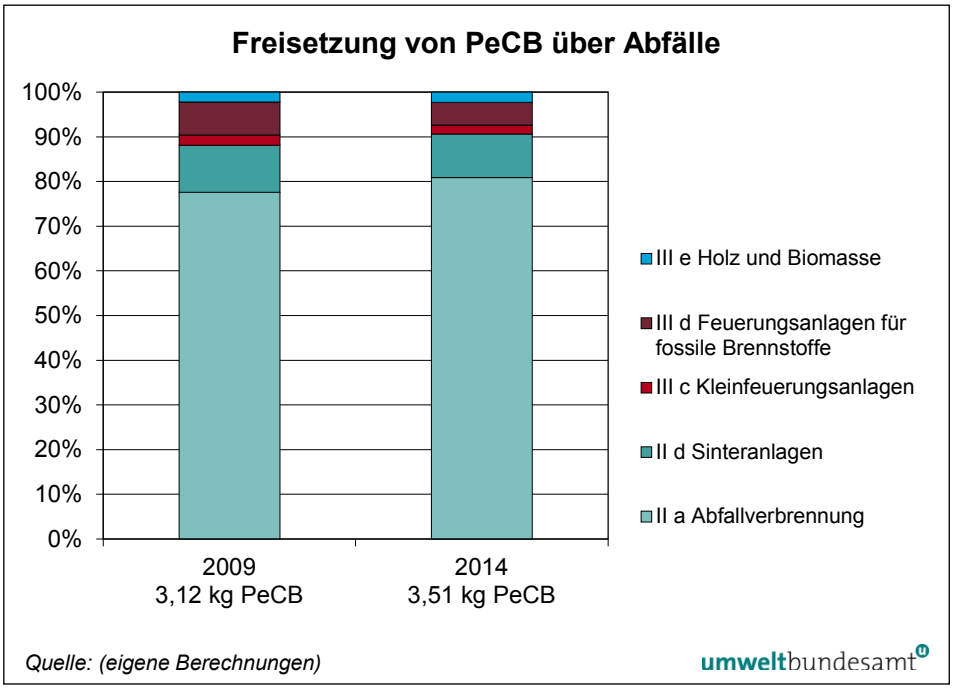



*Tabelle L: PeCB-Freisetzung aus Abfällen für 2009 und 2014 (eigene Berechnung).*

| Quellkategorie | 2009 [kg PeCB] | 2014 [kg PeCB] |
|---|---|---|
| Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm | 2,42 | 2,84 |
| folgende thermische Prozesse in der metallurgischen Industrie: | | |
| (ii) Sinteranlagen in der Eisen- und Stahlindustrie | 0,33 | 0,34 |
| häusliche Verbrennungsquellen | 0,07 | 0,07 |
| mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen | 0,23 | 0,18 |
| Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe | 0,07 | 0,08 |
| **Gesamt** | **3,12** | **3,51** |

## E Freisetzungen aus Produkten

Der Handlungsbedarf betreffend POPs in Produkten ergibt sich u. a. aus Anhang C Teil V A (g) des Stockholmer Übereinkommens („minimization of these chemicals as contaminants in products“). In der Literatur finden sich einige Daten zu Gehalten von PCDD/F in den Produkten Zement, Zellstoff und Papier (siehe Tabelle M). Zu anderen POPs existieren keine Daten. Freisetzungen über Produkte sind jedoch bei den meisten Quellkategorien nicht relevant.

*Tabelle M: PCDD/F-Gehalte in den Produkten Zement, Zellstoff und Papier. Berechnungen basieren auf Literaturdaten (KARSTENSEN 2006, UNEP 2013, GRUBER et al. 1996).*

| Produkt | Freisetzung(g I-TEQ/a) |
|---|---|
| Zement | 4,04 |
| Papier | 4,46 |

*Freisetzungen über den heimischen Zellstoff sind in den Angaben zu Papier enthalten.*

Da es keine signifkanten Änderungen der Produktionsweise gegeben hat, ist das Ausmaß der Freisetzungen von PCDD/F über Zement, Zellstoff und Papier seit 2004 in etwa gleich geblieben.

PCDD/F-Gehalte im Zement sind gering und lassen sich durch die Tatsache erklären, dass die Filterstäube aus der Klinkerproduktion (durchschnittliche PCDD/F-Konzentration: 6,7 ng I-TEQ/kg) dem Produkt beigemengt werden und außerdem auch sekundäre Rohstoffe eingesetzt werden (z. B. Flugasche, Gips aus der Rauchgasentschwefelung). Somit ist auch der Zement selbst mit PCDD/F verunreinigt (durchschnittlich: 0,91 ng I-TEQ/kg Zement) (KARSTENSEN 2006).

Die Bioverfügbarkeit von im Zement gebundenen POPs ist jedoch sehr gering.

Österreich arbeitete aktiv an der Revision des Dioxin Toolkit (UNEP 2013) mit. Dort wird festgehalten: „*Dieser Abschnitt fasst Hochtemperaturprozesse in der Mineralindustrie zusammen. Chloridhaltige Rohstoffe oder Brennstoffe können möglicherweise die Bildung von PCDD/F in unterschiedlichen Produktionsschritten hervorrufen, z. B. während der Kühlphase oder in der Heizzone. Wegen der langen Verweilzeiten im Brennofen und der erforderlichen hohen Temperatur zur Herstellung dieser Produkte ist die Bildung von Dioxinen bei diesem Prozess relativ gering*“.[4]

Zementöfen, die mit gefährlichen Abfällen befeuert werden, sind eine Quellkategorie gemäß Anhang C Teil II (b) des Übereinkommens für Emissionen von PCDD/F, HCB, PAH, PCB und PeCB. Daher ist die Quantifizierung der verschiedenen POPs in den Umweltmedien sowie in Rückständen und Produkten wünschenswert.

Im Fall von Zellstoff und Papier können PCDD/F über die Zellstoffbleiche oder über Altpapier eingetragen werden.

Im Bezugsjahr 2014 betrug die Gesamtproduktion an Zellstoff in Österreich 1.571 kt (2009 waren es 1.514 kt, 2004 1.509 kt). 36 % davon entfielen auf gebleichten Zellstoff, 35 % auf ungebleichten Zellstoff und 28 % auf Textilzellstoff (AUSTROPAPIER 2015).

[4] Zitat aus Dioxin Toolkit (Entwurf 2012) Kapitel 4 Mineral Products
*„This section summarizes high-temperature processes in the mineral industry. Raw materials or fuels that contain chlorides may potentially cause the formation of PCDD/PCDF at various steps of the processes, e.g., during the cooling phase of the gases or in the heat zone. Due to the long residence time in kilns and the high temperatures needed for the product, emissions of PCDD/PCDF are generally low in these processes.”*

Die Berechnung der Freisetzungen aus Zellstoff basieren auf folgenden Emissionsfaktoren: 0,5 µg/t für gebleichten Sulfatzellstoff und 0,1 µg/t für andere Zellstoffe (UNEP 2013). Die Freisetzung von PCDD/F über Zellstoff betrug daher 0,39 g im Jahr 2014.

Als Rohstoffe in der Papierzeugung werden Zellstoff (heimisch oder importiert), Holzstoff und Altpapier (de-inkt oder nicht de-inkt) verwendet.

Daher ist auch der Eintrag über importierten Zellstoff in Betracht zu ziehen. Im Jahr 2014 wurden ungefähr 662.330 t gebleichter Zellstoff importiert, teils aus Ländern, in denen Chlor noch zum Bleichen des Zellstoffs verwendet wird. Zur Berechnung des PCDD/F-Gehaltes wird für 10 % der Importware ein Emissionsfaktor von 0,5 µg/t angenommen und für den Großteil des importierten Zellstoffs ein Emissionsfaktor von 0,1 µg/t. Damit ergibt sich eine Gesamteinfuhr von 0,093 g I-TEQ über Zellstoff.

Der Eintrag von PCDD/F über Holzstoff wurde mit einem Emissionsfaktor von 0,1 µg/t (UNEP 2013) berechnet, daraus ergibt sich ein Gesamteintrag von 0,037 g I-TEQ.

Zusätzlich ist auch der Eintrag von POPs über das Altpapier (insbesondere über Verunreinigungen in den verwendeten Druckfarben) relevant. Ein De-inking reduziert die PCDD/F-Konzentrationen um den Faktor 3 (ungefähr 40 % des Altpapiers in Österreich wird de-inkt) (GRUBER et al. 1996). Vergleichsweise hohe Konzentrationen von bis zu 12 ng/kg wurden in den frühen Neunzigerjahren in Verpackungspapieren und Karton gefunden. Zwischen 1989 und 1994 konnte ein drastischer Rückgang verzeichnet werden, seither sinken die Konzentrationen nur noch geringfügig.

Auf Basis dieser Studien sowie der im UNEP DioxinToolkit (UNEP 2013) angegebenen Emissionsfaktoren wurde die Konzentration an PCDD/F in Altpapier auf 3 µg/t ohne De-inking und auf 0,99 µg/t in de-inktem Papier geschätzt. Daraus ergeben sich ein durchschnittlicher Emissionsfaktor von 2,18 µg/t für Altpapier und eine Gesamtfreisetzung über Papier von 4,46 g I-TEQ (Referenzjahr: 2014).

Diverse wissenschaftliche Publikationen zeigen, dass Altpapier möglicherweise durch Verunreinigungen mit Druckerfarben (z. B. Pigmente) signifikante Spuren von PCDD/F enthalten kann. Im Jahr 2011 führte das Umweltbundesamt eine stichprobenartige Untersuchung der PCDD/F-Gehalte von Kartonagen aus Altpapier durch. Der Vergleich von neuen, unbedruckten Faltschachtelkartons mit bedruckten Schachteln aus der Altpapiersammlung ergab keinen Hinweis auf einen PCDD/F-Eintrag durch Druckerfarben. Die Kartonagenproben enthielten PCDD/F in einem Bereich von 1,2 bis 1,9 ng TEQ/kg (UMWELTBUNDESAMT 2011c).

Im Jahr 2010 legte Austropapier, die Vereinigung der österreichischen Papierindustrie, neue Daten zum PCDD/F-Gehalt bestimmter Produktsorten vor, mit dem Ziel, die im Dioxintoolkit (UNEP 2013) enthaltenen Emissionsfaktoren zu optimieren. Die daraus abgeleiteten Emissionsfaktoren würden die Gesamtfreisetzung von PCDD/F über Papiererzeugnisse um den Faktor 3 reduzieren.

Im Jahr 2011 erfolgte daher eine neuerliche Berechnung der PCDD/F-Freisetzungen über Papier.

*Tabelle N: Freisetzungen vonPCDD/F über Produkte (eigene Berechnung auf Basis der Statistik von Austropapier und der übermittelten Analyseergebnisse).*

| Erzeugnis | Produktion (t/a) | Emissionfaktor (µg TEQ/t) | Freisetzungen (g PCDD/F TEQ/a) | Prozentsatz (%) |
|---|---|---|---|---|
| Zeitungsdruckpapier | 299.205 | 0,068 | 0,02 | 1,2 |
| Druck- und Schreibpapiere | | | | |
| • de-inked | 902.421 | 0,068 | 0,06 | 3,7 |
| • aus Zellstoff | 1.346.070 | 0,050 | 0,07 | 4,0 |
| Faltschachtelkarton | 487.214 | 0,723 | 0,35 | 21,1 |
| Verpackungspapiere | 676.177 | 1,141 | 0,77 | 46,2 |
| Kraftpapiere | | | | 0.0 |
| • mit Altpapieranteil | 374.855 | 0,858 | 0,32 | 19,3 |
| • aus reinem Zellstoff | 250.743 | 0,050 | 0,01 | 0,8 |
| Dünn und Spezialpapiere | | | | 0.0 |
| Hygienepapier | 128.660 | 0,068 | 0,01 | 0,5 |
| Sonstige | 126.896 | 0,050 | 0,01 | 0,4 |
| Wickel- und Spezialpappe | 13.299 | 0,858 | 0,01 | 0,7 |
| Marktzellstoff – exportiert | 95.471 | 0,070 | 0,01 | 0,4 |
| Marktzellstoff (ECF-gebleicht) | 313.818 | 0,090 | 0,03 | 1,7 |
| **Gesamt** | **5.014.829** | | **1,67** | **100,0** |

# F Bewertung der Wirksamkeit der Rechtsvorschriften und Politiken in Bezug auf die Verpflichtungen des Stockholmer Übereinkommens und der EU POP-Verordnung

Auf Basis der in diesem Report dokumentierten Ergebnisse hinsichtlich der Emissionsverzeichnisse, der Datenverfügbarkeit und der bereits getätigten sowie geplanten Maßnahmen ist zu schließen, dass Österreich die Vorschriften der Stockholm Konvention und der EU POP-Verordnung bereits großteils erfüllt. Nichtsdestotrotz sind weitere Anstrengungen notwendig, da das Stockholmer Übereinkommen „die kontinuierliche Verringerung von POP-Freisetzungen“ zum Ziel hat.

PCDD/F- und PAH-Emissionen aus industriellen Prozessen sind von 1990 bis 2014 stetig – mit einer signifikaten Reduktion zwichen 1990 und 1994 – gesunken. PCB-Emissionen nahmen signifikant zwischen 1990 und 1993 ab, erhöhten sich dann langsam von 1994 bis 2014. Mit 180 kg/a sind sie nun 7 % niedriger als 1990, jedoch 11 % höher als 1995.

HCB-Emissionen sanken von 1990 bis 2011, erhöhten sich dann stark in den Jahren 2012, 2013 und 2014 aufgrund einer unbeabsichtigten Freisetzung von HCB in einer österreichischen Zementanlage verursacht durch den Einsatz von HCB-hältigem Abfall und einer unvollständigen Zerstörung von HCB.

Sollten jedoch Weiterentwicklungen im Stand der Technik geringere Emissionen oder sogar eine vollständige Vermeidung derselben bewirken, muss die Politik darauf reagieren und die relevanten Rechtsvorschriften entsprechend anpassen (z. B. durch Einführung strengerer Emissionsgrenzwerte).

Die Nationalen Aktionspläne 2008 und 2012 identifizierten Kleinfeuerungsanlagen als bedeutende Emissionsquellen. Diese waren 2014 für 58 % der PCDD/F-Emissionen, 79 % der PAH-Emissionen und 26 % der PeCB-Emissionen in die Luft verantwortlich. Alle möglichen Maßnahmen müssen untersucht und ausgeschöpft werden, um eine Reduktion dieser POP-Emissionen zu bewirken.

PCDD/F-Emissionen aus der Verbrennung von Biomasse haben sich von 2004 bis 2014 mehr als verdoppelt und sind für 13 % der Gesamtemissionen an PCDD/F verantwortlich. PAH-Emissionen aus der Biomasseverbrennung haben sich zwischen 2004 und 20014 fast verdreichfacht, sind jedoch nur für 3 % der gesamten PAH-Emissionen verantwortlich.

Derzeit wird in Österreich eine Reihe von umfassenden und sektorenübergreifenden Maßnahmen und Instrumenten entwickelt, um verschiedene nationale und internationale Verpflichtungen zu erfüllen. Ziel dieser Maßnahmen (enthalten etwa in der Klimastrategie 2007) ist die Reduktion von Treibhausgasen, $NO_x$ und Feinstaub. Dadurch kann teilweise auch eine indirekte Reduktion von POP-Freisetzungen erreicht werden (z. B. durch die Reduktion des Energieverbrauchs oder durch strengere Luftemissionsgrenzwerte für Staub). Andere Maßnahmen, wie etwa der vermehrte Einsatz von Biomasse für Kleinfeuerungsanlagen, könnten jedoch zu einem Anstieg von POP-Emissionen führen.

Außerdem ist es wichtig, bessere Kenntnis in Bereichen zu erlangen, in denen bisher nur sehr begrenzt zuverlässige Daten zur Verfügung stehen. Deshalb wurden im Folgenden konkrete Vorschläge für Studien, z. B. betreffend POP-Konzentrationen in bestimmten Abfällen oder weitere Monitoringaktivitäten, formuliert.

### Evaluierung des NAP 2012 und weiterer Handlungsbedarf (gemäß § 20 Abs. 2 Chemikaliengesetz 1996 i.d.g.F)

In den Nationalen Aktionsplänen (NAP) 2008 und 2012 wurde bereits eine Reihe von Maßnahmen angeführt, die einerseits eine Verringerung der POP-Emissionen erzielen und andererseits mehr Informationen bezüglich POPs in der Umwelt generieren sollen.

### Freisetzungen von POPs aus den Quellkategorien

Die folgende Tabelle enthält eine Übersicht, welche der im NAP 2012 vorgeschlagenen Maßnahmen bereits im Zeitraum 2012–2016 umgesetzt wurden.

| nationale Gesetze und Verordnungen | POP-relevante Inhalte | vorgeschlagene Maßnahmen im NAP 2012 | derzeitiger Status |
|---|---|---|---|
| Gewerbeordnung 1994 und Verordnungen gemäß § 82 Abs. 1 GewO 1994 | EGW für verschiedene Luftschadstoffe, z. B. Staub, PCDD/F | regelmäßige Überprüfung der Konformität mit BAT | Änderung der Eisen und Stahlverordnung (BGBl. II Nr. 54/2016)<br>Aufhebung der Sinteranlagenverordnung (BGBl. II Nr. 303/2014)<br>Gießerei-Verordnung (BGBl. II Nr. 264/2014) |
| Feuerungsanlagen-Verordnung (BGBl. II Nr. 331/1997) | EGW für Staub, CO, $C_{org}$, $NO_x$ | Anpassung an BAT notwendig (strengere EGW für Staub) | Die Implementierung der MCPD in nationales Gesetz ist derzeit (2017) in Bearbeitung, indem die Feuerungsanlagen-Verordnung novelliert wird. |
| Abfallverbrennungsverordnung (BGBl. II Nr. 389/2002) | EGW für Staub, CO, $C_{org}$, $NO_x$, Schwermetalle, PCDD/F | strengere EGW für Staub bei Mitverbrennungsanlagen wünschenswert | Änderung der Verordnung (BGBl. II Nr. 135/2013) |
| Wasserrechtsgesetz und Verordnungen | EGW für AOX and POX sowie spezifische POPs in den branchenspezifischen Abwasseremissionsverordnungen | | |
| Abwasseremissionsverordnung Verbrennungsgas (BGBl. II Nr. 271/2003) | EGW für PCDD/F | regelmäßige Überprüfung der Konformität mit BAT notwendig | Änderung der Verordnung (BGBl.II Nr. 201/2014) |
| Abwasseremissionsverordnung Kohleverarbeitung (BGBl. II Nr. 346/1997) | EGW für PAHs | regelmäßige Überprüfung der Konformität mit BAT notwendig | Verordnung wird überarbeitet |
| Abwasseremissionsverordnung Pflanzenschutzmittel (BGBl. Nr. 668/1996) | EGW für AOX und spezifische POPs | regelmäßige Überprüfung der Konformität mit BAT notwendig | keine Änderungen |
| Qualitätszielverordnung Oberflächengewässer (BGBl. II Nr. 96/2006) | Umweltqualitätsziel für HCB | Für PAHs wurden 2008 gemeinschaftsweite Qualitätsziele festgelegt. | Änderung der Qualitätszielverordnung (BGBl. II Nr. 461/2010) gemäß der RL 2008/105/EG und 2016 (BGBl. II Nr. 363/2016) |
| Deponieverordnung (BGBl. Nr.39/2008) | Grenzwerte für PAH-Konzentrationen in Abfällen | | Änderung mit BGBl. II Nr. 291/2016 |
| Kompostverordnung[1] (BGBl. II Nr. 292/2001) | Grenzwerte für POP-Konzentrationen in Komposten | regelmäßige Evaluierung der Grenzwerte notwendig | keine Änderung |

| andere relevante Rechtsvorschriften | POP-relevante Inhalte | vorgeschlagene Maßnahmen im NAP 2012 | derzeitiger Status |
|---|---|---|---|
| bereits im Amtsblatt der Europäischen Kommission veröffentlichte BVT Schlussfolgerungen: | EGW für POPs | neue Maßnahme | Umsetzung in nationales Recht (Verordnungen, Bescheid) |
| Zement, Kalk und Magnesiumoxid | EGW für POPs | neue Maßnahme | umgesetzt in Abfallverbrennungsverordnung (BGBl. II Nr. 135/2013) |
| Nichteisenmetalle | EGW für POPs | neue Maßnahme | Umsetzung im Luftbereich in Nichteisenmetallverordnung (BGBl. II Nr. 86/2008), im Wasserbereich in AEV Nichteisenmetallverordnung (BGBl. Nr. 889/1995) und/oder Bescheiden bis 30. Juni 2020 notwendig |
| Eisen und Stahl | EGW für POPs | neue Maßnahme | umgesetzt im Luftbereich mit Änderung der Eisen und Stahlverordnung (BGBl. II Nr. 54/2016), im Wasserbereich mit AEV Eisen-Metallindustrie (BGBl. II Nr. 202/2014) |
| Klärschlamm- und Kompostverordnungen der Bundesländer | Grenzwerte für POPs | regelmäßige Evaluierung der Grenzwerte notwendig | einige Bundesländer regeln POPs im Klärschlamm |
| Immissionsschutzgesetz – Luft (IG-L) | § 21 IG-L: Verordnungsermächtigung | Überprüfung, ob allgemein verbindliche EGW für Krematorien in einer Verordnung gemäß § 21 IG-L notwendig sind | nicht umgesetzt, keine generellen Verpflichtungen für Krematorien |
| Rechtsakte der Bundesländer betreffend häusliche Verbrennungsanlagen (Kleinfeuerungsanlagen) | PM-Emissionsgrenzwerte für Neuanlagen von Kleinfeuerungsanlagen | Vereinbarung gemäß Art. 15a BVG über das Inverkehrbringen und die Überprüfung von Feuerungsanlagen<br>Zeitplan: ehestmögliche Umsetzung dieser Vereinbarung in das Länderrecht | 2011 wurde 15a Vereinbarung von Landeshauptleuten der Bundesländer unterzeichnet.<br>Umgesetzt in einzelnen-Landesgesetzen bzw. -verordnungen (Start 2012) |
| Bundesluftreinhaltegesetz (BGBl. I Nr. 137/2002 i.d. F. von BGBl. I Nr. 50/2012)) | Verbot des Verbrennens biogener Materialien, viele Ausnahmen möglich | Überprüfung der Ausnahmebestimmungen | Integration des Verbots im Bundesluftreinhaltegesetz – BLRG |
| Genehmigungsverfahren | Pop-relevante Inhalte | Kommentare/konkrete Schritte | laufend |
| Deponien | Anforderungen an die Brandverhütung | Implementierung wirksamer Brandverhütungsmaßnahmen für Deponien und Abfallzwischenlager | keine neuen Informationen |

*EGW: Emissionsgrenzwert*

*BAT: Best Available Technique*

**Im Bereich Kleinfeuerungsanlagen durchgeführte Maßnahmen**

Ökodesign-Anforderungen im Hinblick auf das Inverkehrbringen und die Inbetriebnahme von Einzelraumheizgeräten[5] und Festbrennstoffkesseln[6] treten am 1. Jänner 2020 (2015/1189) bzw. am 1. Jänner 2022 (2015/1185) in Kraft und werden schrittweise die nationalen standardisierten Emissionsanforderungen (Artikel 15a Vereinbarung) außer Kraft setzen.

Allerdings sind in der Österreichischen Umweltzeichen-Richtlinie UZ 37 Holzheizungen[7] neben weiteren umweltfreundlichen Kriterien anspruchsvollere Grenzwerte für PM-Emissionen für Neuanlagen festgelegt. Dieses Umweltzeichen ist für Neuanlagen im Bereich Biomasseverbrennung verbindlich, wenn der Austausch von alten, mit fossilen Brennstoffen betriebenen, Heizsystemen durch Förderprogramme unterstützt wird.

Weitere notwendige Maßnahmen betreffen die Bewusstseinsbildung in Hinblick auf emissionsarme Verbrennung in Kleinfeuerungsanlagen oder die Verwendung von Aschen aus Kleinfeuerungsanlagen für die Düngung.

Die Initiative des Ministeriums für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft „Richtig heizen“ wurde 2009 gestartet und ist 2017 noch immer aktuell. Im Rahmen dieser Initiative wurde 2010 eine Broschüre mit dem Titel „Richtig heizen“ herausgegeben. Der Folder informiert über die Auswirkungen von Emissionen aus Holzöfen auf die menschliche Gesundheit und die Umwelt und gibt Hinweise darauf, wie diese Emissionen durch die richtige Bedienungsweise verringert werden können. Die Broschüre wurde über Rauchfangkehrer und Ärzte verteilt.

Zusätzlich wurde auch eine Internetseite eingerichtet (www.richtigheizen.at), die weitere Informationen über die richtige Verwendung von Öfen und über rechtliche Belange bietet. Die Internetseite wurde 2013 mit einem interaktiven Online-Rechner verbessert, der es ermöglicht, den Energiebedarf, PM-Emissionen und den Einsatz an festen Brennstoffen zu berechnen. Anschließend berät der Online-Rechner hinsichtlich möglicher Maßnahmen zur Reduktion des Energieeinsatzes und der Emissionen (Holztrocknung, thermische Isolierung, Austausch des Heizsystems). Informationen zu Ökodesign-Vorschriften und Feinstaub-Filtersystemen für Kleinfeuerungsanlagen werden 2017 ergänzt.

[5] Verordnung (EU) 2015/1185 der Kommission vom 24. April 2015 zur Durchführung der Richtlinie 2009/125/EG des Europäischen Parlaments und des Rates im Hinblick auf die Festlegung von Anforderungen an die umweltgerechte Gestaltung von Festbrennstoff-Einzelraumheizgeräten

[6] Verordnung (EU) 2015/1189 der Kommission vom 28. April 2015 zur Durchführung der Richtlinie 2009/125/EG des Europäischen Parlaments und des Rates im Hinblick auf die Festlegung von Anforderungen an die umweltgerechte Gestaltung von Festbrennstoffkesseln

[7] Österreichisches Umweltzeichen Richtlinie UZ 37 Holzheizungen, Version 6.0 vom 1. Jänner 2017

**Im Bereich Kleinfeuerungsanlagen und Biomasseanlagen vorgeschlagene Maßnahmen**

- Effiziente Förderung des Austausches von kohlebefeuerten Öfen bzw. alten Biomasseanlagen mit vermutlich hohen Emissionen durch moderne Biomasseheizsysteme, Fernwärmesysteme oder erneuerbare Energien;
- regelmäßige Überprüfung und Verbesserung der Förderkriterien für Biomasseverbrennungsanlagen (einschließlich derartiger landwirtschaftlicher Anlagen) in Hinblick auf Betriebsbedingungen, Energieeffizienz (einschließlich Fernwärmesysteme), Brennstoffqualität und Emissionsgrenzwerte für Staub;
- Weiterführung der Informationskampagnen (awareness raising), um die Verbrennung von Abfällen in Kleinfeuerungsanlagen zu verhindern;
- Weiterführung der Informationskampagnen (awareness raising) zur Entsorgung von Ruß und Asche aus Kleinfeuerungsanlagen (insbesondere im Haushalt und in der Landwirtschaft);
- Untersuchung des Emissionsverhaltens von Kleinfeuerungsanlagen (insb. Getreideverbrennung).

  → bezüglich POPs noch teilweise nicht bekannt; eine Literaturstudie wird derzeit durchgeführt.

**Datenverfügbarkeit bzgl. POP-Freisetzungen in die Umwelt**

Für die im Folgenden genannten Quellen existieren bisher nur unzureichend Daten. Um die Relevanz dieser Quellen abschätzen zu können sowie um die österreichischen Quellverzeichnisse zu vervollständigen, sind die unten angeführten Maßnahmen notwendig oder zumindest wünschenswert. Allerdings bleibt die Umsetzung dieser Maßnahmen oft abhängig von der Finanzierbarkeit:

- Verbesserung der Datenqualität in Hinblick auf HCB-, PCB-, PeCB- und, falls durchführbar, PCN-Freisetzungen in die Luft (z. B. durch Planung und Durchführung von Messprogrammen bei prioritären Quellen, wie z. B. häuslichen und industriellen Quellen);
- Überprüfung des PCB-Emissionsfaktors in der Quellkategorie Teil III „thermische Prozesse in der metallurgischen Industrie“ (speziell für den Sektor Sekundärbleierzeugung);
- Einrichtung von Monitoringprogrammen in der Nähe POP-relevanter Quellen: Identifizierung relevanter Standorte für Probenahme- und Messungskampagnen (Winter, Sommer);
- Weiterführung des Monitorings der Umgebungsluft und der Deposition auf POPs;
- Weiterführung der Monitoringprogramme in Nahrungsmitteln (Fleisch, Milch, …);
- Nahrungsmittel- und Futtermittel-Monitoring in der Nachbarschaft von POP-relevanten Emittenten, Identifikation;
- Implementierung eines nationalen Monitoringprogrammes zur Untersuchung der Verteilung der Deposition von POPs;
- Weiterführung der Monitoringprogramme in Böden und Bioindikatoren (Fichtennadeln und/oder Gras) in der Nähe von POP-Quellen;
- Verbesserung der Datenqualität der POP-Freisetzungen aus Deponien und aufgelassenen Industriestandorten sowie kontaminierten Flächen/Altlasten

(z. B. PAH-Anteile im Deponiegas);

- Bestimmung der POP-Konzentrationen in Abfällen aus Kleinfeuerungsanlagen (Haushalt, Versorgungsunternehmen, Landwirtschaft), die mit hoher Wahrscheinlichkeit in die Umwelt gelangen (z. B. Bodenasche und Flugasche);
- Bestimmung der POP-Konzentrationen in Abfällen aus mit fossilen Brennstoffen befeuerten Kesselanlagen (einschließlich Mitverbrennung von Abfällen), die in andere Produktionsprozesse Eingang finden oder mit hoher Wahrscheinlichkeit in die Umwelt gelangen (insb. Flugasche aus Mitverbrennungsanlagen);
- Bestimmung der POP-Konzentrationen in Abfällen aus Biomasseverbrennungsanlagen, die in andere Produktionsprozesse Eingang finden oder mit hoher Wahrscheinlichkeit in die Umwelt gelangen (z. B. Bodenasche);
- Quantifizierung der POP-Emissionen (insb. PCDD/F und PCBs) des Platformer 3 der OMV Raffinerie in Schwechat;
- Emissionsmessungen bei Kraftfahrzeugen und Überprüfung der Emissionsfaktoren, um genauere Trendprognosen zu ermöglichen.

  → Das Handbuch für Emissionsfaktoren des Straßenverkehrs (HBEFA) stellt Emissionsfaktoren für die gängigsten Fahrzeugtypen zur Verfügung (Pkw, leichte und schwere Nutzfahrzeuge, Linien- und Reisebusse sowie Motorräder), differenziert nach Emissionskonzepten sowie nach verschiedenen Verkehrssituationen. HBEFA liefert Emissionsfaktoren für alle reglementierten sowie eine Reihe von nicht-reglementierten Schadstoffen, einschließlich $CO_2$ und Kraftstoffverbrauch. Die Version HBEFA 3.2 wurde 2014 aktualisiert und ist die neueste verfügbare Version. Alle Emissionsfaktoren wurden überarbeitet. (basierend auf breiterem Set von Emissionsdaten und neuen Maßnahmen, neue Emissionsfaktoren wurden angewandt). Für die Eichung des Modells wurden modale Emissionsmessungen bis Euro 6 verwendet.

**Im Bereich Industrieanlagen vorgeschlagene Maßnahmen**

- Limitierung von POP-kontaminierten Abfällen/Rückständen in Mitverbrennungsnlagen und Industrieanlagen. Eine repräsentative Probenahme der einzelnen Chargen ist notwendig, bevor diese als Einsatzmaterial verwendet werden.
- Vermeidung/Verbot von hoch kontaminierten Abfällen/Rückständen in Mitverbrennungsanlagen.
- Bevor POP-kontaminierte Abfälle/Rückstände in Industrieanlagen behandelt werden, sind in einem Probebetrieb Messungen der POP-Emissionen durchzuführen.
- Bei Einsatz von POP-haltigen Abfällen/Rückständen ist die regelmäßige/kontinuierliche Messung der POP-Emissionen notwendig. Falls die Zerstörung der POPs in der Industrieanlage nicht gewährleistet werden kann, darf der POP-haltige Abfall/Rückstand nicht als Einsatzmaterial verwendet werden.
- Falls der Prozess, in dem POP-haltige Abfälle/Rückstände eingesetzt werden, geändert wird, sind Versuchsreihen einschließlich dem Monitoring der POP-Emissionen durchzuführen.

### Andere vorgeschlagene Maßnahmen

- Sukzessive Reduktion der Dieselfahrzeuge durch verstärkten Einsatz von elektrisch betriebenen Fahrzeugen.

| | | |
|---|---|---|
| Bodenschutzgesetze der Bundesländer:<br>Burgenländisches Bodenschutzgesetz LGBl. Nr. 87/1990<br>Niederösterreichisches Bodenschutzgesetz LGBl. Nr. 6160-0<br>Oberösterreichisches Bodenschutzgesetz LGBl. Nr. 63/1997<br>Bodenschutzgesetz Salzburg LGBl Nr. 80/2001<br>Steiermärkisches landwirtschaftliches Bodenschutzgesetz LGBl. Nr. 66/1987 | Festlegung von Zielwerten für organische Schadstoffe (einschließlich polybromierte Diphenylether, perfluorierte Tenside und Pestizide) zur Verminderung von Bodenkontaminationen zweckmäßig | AustroPOP-Projekt mit dem Ziel, ein nationales POP-Boden Monitoring System zu implementieren wird diskutiert |

# 1 INTRODUCTION

This report covers the second review of the National Action Plan for POPs which was published in 2008. Article 5 of the Stockholm Convention requires Parties to develop an Action Plan to identify, characterise and address the release of chemicals listed in Annex C. Article 5 further requires a review of the National Action Plan every five years, including the strategies and their success in meeting the relevant obligations.

Currently listed in Annex C are polychlorinated dibenzo(p)dioxins (PCDD), polychlorinated dibenzofurans (PCDF), hexachlorobenzene (HCB), polychlorinated biphenyls (PCB) and pentachlorobenzene (PeCB) when produced unintentionally. Polychlorinated Napthalenes (PCN) have been part of Annex C since the end of 2016.

In line with the European POP-Regulation (850/2004) polyaromatic hydrocarbons (namely the substances benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene) shall be included in the Action Plan as well.

The definition of the term “release” includes emissions of POPs into air, water and soil as well as releases via residues and waste from processes and releases via products.

The Action Plan is part of the Party’s National Implementation Plan specified in Article 7 of the Convention and includes strategies for meeting obligations to reduce or eliminate releases of chemicals listed in Annex C of the Stockholm Convention (including PAH as an additional requirement under the EU POP Regulation), and a schedule for the Action Plan. The Plan identifies priorities for action and includes those source categories that provide the most cost-effective opportunities for release reduction or elimination. It also includes an inventory of the releases of chemicals listed in Annex C.

For the second review of the National Action Plan the inventory (2004, 2009 and 20014) of POP releases has been updated. Based on this inventory instruments and measures aiming at the reduction of POP releases are described. In particular, the effectiveness of national legal regulations is assessed and the report examines whether Best Available Techniques (BAT) in combination with Best Environmental Practices (BEP) have already been applied in the source categories defined by the Stockholm Convention. If applicable, recommendations on how BAT and BEP can be implemented are given. In addition data gaps are identified and proposals for the improvement of data quality elaborated.

The Action Plan will be reviewed and updated on a periodic basis (every 5 years).

## 1.1 Methodology for Inventories

The inventory is based on activity data which is multiplied with activity specific emission factors. Activity data – units are preferably given in GJ in the case of combustion processes or in Mg in the case of production processes – were tak-

en from the Austrian Energy Balance (UMWELTBUNDESAMT 2015a). Data for this report was taken from the emissions inventory of 2015, which provided data for the years 2004, 2009 and 2014. The emissions inventory underwent changes in 2014, when the new IPCC guidelines (2006) had to be implemented. This led to a new aggregation of and re-allocations in some subsectors. Changes in total emissions are mainly attributed to ameliorations of the energy balance.

Both types of activity data are given in specific formats which are called SNAP[8]- and NFR[9]-Codes. Both formats show relevant differences to the Stockholm Convention with respect to the classification of source categories. Therefore, activity data on individual processes had to be identified and re-classified in order to obtain source specific activity data in line with the requirements of the Stockholm Convention.

In addition to that data from literature and further information from recent studies were used where available (see description of releases from individual source categories).

Emission factors for air emissions were taken from the Austrian Air Emissions Inventory ("Österreichische Luftschadstoffinventur – OLI") which gives a yearly update of emissions of air pollutants, among them PCDD/F (I-TEQ), HCB, PCB and PAH (4 congeneres). Where necessary emission factors have been recalculated to reflect recent developments in data quality (see description of releases from individual source categories).

## 1.2 Pollutants of concern

### 1.2.1 Polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF)

Polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) are formed unintentionally in industrial-chemical processes, such as chemical manufacture, and thermal processes, such as waste incineration. PCDD/PCDF are the only POPs whose mechanism of formation has been studied extensively in combustion-related processes and to a lesser extent in non-combustion-related chemical processes; even so, the mechanisms and the exact formation conditions are not fully resolved.

Carbon, oxygen, hydrogen and chlorine, whether in elemental, organic or inorganic form, are needed. At some point in the synthesis process, whether present in a precursor or generated by a chemical reaction, the carbon must assume an aromatic structure.

There are two main pathways by which these compounds can be synthesized: from precursors such as chlorinated phenols or de novo from carbonaceous structures in fly ash, activated carbon, soot or smaller molecule products of incomplete combustion. Under conditions of poor combustion, PCDD/PCDF can be formed in the burning process itself.

[8] SNAP: Standard Nomenclature of Air Pollutants

[9] NFR: Nomenclature for Reporting

The mechanism associated with this synthesis can be homogeneous (molecules react all in the gas phase or all in the solid phase) or heterogeneous (involving reactions between gas phase molecules and surfaces).

PCDD/PCDF can also be destroyed when incinerated at sufficient temperature with adequate residence time and appropriate mixing of combustion gases and waste or fuel feed. Good combustion practice includes management of the “3 Ts” – time of residence, temperature and turbulence. Use of a fast temperature quench and other known processes are necessary to prevent reformation.

In addition to the primary measures there are a variety of well proven and effective secondary measures to reduce emissions of once formed PCDD/F, including different techniques of adsorption on activated coke or oxidation with the help of a catalyst.

### 1.2.2 Hexachlorobenzene (HCB)

Hexachlorobenzene (HCB) has been widely employed as a fungicide on seeds, especially against the fungal disease 'bunt' that affects some cereal crops. The marketing and use of hexachlorobenzene as a plant protection product was banned in the European Union in 1988.

As hexachlorobenzene is no longer produced in the EU, the only man-made release of hexachlorobenzene is as unintentionally produced pollutant. HCB can still be found as an impurity in certain active ingredients of some plant protection products and biocides, although in much smaller amounts than there used to be. Further, it is emitted from the same chemical and thermal processes as dioxins and furans and formed via a similar mechanism.

There is far less information on the formation of HCB, especially in combustion processes. Since there are similarities in the structure and occurrence of PCDD/PCDF, PCB and HCB, it is usually assumed that, with the exception of oxygen-containing species, those parameters and factors that favour formation of PCDD/PCDF also generate PCB and HCB.

### 1.2.3 Polychlorinated biphenyls (PCB)

Polychlorinated biphenyls (PCB) have been widely used as additives in transformer oils, in capacitors, as hydraulic fluids and as softeners in lacquers and plastics.

As PCB is no longer produced in the EU, the only man-made release of PCB is as unintentionally produced pollutant; it is emitted from the same chemical and thermal processes as dioxins and furans and formed via a similar mechanism.

There is far less information on the formation of PCB, especially in combustion processes. Since there are similarities in the structure and occurrence of PCDD/PCDF, PCB and HCB, it is usually assumed that, with the exception of oxygen-containing species, those parameters and factors that favour the formation of PCDD/PCDF also generate PCB and HCB.

### 1.2.4 Polycyclic aromatic hydrocarbons (PAH)

Polycyclic aromatic hydrocarbons (PAH) are molecules built up of benzene rings. PAHs are a group of approximately 100 compounds. Most PAHs in the environment arise from incomplete combustion of carbon-containing materials like oil, wood, garbage or coal. Fires are able to produce fine PAH particles, which bind to ash particles and are considered long range airpollutants. Thus PAHs have been ubiquitously distributed in the environment for thousands of years.

The four compounds benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene are used as indicators for the purposes of emission inventories.

### 1.2.5 Pentachlorobenzene (PeCB)

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

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.

The production of PeCB was phased out in the main producer countries some decades ago as efficient and cost-effective alternatives are available. Applying Best Available Techniques and Best Environmental Practices would significantly reduce the unintentional production of PeCB.

(webpage Stockholm Convention on Persistant Organic Pollutants, http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx)

### 1.2.6 Polychlorinated Naphthalenes (PCN)

Commercial PCNs are mixtures of up to 75 chlorinated naphthalene congeners plus byproducts and are often described by the total fraction of chlorine. PCNs make effective insulating coatings for electrical wires. Others have been used as wood preservatives, as rubber and plastic additives, for capacitor dielectrics and in lubricants. PCNs started to be produced for high-volume uses around 1910 in both Europe and the United States. To date, intentional production of PCN is assumed to have ended. PCN are unintentionally generated during high-temperature industrial processes in the presence of chlorine.

(webpage Stockholm Convention on Persistant Organic Pollutants, http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx)

# 2 SOURCE INVENTORY OF POPS RELEASES INTO AIR

In this section two inventories are described: the Austrian air emissions inventory („Österreichische Luftschadstoff-Inventur OLI“) according to UNECE/LRTAP and the inventory developed according to the source categories of Annex C of the Stockholm Convention (including PAH as required by the EU-POP Regulation).

There are distinct methodological differences between these two inventories: The OLI includes a variety of air pollutants, among them PCDD/F (I-TEQ), HCB, PCB and PAH. Source categories are combined in SNAP codes (SNAP: Standard Nomenclature for Air Pollutants) and in NFR codes (NFR: Nomenclature For Reporting).

On the other hand the inventory required by the Stockholm Convention should help to identify major sources of POPs emissions and therefore follows a more source-based approach: Emissions to air (but also emissions to water, soil and releases via residues and waste) should be given for individual processes which have been identified by the relevant Technical Working Group as having the potential for substantial POPs releases.

The National Action Plan according to Article 5 of the Stockholm Convention should also present an inventory of PCN releases. However, due to a general lack of data, this requirement could not be fulfilled.

With respect to emissions into air there are specific differences in the results of the two inventories. These can be explained by the different formats used for activity data and by the incorporation of updated emission factors for the Action Plan’s inventory. Relevant discrepancies are described in detail in the source specific sections.

## 2.1 Austrian Air emissions Inventory according to UNECE/LRTAP

The Umweltbundesamt, in its capacity as the Environment Agency Austria, has been designated by law as the national entity which is responsible for the preparation of the annual air pollutant inventory. The Environmental Control Act (BGBl. I Nr. (Federal Law Gazette No.) 1998/152 as amended) regulates the responsibilities of environmental control in Austria and lists the tasks of the Umweltbundesamt. One of these tasks is to provide technical expertise and the data basis for the fulfilment of the emission related reporting obligations under the UNECE LRTAP Convention.

To this end, the Umweltbundesamt prepares and annually updates the Austrian air emissions inventory („Österreichische Luftschadstoff-Inventur OLI“), which covers

- Greenhouse gases ($CO_2$, $N_2O$, $CH_4$, F-gases)
- $SO_x$, $NO_x$, $NH_3$, NMVOC (under the NEC Directive) and CO
- POPs (PAHs, HCB, PCB, PCDD/F)
- Heavy metals (Pb, Cd, Hg)
- Particulate matter (TSP, $PM_{10}$ and $PM_{2.5}$).

For the Umweltbundesamt a national air emission inventory that identifies and quantifies the sources of pollutants in a consistent manner has a high priority. Such an inventory provides a common basis for comparing the relative contributions of different emission sources and hence can be a basis for policies to reduce emissions.

### 2.1.1 Trends for POPs Emissions into Air

Emissions of PCDD/F decreased between the years 1990–2014 with the biggest drop between the years 1990 and 1994 as a result of legal regulations concerning emission reduction from industry and waste incineration. Emissions of PCDD/F increased in the years 1995 and 1996, and steadily declined afterwards until the year 2001. PCDD/F dropped remarkably between 2001 and 2002 (due to a reduction measure in one sinter plant).

Emissions of PAH decreased steadily from 1990 to 2014 with a significant drop between the years 1990 and 1994.

Emissions of PCB declined significantly from 1990 to 1993, then increased slowly from 1994 to 2014 and at 180 kg per year they are now 7% lower than in 1990, but 11% higher than in 1995. Thermal processes in the metallurgical industry (sinter plants, secondary lead production) contribute – with a lion's share of 99% - significantly to the total emissions of PCB. The inventory of emissions in the Austrian inventory is based on activity data which is multiplied with an activity specific emission factor. This factor (for PCB) has not changed in the considered years. As activity data (production data) has increased, also the calculated emissions of PCB increased. A review of the emission factors for PCB in the different source categories is necessary.

Emissions of HCB declined from 1990 to 2011, and then increased strongly in the years 2012, 2013 and 2014. This increase is due to an unintentional release of HCB in an Austrian cement installation which was caused by the input of HCB containing waste and incomplete destruction of HCB.

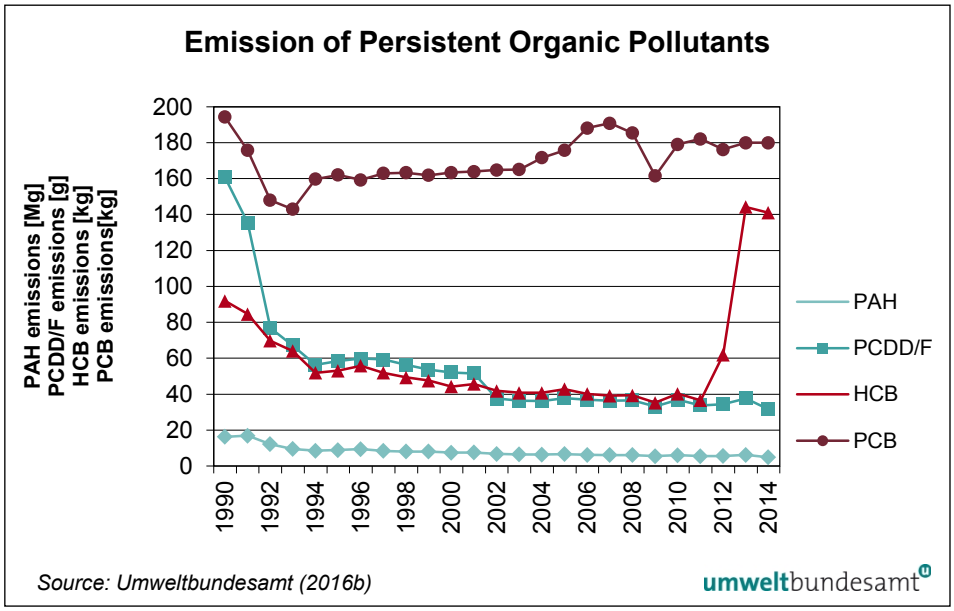
*Table 1: Emissions and emission trends for POPs 1990–2014 (UMWELTBUNDESAMT 2016b)*

| Year | Emission | | | |
|---|---|---|---|---|
| | PAH [Mg] | PCDD/F [I-TEQ, g] | HCB [kg] | PCB [kg] |
| 1990 | 16.27 | 160.69 | 91.93 | 194.23 |
| 1991 | 16.90 | 135.39 | 84.62 | 175.76 |
| 1992 | 12.16 | 76.81 | 69.67 | 147.97 |
| 1993 | 9.49 | 67.03 | 64.02 | 142.96 |
| 1994 | 8.50 | 56.26 | 51.93 | 159.73 |
| 1995 | 8.85 | 58.48 | 53.09 | 161.98 |
| 1996 | 9.40 | 59.84 | 55.80 | 159.26 |
| 1997 | 8.44 | 59.32 | 51.91 | 162.91 |
| 1998 | 8.05 | 56.33 | 49.34 | 163.23 |
| 1999 | 8.03 | 53.62 | 47.57 | 161.86 |
| 2000 | 7.40 | 52.04 | 44.28 | 163.35 |

| Year | Emission | | | |
|---|---|---|---|---|
| | PAH [Mg] | PCDD/F [I-TEQ, g] | HCB [kg] | PCB [kg] |
| 2001 | 7.50 | 51.56 | 45.65 | 163.88 |
| 2002 | 6.75 | 37.60 | 41.81 | 164.77 |
| 2003 | 6.48 | 36.36 | 40.77 | 165.08 |
| 2004 | 6.40 | 36.19 | 40.77 | 171.63 |
| 2005 | 6.65 | 37.77 | 42.77 | 175.74 |
| 2006 | 6.23 | 36.89 | 40.14 | 188.13 |
| 2007 | 6.07 | 36.32 | 39.11 | 190.75 |
| 2008 | 6.09 | 36.54 | 39.35 | 185.35 |
| 2009 | 5.48 | 33.14 | 35.21 | 161.43 |
| 2010 | 6.04 | 36.91 | 40.25 | 179.04 |
| 2011 | 5.44 | 33.69 | 36.56 | 182.04 |
| 2012 | 5.58 | 34.44 | 61.88 | 176.17 |
| 2013 | 6.21 | 37.68 | 144.20 | 179.91 |
| 2014 | 4.89 | 31.57 | 140.95 | 179.94 |
| ***Trend 1990–2014*** | **-70%** | **-80%** | **+53%** | **-7%** |
| ***Trend 1995-2014*** | **-45%** | **-46%** | **+165%** | **+11%** |

*Remark: Please note different units used for different groups of pollutants. PeCB and PCN are not covered in the Austrian air emissions inventory.*

*Figure 1: Emission of Persistent Organic Pollutants 1990–2014: PAH in Mg, PCDD/F in g, HCB in kg and PCB in kg according to UNECE/LRTAP.*




*Remark: Please note different units used for different groups of pollutants. PeCB and PCN are not covered in the Austrian air emissions inventory. Due to the economic crisis activity data and therefore emissions decreased in 2009.*

## 2.2 Releases of polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) – Source categories of the Stockholm Convention

### 2.2.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge

The following description of this source category is given in the Stockholm Convention's Technical Guidebook, Waste Incinerators (UNEP 2007):

"This section deals only with the dedicated incineration of wastes and not with other situations where waste is thermally treated, for example co-incineration processes such as cement kilns and large combustion plants, which are dealt with in the sections relating to those processes."

#### 2.2.1.1 Emission Factors and Emissions

PCDD/F emissions into air are in the range of 0.0013 to 0.05 ng/Nm$^3$ (I-TEQ; at 11% oxygen), which is within (or in some cases even below) the ranges associated with Best Available Techniques (0.01–0.1 ng/Nm$^3$; EUROPEAN COMMISSION 2006a). Most of the measurements are done on a discontinuous basis. However, in some cases PCDD/F-emissions were measured on a semi-continuous basis (i.e. continuous sampling of flue-gas followed by an analysis of the filter cartridge every two weeks).

**Municipal Waste**

About 1.341 million t municipal waste (mixed municipal waste, bulky waste) were incinerated in municipal waste incineration plants (BMLFUW 2015a).

**Hazardous Waste**

In 2014, about 1.324 million t of hazardous waste were treated (BMLFUW 2015), 0.227 million t were incinerated in 2014 (assumption Umweltbundesamt 2015).

**Sewage sludge**

In 2014 an amount of 0.239 million t of sewage sludge was produced in Austria. 1% of this amount was landfilled, 49% was incinerated, 17% was applied on land and 33% was treated in another way. (BMLFUW 2015).

Table 2 lists the PCDD/F-Emissions into air of the source category Waste Incineration for the years 2004, 2009 and 2014. (BMLFUW 2015)

*Table 2: PCDD/F-emissions into air from the source category Waste Incineration (UMWELTBUNDESAMT 2007a, own calculation).*

| | Emissions 2004 (g I-TEQ) | Emissions 2009 (g I-TEQ) | Emissions 2014 (g I-TEQ) |
|---|---|---|---|
| Municipal Solid Waste | 0.214 | 0.210 | 0.241 |
| Hazardous Waste | 0.013 | 0.017 | 0.024 |
| Sewage Sludge | 0.002 | 0.002 | 0.003 |
| **Total** | **0.230** | **0.229** | **0.267** |

### 2.2.2 Cement kilns firing hazardous waste

The following description of this source category is given in the Stockholm Convention's Technical Guidebook, Cement Kilns (UNEP 2007):

"The following draft guidelines provide guidance on best available techniques and guidance on best environmental practices for cement kilns relevant to Article 5 and Annex C, Part II of the Convention. Waste may be co-processes in cement kilns either als alternative fuel or for destruction purposes. Therefore this section also considers the requirements of Article 6 of the Convention regarding destruction of wastes containing POPs.

Destruction and co-incineration of wastes and hazardous wastes in cement kilns also fall within the scope of this section. It should be kept in mind when reading these guidelines that stringent definitions of the terms "waste" and "hazardous waste" do not currently exist. In the context of this guideline the term "waste" is used independent of its calorific value or its potential to substitute mineral resources."

#### 2.2.2.1 Emission Factors and Emissions

In all Austrian cement plants waste is co-incinerated with an upward trend. Emission factors used in the OLI were assessed using reported emissions from Austrian cement kilns (ENVIRONMENTAL IMPACT STATEMENT WIETERSDORF (2003), ENVIRONMENTAL IMPACT STATEMENT RETZNEI (2004), ENVIRONMENTAL IMPACT STATEMENT LEUBE (2005), KARSTENSEN (2006)).

In 2014 3.14 million t of clinker were produced in nine plants. In total about 493,609 t of waste were co-incinerated in 2014 (VÖZ 2015). Data from single measurements (done in 2014) show emission concentrations between 0.0006–0.058 ng/Nm$^3$ (I-TEQ); all but one plant are considerably below the BAT ranges of <0.05-0.1 ng PCDD/F I-TEQ/Nm$^3$ (10 vol-% $O_2$, dry flue gas, standard state, average over the sampling period 6–8 hours, BMLFUW 2016a). In the Waste Incineration Ordinance (AVV – relevant ordinance for co-incineration of waste in cement plants) the ELV for PCDD/F for cement plants is 0.1 ng/Nm³. Results from literature show that PCDD/F emissions are not primarily depending on the type of fuel or waste but on the operating conditions and on the prevention of conditions which favour de-novo synthesis.

The next table presents calculated emissions loads from Austrian cement kilns:

*Table 3: PCDD/F-emissions from Austrian cement plants (UMWELTBUNDESAMT 2016b).*

| | Emissions 2004 (g I-TEQ) | Emissions 2009 (g I-TEQ) | Emissions 2014 (g I-TEQ) |
|---|---|---|---|
| Cement kilns (total emissions) | 0.119 | 0.131 | 0,121 |

It should be mentioned, that PAH-emissions such as benzene or naphthalene may arise from cement plants. These emissions have so far been reported by a small number of Austrian cement plants. PAHs mainly escape from preheating raw meal and to some extent from the rotary kiln (see PRTR data on the website of the Environment Agency Austria: www.prtr.at).

### 2.2.3 Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching

The production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching is described in the Stockholm Convention's Technical Guidebook, Production of Pulp (UNEP 2007) as follows:

"The main processes involved in making pulp and paper products are raw material handling and preparation, storage (and preservation for non-woods), wood debarking, chipping and agricultural residue cleaning, deknotting, pulping, pulp processing and bleaching if required and, finally, paper or paperboard manufacturing. Most of the formation of the 2,3,7,8-TCDD and 2,3,7,8-TCDF is generated in the C-stage of bleaching via the reaction of chlorine with precursors of TCDD and TCDF. HCB and PCB are not formed during pulp bleaching".

In the BAT-Conclusions for the production of pulp, paper and board (2014/687/EU) the bleaching of pulp with elemental chlorine or chemicals generating elemental chlorine is not considered as BAT (Best available technique). According to the BAT-Conclusions, state of the art techniques for kraft pulping, sulphite pulping, mechanical and chemimechanical pulping are totally chlorine free bleaching (TCF), modern elemental chlorine free (ECF) bleaching and high consistency (peroxide) bleaching.

#### 2.2.3.1 Emission Factors and Emissions

Emissions into air are released by recovery boilers (incineration of black liquor and fuel oil), fluidised bed reactors (incineration of bark, sludge, coal, fuel oil, biomass and waste), lime kilns (incineration of gas and fuel oil) and other fossil fuel fired incineration plants (UMWELTBUNDESAMT 2007b). Although PCDD/F-emissions are not measured in most of the above mentioned incineration plants (emissions are routinely measured at fluidised bed reactors when waste in co-incinerated) emissions are generally considered to be low (UNEP 2005). Emissions of these incineration plants are reported in section 2.2.8 (fossil fuel-fired utility and industrial boilers).

### 2.2.4 Thermal processes in the metallurgical industry (secondary copper production; sinter plants in the iron and steel industry; secondary aluminium production; secondary zinc production)

This source category is described in the Stockholm Convention's Technical Guidebook, metallurgical industry (UNEP 2007) as follows:

"Secondary copper smelting involves pyrometallurgical processes dependent on the copper content of the feed material, size distribution and other constituents. Feed sources are copper scrap, sludge, computer scrap, drosses from refineries and semi-finished products. These materials may contain organic materials like coatings or oil, and installations take this into account by using de-oiling and de-coating methods or by correct design of the furnace and abatement system."

"Iron sintering plants may be used in the manufacture of iron and steel, often in integrated steel mills. The sintering process is a pretreatment step in the production of iron whereby fine particles of iron ores and, in some plants, secondary iron oxide wastes (collected dusts, mill scale) are agglomerated by combustion."

"Processes used in secondary aluminium smelting are dependent on feed material. Pretreatment, furnace type and fluxes used will vary with each installation. Production processes involve scrap pretreatment and smelting/refining. Pretreatment methods include mechanical, pyrometallurgical and hydrometallurgical cleaning. Smelting is conducted using reverberatory or rotary furnaces. Induction furnaces may also be used to smelt the cleaner aluminium feed materials."

"Secondary zinc smelting involves the processing of zinc scrap from various sources. Feed material includes dusts from copper alloy production and electric arc steel making (both of which have the potential to be contaminated with chemicals listed in Annex C of the Stockholm Convention), residues from steel scrap shredding, and scrap from galvanizing processes. The process method is dependent on zinc purity, form and degree of contamination. Scrap is processed as zinc dust, oxides or slabs. The three general stages of production are pretreatment, melting and refining."

The latter process is not applied in Austria.

#### 2.2.4.1 Emission Factors and Emissions

**Secondary copper plant**

In Austria only one secondary copper plant is in operation with a production capacity of 92,400 t/a copper anodes, 113,500 t/a copper cathodes and 91,000 t/a of bolts (MONTANWERKE BRIXLEGG 2012).

Emissions are reduced via fabric filter and regenerative afterburner including a catalytical reduction step after the shaft furnace. The general ELV for PCDD/F according to the Ordinance on non ferrous metals and refractory metals (BGBl. II No. 86/2008) is 0.4 ng/Nm$^3$. According to the BAT-Conclusions for Non Ferrous Metals Industries (EUROPEAN COMMISSION 2016) the emission limit value will have to be changed to 0.1 ng/Nm$^3$.

There are no dioxin emission reduction measures installed after the converter and the anode furnace.

**Sinter Plants**

In Austria two sinter plants are in operation with a production capacity of 1.5 million t/a (VA Donawitz) and 2.75 million t/a (VA Linz), respectively. Both plants are equipped with bag filter. For the larger plant the emission limit value is 0.1 ng/Nm$^3$ PCDD/F (as I-TEQ; ENVIRONMENTAL IMPACT ASSESSMENT 2004), reported emissions are < 0.05 ng/ Nm$^3$ PCDD/F (BREF review Iron and Steel Production, 2012). The other plant emits less than 0.1 ng/Nm$^3$ PCDD/F (BREF review Iron and Steel Production, 2012). The review on the BREF Iron and Steel has been published on 28/02/2012 (EUROPEAN COMMISSION 2012). The BAT- associated emission level for PCDD/F in case of the the application of a bag filter is < 0,05 – 0,2 ng I-TEQ/Nm$^3$. Permit conditions have to be reconsidered within 4 years of publication of decisions on BAT conclusions. With status 06/2016 there is no information available on the permit conditions of the smaller installation.

**Secondary aluminium smelting plants**

In Austria the following companies are producing secondary aluminium:

- AMAG: 375,900 t/a (AMAG 2014)
- Aluminium Lend GmbH & Co KG (SAG): capacity: 45.000 t/a ; http://www.hrforce.at/hr-infotag2012/vortraege/006-B_Outsourcing_unterjaehrig.pdf;
- Hütte Klein-Reichenbach: capacity: 10.000 t/a.

Different furnaces are used in the secondary aluminium production in Austria like reverberatory furnace, rotary furnace, tilting rotary furnace, induction furnace. Emissions of PCDD/F are reduced via afterburning, dry sorption technique ($NaHCO_3$, coke) or injection of sorbalite (lime and coke). Measured PCDD/F emissions are below <0.1 ng/Nm$^3$, (UMWELTBUNDESAMT 2010) which is below the emission value associated with Best Available Techniques (≤0.1 ng/Nm$^3$, EUROPEAN COMMISSION 2016).

Benzo(a)pyrene is limited in the non ferrous metals Ordinance with an emission limit value of 0.05 mg/Nm$^3$. Measured values (as far as they are available) are far below this limit value.

**Emissions**

Table 4 gives an overview of calculated emissions from the processes described above:

| | Emissions 2004 (g I-TEQ) | Emissions 2009 (g I-TEQ) | Emissions 2014 (g I-TEQ) |
|---|---|---|---|
| Secondary copper production | 0.279 | 0.279 | 0.279 |
| Sinter plants in the iron and steel industry | 3.106 | 2.538 | 3.353 |
| Secondary aluminium production | 1.309 | 1.282 | 1.256 |
| Secondary zinc production | NO | NO | NO |
| **Total** | **4.694** | **4.099** | **4.887** |

*Table 4: PCDD/F-emissions from thermal processes in the metallurgical industry – Part II (UMWELTBUNDESAMT 2016b).*

## 2.2.5 Open burning of waste, including burning of landfill sites

This source category is described in the Stockholm Convention's Technical Guidebook, open burning of waste (UNEP 2007) as follows:

"Open burning covers a wide range of different uncontrolled waste combustion practices, including dump fires, pit burning, fires on plain soil and barrel burning."

### 2.2.5.1 Emission Factors and Emissions

This source category includes on-field burning of stubble, straw, etc. and open burning of agricultural waste. Releases are taken from the Austrian National Inventory (see Table 5).

Intentional fires like bonfires bear a risk of abuse when used as a method of domestic waste disposal. This issue has been addressed in a single case study showing the effectiveness of current regulation in this field of activity. The situation with unintentional fires is more unclear. Emission factors reported in literature show high uncertainty due to limited sets of data.

In addition releases from accidental burning of landfill sites (esp. landfills for the intermediate storage of waste) should be added here as well as releases during accidental fires of houses and other facilities. In recent years burning of intermediate storage facilities of waste has occurred relatively often. However, due to missing data on the quantities of burnt waste and the great uncertainties associated with the relevant emission factors no quantification of emissions has been done for these types of unwanted emissions.

Nevertheless, it can be assumed that these incidents contribute substantially to the overall emissions of PCDD/F into air: The Dioxin Toolkit (UNEP 2005) gives a default emission factor of 1 mg per tonne of burnt material.

*Table 5: PCDD/F-emissions from the source category open burning of waste (UMWELTBUNDESAMT 2016b).*

| | Emissions 2004 (g I-TEQ) | Emissions 2009 (g I-TEQ) | Emissions 2014 (g I-TEQ) |
|---|---|---|---|
| Open burning of waste* | 0.223 | 0.132 | 0.069 |

** without burning of landfill sites and accidental fires*

### 2.2.6 Thermal processes in the metallurgical industry not mentioned in Part II

This source category is described in the Stockholm Convention's Technical Guidebook, metallurgical industry (UNEP 2007) as follows:

"Secondary lead smelting involves the production of lead and lead alloys, primarily from scrap automobile batteries, and also from other used lead sources (pipe, solder, drosses, lead sheathing). Production processes include scrap pretreatment, smelting and refining. Incomplete combustion; high levels of oils, plastics and other organic materials in feed; and temperatures between 250°C and 500°C may all give rise to chemicals listed in Annex C of the Stockholm Convention."

"Primary aluminium is produced directly from the mined ore, bauxite. The bauxite is refined into alumina through the Bayer process. The alumina is reduced into metallic aluminium by electrolysis through the Hall-Héroult process (either using self-baking anodes – Söderberg anodes – or using prebaked anodes)."

"Magnesium is produced either from raw magnesium chloride with molten salt electrolysis, or magnesium oxide reduction with ferrosilicon or aluminium at high temperatures, as well as through secondary magnesium recovery (for example, from asbestos tailings)."

"Secondary steel is produced through direct smelting of ferrous scrap using electric arc furnaces. The furnace melts and refines a metallic charge of scrap steel to produce carbon, alloy or stainless steels at non integrated steel mills. Ferrous feed materials may include scrap, such as shredded vehicles and metal turnings, or direct reduced iron. In addition scrap may be added to other melting furnaces in the foundry and primary iron and steel sectors.

"Primary base metals smelting involves the extraction and refining of nickel, lead, copper, zinc and cobalt. Generally, primary base metals smelting facilities process ore concentrates. Most primary smelters have the technical capability to supplement primary concentrate feed with secondary materials (e.g. recyclables)."

#### 2.2.6.1 Emission factors and emissions

**Secondary lead production**

Only one plant in Austria (BMG Metall & Recycling GmbH in Arnoldstein/Kärnten) produces secondary lead from old batteries with a production capacity of 23,000 t/a. (UMWELTERKLÄRUNG 2015). An afterburner has been installed after the furnaces. An emission limit value of 0.4 ng/Nm$^3$ for PCDD/F exists in the current ordinance (BGBl. II Nr. 86/2008). Measured values are below this ELV.

The ELV will have to be changed due to the revised BAT-AEL of 0.1 ng/Nm$^3$ for PCDD/F in the European BAT Conclusions. (EUROPEAN COMMISSION 2016) Benzo(a)pyrene is limited by ordinance (BGBl. II No. 86/2008) with an emission limit value of 0.05 mg/Nm$^3$, a measured value of 0.0064 mg/Nm$^3$ (UMWELT-ERKLÄRUNG 2015) is far below the limit value.

**Primary aluminium production**

Primary aluminium is no longer produced in Austria (1992 – change to secondary aluminium production).

**Secondary steel production**

Secondary steel (Electric Arc Furnace) is produced in three plants (Böhler Uddeholm, Marienhütte, Breitenfeld). Total production was 664 kt in the year 2013 and 691 kt in the year 2014. www.worldsteel.org.

**Emissions**

Releases have been taken from the Austrian National Inventory (see Table 6).

*Table 6: PCDD/F-emissions from the source category thermal processes in the metallurgical industry – Part III (UMWELTBUNDESAMT 2016b).*

| | Emissions 2004 (g I-TEQ) | Emissions 2009 (g I-TEQ) | Emissions 2014 (g I-TEQ) |
|---|---|---|---|
| Thermal processes in the metallurgical industry not mentioned in Part II | 0.204 | 0.191 | 0.213 |

### 2.2.7 Residential combustion sources

Residential combustion plants are defined in the Stockholm Convention's Technical Guidebook (UNEP 2007) as follows:

"This section considers the combustion of wood, coal, gas, as well as other organic matter mainly for residential heating and cooking. Combustion takes place in hand-fired stoves or fireplaces or, in the case of larger central heating systems, in automatically fired installations."

Activity data for residential combustion plants can be found within the Austrian National Energy Balance in the NFR-codes (NFR: Nomenclature for Reporting) "Commercial/Institutional" (NFR: 1A4a, SNAP: 0201), "Residential Plants" (NFR: 1A4b1, SNAP: 0202) and "Plants in Agriculture/Forestry" (NFR: 1A4c1, SNAP: 0203). Since these plants are regarded as small scale installations, their emissions are allocated to the source category "Residential combustion sources".

#### 2.2.7.1 Emission factors – NFR-code: "Residential Combustion Sources"

In the next table emission factors of relevant fuels are compiled:

*Table 7: PCDD/F emission factors for Residential Plants, Commercial/ Institutional Plants and Plants in Agriculture/ Forestry*

| EF PCDD/F [µg/GJ] | UMWELTBUNDESAMT (2016b) | UNEP Toolkit (UNEP 2013) |
|---|---|---|
| **1A4a Commercial/Institutional plants (SNAP 020103)** | | |
| 102A Lignite<br>104A Lignite briquettes<br>105A Brown coal<br>106A Brown coal briquettes<br>107A Coke | 0.24 | 0.200 (low chlorine)<br>1.700 (high chlorine) |
| 203B Light fuel oil<br>203C Medium fuel oil | 0.002 | 0.010 (general) |
| 203D Heavy fuel oil | 0.0009 | 0.010 (general) |
| 204A Heating oil<br>206A Petroleum | 0.0012 | 0.010 (general) |
| 224A Other Oil Products | 0.0017 | 0.010 (general) |
| 301A Natural gas | 0.0016 | 0.0015 (general) |
| 303A LPG<br>310A Landfill gas | 0.0017 | not available |
| 309A Biogas<br>309B Sewage sludge gas | 0.0006 | not available |
| 111A Wood (IEF 2004)<br>111A Wood (IEF 2009)<br>111A Wood (IEF 2014) | 0.2246<br>0.1948<br>0.1699 | 1.500 (contaminated)<br>0.100 (advanced) |
| 115A Industrial waste | 0.3 | 0.200 (low chlorine)<br>1.700 (high chlorine) |
| 116A Wood waste (IEF 2004)<br>116A Wood waste (IEF 2009)<br>116A Wood waste (IEF 2014) | 0.3333<br>0.43<br>0.43 | 1.500 (contaminated)<br>0.450 (straw)<br>0.100 (advanced) |
| **1A4c i Plants in Agriculture/Forestry/Fishing (SNAP 020302)** | | |
| 102A Lignite<br>104A Lignite briquettes<br>105A Brown coal<br>106A Brown coal briquettes<br>107A Coke | 0.24 | 0.200 (low chlorine)<br>1.700 (high chlorine) |
| 203B Light fuel oil<br>204A Heating oil | 0.0015 | 0.010 (general) |
| 301A Natural gas | 0.0025 | 0.0015 (general) |
| 303A LPG | 0.0025 | not available |
| 111A Wood (IEF 2004)<br>111A Wood (IEF 2009)<br>111A Wood (IEF 2014) | 0.2878<br>0.2163<br>0.1654 | 1.500 (contaminated)<br>0.100 (advanced) |
| 116A Wood waste | 0.38 | 1.500 (contaminated)<br>0.450 (straw)<br>0.100 (advanced) |
| **1A4b Residential plants: central and apartment heating (SNAP 020202)** | | |
| 102A Lignite<br>105A Brown coal<br>106A Brown coal briquettes<br>107A Coke | 0.38 | 0.200 (low chlorine)<br>1.700 (high chlorine) |

| EF PCDD/F [µg/GJ] | UMWELTBUNDESAMT (2016b) | UNEP Toolkit (UNEP 2013) |
|---|---|---|
| 203B Light fuel oil<br>204A Heating oil | 0.0015 | 0.010 (general) |
| 224A Other Oil Products | 0.0017 | 0.010 (general) |
| 301A Natural gas | 0.0025 | 0.0015 (general) |
| 303A LPG | 0.0025 | not available |
| 111A Wood: central heating (IEF 2004)<br>111A Wood: central heating (IEF 2009)<br>111A Wood: central heating (IEF 2014) | 0.2878<br>0.2163<br>0.1654 | 1.500 (contaminated)<br>0.100 (advanced) |
| 111A Wood: apartment heating | 0.38 | 1.500 (contaminated)<br>0.100 (advanced) |
| 116A Wood waste: central heating (IEF 2004)<br>116A Wood waste: central heating (IEF 2009)<br>116A Wood waste: central heating (IEF 2014) | 0.2878<br>0.2163<br>0.1654 | 1.500 (contaminated)<br>0.450 (straw)<br>0.100 (advanced) |
| 116A Wood waste: apartment heating | 0.38 | 1.500 (contaminated)<br>0.450 (straw)<br>0.100 (advanced) |
| **1A4b Residential plants: stoves[10] (SNAP 020205)** | | |
| 102A Lignite*<br>104A Lignite briquettes*<br>105A Brown coal*<br>106A Brown coal briquettes*<br>107A Coke* | 0.75 | 0.200 (low chlorine)<br>1.700 (high chlorine) |
| 204A Heating oil | 0.003 | 0.010 (general) |
| 301A Natural gas | 0.006 | 0.0015 (general) |
| 111A Wood*<br>113A Peat*<br>116A Wood waste* | 0.75 | 1.500 (contaminated)<br>0.450 (straw)<br>0.100 (advanced) |

** see footnote fur further details*

#### 2.2.7.2 Activity data – NFR-code: "Residential Plants"

In 2014 total energy consumption under the NFR-code "Residential Plants" was 140 PJ. Major fuels were wood with a share of 34.7%, followed by natural gas (29.9%), oil (light and extra light heating oil and liquified petroleum gas) (25.5%) and wood waste (8.2%). Other fuels (0.9%) and coal (0.7%) are of minor importance.

[10] Referring to UMWELTBUNDESAMT (2002): Coal: 7.74 µg/GJ (stoves, fireplaces). Coke: 1.47 µg/GJ (stoves, fireplaces). Wood, peat & wood waste: 0.32 µg/GJ (stoves, fireplaces).

*Table 8: Fuel mix in the NFR-code „Residential Plants“ (UMWELTBUNDESAMT 2016a).*

| Residential Plants | 2004 | 2009 | 2014 |
|---|---|---|---|
| Coal | 3.1% | 1.5% | 0.7% |
| Oil | 36.1% | 30.7% | 25.5% |
| Gas | 28.5% | 28.9% | 29.9% |
| Wood waste | 3.6% | 5.3% | 8.2% |
| Wood | 27.8% | 32.4% | 34.7% |
| Others | 0.9% | 1.2% | 0.9% |
| **Sum** | **100%** | **100%** | **100%** |
| **Total Energy Consumption** | **180 PJ** | **152 PJ** | **140 PJ** |

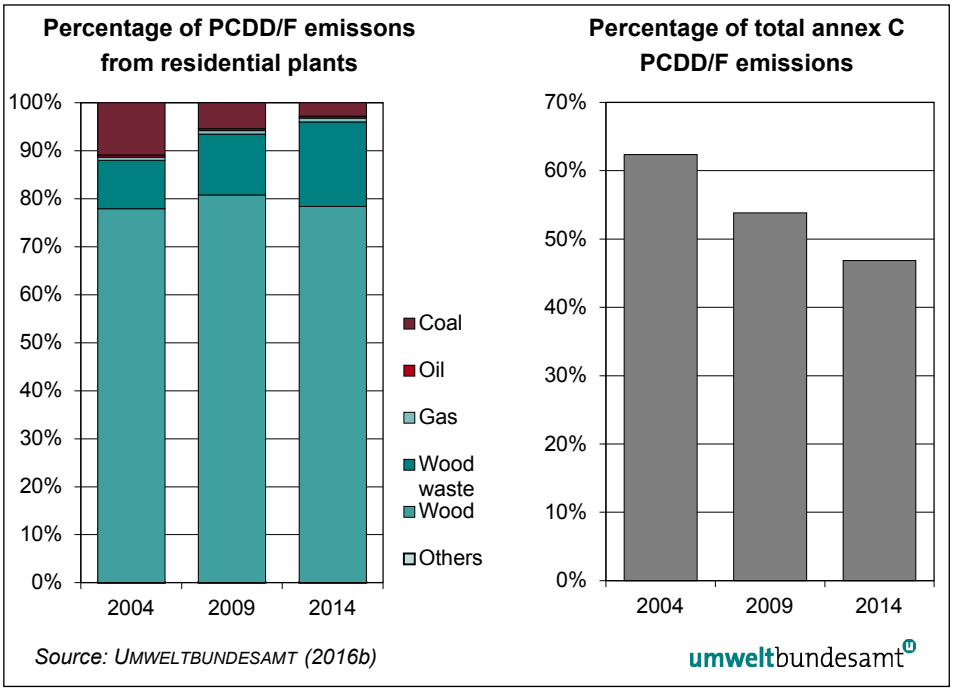
### 2.2.7.3 Emissions of PCDD/F – NFR-code: “Residential Plants”

Emission factors were taken from the OLI. In the table below emissions of residential plants are listed in relation to the fuel input. The largest part of the emissions stems from the incineration of wood. The incineration of fossil solid fuels (coal, lignite, coke) contributes significantly to the overall emissions from this source category. However, emissions from fossil solid fuels are expected to decrease even further due to a decline in fuel consumption.

*Table 9: Emissions of dioxines/furanes from residential plants (UMWELTBUNDESAMT 2016b, own calculation)*

| Residential Plants | 2004 (g I-TEQ) | 2009 (g I-TEQ) | 2014 (g I-TEQ) |
|---|---|---|---|
| Coal | 2.40 | 0.94 | 0.41 |
| Oil | 0.10 | 0.07 | 0.05 |
| Gas | 0.15 | 0.13 | 0.12 |
| Wood waste | 2.22 | 2.21 | 2.56 |
| Wood | 17.24 | 14.11 | 11.42 |
| Others | 0.01 | 0.01 | 0.01 |
| **Sum** | **22.12** | **17.46** | **14.57** |

*Figure 2: Percentage of PCDD/F emissions from residential plants by fuel and as share of total annex C PCDD/F emissions 2004, 2009 and 2014.*



#### 2.2.7.4 Activity data – NFR-code "Commercial/Institutional" and "Plants in Agriculture/Forestry"

In the year 2014 the total input within these subcategories was 45 PJ. The major fuels were natural gas and other gases (50%), followed by oil (sum of heating oils and LPG: 21%), wood waste (16%) and wood (8.7%). Others (3.8%), solid fossil fuels (total of coke, coal and lignite: 0.3%) and industrial waste (0.2%) were of minor importance. Activity data in this sector suffer from substantial uncertainties which are the result of a lack of qualified data.

| Commercial/Institutional + Plants in Agriculture/Forestry | 2004 | 2009 | 2014 |
|---|---|---|---|
| Coal | 1.1% | 0.4% | 0.3% |
| Oil | 26.8% | 28.9% | 20.9% |
| Gas | 53.7% | 48.5% | 50.2% |
| Wood waste | 7.4% | 11.8% | 15.8% |
| Industrial waste | 0.6% | 0.1% | 0.2% |
| Wood | 4.6% | 6.6% | 8.7% |
| Others (biogas, sewage gas, landfill gas) | 5.8% | 3.7% | 3.8% |
| **Sum** | **100%** | **100%** | **100%** |
| **Total Energy Consumption** | **81 PJ** | **60 PJ** | **45 PJ** |

*Table 10: Share of fuels within the subcategories "Commercial/Institutional" and "Stationary" (UMWELTBUNDESAMT 2016a).*

#### 2.2.7.5 Emissions of PCDD/F – NFR-code "Commercial/Institutional" and „Plants in Agriculture/Forestry"

Emission factors were taken from the OLI. Due to the high activity rate of wood waste this type of waste contributes most to the overall emissions.

| Commercial/Institutional + Plants in Agriculture/Forestry | 2004 (g I-TEQ) | 2009 (g I-TEQ) | 2014 (g I-TEQ) |
|---|---|---|---|
| Coal | 0.22 | 0.05 | 0.04 |
| Oil | 0.03 | 0.02 | 0.01 |
| Wood waste | 2.12 | 2.83 | 2.80 |
| Wood | 1.03 | 0.85 | 0.65 |
| Gas | 0.07 | 0.05 | 0.04 |
| Industrial waste | 0.16 | 0.02 | 0.03 |
| Others | 0.01 | 0.00 | 0.00 |
| **Sum** | **3.63** | **3.83** | **3.56** |

*Table 11: Emissions of Dioxines/Furanes caused by different fuel types (UMWELTBUNDESAMT 2016b, own calculation).*

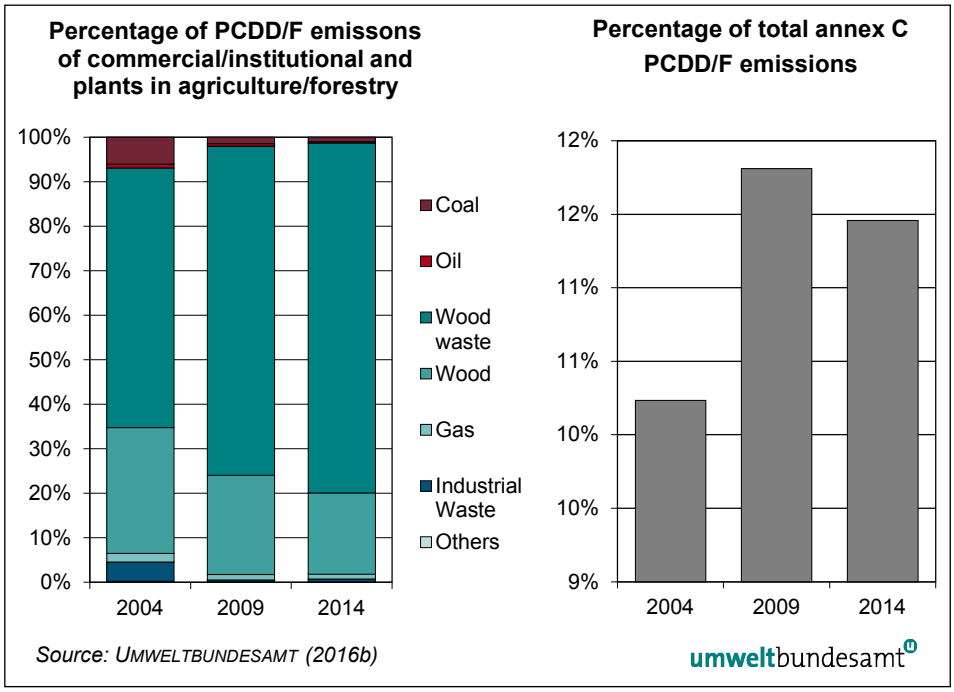



*Figure 3: Percentage of PCDD/F emissions from commercial/institutional and plants in agriculture/forestry by fuel and as share of total annex C PCDD/F emissions 2005, 2009 and 2014.*

### 2.2.8 Fossil fuel-fired utility and industrial boilers

Fossil fuel-fired utility and industrial boilers are described in the Stockholm Convention's Technical Guidebook, fossil fuel-fired utility and industrial boilers (UNEP 2007) as follows:

"Boilers are facilities designed to burn fuel to heat water or to produce steam. The majority of boilers use fossil fuels to provide the energy source, although boilers can also be designed to burn biomass and wastes. The steam produced from the boiler can be used for electricity production or used in industrial processes; likewise hot water can be used in industrial processing, or for domestic and industrial heating."

#### 2.2.8.1 Emission Factors and Emissions

Emission factors used by the Austrian Air Emissions Inventory are consistent with data from literature (UMWELTBUNDESAMT 2003, EUROPEAN COMMISSION 2003, 2006b). In general emission concentrations of investigated boilers are (far) below 0.1 ng/Nm$^3$.

*Table 12: PCDD/F-emissions from the source category fossil fuel fired utility and industrial boilers (UMWELTBUNDESAMT 2016a).*

| | Emissions 2004 (g I-TEQ) | Emissions 2009 (g I-TEQ) | Emissions 2014 (g I-TEQ) |
|---|---|---|---|
| Fossil fuel-fired utility and industrial boilers | 0.989 | 1.079 | 0.856 |

### 2.2.9 Firing installations for wood and other biomass fuels

Firing installations for wood and other biomass fuels are described in the Stockholm Convention's Technical Guidebook, firing installations for wood and other biomass fuels (UNEP 2007) as follows:

"The main purpose of firing installations for wood and other biomass fuels is energy conversion. Large-scale installations for firing wood and other biomass fuels mainly use fluidized bed combustion and grate furnaces. Technologies for small-scale plants include underfeed furnaces and cyclone suspension furnaces. Recovery boilers in the pulp and paper industry apply specific combustion conditions. Technology selection is related to fuel properties and required thermal capacity."

In the present section only large-scale applications in, for example, industry, power generation and district heating are covered.

#### 2.2.9.1 Emission Factors and Emissions

Some emission factors used by the Austrian Air Emissions Inventory have been updated according to available literature (UMWELTBUNDESAMT 2007c). For example emission factors for industrial firing installations have been reduced from 0.08 µg/GJ to 0.03 µg/GJ. Due to the increasing number of commercial biomass firing installations emissions from this source category have risen to  to more than 2.5 times in the period from 2004 to 2014.

*Table 13: PCDD/F-emissions from the source category firing installations for wood and other biomass fuels (UMWELTBUNDESAMT 2016b).*

| | Emissions 2004 (g I-TEQ) | Emissions 2009 (g I-TEQ) | Emissions 2014 (g I-TEQ) |
|---|---|---|---|
| Firing installations for wood and other biomass fuels | 1.644 | 3.147 | 4.192 |

### 2.2.10 Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil

This source category is described in the Stockholm Convention's Technical Guidebook, specific chemical production (UNEP 2007) as follows:

"This section focuses on processes for the manufacture of industrial chemicals that could theoretically give rise to persistent organic pollutants (particularly those chemicals listed in Annex C of the Stockholm Convention). Most of the processes described share common steps, including chlorination of organic or inorganic raw materials, purification of the products, separation of product streams (usually by distillation), destruction of high-molecular-weight side products and recycle or sale of hydrogen chloride."

#### 2.2.10.1 Emission Factors and Emissions

No national emission factors are available. It is assumed that – if any – emissions are negligible due to low activity figures.

### 2.2.11 Crematoria

This source category is described in the Stockholm Convention's Technical Guidebook, crematoria (UNEP 2007) as follows:

"Cremation is the disposal of a cadaver by the process of burning. This can be undertaken in either an uncontrolled, open burning fashion on funeral pyres, or in a controlled fashion within a cremator, installed within a crematorium or crematory. For the purposes of this document, only the cremator installations are discussed with respect to preventing releases of persistent organic pollutants, and not open burning or non combustion alternatives."

#### 2.2.11.1 Emission factors and emissions

In the year 2013 nine of eleven Austrian crematoria were equipped with emission reduction techniques, eight of which with PCDD/F reduction techniques. The emission limit value given in the permits is 0.1 ng/Nm$^3$ (11% $O_2$) (communication from operators, permits). There exists no generally binding rule concerning emission reduction for crematoria in Austria.

Due to a general lack of data emission factors from the Austrian Air Emissions Inventory have been used (Table 14).

*Table 14: PCDD/F-emissions from the source category crematoria (UMWELTBUNDESAMT 2016b).*

| | Emissions 2004 (g I-TEQ) | Emissions 2009 (g I-TEQ) | Emissions 2014 (g I-TEQ) |
|---|---|---|---|
| Crematoria | 0.154 | 0.164 | 0.164 |

### 2.2.12 Motor vehicles, particularly those burning leaded gasoline

This source category is described in the Stockholm Convention's Technical Guidebook, motor vehicles (UNEP 2007) as follows:

"The major fuels used in motor vehicle transportation are gasoline and diesel. Liquefied petroleum gas, vegetable oil-based and other biofuels, and alcohol-oil mixtures are gaining importance."

#### 2.2.12.1 Methodology

Activity data for motor vehicles can be found within the Austrian National Energy Balance in the NFR-codes:

**Road Transportation (SNAP: 07)**

- Passenger cars
- Light duty vehicles <3.5 t
- Heavy duty vehicles >3.5 t and buses (r)
- Mopeds and motorcycles <50 $cm^3$
- Motorcycles >50 $cm^3$

**Other Mobile Sources and Machinery (SNAP: 08)**

- Military
- Railways
- Inland waterways
- Agriculture
- Forestry
- Industry
- Household and gardening

#### 2.2.12.2 Activity data – Road Transportation

In 2014 total energy consumption in the category "Road Transportation" was 324.6 PJ. The major source category with a share of 49.6% was passenger cars, followed by heavy duty vehicles (37%), followed by light duty vehicles, motorcycles and mopeds (13.4%) excluding the relative proportions of liquid biofuels.

*Table 15: Fuel Allocation Road Transportation (UMWELTBUNDESAMT 2016a).*

| Source category | Activity 2004 | | Activity 2009 | | Activity 2014 | |
|---|---|---|---|---|---|---|
| | (PJ) | (%) | (PJ) | (%) | (PJ) | (%) |
| Passenger cars | 182.0 | 57.4 | 181.0 | 57.5 | 162.0 | 49.9 |
| *thereof Gasoline* | 82.5 | 26.0 | 67.6 | 21.5 | 59.7 | 18.4 |
| *thereof Diesel* | 98.6 | 31.1 | 101.9 | 32.4 | 91.1 | 28.1 |
| Light duty vehicles <3.5 t (r) | 17.1 | 5.4 | 18.9 | 6.0 | 19.4 | 6.0 |
| Heavy duty vehicles >3.5 t and buses (r) | 118.0 | 37.2 | 95.4 | 30.3 | 121.5 | 37.4 |
| Mopeds and Motorcycles <50 $cm^3$ | 0.2 | 0.1 | 0.3 | 0.1 | 0.2 | 0.1 |
| Motorcycles >50 $cm^3$ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **317.4** | **100** | **314.7** | **100** | **324.6** | **100** |
| *thereof liquid biofuels* | *0.0* | *0.0* | *19.2* | *6* | *21.5* | *6.6* |

#### 2.2.12.3 Activity data – Other Mobile Sources and Machinery

In 2014 total energy consumption in the category "Other Mobile Sources and Machinery" was 31.3 PJ.

*Table 16: Fuel Allocation Other Mobile Sources and Machinery (UMWELTBUNDESAMT 2016a).*

| Source category | Activity 2004 | | Activity 2009 | | Activity 2014 | |
|---|---|---|---|---|---|---|
| | (PJ) | (%) | (PJ) | (%) | (PJ) | (%) |
| Military | 0.6 | 3 | 0.6 | 2 | 0.7 | 2 |
| Railways | 1.9 | 8 | 2.2 | 7 | 1.7 | 5 |
| Inland Waterways | 0.2 | 1 | 0.2 | 1 | 0.2 | 1 |
| Agriculture | 9.6 | 41 | 9.8 | 31 | 10.0 | 32 |
| Forestry | 1.2 | 5 | 1.1 | 3 | 1.1 | 4 |
| Industry | 8.0 | 34 | 16.1 | 51 | 15.8 | 51 |
| Household and gardening | 1.9 | 8 | 1.8 | 6 | 1.7 | 6 |
| **Total** | **23.3** | **100** | **31.6** | **100** | **31.3** | **100** |

#### 2.2.12.4 Emission factors – NFR-code: "Road Transportation, Other Mobile Sources and Machinery"

The emission factors used in the Austrian air emission Inventory are also used for the emission projection. These emission factors are based on a study entitled "Österreichische Emissionsinventur für POPs, Forschungsgesellschaft Techn. Umweltschutz GmbH" financed by the Umweltbundesamt and completed in 2001 (HÜBNER 2001).

#### 2.2.12.5 Emissions of dioxins/ – NFR-code "Road Transportation" and "Other Mobile Sources and Machinery"

*Table 17: Emissions of dioxins from "Road Transportation" (HÜBNER 2001).*

| Source category | Emissions 2004 | | Emissions 2009 | | Emissions 2014 | |
|---|---|---|---|---|---|---|
| | (g) | (%) | (g) | (%) | (g) | (%) |
| Passenger cars | 0.477 | 38 | 0.763 | 46 | 0.708 | 39 |
| *thereof Gasoline conventional* | 0.365 | 29 | 0.165 | 10 | 0.131 | 7 |
| *thereof Diesel (incl. biofuels)* | 0.112 | 9 | 0.598 | 36 | 0.577 | 31 |
| Light duty vehicles <3.5 t(r) | 0.093 | 7 | 0.108 | 7 | 0.105 | 6 |
| Heavy duty vehicles >3.5 t and buses (r) | 0.673 | 54 | 0.775 | 47 | 1.013 | 55 |
| Mopeds and Motorcycles <50 $cm^3$ | 0.001 | 0 | 0.001 | 0 | 0.001 | 0 |
| Motorcycles >50 $cm^3$ | 0.004 | 0 | 0.009 | 1 | 0.011 | 1 |
| **Total** | **1.248** | **100** | **1.656** | **100** | **1.837** | **100** |

*Table 18: Emissions of dioxins from "Other Mobile sources and Machinery" (HÜBNER 2001).*

| Source category | Emission 2004 | | Emission 2009 | | Emission 2014 | |
|---|---|---|---|---|---|---|
| | (g) | (%) | (g) | (%) | (g) | (%) |
| Military | 0.000 | 0 | 0.000 | 0 | 0.000 | 0 |
| Railways | 0.013 | 6 | 0.019 | 6 | 0.016 | 5 |
| Inland Waterways | 0.006 | 3 | 0.005 | 2 | 0.005 | 2 |
| International Sea Traffic | 0.006 | 3 | 0.004 | 1 | 0.005 | 1 |
| Agriculture | 0.062 | 31 | 0.086 | 27 | 0.091 | 29 |
| Forestry | 0.015 | 7 | 0.016 | 5 | 0.017 | 5 |
| Industry | 0.049 | 24 | 0.133 | 42 | 0.135 | 43 |
| Household and gardening | 0.052 | 26 | 0.049 | 16 | 0.048 | 15 |
| **Total** | **0.202** | **100** | **0.314** | **100** | **0.316** | **100** |

*Remark: the strong increase in emissions in all categories is besides the increased traffic volume due to the higher proportion of biodiesel.*

### 2.2.13 Destruction of animal carcasses

This source category is described in the Stockholm Convention's Technical Guidebook, destruction of animal carcasses (UNEP 2007) as follows:

"Destruction of animal carcasses is generally achieved by incineration, rendering or a combination of these two activities. Incineration techniques may include pyrolysis, gasification or other forms of heat treatment, and may involve burning of complete carcasses or parts of carcasses. Rendering covers a range of activities for processing of carcasses to recover materials."

#### 2.2.13.1 Emission Factors and Emissions

No national emission factors are available. It is assumed that emissions, if any, are negligible due to the low activity figures.

### 2.2.14 Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)

This source category is described in the Stockholm Convention's Technical Guidebook, textile and leather dyeing (UNEP 2007) as follows:

"Woven and knit fabrics cannot be processed into finished goods until the fabrics have passed through several water-intensive wet processing stages (also known as finishing) such as fabric preparation, dyeing, printing and finishing. Natural fibres typically require more processing steps than artificial fibres. Relatively large volumes of wastewater are generated, containing a wide range of contaminants, which must be treated prior to disposal. Significant quantities of energy are used in heating and cooling chemical baths and drying fabrics and yarns."

#### 2.2.14.1 Emission Factors and Emissions

No national emission factors are available. It is assumed that emissions, if any, are negligible due to the low activity figures.

### 2.2.15 Shredder plants for the treatment of end of life vehicles

This source category is described in the Stockholm Convention's Technical Guidebook, shredder plants (UNEP 2007) as follows:

"Shredder plants for treatment of end-of-life vehicles are listed in Annex C of the Stockholm Convention as a source that has the potential to form and release chemicals listed in Annex C. Shredders are large-scale machines equipped inside with one or more anvils or breaker bars and lined with alloy steel wear plates. An electric motor drives the rotor with the freeswinging alloy steel hammers. Beneath the shredder is a vibratory pan, which receives the shredded material discharged through the grates. Typically a ferrous metal stream is produced, which is relatively clean and consists of small (50 mm) pieces of steel and a "fluff" stream, which contains the fragments of non-ferrous metals and other materials that entered the shredder (also known as fragmentiser).

Very few data on stack emission measurements at shredder plants are available. However, the results of some studies have shown levels of dioxin compounds greater than 0.1 ng I-TEQ/$m^3$.

At present there is not sufficient evidence that new formation of polychlorinated dibenzo(p)dioxins (PCDD), polychlorinated dibenzofurans (PCDF) or polychlorinated biphenyls (PCB) occurs in the (mechanical) shredding of vehicles, household electrical equipment or other electrical appliances. The data available indicate that the PCDD/PCDF and PCB released from shredderplants are from industrial, intentional production and have been introduced with oils, dielectric fluids, and other materials contained in these vehicles or consumer goods and which are simply set free through this mechanical process."

#### 2.2.15.1 Emission Factors and Emissions

According to BMLFUW 2015a, six shredder plants and four post-shredder plants are in operation in Austria.

No national emission factors are available for this activity.

### 2.2.16 Smouldering of copper cables

This source category is described in the Stockholm Convention's Technical Guidebook, smouldering of copper cables (UNEP 2007) as follows:

"Smouldering of copper cables involves the open burning of plastic coatings from electrical cable and wiring to recover scrap copper and other constituents of the cables. This process is labour intensive, and is performed by individuals or in small facilities without any abatement measures for air emissions. Smouldering is conducted in burn barrels or on open ground. No means of temperature control or oxygen addition are used to achieve complete combustion of plastic compounds."

#### 2.2.16.1 Emission Factors and Emissions

This process is not applied in Austria.

### 2.2.17 Waste oil refineries

This source category is described in the Stockholm Convention's Technical Guidebook, waste oil refineries (UNEP 2007) as follows:

"For the purpose of this guidance section, waste oils (or used oils) are defined as any petroleum-based, synthetic, or plant- or animal-based oil that has been used. Waste oils may originate from two large sources: industrial waste oils, and vegetable and animal waste oils. Among the industrial waste oils, three main oil streams can be identified: industrial oil (e.g. hydraulic oil, engine lubricant, cutting oil); garage or workshop oil; and transformer oil.

Waste oils have been found to be contaminated with PCDD, PCDF and PCB. At present there is no available evidence that PCDD/PCDF or PCB are newly formed in waste oil refineries. The data available indicate that the PCDD/PCDF and PCB released from waste oil refineries or waste oil handling and management plants are from industrial, intentional production of PCB or chlorobenzenes that are present in the waste oils either by contamination in the synthesis process (of these chemicals) or have become contaminated during the use phase or earlier recycling processes. In this sense, waste oil refineries represent a distribution source of chemicals listed in Annex C rather than a formation source.

According to available information, waste oil management options include reuse or regeneration; thermal cracking; and incineration or use as fuel. It should be noted that dumping and open burning are also practised in many countries."

#### 2.2.17.1 Emission Factors and Emissions

This process is not applied in Austria.

### 2.2.18 Summary of PCDD/F – Releases to Air from Source Categories of the Stockholm Convention

In the year 2014 a total of 31.05 g PCDD/F (I-TEQ) was emitted in Austria from the source categories according to the Stockholm Convention. In the Austrian Air Emissions Inventory (OLI) PCDD/F emissions into air were calculated to be 31.61 g (I-TEQ, 2009). The difference can be explained by the fact, that the OLI is more comprehensive (i.e. more activities are covered). On the other hand, some emission factors have been updated for this report (see description of source categories).

Only a few source categories contribute significantly to the total emissions of dioxins and furans, the most important being residential combustion sources with a share of 58% and thermal processes in the metallurgical sector with a share of 17%. Other sources are motor vehicles with 7%, biomass combustion (13%) and fossil fuel use in industry (3%) (Table 20, Table 20 and Figure 4).

*Figure 4: Relevant source categories for PCDD/F.*

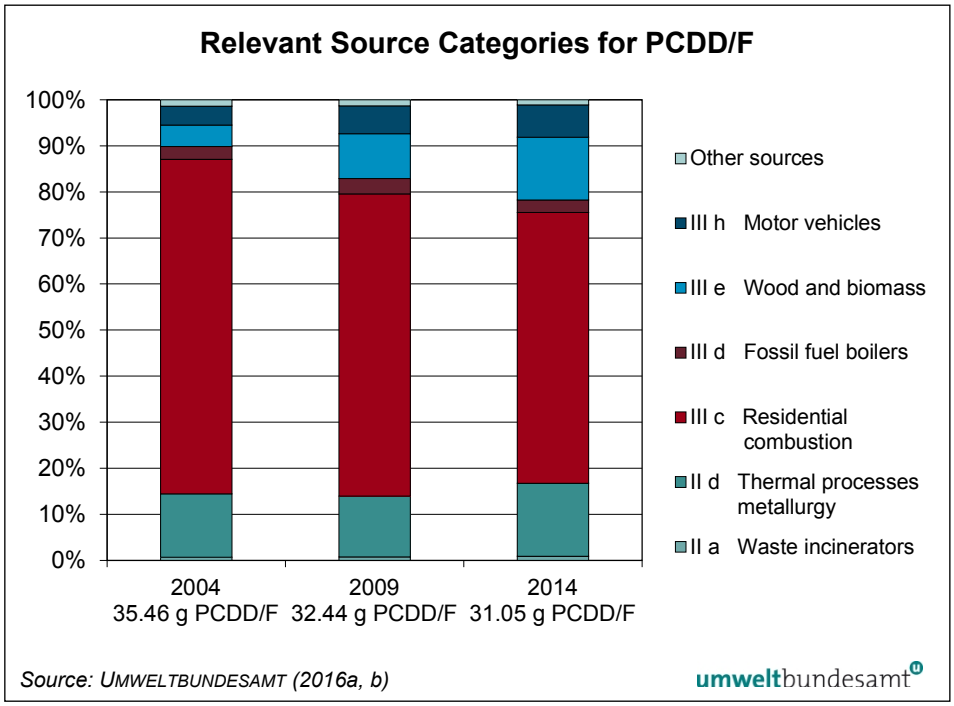



*Table 19: PCDD/F emissions from Source Categories Part II for 2004, 2009 and 2014 (Umweltbundesamt 2016a, b).*

| **Source Category Part II** | **2004 [g I-TEQ]** | **2009 [g I-TEQ]** | **2014 [g I-TEQ]** |
|---|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 0.230 | 0.229 | 0.267 |
| Cement kilns firing hazardous waste[1] | 0.119 | 0.131 | 0.121 |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2] | IE | IE | IE |
| The following thermal processes in the metallurgical industry | | | |
| (i) Secondary copper production | 0.279 | 0.279 | 0.279 |
| (ii) Sinter plants in the iron and steel industry | 3.106 | 2.538 | 3.353 |
| (iii) Secondary aluminium production | 1.309 | 1.282 | 1.256 |
| (iv) Secondary zinc production | NO | NO | NO |
| **Total (Part II)** | **5.043** | **4.459** | **5.275** |

[1] *figures represent total emissions from cement kilns*

[2] *only process emissions are covered here; PCDD/F emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.*

*NO: not occurring*

*IE: included elsewhere*

*Table 20: PCDD/F emissions from Source Categories Part III for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| Source Category Part III | 2004 [g I-TEQ] | 2009 [g I-TEQ] | 2014 [g I-TEQ] |
|---|---|---|---|
| Open burning of waste* | 0.223 | 0.132 | 0.069 |
| Thermal processes in the metallurgical industry not mentioned in Part II | 0.204 | 0.191 | 0.213 |
| Residential combustion sources | 25.748 | 21.295 | 18.127 |
| Fossil fuel-fired utility and industrial boilers | 0.989 | 1.079 | 0.856 |
| Firing installations for wood and other biomass fuels | 1.644 | 3.147 | 4.192 |
| Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil | NA | NA | NA |
| Crematoria | 0.154 | 0.164 | 0.164 |
| Motor vehicles, particularly those burning leaded gasoline | 1.451 | 1.972 | 2.155 |
| Destruction of animal carcasses | NA | NA | NA |
| Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) | NA | NA | NA |
| Shredder plants for treatment of end of life vehicles | NE | NE | NE |
| Smouldering of copper cables | NO | NO | NO |
| Waste oil refineries | NO | NO | NO |
| **Total (Part III)** | **30.414** | **27.980** | **25.776** |

* *without burning of landfill sites and accidental fires*

*NA: not applicable*

*NO: not occurring*

*NE: not estimated*

### 2.2.19 Austrian Air Emissions Inventory – Polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF)

In 1990 national total dioxin/furan emissions amounted to about 160 g and in 1995 they amounted to about 60 g; emissions have decreased steadily and by the year 2014 emissions were reduced by about 80% (to 31.6 g in 2014).

In 1990 the main sources for dioxin/furan (as I-TEQ) emissions were the NFR-Sectors Energy (62%; note: the NFR-code Energy includes Energy consumption in industry and energy as well as in the traffic sector) and Industrial Processes and product use (especially iron and steel production) (26%). In 2014 the main sector regarding PCDD/F (as I-TEQ) emissions was Energy with a share of 84% of the National Total.

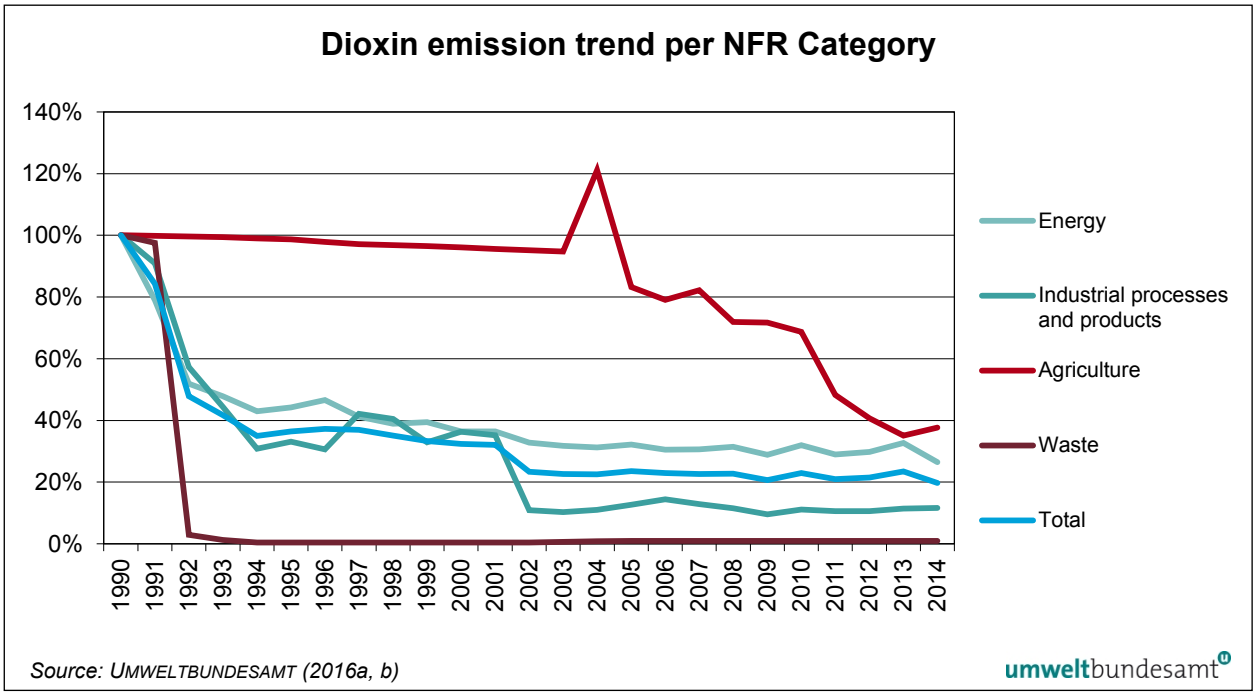



*Figure 5: Dioxin emission trend per NFR Category 1990–2014, base year 1990 = 100%.*

## 2.3 Releases of Hexachlorobenzene (HCB) – Source categories of the Stockholm Convention

### 2.3.1 Cement kilns

The emissions of HCB from cement kilns were exceptionally high in the year 2014 (107.85 kg HCB) compared to 2004 (0.018 kg HCB) and 2009 (0.020 kg). This is the result of an unintentional release of HCB from one Austrian cement kiln. In order to eliminate large amounts of HCB-contaminated lime sludge from a historic hazardous lime waste site, the lime sludge was used as substitute lime feedstock in a cement kiln. Unintentionally, a part of the contained HCB was not destroyed in the process but emitted to the air instead. The use of the contaminated lime sludge was stopped and prohibited by the competent authority in December 2014 (UMWELTBUNDESAMT 2016c). The total emission of HCB from this cement kiln was estimated by the competent authority (LAND KÄRNTEN 2015) and included in the Austrian Air Emissions Inventory for the respective period.

The HCB emission from the other Austrian cement kilns without the HCB-contaminated feedstock was calculated using emission factors, as for the years 2004 and 2009.

### 2.3.2 Residential combustion sources

Residential combustion plants are defined in the Stockholm Convention's Technical Guidebook (UNEP 2007) as follows:

"This section considers the combustion of wood, coal and gas, mainly for residential heating and cooking. Combustion takes place in hand-fired stoves or fireplaces or, in the case of larger central heating systems, in automatically fired installations."

Activity data for residential combustion plants can be found within the Austrian National Energy Balance in the NFR-codes (NFR: Nomenclature for Reporting) "Commercial/Institutional" (NFR: 1A4a, SNAP: 0201), "Residential Plants" (NFR: 1A4b1, SNAP: 0202) and "Plants in Agriculture/Forestry" (NFR: 1A4c1, SNAP: 0203). Since these plants are regarded as small scale installations, their emissions are allocated to the source category "Residential combustion sources".

#### 2.3.2.1 Emission factors – NFR-code: "Residential Combustion Sources"

In the next table emission factors of relevant fuels are compiled:

| EF HCB [µg/GJ] | UMWELTBUNDESAMT (2016b) | UNEP Toolkit (UNEP 2013) |
|---|---|---|
| **1A4a Commercial/Institutional plants (SNAP 020103)** | | |
| 102A Lignite<br>104A Lignite briquettes<br>107A Coke | 180 | not available |
| 105A Brown coal | 160 | not available |
| 106A Brown coal briquettes | 190 | not available |
| 203B Light fuel oil<br>203C Medium fuel oil | 0.19 | not available |

*Table 21: HCB emission factors for Residential Plants, Commercial/ Institutional Plants and Plants in Agriculture/ Forestry*

| EF HCB [µg/GJ] | UMWELTBUNDESAMT (2016b) | UNEP Toolkit (UNEP 2013) |
|---|---|---|
| 203D Heavy fuel oil | 0.12 | not available |
| 204A Heating oil<br>206A Petroleum | 0.12 | not available |
| 224A Other Oil Products | 0.14 | not available |
| 301A Natural gas | 0.14 | not available |
| 303A LPG<br>310A Landfill gas | 0.14 | not available |
| 309A Biogas<br>309B Sewage sludge gas | 0.072 | not available |
| 111A Wood (IEF 2004)<br>111A Wood (IEF 2009)<br>111A Wood (IEF 2014) | 193<br>180<br>170 | not available |
| 115A Industrial waste | 250 | not available |
| 116A Wood waste (IEF 2004)<br>116A Wood waste (IEF 2009)<br>116A Wood waste (IEF 2014) | 199<br>240<br>240 | not available |
| **1A4c i Plants in Agriculture/Forestry/Fishing (SNAP 020302)** | | |
| 102A Lignite<br>107A Coke | 180 | not available |
| 106A Brown coal briquettes | 190 | |
| 203B Light fuel oil<br>204A Heating oil | 0.15 | not available |
| 301A Natural gas | 0.25 | not available |
| 303A LPG | 0.25 | not available |
| 111A Wood (IEF 2004)<br>111A Wood (IEF 2009)<br>111A Wood (IEF 2014) | 475<br>379<br>310 | not available |
| 116A Wood waste | 600 | not available |
| **1A4b Residential plants: central and apartment heating (SNAP 020202)** | | |
| 102A Lignite<br>104A Lignite briquettes<br>105A Brown coal<br>106A Brown coal briquettes<br>107A Coke | 600 | not available |
| 203B Light fuel oil<br>204A Heating oil | 0.15 | not available |
| 224A Other Oil Products | 0.14 | not available |
| 301A Natural gas | 0.25 | not available |
| 303A LPG | 0.25 | not available |
| 111A Wood: central heating (IEF 2004)<br>111A Wood: central heating (IEF 2009)<br>111A Wood: central heating (IEF 2014) | 475<br>379<br>310 | not available |
| 111A Wood: apartment heating | 600 | not available |
| 116A Wood waste: central heating (IEF 2004)<br>116A Wood waste: central heating (IEF 2009)<br>116A Wood waste: central heating (IEF 2014) | 475<br>379<br>310 | not available |

| EF HCB [µg/GJ] | UMWELTBUNDESAMT (2016b) | UNEP Toolkit (UNEP 2013) |
|---|---|---|
| 116A Wood waste: apartment heating | 600 | not available |
| **1A4b Residential plants: stoves (SNAP 020205)** | | |
| 102A Lignite<br>104A Lignite briquettes<br>105A Brown coal<br>106A Brown coal briquettes<br>107A Coke | 600 | not available |
| 204A Heating oil | 0.3 | not available |
| 301A Natural gas | 0.6 | not available |
| 111A Wood<br>113A Peat<br>116A Wood waste | 600 | not available |

#### 2.3.2.2 Activity data – NFR-code: "Residential Plants"

In 2014 total energy consumption under the NFR-code "Residential Plants" was 140 PJ. Major fuels were wood with a share of 34.7%, followed by natural gas (29.9%), oil (light and extra light heating oil and liquified petroleum gas) (25.5%) and wood waste (8.2%). Other fuels (0.9%) and coal (0.7%) are of minor importance.

| Residential Plants | 2004 | 2009 | 2014 |
|---|---|---|---|
| Coal | 3.1% | 1.5% | 0.7% |
| Oil | 36.1% | 30.7% | 25.5% |
| Gas | 28.5% | 28.9% | 29.9% |
| Wood waste | 3.6% | 5.3% | 8.2% |
| Wood | 27.8% | 32.4% | 34.7% |
| Others | 0.9% | 1.2% | 0.9% |
| **Sum** | **100%** | **100%** | **100%** |
| **Total Energy Consumption** | **180 PJ** | **152 PJ** | **140 PJ** |

*Table 22: Fuel mix in the NFR-code „Residential Plants" (UMWELTBUNDESAMT 2016a).*

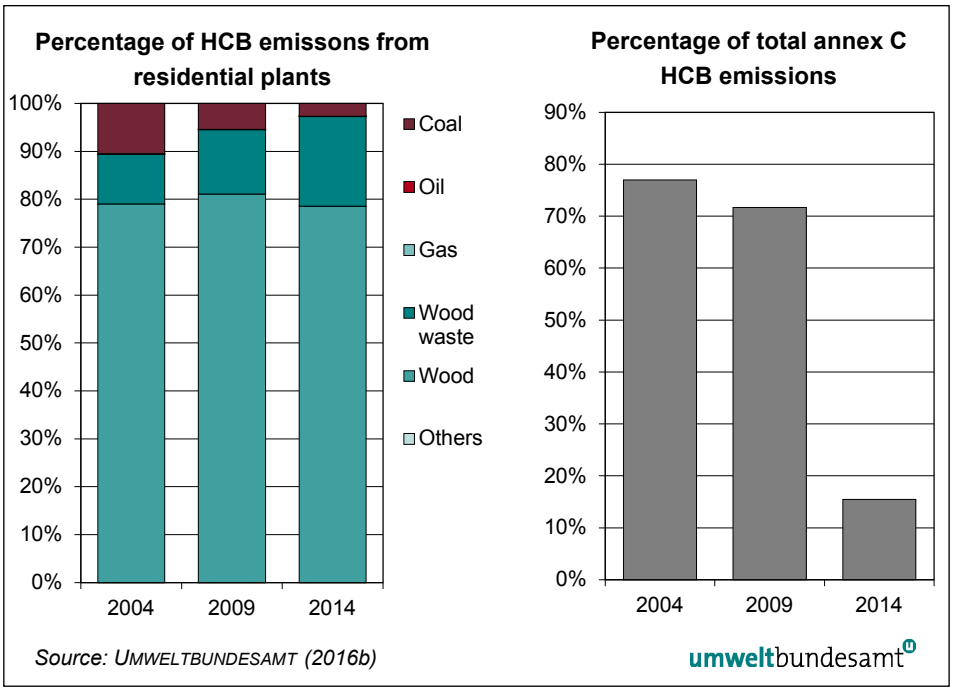
#### 2.3.2.3 Emissions of HCB – NFR-code: "Residential Plants"

Emission factors were taken from the OLI. In the table below emissions of residential plants are listed in relation to the fuel input. The largest part of the emissions stems from the incineration of wood and wood waste. Technology improvement of wood burners and shift to wood pellets (accounted within "wood waste") cause lower emissions in 2014 compared to 2004 and 2009 for total biomass. The incineration of fossil solid fuels (coal, lignite, coke) contributes little to the overall emissions from this source category. However, emissions from fossil solid fuels are expected to decrease even further due to a decline in fuel consumption.

*Table 23: Emissions of HCB from residential plants (UMWELTBUNDESAMT 2016b, own calculation)*

| Residential Plants | 2004 (g HCB) | 2009 (g HCB) | 2014 (g HCB) |
|---|---|---|---|
| Coal | 3 295 | 1 362 | 580 |
| Oil | 10 | 7.2 | 5.4 |
| Gas | 15 | 13 | 12 |
| Wood waste | 3 249 | 3 381 | 4 070 |
| Wood | 24 766 | 20 442 | 17 118 |
| Others | 3.0 | 3.1 | 3.0 |
| **Sum** | **31 339** | **25 208** | **21 788** |

*Figure 6: Percentage of HCB emissions from residential plants by fuel and as share of total annex C HCB emissions 2004, 2009 and 2014.*




### 2.3.2.4 Activity data – NFR-code "Commercial/Institutional" and "Plants in Agriculture/Forestry"

In the year 2014 the total input within these subcategories was 45 PJ. The major fuels were natural gas and other gases (50%), followed by oil (sum of heating oils and LPG: 21%), wood waste (16%) and wood (8.7%). Others (3.8%), solid fossil fuels (total of coke, coal and lignite: 0.3%) and industrial waste (0.2%) were of minor importance. Activity data in this sector suffer from substantial uncertainties which are the result of a lack of qualified data.

*Table 24: Share of fuels within the subcategories "Commercial/Institutional" and "Stationary" (UMWELTBUNDESAMT 2016a).*

| Commercial/Institutional + Plants in Agriculture/Forestry | 2004 | 2009 | 2014 |
|---|---|---|---|
| Coal | 1.1% | 0.4% | 0.3% |
| Oil | 26.8% | 28.9% | 20.9% |
| Gas | 53.7% | 48.5% | 50.2% |
| Wood waste | 7.4% | 11.8% | 15.8% |

| | | | |
|---|---|---|---|
| Industrial waste | 0.6% | 0.1% | 0.2% |
| Wood | 4.6% | 6.6% | 8.7% |
| Others (biogas, sewage gas, landfill gas) | 5.8% | 3.7% | 3.8% |
| **Sum** | **100%** | **100%** | **100%** |
| **Total Energy Consumption** | **81 PJ** | **60 PJ** | **45 PJ** |

#### 2.3.2.5 Emissions of HCB – NFR-code "Commercial/Institutional" and „Plants in Agriculture/Forestry"

Emission factors were taken from the OLI. Due to the high activity rate of wood waste this type of waste contributes most to the overall emissions.

| Commercial/Institutional + Plants in Agriculture/Forestry | 2004 (g HCB) | 2009 (g HCB) | 2014 (g HCB) |
|---|---|---|---|
| Coal | 168 | 42 | 27 |
| Oil | 2.9 | 2.2 | 1.1 |
| Wood waste | 2 334 | 3 387 | 3 692 |
| Wood | 1 604 | 1 374 | 1 125 |
| Gas | 6.1 | 4.2 | 3.2 |
| Industrial waste | 131 | 13 | 21 |
| Others | 0.7 | 0.3 | 0.2 |
| **Sum** | **4 247** | **4 824** | **4 869** |

*Table 25: Emissions of HCB caused by different fuel types (UMWELTBUNDESAMT 2016b, own calculation).*

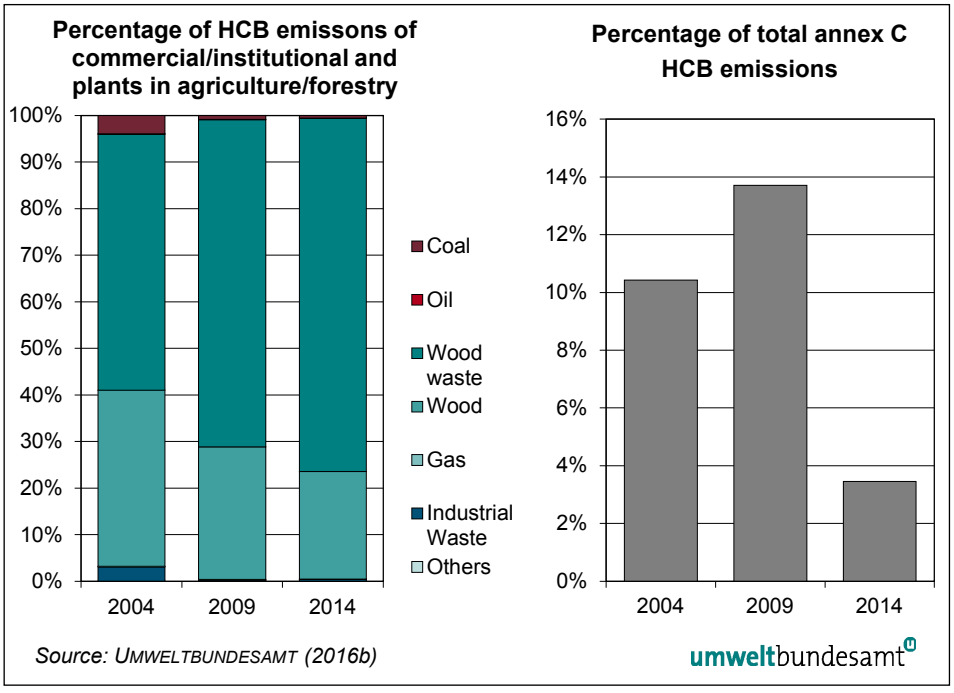



*Figure 7: Percentage of HCB emissions from commercial/institutional and plants in agriculture/forestry by fuel and as share of total annex C HCB emissions 2004, 2009 and 2014.*

### 2.3.3 Motor vehicles, particularly those burning leaded gasoline

#### 2.3.3.1 Activity data – "Road Transportation, Other Mobile Sources and Machinery"

Activity data can be found in chapter 2.2.12.

#### 2.3.3.2 Emission factors– NFR-code: "Road Transportation, Other Mobile Sources and Machinery"

The emission factors used in the Austrian air emission inventory are also used for emission projection. These emission factors are based on the study "Österreichische Emissionsinventur für POPs, Forschungsgesellschaft Techn. Umweltschutz GmbH" (HÜBNER 2001).

#### 2.3.3.3 Emissions HCB – NFR-code "Road Transportation" and "Other Mobile Sources and Machinery"

*Table 26: Emissions of HCB from road transport (HÜBNER 2001).*

| Source category | Emissions 2004 | | Emissions 2009 | | Emissions 2014 | |
|---|---|---|---|---|---|---|
| | (g) | (%) | (g) | (%) | (g) | (%) |
| Passenger cars | 95.33 | 38 | 152.66 | 46 | 141.65 | 39 |
| *thereof Gasoline conventional* | 72.99 | 29 | 33.09 | 10 | 26.19 | 7 |
| *thereof Diesel (incl. biofuels)* | 22.34 | 9 | 119.57 | 36 | 115.46 | 31 |
| Light duty vehicles <3.5 t(r) | 18.57 | 7 | 21.58 | 7 | 20.91 | 6 |
| Heavy duty vehicles >3.5 t and buses (r) | 134.70 | 54 | 155.00 | 47 | 202.52 | 55 |
| Mopeds and Motorcycles <50 $cm^3$ | 0.15 | 0 | 0.16 | 0 | 0.15 | 0 |
| Motorcycles >50 $cm^3$ | 0.85 | 0 | 1.89 | 1 | 2.20 | 1 |
| **Total** | **249.59** | **100** | **331.29** | **100** | **367.43** | **100** |

*Table 27: Emissions of HCB from other mobile sources and machinery (HÜBNER 2001)*

| Source category | Emission 2004 | | Emission 2009 | | Emission 2014 | |
|---|---|---|---|---|---|---|
| | (g) | (%) | (g) | (%) | (g) | (%) |
| Military | 0.03 | 0 | 0.04 | 0 | 0.04 | 0 |
| Railways | 2.53 | 6 | 3.90 | 6 | 3.17 | 5 |
| Inland Waterways | 1.15 | 3 | 1.03 | 2 | 0.98 | 2 |
| International Sea Traffic | 1.22 | 3 | 0.88 | 1 | 0.95 | 1 |
| Agriculture | 12.41 | 31 | 17.24 | 27 | 18.12 | 29 |
| Forestry | 2.94 | 7 | 3.26 | 5 | 3.34 | 5 |
| Industry | 9.70 | 24 | 26.58 | 42 | 26.95 | 43 |
| Household and gardening | 10.44 | 26 | 9.80 | 16 | 9.68 | 15 |
| **Total** | **40.42** | **100** | **62.74** | **100** | **63.23** | **100** |

*Remark: the strong increase in emissions in all categories is besides the increased traffic volume due to the higher proportion of biodiesel.*

### 2.3.4 Summary of Source Categories of the Stockholm Convention: HCB – Releases to Air

In Austria only a few source categories contribute significantly to the total emissions of HCB. In the year 2014, 140.92 kg were emitted in total. Cement kilns sources had the lion's share (76.5%) while residential combustion sources accounted for 19%. Thermal processes in the metallurgical industries emitted 3.4% of the total emissions. All other sources are well below 1%. The situation is totally different than in the years 2004 and 2009 when the lion's share of HCB came from residential combustion sources. The increase in 2014 is due to an unintentional release of HCB in an Austrian cement plant.

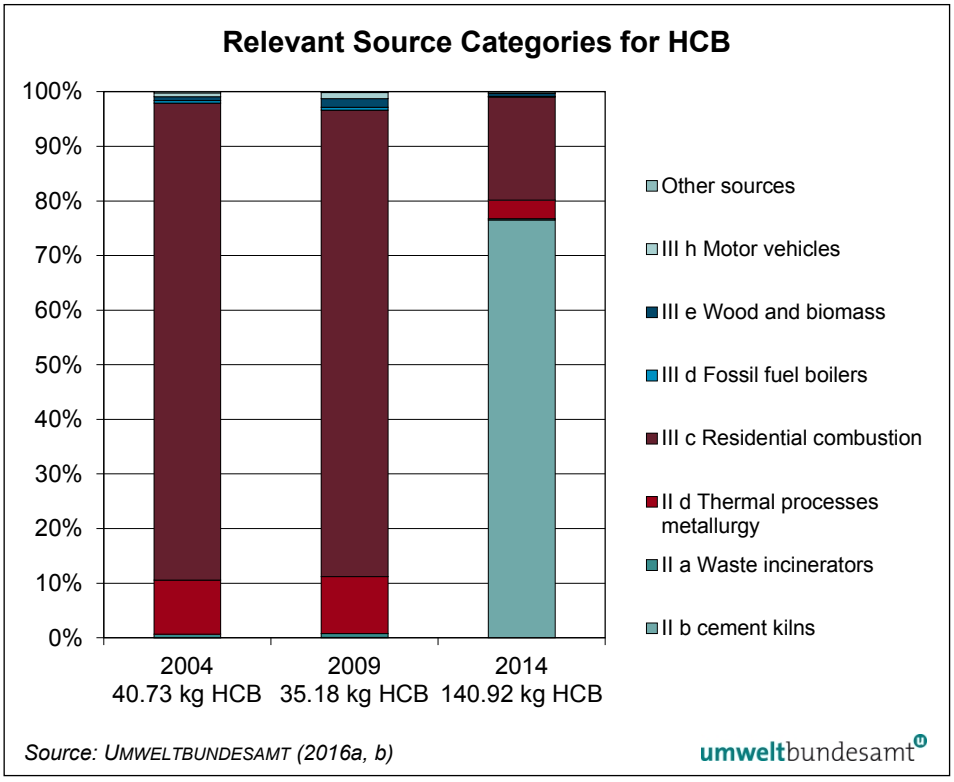



*Figure 8: Relevant source categories for HCB.*

*Table 28: HCB emissions in Source Category Part II for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| Source Category Part II | 2004 [kg HCB] | 2009 [kg HCB] | 2014 [kg HCB] |
|---|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 0.253 | 0.262 | 0.301 |
| Cement kilns firing hazardous waste[1] | 0.018 | 0.020 | 107.851 |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2] | IE | IE | IE |
| The following thermal processes in the metallurgical industry | | | |
| (i) Secondary copper production | 0.091 | 0.091 | 0.091 |
| (ii) Sinter plants in the iron and steel industry | 3.261 | 2.926 | 4.031 |
| (iii) Secondary aluminium production | 0.654 | 0.641 | 0.628 |
| (iv) Secondary zinc production | NO | NO | NO |
| **Total (Part II)** | **4.277** | **3.939** | **112.902** |

*[1] figures represent total emissions from cement kilns*

*[2] only process emissions are covered here; HCB emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.*

*NO: not occurring*

*IE: included elsewhere.*

*Table 29: HCB emissions in Source Category Part III for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| Source Category Part III | 2004 [kg HCB] | 2009 [kg HCB] | 2014 [kg HCB] |
|---|---|---|---|
| Open burning of waste* | 0.045 | 0.026 | 0.014 |
| Thermal processes in the metallurgical industry not mentioned in Part II | 0.016 | 0.014 | 0.017 |
| Residential combustion sources | 35.586 | 30.032 | 26.657 |
| Fossil fuel-fired utility and industrial boilers | 0.197 | 0.195 | 0.152 |
| Firing installations for wood and other biomass fuels | 0.287 | 0.543 | 0.715 |
| Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil | NA | NA | NA |
| Crematoria | 0.031 | 0.033 | 0.033 |
| Motor vehicles, particularly those burning leaded gasoline | 0.290 | 0.394 | 0.431 |
| Destruction of animal carcasses | NA | NA | NA |
| Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) | NA | NA | NA |
| Shredder plants for treatment of end of life vehicles | NE | NE | NE |
| Smouldering of copper cables | NO | NO | NO |
| Waste oil refineries | NO | NO | NO |
| **Total (Part III)** | **36.451** | **31.238** | **28.019** |

** without burning of landfill sites and accidental fires*

*NA: not applicable*

*NE: not estimated*

*NO: not occurring*

### 2.3.5 Austrian Air Emissions Inventory – Hexachlorobenzene (HCB)

In 1990 national total HCB emissions amounted to 92 kg. They decreased to 53 kg in 1995. Emissions have decreased steadily and by the year 2011 emissions were reduced by about 60% (to 36.5 kg in 2011). In the years 2012, 2013 and 2014 HCB emissions strongly increased to 141 kg due to an unintentionally release in an Austrian cement plant. The increase was caused by the input of HCB containing waste and the incomplete destruction of HCB.

In 1990 the two main sources for HCB emissions were the NFR-sectors Energy (78%; note: the NFR-code *Energy* includes Energy consumption in industry and energy as well as in the traffic sector) and Industrial processes and product use (20%). In 2014 the main NFR-sector for HCB emissions was Energy with a share of 96% of the National Total.

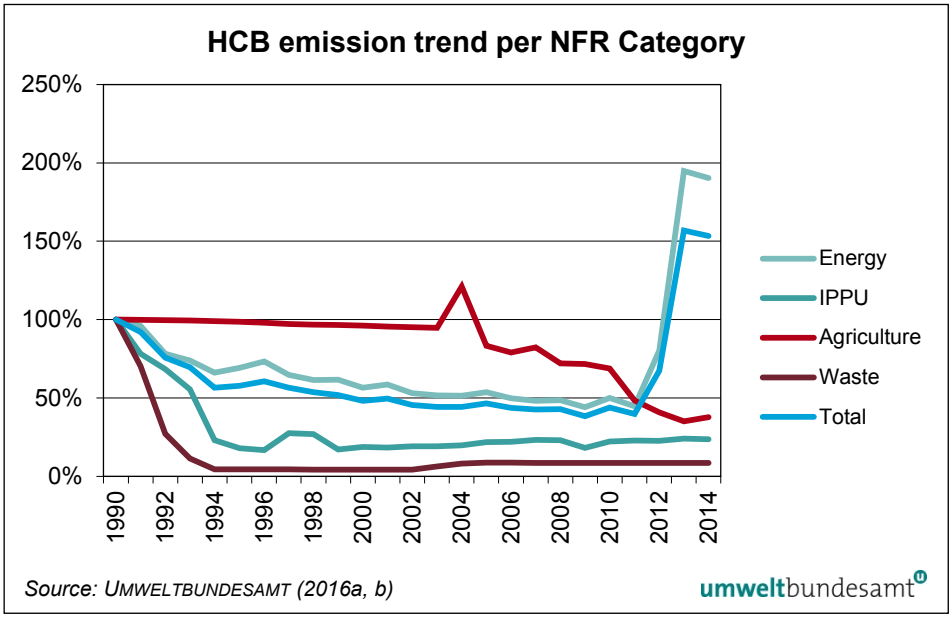



*Figure 9: HCB emission trend per NFR Category 1990–2014 (base year 1990 = 100%).*

Cement plants are included in NFR-sector Energy. The emissions of HCB were exceptionally high in the year 2014. This is the result of an unintentional release of HCB from one Austrian cement kiln. The increase was caused by the input of HCB containing waste and the incomplete destruction of HCB.

## 2.4 Releases of polychlorinated biphenyls (PCB) – Source categories of the Stockholm Convention

### 2.4.1 Summary of Source Categories of the Stockholm Convention: PCB – Releases to Air

In Austria only a few source categories contribute significantly to the total emissions of PCB. In the year 2014, 116.87 kg were emitted in total (Table 31, Table 31 and Figure 10). Thermal processes in the metallurgical industry had the lion's share (99%). All other sources were well below 1%.

*Figure 10: Relevant source categories for PCB.*

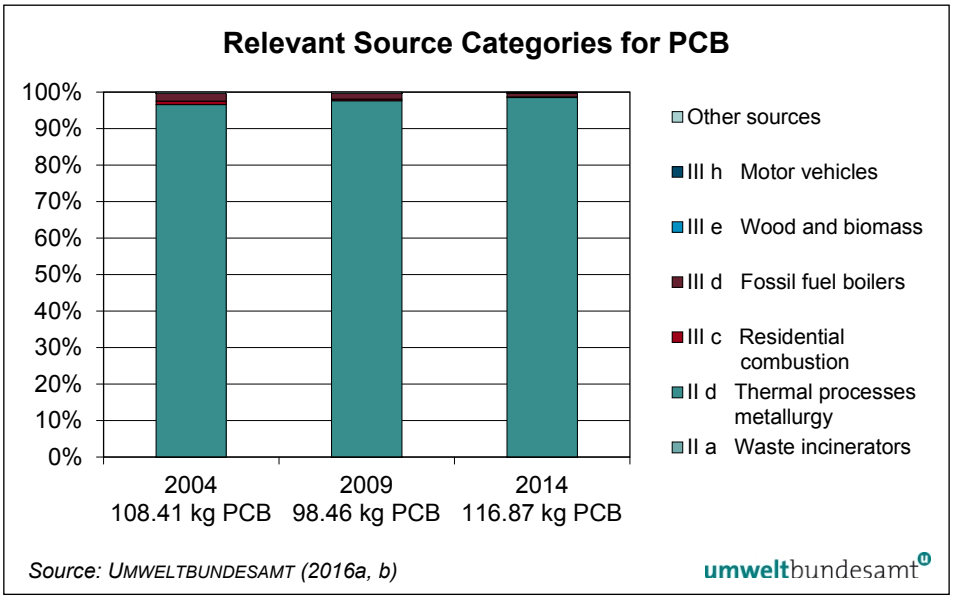



*Table 30: PCB emissions from Source Categories Part II for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| **Source Category Part II** | **2004 [g PCB]** | **2009 [g PCB]** | **2014 [g PCB]** |
|---|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 0.065 | 0.068 | 0.053 |
| Cement kilns firing hazardous waste[1] | 331.949 | 353.098 | 323.780 |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2] | IE | IE | IE |
| The following thermal processes in the metallurgical industry | | | |
| (i) Secondary copper production | NA | NA | NA |
| (ii) Sinter plants in the iron and steel industry | 26,903.600 | 23,633.234 | 33,000.000 |
| (iii) Secondary aluminium production | NA | NA | NA |
| (iv) Secondary zinc production | NO | NO | NO |
| **Total (Part II)** | **27,235.614** | **23,986.401** | **33,323.833** |

[1] *figures represent total emissions from cement kilns*

[2] *only process emissions are covered here; PCB emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.*

*NA: not applicable*

*NO: not occurring*

*IE: included elsewhere*

*Table 31: PCB emissions from Source Categories Part III for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| Source Category Part III | 2004 [g PCB] | 2009 [g PCB] | 2014 [g PCB] |
|---|---|---|---|
| Open burning of waste* | NA | NA | NA |
| Thermal processes in the metallurgical industry not mentioned in Part II | 77,779.105 | 72,499.525 | 82,162.70 |
| Residential combustion sources | 1,091.570 | 426.201 | 190.817 |
| Fossil fuel-fired utility and industrial boilers | 2,298.303 | 1,547.341 | 1,196.029 |
| Firing installations for wood and other biomass fuels | 0.128 | 0.261 | 0.351 |
| Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil | NA | NA | NA |
| Crematoria | NA | NA | NA |
| Motor vehicles, particularly those burning leaded gasoline | 0.924 | 0.841 | 0.508 |
| Destruction of animal carcasses | NA | NA | NA |
| Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) | NA | NA | NA |
| Shredder plants for treatment of end of life vehicles | NE | NE | NE |
| Smouldering of copper cables | NO | NO | NO |
| Waste oil refineries | NO | NO | NO |
| **Total (Part III)** | **81,170.031** | **74,474.169** | **83,550.405** |

**without burning of landfills sites and accidential fires*

*NA: not applicable*

*NO: not occurring*

*NE: not estimated*

### 2.4.2 Austrian Air Emissions Inventory – PCB

In 1990 national total PCB emissions amounted to 194 kg. They decreased to 143 kg in 1993. Between 1994 and 2003 emissions of PCB were around 160 kg. Emissions then increased steadily and by the year 2014 PCB emissions amounted to 180 kg (decrease of 7% compared to 1990; increase of 11% compared to 1995).

In 1990 the two sources for PCB emissions were the NFR-sectors Industrial processes and product use (IPPU) (95%) and Energy (5%; note: the NFR-code *Energy* includes Energy consumption in industry and energy as well as in the traffic sector) and. In 2014 the main NFR-sector for PCB emissions was Industrial processes and product use with a share of 99% of the National Total.

The inventory of emissions in the Austrian OLI is based on activity data which is multiplied with an activity specific emission factor. This factor (for PCB) has not changed in the considered years. As activity data (production data) has increased, also the calculated emissions of PCB increased. A review of the emission factors for PCB in the different source categories is necessary.

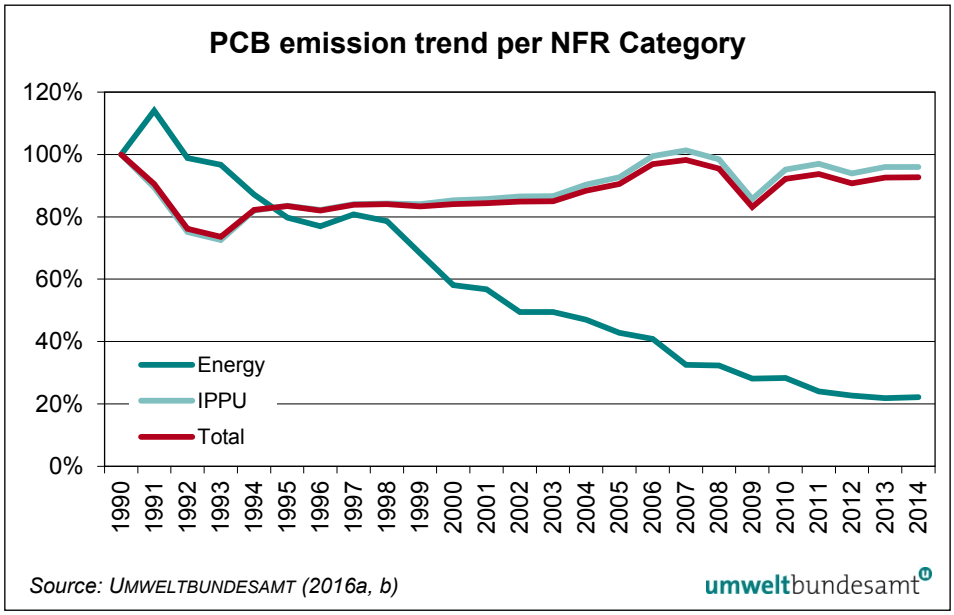



*Figure 11: PCB emission trend per NFR Category 1990–2014 (base year 1990 = 100%). (UMWELTBUNDESAMT 2016 a, b). Due to the economic crisis activity data and therefore emissions decreased significantly in 2009.*

## 2.5 Releases of polycyclic aromatic hydrocarbons (PAH) – Source categories of the Stockholm Convention

### 2.5.1 Residential combustion sources

Emission factors of the Austrian Air Emissions Inventory have been used for calculating emissions of residential combustion sources. They have been checked and considered appropriate by now.

However, recent study results indicate that these emission factors could be unrealistically low (UMWELTBUNDESAMT 2016e, 2017a). Air quality monitoring results strongly deviate from the dispersion model results of PAH concentrations (OETTL et al. 2017), which were based on emission data calculated with Austrian Emissions Inventory emission factors. On the other hand, recommended Tier 2 standard emission factors of the EMEP/EEA air pollutant emission inventory guidebook 2013 led to considerable higher concentrations than the air quality monitoring results. Good matching results were achieved by technology-specific weighting of EMEP/EEA Tier 2 emission factors with heating technology share of the Austrian Air Emissions Inventory.

In-depth literature survey on PAH emission factors in combination with the devolopment of an advanced modelling approach targeting residential combustion emissions are ongoing and foreseen to be concluded by the end of 2017 both (UMWELTBUNDESAMT 2017b).

### 2.5.2 Motor vehicles, particularly those burning leaded gasoline

Emission factors used by the Austrian Air Emissions Inventory for calculating emissions have been checked and considered appropriate.

#### 2.5.2.1 Activity data – "Road Transportation, Other Mobile Sources and Machinery"

Activity data can be found in chapter 2.2.12.2 and 2.2.12.3

#### 2.5.2.2 Emission factors– NFR-code: "Road Transportation, Other Mobile Sources and Machinery"

The emission factors used in the Austrian air emission inventory are also used for emission projection. These emission factors are based on the EMEP/EEA air pollutant emission inventory Guidebook (2013).

#### 2.5.2.3 Emissions PAH – NFR-code "Road Transportation" and "Other Mobile Sources and Machinery"

*Table 32: Emissions of PAH from Road Transport (EMEP/EEA 2013)*

| Source category | Emissions 2004 | | Emissions 2009 | | Emissions 2014 | |
|---|---|---|---|---|---|---|
| | (g) | (%) | (g) | (%) | (g) | (%) |
| Passenger cars | 195.19 | 52 | 162.29 | 51 | 136.55 | 42 |
| *thereof Gasoline conventional* | 46.73 | 12 | 40.70 | 13 | 37.62 | 11 |
| *thereof Diesel (incl. biofuels)* | 148.46 | 40 | 121.59 | 38 | 98.93 | 30 |
| *non exhaust* | 7.16 | 2 | 6.93 | 2 | 7.41 | 2 |
| Light duty vehicles <3.5 t(r) | 27.52 | 7 | 20.95 | 7 | 17.48 | 5 |
| Heavy duty vehicles >3.5 t and buses (r) | 143.77 | 38 | 124.99 | 39 | 164.92 | 50 |
| Mopeds and Motorcycles <50 $cm^3$ | 0.69 | 0 | 0.63 | 0 | 0.52 | 0 |
| Motorcycles >50 $cm^3$ | 1.41 | 0 | 1.66 | 1 | 1.98 | 1 |
| **Total** | **375.74** | **100** | **317.45** | **100** | **328.85** | **100** |

| Source category | Emission 2004 | | Emission 2009 | | Emission 2014 | |
|---|---|---|---|---|---|---|
| | (g) | (%) | (g) | (%) | (g) | (%) |
| Military | 0.17 | 0 | 0.17 | 0 | 0.17 | 0 |
| Railways | 12.55 | 7 | 14.11 | 6 | 11.15 | 5 |
| Inland Waterways | 1.21 | 1 | 0.90 | 0 | 0.90 | 0 |
| International Sea Traffic | 7.07 | 4 | 5.14 | 2 | 5.50 | 3 |
| Agriculture | 61.31 | 36 | 61.64 | 28 | 63.29 | 29 |
| Forestry | 10.41 | 6 | 9.67 | 4 | 9.79 | 5 |
| Industry | 52.67 | 31 | 103.50 | 47 | 101.80 | 47 |
| Household and gardening | 27.07 | 16 | 23.91 | 11 | 23.56 | 11 |
| **Total** | **172.48** | **100** | **219.04** | **100** | **216.17** | **100** |

*Table 33: Emissions of PAH from Other Mobile Sources and Machinery (EMEP/EEA 2013)*

### 2.5.3 Summary of Source Categories of the Stockholm Convention: PAHs – Releases to Air

In the year 2014, 4,845 kg PAH were emitted in Austria. PAH emissions are mainly caused by two source categories (Table 35 and Figure 12). Residential combustion sources accounted for 79% and mobile vehicles for 11%. Other notable sources were firing installations for wood and biomass (2.7%) and sinter plants (4%).

*Figure 12: Relevant source categories for PAH.*

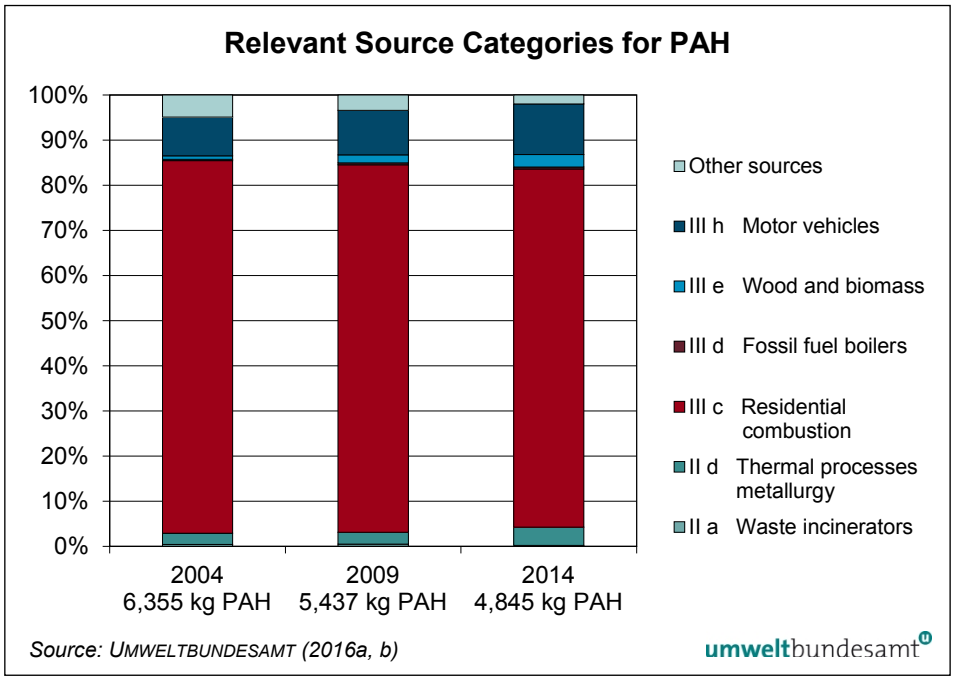



*Table 34: PAH emissions in Source Category Part II for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| Source Category Part II | 2004 [kg PAH] | 2009 [kg PAH] | 2014 [kg PAH] |
|---|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 24.066 | 24.095 | 9.443 |
| Cement kilns firing hazardous waste[1] | 3.332 | 3.663 | 3.385 |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2] | IE | IE | IE |
| The following thermal processes in the metallurgical industry | | | |
| (i) Secondary copper production | NE | NE | NE |
| (ii) Sinter plants in the iron and steel industry | 156.484 | 140.891 | 193.647 |
| (iii) Secondary aluminium production | NE | NE | NE |
| (iv) Secondary zinc production | NO | NO | NO |
| **Total (Part II)** | **183.872** | **168.649** | **206.476** |

[1] *figures represent total emissions from cement kilns*

[2] *only process emissions are covered here; PAH emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.*

*NO: not occurring; NE: not estimated; IE: included elsewhere.*

*Table 35: PAH emissions in Source Category Part III for 2004, 2009 and 2014 (UMWELTBUNDESAMT 2016a, b).*

| Source Category Part III | 2004 [kg PAH] | 2009 [kg PAH] | 2014 [kg PAH] |
|---|---|---|---|
| Open burning of waste* | 305.551 | 178.625 | 90.885 |
| Thermal processes in the metallurgical industry not mentioned in Part II | 2.909 | 2.763 | 3.250 |
| Residential combustion sources | 5,250.076 | 4428.292 | 3,846.067 |
| Fossil fuel-fired utility and industrial boilers | 16.925 | 25.973 | 20.121 |
| Firing installations for wood and other biomass fuels | 46.961 | 96.496 | 133.194 |
| Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil | NA | NA | NA |
| Crematoria | 0.007 | 0.008 | 0.008 |
| Motor vehicles, particularly those burning leaded gasoline | 548.220 | 536.494 | 545.0025 |
| Destruction of animal carcasses | NA | NA | NA |
| Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) | NA | NA | NA |
| Shredder plants for treatment of end of life vehicles | NE | NE | NE |
| Smouldering of copper cables | NO | NO | NO |
| Waste oil refineries | NO | NO | NO |
| **Total (Part III)** | **6,170.651** | **5,268.651** | **4,638.550** |

*NA: not applicable*

*NE: not estimated*

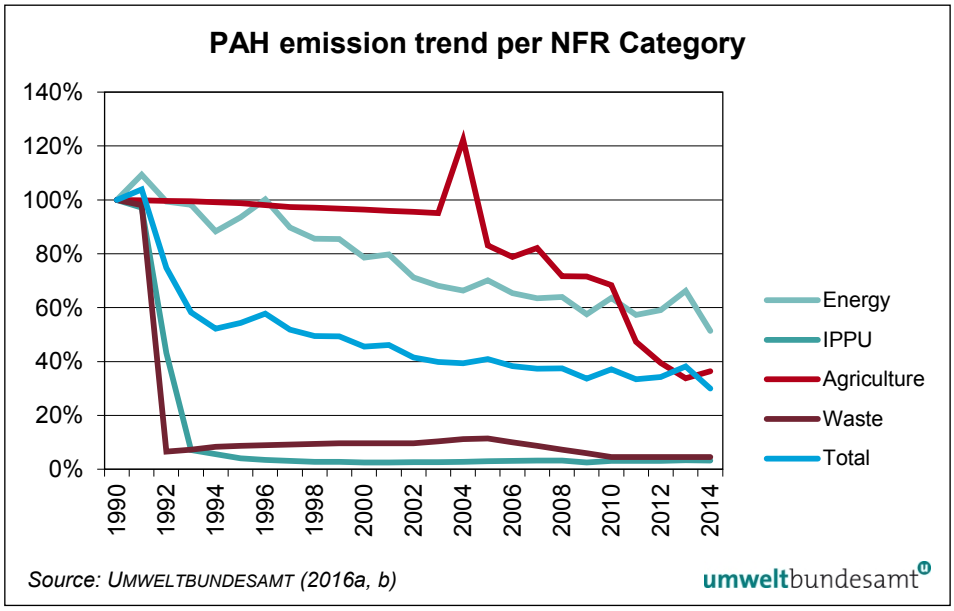
*NO: not occurring*

### 2.5.4 Austrian Air Emissions Inventory – Polycyclic Aromatic Hydrocarbons (PAH)

In 1990 national total PAH emissions were 16.27 Mg; they decreased to 8.50 Mg in 1994; emissions have decreased steadily since then and by the year 2014 emissions have gone down by about 70% (to 4.89 Mg in 2014).

In 1990 the main emission sources for PAH emissions were the NFR-sectors Energy (55%; note: the NFR-code *Energy* includes Energy consumption in industry and energy as well as in the traffic sector) and Industrial processes and product use (44%). In 2009 the main NFR-sector regarding PAH emissions was *Energy* with a share of 93% of the national total. From 1990 to 2014 PAH emissions from the sector Industrial processes decreased by 97% due to the shut down of primary aluminium production plants in Austria, a main source for PAH emissions.

*Figure 13: PAH emission trend per NFR Category 1990–2004 (base year 1990 = 100%).*




## 2.6 Releases of Pentachlorobenzene (PeCB) – Source categories of the Stockholm Convention

The most relevant source of PeCB emitted to the environment is caused by unintentional production due to different processes (i.e. municipal solid waste incineration, hazardous waste incineration, power production from coal, domestic burning and waste water treatment which leads to the generation of sewage sludge containing PeCB). Table 36 shows which sectors are considered relevant for the emissions of PeCB and which are considered of low relevance due to the low amounts (BIPRO 2011).

*Table 36: Overview on sectors and their relevance for PeCB emissions (BIPRO 2011).*

| Sector | Considered relevant | Not considered relevant |
|---|---|---|
| Municipal solid waste incineration (MSWI) including incineration of biomass | x | |
| Hazardous waste incineration (HWI) | x | |
| Power production (coal) including power production in iron and steel industry | x | |
| Domestic burning | x | |
| Sewage sludge (waste water treatment) | x | |
| Chemical industry | | x |
| Non-ferrous metal industry (aluminium, secondary copper, magnesium) | | x |

### 2.6.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge

**Municipal waste**

Since PeCB is not commercially used anymore within Europe it can be assumed that municipal solid waste (MSW) is not contaminated with PeCB. But due to the heterogeneous composition of municipal solid waste PeCB can be formed unintentionally when municipal solid waste is burned since PeCB is produced whenever organic compounds are burned or exposed to high energy in the presence of a chlorine source (BIPRO 2011).

There exist only few data on PeCB concentrations in the flue gas of municipal waste incineration facilities. Kato and Urano found, that under normal operating conditions PeCB correlated with PCDD/F within a factor of 3 (KATO & URANO 2001). Both authors derived from emission data on 24 municipal solid waste incinerators in Japan an emission factor for PeCB of 7 mg/t. However, other studies found other factors significantly influencing concentration levels in the flue gas such as combustion conditions and fuel composition. Investigations performed between 1983 and 2001 resulted in emission factors in the range of 3–273 mg/t incinerated waste.

REIMANN et al. (2006) measured a value of 750 ng/m$^3$ PeCB in the flue gas of a municipal waste incineration plant. This value would correspond to an emission factor of 4 mg/t of incinerated waste.

Given the available data it is suggested that, for the purpose of this emission inventory, an emission factor of **4 mg/t of waste** should be used, independent of the source (i.e. household or industrial waste). This emission factor should also be used for sewage sludge.

In 2014, about 1.341 million t municipal waste (mixed municipal waste, bulky waste) were incinerated in municipal waste incineration plants (BMLFUW 2015a).

**Hazardous waste**

For hazardous waste it has been reported that an average of 7 mg PeCB is found in flue gas per tonne HW incinerated (KAUNE et al. 1994).

In 2014, about 1.324 million t of hazardous waste were treated (BMLFUW 2015a), 0.227 million t were incinerated in 2014 (assumption Umweltbundesamt 2016).

**Sewage sludge**

In 2014 an amount of 0.239 million t of sewage sludge was produced in Austria (assumption Umweltbundesamt 2016). 1% of the sewage sludge was landfilled, 49% incinerated, 17% applied on land, 19% treated in another way and 33% stored (BMLFUW 2015a).

Emission into air caused by the incineration of sewage sludge is calculated by using the emission factor for municipal solid waste (4 mg/t of sewage sludge).

*Table 37: PeCB emissions into air from the source category waste incineration (STATISTIK AUSTRIA 2015, own calculation, Umweltbundesamt 2016).*

| | PeCB Emissions [kg] 2009 | PeCB Emissions [kg] 2014 |
|---|---|---|
| Municipal Solid Waste | 4.69 | 5.36 |
| Hazardous Waste | 1.12 | 1.59 |
| Sewage Sludge | 0.4 | 0.47 |
| **Total** | **6.21** | **7.42** |

### 2.6.2 Thermal processes in the metallurgical industry (secondary copper production; sinter plants in the iron steel industry; secondary aluminum production; secondary zinc production)

In iron and steel industries an amount of 1.77 million t of coal was used in 2014 (STATISTIK AUSTRIA 2015).

In the case of coal combustion, the emission factor available in the literature is 2.5 mg/t of coal (HOGENDOORN et al 2009).

*Table 38: PeCB emissions from the source category thermal processes in the metallurgical industry (STATISTIK AUSTRIA 2015, own calculation).*

| | Million t coal incinerated | PeCB emissions [kg] |
|---|---|---|
| 2009 | 1.69 | 4.2 |
| 2014 | 1,77 | 4.4 |

### 2.6.3 Residential combustion sources

Domestic burning of wood, fossil fuels and mixed wastes is private burning in single stoves or open burning places. Domestic burning is associated with higher levels of air emissions as no flue gas treatment is performed. In addition, process conditions can vary strongly due to specific oven characteristics and the properties of the used fuel. As a consequence, measured contamination and emission data as well as derived emission factors, are highly inhomogeneous within a wide range of possible results. In general it can be assumed that the emissions exceed the discharge via residues by far and that burning of treated wood or co-combustion of waste significantly increases formation and discharge of PeCB (BIPRO 2011).

Information about emissions of PeCB from residential combustion is scarce as well. For domestic burning of wood, an emission factor of 1.2 mg/t of wood burned is used (ZIMMERMANN et al.2001).

Residential combustion of coal is not considered relevant in Austria since the amounts are low.

| | Incinerated biomass [million t] | PeCB emissions [kg] |
|---|---|---|
| 2009 | 4.6 | 5.5 |
| 2014 | 5.0 | 6.0 |

*Table 39: PeCB emissions from the source category residential combustion (STATISTIK AUSTRIA 2015, own calculation).*

### 2.6.4 Fossil fuel-fired utility and industrial boilers

In 2014 about 0.95 million t of coal were incinerated in coal fired power plants (STATISTIK AUSTRIA 2015).

In the case of coal combustion, the emission factor which can be found in the literature is 2.5 mg/t of coal (HOGENDOORN et al. 2009).

| | Million t coal incinerated | PeCB emissions [kg] |
|---|---|---|
| 2009 | 1.2 | 3.0 |
| 2014 | 0.95 | 2.4 |

*Table 40: PeCB emissions from the source category fossil fuel-fired utility and industrial boilers (STATISTIK AUSTRIA 2015, own calculation)*

### 2.6.5 Firing installations for wood and other biomass

For biomass incineration, emission data are scarce as well. Zimmermann et al. reported a value of 87 ng/nm$^3$ (ZIMMERMANN et al. 2001) corresponding to an emission factor of 54 mg/TJ. However, this emission value was obtained under controlled incineration processes in a 1 MW combustion plant to study emission profiles of products of incomplete combustion with shredded waste wood contaminated with plastics and paints as feed materials. Thus this value might not be representative for the incineration of biomass in general.

*Table 41: PeCB emissions from the source category firing installations for wood and other biomass (STATISTIK AUSTRIA 2015, own calculation)*

| | Incinerated wood [TJ] | PeCB emissions [kg] |
|---|---|---|
| 2009 | 43,857 | 2.37 |
| 2014 | 55,225 | 2.98 |

### 2.6.6 Summary of PeCB – Releases to Air from Source Categories of the Stockholm Convention

In the year 2014, a total of 23.2 kg of PeCB were emitted in Austria from the source categories according to the Stockholm Convention.

PeCB emissions are not available from the Austrian inventory but have been calculated using default emission factors from the literature and the given activity data. Therefore, there are some uncertainties in the calculated PeCB emissions.

*Figure 14: Relevant source categories for PeCB for 2009 and 2014 (STATISTIK AUSTRIA 2015, BMLFUW 2015a; own calculation)*

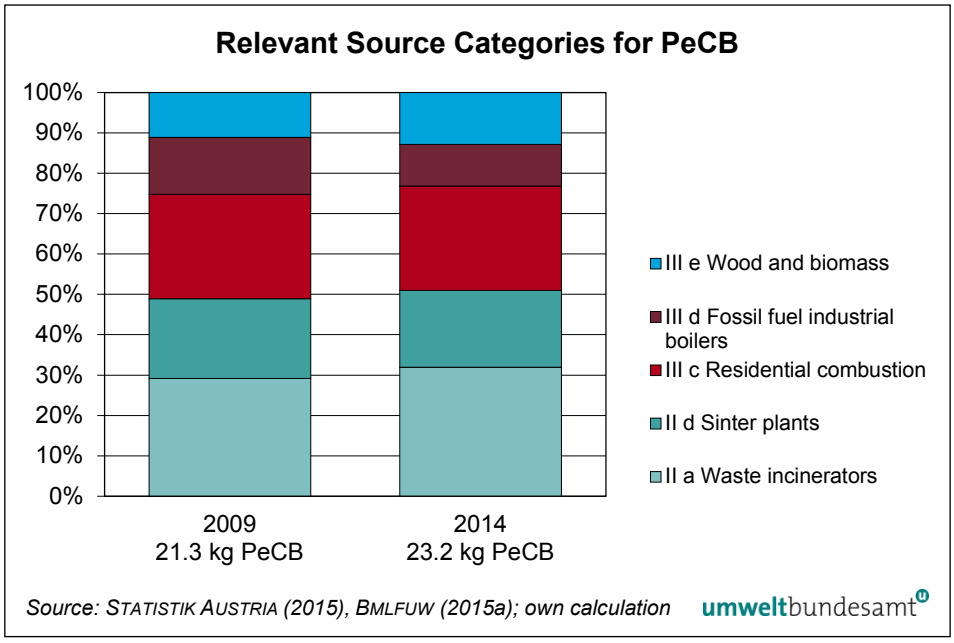


*Table 42: PeCB emissions from Source Category Part II for 2009 and 2014 (STATISTIK AUSTRIA 2015, BMLFUW 2015a; own calculation).*

| Source Category Part II | 2009 [kg PeCB] | 2014 [kg PeCB] |
|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 6.21 | 7.42 |
| Cement kilns firing hazardous waste | NA | NA |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching | NA | NA |
| The following thermal processes in the metallurgical industry | | |
| (i) Secondary copper production | NA | NA |
| (ii) Sinter plants in the iron and steel industry | 4.2 | 4.4 |
| (iii) Secondary aluminium production | NA | NA |
| (iv) Secondary zinc production | NO | NO |
| **Total (Part II)** | **10.41** | **11.82** |

*NO: not occurring*

*NA: not applicable.*

*Table 43: PeCB emissions in Source Category Part III for 2009 and 2014 (STATISTIK AUSTRIA 2015, BMLFUW 2015a, own calculation).*

| Source Category Part III | 2009 [kg PeCB] | 2014 [kg PeCB] |
|---|---|---|
| Open burning of waste, including burning of landfill sites | NA | NA |
| Thermal processes in the metallurgical industry not mentioned in Part II | NA | NA |
| Residential combustion sources | 5.5 | 6.0 |
| Fossil fuel-fired utility and industrial boilers | 3.00 | 2.4 |
| Firing installations for wood and other biomass fuels | 2.37 | 2.98 |
| Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil | NA | NA |
| Crematoria | NA | NA |
| Motor vehicles, particularly those burning leaded gasoline | NA | NA |
| Destruction of animal carcasses | NA | NA |
| Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) | NA | NA |
| Shredder plants for treatment of end of life vehicles | NA | NA |
| Smouldering of copper cables | NO | NO |
| Waste oil refineries | NO | NO |
| **Total (Part III)** | **10.87** | **11.38** |

*NA: not applicable.*

*NO: not occurring*

## 2.7 Releases of polychlorinated Napthalenes (PCN) – Source categories of the Stockholm Convention

Due to the limited availability of qualified data, releases of PCN have not been calculated.

# 3 SOURCE INVENTORY OF POPS RELEASES INTO WATER

Data on sources for POPs releases into water are held in two registers in Austria:

In principle, point sources and emissions to water for all POPs are included in the European Pollutant Release and Transfer Register – PRTR[11]. In practice, a reporting obligation to PRTR exists (for most industrial sectors) only for facilities exceeding a certain production capacity threshold and for emissions which exceed a pollutant release threshold. For Austria, with its mainly small and medium-sized enterprises and thus lower production capacity thresholds, approx 70 facilities with emissions to water or waste water are listed in the PRTR. None of these facilities have reported emissions to water for the pollutants hexachlorobenzene, pentachlorobenzene and polychlorinated biphenyls. One PRTR-facility reported PCDD/PCDF emissions to water for the years 2010 to 2013. One additional PRTR facility reported PCDD/PCDF emission to water for the year 2013. For PAH only one PRTR facility reported emissions to water for the year 2013. So far, no data on diffuse sources of POPs have been entered in the PRTR.

Additional information on POP releases was gathered as part of a project undertaken to set up the national emissions inventory in 2007/2008[12]. Some 70 substances were analysed at the inlet and outlet of 15 urban waste water treatment plants with different capacity, purification technology and waste water composition. The analytical programme comprised the priority substances and certain other substances listed in the daughter Directive 2008/105/EC[13] of the Water Framework Directive [14] and pollutants of national relevance regulated in the Austrian Ordinance on Quality Standards for Surface Waters[15]. DDT, chlordane, aldrin, dieldrin, endrin, heptachlor, hexachlorobenzene and pentachlorobenzene could not be detected in untreated waste water. With the exception of one facility, PAHs were only detectable in untreated waste water. Only polybrominated diphenylethers were detected in effluents in the sub-ng/l range and hexachlorocyclohexane (lindane) in the ng/l range. The use of lindane has been allowed for some selected minor applications until 1. January 2008.

[11] Regulation (EC) No 166/2006 of the European Parliament and of the Council of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC, http://prtr.ec.europa.eu/.

[12] Qualitätszielverordnung ChemieOberflächengewässer:Emissionen aus kommunalen Kläranlagen, Endbericht, UMWELTBUNDESAMT 2009.

[13] Directive 2008/105/EC of the European Parliament and of the Councilof 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC andamending Directive 2000/60/EC of the European Parliament and of the Council.

[14] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

[15] Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt undWasserwirtschaft über die Festlegung des Zielzustandes für Oberflächengewässer (Qualitätszielverordnung Chemie Oberflächengewässer – QZV Chemie OG), BGBl. II Nr. 96/2006 i.d.F. BGBl. II Nr. 461/2010.

In 2009 a national inventory on pollutant emissions to surface waters was established[16]. This national register comprises the emissions of the following point sources: PRTR-facilities, urban waste water treatment plants with a capacity from 2.000 population equivalents upwards, food processing facilities according to annex III of the UWWTD (91/271/EEC) and waste incineration facilities with a capacity of more than 2 tonnes of waste per hour. Priority substances are attributed to industrial activities. There is no release threshold for reporting. The lower release limit is determined by the limit of quantification of the specified analytical method and the waste water discharge. The first reporting cycle (for the data for 2009) covered only basic waste water parameters. Since 2010 discharges have been reported for a number of substances including POPs. The emissions are reported as annual load data.

## 3.1 Other sources: Contaminated Sites & Persistent Organic Pollutants

The most important problem regarding POPs and especially HCB stems from a contaminated site resulting from the production of chloroalkanes. The production was shut down in 1992. A nearby river has ben affected by the contaminated site via groundwater exchange.

Mitigation measures to reduce the spreading of contaminants are under way since 1995. By 2014, the remediation of a historical landfill had to be stopped as off-site thermal treatment of HCB-contaminated lime sludge from a cement kiln caused unintended releases to air (see 2.3.1). As a new tender for ex-situ treatment of sludges failed, a containment system to minimise pollutant releases from the abandoned landfill is now being installed.

Other most commonly recognised and wide spread contaminated sites problems correlated to persistent organic pollutants in Austria are old gaswork sites and tar manufacturing facilities. Regarding PCDD/F, HCB and PCB, hardly any data on site pollution or wider environmental impacts is available.

Most gasworks in Austria were shut down during the early 1960ies. Due to the usual practices of operation and closure it is in general likely that severe soil and groundwater contamination exists. Persistent organic pollutants of concern stem from tar oil spills and losses. The main components of tar oils are PAH (~ 85%), heterocyclic PAH (N,S,O-PAH 5 to 13%), phenols (1–10%). The fate and transport of those pollutants in the underground environment is governed by their physical-chemical properties and interactions to a specific geological and hydrogeological situation. According to the available literature and experiences in Austria the environmental impacts of sites contaminated with PAH are generally limited. Especially benzo(a)pyrene and also other regulated PAH substances are to be characterised by hardly any significant volatilisation to soil vapour, only a low solution to groundwater but a strong sorption to the solid

[16] Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über ein elektronisches Register zur Erfassung aller wesentlichen Belastungen von Oberflächenwasserkörpern durch Emissionen von Stoffen aus Punktquellen (EmRegV-OW), BGBl. II Nr. 29/2009, (Web based inventory, for the time being only with limited access)

phase. Also because of the high retardation of these higher molecular PAHs, reports on travel distances show that pollutant plumes in groundwater are rather short (<100 m) even after several decades. It can be concluded that underground pollution by PAH causes local impacts to soil and groundwater. Nevertheless, it should be pointed out that, depending on the site-specific situation and whether sensitive land uses are concerned, an analysis of the risks to human health or ecosystems is required.

Remediation and redevelopment of gaswork sites is frequently done as a part of local urban revitalization projects. Such at the largest Austrian gaswork site in Simmering (city of Vienna) projects are under way since the late 20$^{th}$ century. During the period since 2012 a hydraulic barrier system and a water treatment plant were constructed and are effectively limiting groundwater contamination (SCHÖBERL & ROHRHOFER 2015).

Investigations at a coking plant near the Danube proved a major local groundwater damage, which for approximately 70 years caused a continuous PAH-input at the order of 0.2 kg per day. Although the water quality of the Danube always met respective environmental target criteria for PAH, a remediation project to reduce groundwater pollution is under way. To eliminate PAH inputs to the Danube a permeable barrier treating contaminated groundwater was constructed and is functional since January 2015.

Whereas underground pollution by PAH is a well known problem, available information on sites contaminated by PCDD/F, HCB and PCB is scarce. As for the sites recorded in the register of polluted sites (www.umweltbundesamt.at/prtr) the share of such sites can be estimated as being rather low (<5%). Referring to the experiences regarding fate and transport of PAH in the underground environment and given the physical-chemical properties of PCDD/F, HCB or PCB wider environmental impacts seem to be unlikely in general, but may appear in the presence of sensitive land use patterns in the surroundings of a specific site.

As for old municipal landfill sites, where it is likely that ashes and slags have been disposed of, there are hardly any data on PCDD/F, HCB and PCB. Regarding PAHs, which might be addressed as an ‘indicator’ for POPs, the available data do not show significant loads in percolating water or groundwater. Apart from old landfill sites which were built before 1997, there is no information available on new landfills in compliance with the Landfill Ordinance.

# 4 SOURCE INVENTORY OF POPS RELEASES VIA WASTE

With regard to waste, an estimation of releases can be established for PCDD/F and PeCB. In the case of the other POPs, qualified data are not available.

## 4.1 Releases of Polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF)

Figure 15 gives an overview of the contribution of the source categories to PCDD/F emissions via waste. In the year 2014 a total of 302.7 g I-TEQ were emitted, which is approximately ten times as much as the emissions to air (see2.2.18). Solid waste from waste incineration contributes most (63%) to the overall releases. Waste from residential sources also presents a significant release (25%). Other releases come from thermal processes in the metallurgical sector and from fossil fuel and biomass combustion.

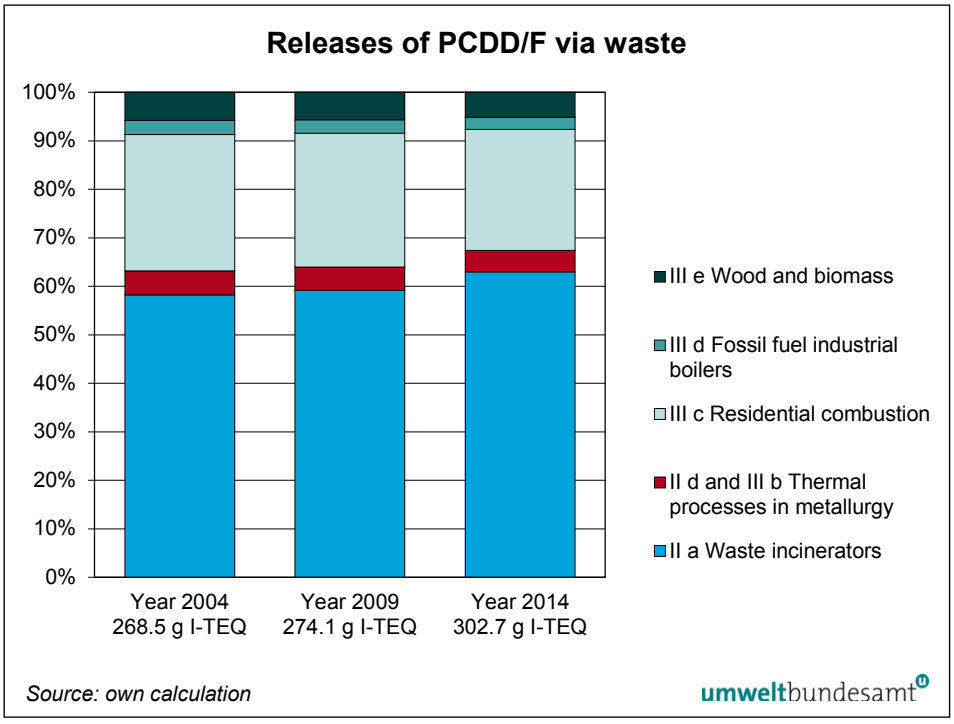



*Figure 15: Releases (though hardly bio-available) of PCDD/F via waste (own calculation).*

*Note: Total releases may be higher since for many source categories (e.g. the metallurgical sector) which have the potential of POPs releases via waste qualified emission factors are not available.*

*Table 44: Releases of PCDD/F via waste (own calculation).*

| Source Category | 2004<br>g I-TEQ | 2009<br>g I-TEQ | 2014<br>g I-TEQ |
|---|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 156.37 | 162.1 | 190.7 |
| Thermal processes in the metallurgical industry | 13.3 | 13.3 | 13.3 |
| Residential combustion | 75.5 | 75.5 | 75.5 |
| Fossil fuel industrial boilers | 7.7 | 7.7 | 7.7 |
| Wood and biomass | 15.6 | 15.6 | 15.6 |
| **Total** | **268.5** | **274.1** | **302.7** |

### 4.1.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge

Table 45 gives an estimation of PCDD/F releases via waste. Concentrations as well as loads are considerably high and follow an upward trend. However, it must be stated that all waste streams resulting from waste incineration are sent to landfills (mass waste, residual waste, underground disposal) and in case provided they are properly designed and operated, these landfills no longer present a risk for the environment.

*Table 45: Estimation of PCDD/F releases via waste from waste incineration (municipal waste, hazardous waste; own calculation).*

| | PCDD/F | | | |
|---|---|---|---|---|
| Type of Waste | Average concentration (µg/kg) | Total mass (g/a) 2004 | Total mass (g/a) 2009 | Total mass (g/a) 2014 |
| Bottom Ash | 0.046 | 11.40 | 15.04 | 17.59 |
| Fly Ash | 2.95 | 138.29 | 140.24 | 165.09 |
| Filtercake | 4.0 | 6.68 | 6.77 | 7.96 |
| **Total** | | **156.37** | **162.05** | **190.65** |

### 4.1.2 Secondary aluminium production

Wastes/residues from secondary aluminium production are salt slag, filter dust, furnace linings and drosses/skimmings (UMWELTBUNDESAMT 2000).

The following table gives an overview of wastes/residues arising from secondary aluminum production, as well as their treatment and disposal.

Estimated releases using the reported values of “Stand der Technik in der Sekundäraluminiumerzeugung im Hinblick auf die IPPC-Richtlinie” (UMWELTBUNDESAMT 2000) and the BREF “Non Ferrous Metals Industries” (EUROPEAN COMMISSION 2001) are given in the next table:

| Waste/Residue | Release (g/a) | Treatment |
|---|---|---|
| Filter dust | 1.25 | Underground disposal, disposal with pre-treatment, partly reconditioned with salt slag, use in steel industry. |
| Salt slag | 0.175 | Treatment via dissolution and crystallization technique → reusable substances Al-granulate, mixed salt, non metallic products.<br>Also other treatment techniques are used which are not state of the art. |
| Furnace lining | No data available | Leaching and landfill, potential for reconditioning with skimmings |
| Drosses/skimmings | No data available | Recovery |

*Table 46: Estimation of PCDD/F releases via wastes/ residues arising from secondary aluminum production (UMWELTBUNDESAMT 2000).*

*Table 47: Composition of salt slag (UMWELTBUNDESAMT 2000).*

| Pollutant | Typical value | Range |
|---|---|---|
| PCDD/F | 5 ng/kg | 2–20 ng/kg |

*Table 48: Composition of filter dust (UMWELTBUNDESAMT 2000, EUROPEAN COMMISSION 2016).*

| Pollutant | Typical value | Range |
|---|---|---|
| PCDD/F | 5 µg/kg | 3–10 µg/kg |

No new values for the years 2009 and 2014 were calculated or estimated.

### 4.1.3 Secondary copper production

In Austria there is one secondary copper plant in operation which produces 92,400 t/a copper anodes, 113,500 t/a copper cathodes and 91,000 t/a of bolts (MONTANWERKE BRIXLEGG 2012). Wastes/residues from the secondary copper plant are given in the table below. Releases in g/a could not be estimated due to a lack of data.

| Residue | Treatment |
|---|---|
| Filter dust from the shaft furnace | Exported |
| Filter dust from the converter | Exported |
| Filter dust from the anode furnace | Use in shaft furnace |
| Furnace linings | Use in furnace |
| Slag from the shaft furnace | Construction material |
| Slag from the converter | Use in shaft furnace |
| Slag from the anode furnace | Use in shaft furnace |

*Table 49: PCDD/F releases via wastes/residues arising from secondary copper production (UMWELTBUNDESAMT 1999b).*

### 4.1.4 Secondary lead production

The only secondary lead plant in Austria produces approximately 23,000 t lead/a. Residues/wastes from the secondary lead plant are given below (UMWELTBUNDESAMT 2004). Releases in g/a could not be estimated due to a lack of data.

*Table 50: PCDD/F releases via wastes/residues arising from secondary lead production (UMWELTBUNDESAMT 2004).*

| Residue | Treatment |
|---|---|
| Filter dust | Reuse in furnace |
| Furnace linings | Landfill |
| Slag | Landfill |

### 4.1.5 Thermal processes in the metallurgical industry

PCDD/F releases are summarised below:

*Table 51: PCDD/F releases via waste from thermal processes in the metallurgical industry (own calculation).*

| Residue | Release (g/a) |
|---|---|
| Sinter plant – residue from flue gas cleaning | n.a. |
| Electric arc furnace – slag | 0.08 |
| Electric arc furnace – residue from flue gas cleaning | 9.78 |
| Ferrous metal foundries – residue from flue gas cleaning | 1.90 |
| Ferrous metal foundries – sand | 0.10 |
| **Total** | **11.86** |

No new values for the year 2014 were calculated or estimated. As regards the sinter plant residues from flue gas cleaning there are no values available.

### 4.1.6 Residential combustion sources

The Dioxin Toolkit reports concentrations of PCDD/F in the ash of 10 µg/kg ash for clean biomass and 1,000 µg/kg ash for contaminated biomass, respectively. Both values seem to be unreasonably high (UNEP 2005).

Another study (UMWELTBUNDESAMT 2002) gives emission factors based on the fuel input for chimney soot of 5 ng/kg fuel (coal) and 1 ng/kg fuel in the case of biomass combustion. According to this study, releases via bottom ash are below 1 ng/kg combusted fuel (both for biomass and coal).

BIPRO based their calculations on average values of 0.11 µg/kg (ash from wood combustion) and 0.056 µg/kg (ash from coal combustion). As regards chimney soot BIPRO uses values of 6.15 µg/kg (coal) and 3.19 µg/kg (wood) (BIPRO 2005).

In the field tests described in (UMWELTBUNDESAMT 2002) untreated beech wood was used, whereas the value used by (BIPRO 2005) includes all kind of treated and untreated wood.

The ash content of biomass is in the range of 1% (wood) and 5% (bark). Normally, only bottom ash accumulates in residential plants.

Estimated releases based on reported values are given in the next table:

*Table 52: Calculation of PCDD/F releases via waste based on available literature (UMWELTBUNDESAMT 2002, BIPRO 2005, own calculation).*

| Residue | Release (g/a) | Treatment |
|---|---|---|
| Bottom ash from biomass combustion | 0.1–6.98[1] | Disposal with MSW; spreading on land |
| Bottom ash from coal combustion | 0.24–0.589[1] | Disposal with MSW; spreading on land |
| Chimney soot – wood combustion | 6.34–60.69[1] | Disposal with MSW; spreading on land; others? |
| Chimney soot – coal combustion | 1.18–7.25[1] | Disposal with MSW; spreading on land; others? |

[1] *Higher value more often supported by data from the literature.*

*MSW: municipal solid waste*

As can be seen from the results given in the table above, the calculation of releases via waste from residential combustion sources is associated with great uncertainties. The reasons for these uncertainties are (among others) a wide variety of types (including some types of waste) and quality of fuels used (e.g. water content, ash content, calorific value, chlorine content), the wide variety of firing systems with different combustion conditions and a wide variety of "local" factors (such as the manual loading of the firing system).

However, these releases are relevant because a certain part of this waste is re-transferred to the environment (e.g. when ash is used as "fertiliser" in private gardens).

No new values for the year 2014 were calculated or estimated.

### 4.1.7 Fossil fuel-fired utility and industrial boilers

Few data are available on POPs concentrations of solid residues/wastes from fossil fuel fired utility and industrial boilers. The Dioxin Toolkit (UNEP 2005) gives a value of 14 µg/TJ for the combustion of coal and a value of 15 µg/TJ for biomass combustion. Concentrations in fly ash from coal combustion range from 0.23–8.7 ng/kg and for bottom ash from 0.02–13.5 ng/kg (UNEP 2005). For the following calculation concentrations of 5 ng/kg (fly ash) and 10 ng/kg (bottom ash) have been used. The total emission factors for coal and lignite combustion reported by BIPRO do not differentiate between fly ash and bottom ash and result in much higher release estimations (see Table 53).

*Table 53: Calculation of PCDD/F releases via ashes from coal combustion based on available literature (UNEP 2005, BIPRO 2005, own calculation).*

| Type of Residue/Waste | Release (g/a) | Treatment |
|---|---|---|
| Fly ash (coal combustion) | 0.70 | Use in cement, brick and construction industry |
| Bottom ash (coal combustion) | 0.46 | Use in cement, brick and construction industry |
| All ashes from coal combustion – BIPRO | 3.00 | Use in cement, brick and construction industry |
| Ashes from lignite – BIPRO (other data not available) | 3.52 | Backfilling of coal mine |

Total releases are estimated to be in the range of 1.16 g/a (UNEP 2005) and 6.62 g/a (BIPRO 2005).

No new values for the year 2014 were calculated or estimated.

### 4.1.8 Firing installations for wood and other biomass fuels

For biomass combustion a wide range of emission factors are reported:

- UNEP (2005): Fly ash: 30–23,300 ng/kg; bottom ash: 30–3,000 ng/kg
- BIPRO (2005): all ashes: 1,135 µg/kg
- UMWELTBUNDESAMT (2002): 0.03 µg/kg (both for fly ash and bottom ash)

The results (using the concentration figures described) are presented in the table below:

*Table 54: Calculation of PCDD/F releases via ashes from biomass combustion based on available literature (UNEP 2005, BIPRO 2005, UMWELTBUNDESAMT 2002, own calculation).*

| Type of Residue/Waste | Release (g/a) | Treatment |
|---|---|---|
| Fly ash (conc: 0.03 µg/kg) | 0.67 | Landfill |
| Bottom ash (conc: 0.03 µg/kg) | 2.67 | Application on land; composting |
| Ashes from Biomass combustion (conc: 0.11 µg/kg) | 12.21 | Fly ash: landfilled; bottom ash: use as composting agent |

These releases are potentially relevant because some part of bottom ash is used as composting agent and applied on soil.

No new values for the year 2014 were calculated or estimated.

## 4.2 Releases of Pentachlorobenzene (PeCB)

Table 55 and Figure 16 give an overview of the contribution of the source categories to PeCB emissions to waste. In the year 2014 a total of 3.51 kg PeCB was emitted. Solid waste from waste incineration contributes most (81%) to the overall releases. Other releases come from thermal processes in the metallurgical sector and from fossil fuel and biomass combustion. However, it should be mentioned that the availability of data was scarce.

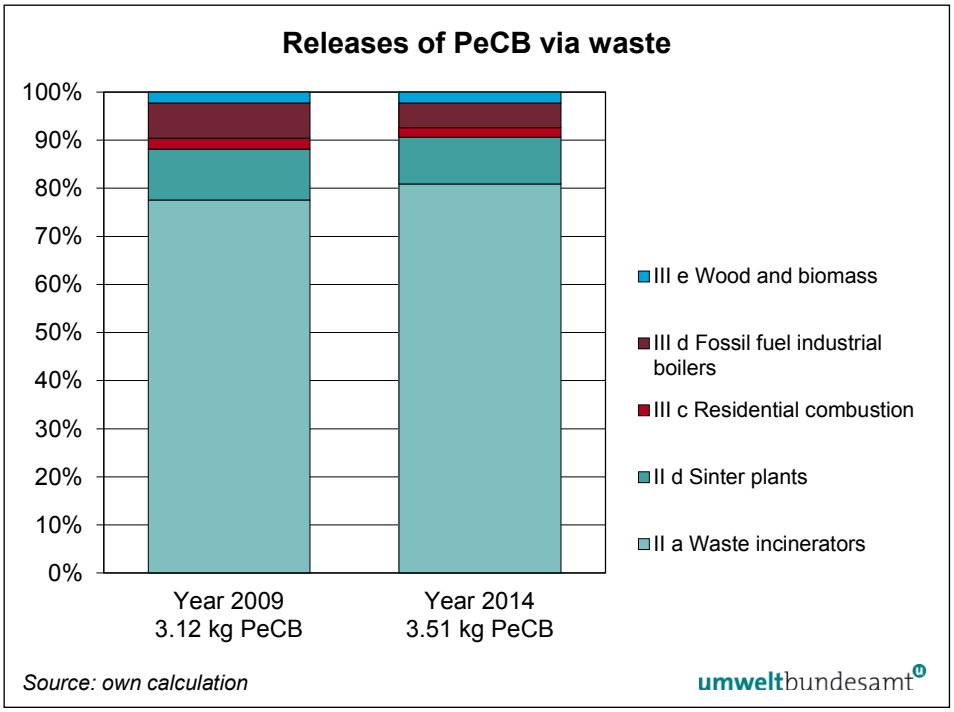



*Figure 16: Releases of PeCB via waste (own calculation).*

| Source Category | 2009 [kg PeCB] | 2014 [kg PeCB] |
|---|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | 2.42 | 2.84 |
| The following thermal processes in the metallurgical industry | | |
| (ii) Sinter plants in the iron and steel industry | 0.33 | 0.34 |
| Residential combustion sources | 0.07 | 0.07 |
| Fossil fuel-fired utility and industrial boilers | 0.23 | 0.18 |
| Firing installations for wood and other biomass fuels | 0.07 | 0.08 |
| **Total** | **3.12** | **3.51** |

*Table 55: Releases of PeCB via waste for 2009 and 2014 (own calculation).*

### 4.2.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge

Solid waste from waste incineration contributes most to the overall releases.

Significant amounts of PeCB have been found in fly-ash samples. Korenkova et al. reported that PeCB concentrations in a fly-ash sample taken from an Italian municipal solid waste incinerator amounted to 31 ng/g of fly-ash (IPEN 2008); in Norway fly-ash samples from a municipal solid waste incinerator contained 50 ng/g (VIAU et al. 1984), in the UK 11.5 ng/g (BALAMPANIS et al. 2010), in Sweden 240 ng/g (ÖBERG et al. 2007) and in Germany 39.6 ng/g (SCHREINER et al. 1986). An average contamination factor of 74.4 ng PeCB/g fly ash has been used for the calculation of the mass flows (BIPRO 2011).

Through incineration of municipal waste, residues amounting to 37.75 kg/t are generated. Of these, 22.25 kg/t are fly ash and filter dust and 15.5 kg/t are remaining ACP residues (BIPRO 2011).

As regards the hazardous waste reported PeCB values in fly ash amount to an average of 9.57 ng PeCB/g fly ash (SCHREINER et al. 1986). It has been assumed that the amount of fly ash and filter dust generated is the same as for municipal waste (22.25 kg/t MW incinerated).

In 2014, about 1.341 million t municipal waste (mixed municipal waste, bulky waste) were incinerated in municipal waste incineration plants (BMLFUW 2015a).

In 2014, about 1.324 million t of hazardous waste were treated (BMLFUW 2015a), 0.227 million t were incinerated in 2014 (assumption Umweltbundesamt 2015).

**Sewage sludge**

As PeCB tends to adsorb on particles, a relevant share of the PeCB content of waste water accumulates in sewage sludge during waste water treatment.

In terms of PeCB contamination data on sewage sludge, a median of 4.85 mg PeCB/t sewage sludge has been used according to a study of Wang et al. for sewage sludge samples analysed in the UK (WANG et al. 1994).

In 2014 an amount of 0.239 million t of sewage sludge was produced in Austria. 1% of this amount was landfilled, 49% was incinerated, 17% was applied on land and 33% was treated in another way. (BMLFUW 2015a)

The following table shows the amounts PeCB in fly ash and filter dust:

*Table 56: PeCB-discharge via waste (fly ash and filter dust) for the source category Waste Incineration (BMLFUW 2015a, own calculation).*

| | Incinerated waste 2014 [Million t] | PeCB Emissions [kg], 2009 | PeCB Emissions [kg], 2014 |
|---|---|---|---|
| Municipal Solid Waste | 1.341 | 1.94 | 2.22 |
| Hazardous Waste | 0.227 | 0.03 | 0.05 |
| Sewage Sludge | 0.117 | 0.45 | 0.57 |
| **Sum** | | **2.42** | **2.84** |

### 4.2.2 Thermal processes in the metallurgical industry (secondary copper production; sinter plants in the iron steel industry; secondary aluminium production; secondary zinc production)

Compared to incineration and combustion processes, industrial processes, where PeCB can be produced as a by-product are of comparatively low relevance. Nevertheless, it should be mentioned that most industrial processes use incineration or combustion processes, e.g. the industrial production of steel and iron, which according to Eurostat data uses more than 50% of the coal finally consumed within Europe (BIPRO 2011).

In iron and steel mills an amount of 1.77 million t of coal was used in 2014 (STATISTIK AUSTRIA 2015).

Contamination values for fly ashes from coal incineration range from 0.0004 to 7.0 ng/g. The PeCB flow is calculated on the basis of an estimated average of 2.40 ng/g (SCHREINER et al.1986; BIPRO 2011).

The available data and assumptions allow an estimation of PeCB emissions to solid residues (general estimation for ashes: bottom ash, fluidised bed ash, fly ash including FGT residues) resulting from power production from coal. An average of 80 kg ash (no differentiation of ashes) per tonne solid fuel has been taken as the basis for the calculation of the PeCB flow into waste (BIPRO 2011).

| | Incinerated coal [Million t] | PeCB Emissions [kg] |
|---|---|---|
| 2009 | 1.69 | 0.33 |
| 2014 | 1.77 | 0.34 |

*Table 57: PeCB discharge to waste of iron and steel mills (STATISTIK AUSTRIA 2015, own calculation).*

### 4.2.3 Residential combustion sources

For wood, the waste generation factor amounts to 0.017 t ash/t wood and 0.0003 t soot/t wood. A contamination factor of 0.2 ng/g for the resulting ash has been used according to Schreiner et al. (SCHREINER et al. 1986). No information has been available on the PeCB contamination in soot. Since the generation factor of soot for wood is relatively small, it is considered as insignificant (BIPRO 2005).

The available data and assumptions allow an estimation of PeCB discharge to ashes:

| | Incinerated wood [Million t] | PeCB emissions [kg] |
|---|---|---|
| 2009 | 4.6 | 0.07 |
| 2014 | 4.2 | 0.07 |

*Table 58: PeCB discharge to waste (ash) of residential combustion (STATISTIK AUSTRIA 2015, own calculation).*

### 4.2.4 Fossil fuel-fired utility and industrial boilers

The available data and assumptions allow an estimation of PeCB concentrations in solid residues (general estimation for ashes: bottom ash, fluidised bed ash, fly ash including FGT residues) resulting from power production from coal.

An average of 80 kg of ash (no differentiation of ashes) per tone of solid fuel has been taken as the basis for the calculation of the PeCB flow into waste (BIPRO 2011).

Contamination values for fly ashes from coal incineration range from 0.0004 to 7.0 ng/g. The PeCB flow is calculated on the basis of an estimated average of 2.40 ng/g (SCHREINER et al.1986; BIPRO 2011).

In 2014 about 0.9 million t were incinerated in coal fired power plants (STATISTIK AUSTRIA 2015).

*Table 59: PeCB discharge to waste of power plants (STATISTIK AUSTRIA 2015, own calculation).*

| | Incinerated coal [Million t] | PeCB emissions [kg] |
|---|---|---|
| 2009 | 1.2 | 0.23 |
| 2014 | 0.9 | 0.18 |

### 4.2.5 Firing installations for wood and other biomass fuels

For wood, the waste generation factor amounts to 0.017 t ash/t wood and 0.0003 t soot/t wood. A contamination factor of 0.2 ng/g for the resulting ash has been used according to Schreiner et al. (SCHREINER et al. 1986). No information was available on PeCB contamination of soot.

The available data and assumptions allow an estimation of PeCB discharge to ashes.

*Table 60: PeCB emissions to ashes from Incinerated wood, source category firing installations for wood and other biomass fuels (STATISTIK AUSTRIA 2015, own calculation).*

| | Incinerated wood [Million t] | PeCB Emissions [kg] |
|---|---|---|
| 2009 | 4.6 | 0.07 |
| 2014 | 5.0 | 0.08 |

# 5 SOURCE INVENTORY OF POPS RELEASES VIA PRODUCTS

Action on POPs in products is specified in Annex C Part V A (g) of the Convention ("minimization of these chemicals as contaminants in products"). Some data can be found in the literature relating to concentrations of PCDD/F in sold cement and pulp and paper products (KARSTENSEN 2006, UNEP 2013, GRUBER 1996). No data are available on the other POPs described in this report.

However, for most source categories there are no relevant releases via the product.

*Table 61: PCDD/F-Releases via the products cement and pulp and paper – calculations were based on data from literature (KARSTENSEN 2006, UNEP 2013, GRUBER 1996).*

| | Release (g I-TEQ/a) |
|---|---|
| Cement | 4.04 |
| Paper | 4.46 |

*Releases via pulp which is not exported are included in the figure for paper.*

PCDD/F-releases via cement and pulp and paper products in 2014 were almost the same as in 2009 and 2004 since there were no significant changes in production.

Concentrations of PCDD/F in cement are considered to be low and can be explained by the fact that filter dust from the clinker process (average PCDD/F concentration: 6.7 ng I-TEQ/kg) is added to the product and that secondary raw materials (e.g. fly ash, gypsum from flue gas desulphurisation) are used. Consequently, the cement is contaminated with low concentrations of PCDD/F (average: 0.91 ng I-TEQ/kg cement) (KARSTENSEN 2006).

It should be mentioned that the bio-availability of POPs in cement has been greatly reduced.

Austria participated in the revision of the Dioxin Toolkit (UNEP 2013). UNEP 2013 states under "mineral products": „This section summarises high-temperature processes in the mineral industry. Raw materials or fuels that contain chlorides may potentially cause the formation of PCDD/PCDF at various steps of the processes, e.g., during the cooling phase of the gases or in the heat zone. Due to the long residence time in kilns and the high temperatures needed for the product, emissions of PCDD/PCDF are generally low in these processes."

Cement kilns firing hazardous waste are a source covered in Annex C Part II (b) of the Convention concerning emissions of PCDD/F, HCB, PAH, PCB and PeCB. Therefore the quantification of these POPs in environmental media, as well as in residues and products is desirable.

In pulp and paper production PCDD/F are introduced into the products mainly via bleached (Kraft-)pulp and recycled papers.

In Austria, total pulp production (reference year 2014) amounted to 1,571 kt (2009: 1,514 kt; 2004: 1,509 kt) with bleached pulp having a share of 36%, unbleached pulp 35% and textile pulp 28% (AUSTROPAPIER 2015).

The releases from pulp were calculated was based on emission factors of 0.5 µg/t (bleached Kraft-pulp) and 0.1 µg/t (other pulp) (UNEP 2013). Thus, the total releases via pulp amounted to 0.39 g in the year 2014.

Relevant raw materials for paper production are pulp (both from national production and from imports), wood pulp and recovered paper (both de-inked or not de-inked).

In addition to pulp produced in Austria (see above), imported pulp has to be taken into account: In 2014 about 662,330 t of bleached (Kraft-)pulp were imported. Part of the imported pulp came from countries where chlorine is still used as a bleaching agent. For the calculation of the PCDD/F content it is assumed that the emissions factor is 0.5 µg/t for 10% of the imported pulp, whereas the other imported pulp is less contaminated (0.1 µg/t). This leads to a total of 0.093 g I-TEQ imported via pulp. Input of PCDD/F via wood pulp has been calculated using an emission factor of 0.1 µg/t (UNEP 2013; total input: 0.037 g I-TEQ).

On the other hand, PCDD/F is introduced via recycled paper and more specifically via impurities in used inks. Where de-inking is applied (about 40% of recovered paper is de-inked in Austria), the PCDD/F will be reduced by a factor of 3 (GRUBER 1996). Comparable high concentrations (up to 12 ng/kg) were found in packaging papers and paper board in the early 1990s. In general, there was a sharp decline in average concentrations could be observed between 1989 and 1994 whereas concentrations have been decreasing slowly since 1994 (GRUBER 1996).

Based on that information above and on data given in the Dioxin Toolkit (UNEP 2013), it has been assumed that the PCDD/F concentration in recovered paper is 3 µg/t (without de-inking) and 0.99 µg/t (with de-inking). These assumptions result in an average emission factor of 2.24 µg/t (averaged over paper which undergoes a de-inking step and which does not). Thus the total release of PCDD/F via paper amounts to 4.46 g (reference year: 2014).

Publications in the scientific literature give some indication that waste paper could be contaminated by printing inks containing significant residues of PCDD/F, e.g. through pigments. In 2011 the Environment Agency Austria conducted a survey assessing the PCDD/F contents of cardboard-boxes which are known to be produced from waste paper as the predominant raw material. Comparing the PCDD/F content of brand-new non printed cardboard boxes with used cardboard boxes imprinted to a large extent this limited study did not show any indication of PCDD/F input via printing inks. The cardboard-box samples analysed in this study showed PCDD/F contents in the range of 1.2 to 1.9 ng TEQ/kg (UMWELTBUNDESAMT 2011c).

In 2010 Austropapier, the Association of the Austrian Paper Industry, submitted new data on the PCDD/F content of selected paper products in order to refine calculations based on the emissions factors taken from the Dioxin Toolkit (UNEP 2005). The emission factors derived from the new data indicate a reduction of the overall PCDD/F release via paper products by a factor of three.

A new calculation was performed in 2011:

*Table 62: Releases of PCDD/F via products (calculation on the basis of the output of Austropapier and transmitted results of analysis)*

| Product | Production (t/a) | Emission factor (µg TEQ/t) | Releases (g PCDD/F TEQ/a) | Percentage (%) |
|---|---|---|---|---|
| Newspaper printing paper | 299,205 | 0.068 | 0.02 | 1.2 |
| Printing and writing paper | | | | |
| • deinked | 902,421 | 0.068 | 0.06 | 3.7 |
| • from pulp | 1,346,070 | 0.050 | 0.07 | 4.0 |
| Folding box cardboard | 487,214 | 0.723 | 0.35 | 21.1 |
| Packaging paper | 676,177 | 1.141 | 0.77 | 46.2 |
| Kraft paper | | | | 0.0 |
| • with recovered paper | 374,855 | 0.858 | 0.32 | 19.3 |
| • only from pulp | 250,743 | 0.050 | 0.01 | 0.8 |
| Thin- and special papers | | | | 0.0 |
| Sanitary paper | 128,660 | 0.068 | 0.01 | 0.5 |
| Others | 126,896 | 0.050 | 0.01 | 0.4 |
| Packing and spezial board | 13,299 | 0.858 | 0.01 | 0.7 |
| Market pulp exported | 95,471 | 0.070 | 0.01 | 0.4 |
| Market pulp (ECF) | 313,818 | 0.090 | 0.03 | 1.7 |
| **Total** | **5,014,829** | | **1.67** | **100.0** |

# 6 POLICIES (PROVISIONS) AND MEASURES

This chapter gives an overview of the relevant international, European and national legislation applicable to unintentionally produced POPs. It should be noted that chapter 6 of the National Action Plan 2008 (UMWELTBUNDESAMT 2008b) and chapter 6 of the First Review of the National Action PLAN 2012 (UMWELTBUNDESAMT 2012) already contained comprehensive information on policies and measures. Therefore, this Second Review of the National Action Plan only focuses on new developments or amendments of the relevant policies. For more general information please refer to the National Action Plan 2008 and the First Review of the National Action Plan 2012 (UMWELTBUNDESAMT 2008b, UMWELTBUNDESAMT 2012).

## 6.1 New developments in International and European Legislation since 2012

### 6.1.1 Stockholm Convention

The Stockholm Convention on POPs was formally adopted on 22–23 May 2001 and entered into force 17 May 2004. Parties to the convention have agreed to a process by which persistent toxic compounds can be reviewed and added to the convention, if they meet certain criteria for persistence and transboundary threat. The first set of new chemicals to be added to the Convention was agreed at a conference in Geneva on 8 May 2009.

The chemicals targeted by the Stockholm Convention are listed in the annexes of the convention text:

Annex A (elimination):

aldrin, chlordane, chlordecone, dieldrin, endrin, heptachlor, hexabromobiphenyl, hexabromocyclododecane (HBCD), hexabromodiphenyl ether and heptabromodiphenyl ether, hexachlorobenzene (HCB), hexachlorobutadiene, alpha hexachlorocyclohexane, beta hexachlorocyclohexane, lindane, mirex, pentachlorobenzene (PeCB), pentachlorophenol and its salts and esters, polychlorinated biphenyls (PCB), polychlorinated naphthalenes, technical endosulfan and its related isomers, tetrabromodiphenyl ether and pentabromodiphenyl ether, toxaphene.

Annex B (restriction):

DDT, perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluorid.

Annex C (unintentional production):

hexachlorbenzene (HCB), pentachlorobenzene (PeCB), polychlorinated biphenyls (PCB), polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofurans (PCDF), polychlorinated naphthalenes (PCN).

Releases of unintentionally produced by-products listed in Annex C (dioxins, furans, PCBs, HCB, PeCB and PCN) are subject to continuous reduction with the objective to achieve ultimate elimination where feasible. The main tool for this is the National Action Plan which should cover the source inventories and release estimates as well as plans for release reductions.

Under the Stockholm Convention on Persistent Organic Pollutants, Parties shall promote in some cases and prescribe in others the use of best available techniques, and promote the application of best environmental practices. In short, each Party shall:

- Develop, within two years of the date of entry into force of the Convention, an action plan (national or regional) where releases of chemicals listed in Annex C of the Convention are identified, characterized and addressed; the plan shall include source inventories and take into consideration the source categories listed in Parts II and III of Annex C (subparagraph (a) of Article 5);
- For new sources:
  - Promote and, in accordance with the schedule in its action plan, require the use of best available techniques within the source categories identified as warranting such action, with particular initial focus on sources categories identified in Part II of Annex C; the requirement to use best available techniques for Part II source categories shall be phased in a soon as practicable, but no later than four years after entry into force of the Convention for the Party (subparagraph (d) of Article 5);
  - Promote, for those categories identified above, the use of best environmental practices (subparagraph (d) of Article 5);
  - Promote in accordance with the action plan, best available techniques and best environmental practices within source categories such as those listed in Part III of Annex C which a Party has not addressed above (subparagraph (e) (ii) of Article 5);
- For existing sources:
  - Promote, in accordance with the action plan the use of best available techniques and best environmental practices for source categories listed in Part II of Annex C and such sources as those in Part III of the Annex (subparagraph (e) (i) of Article 5).

*Table 63: Source Categories according to Annex C of the Stockholm Convention on POPs.*

| Part II: Source categories | Part III: Source categories |
|---|---|
| Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge | Open burning of waste, including burning of landfill sites |
| Cement kilns firing hazardous waste | Thermal processes in the metallurgical industry not mentioned in Part II |
| Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching | Residential combustion sources |
| The following thermal processes in the metallurgical industry:<br>(i) Secondary copper production;<br>(ii) Sinter plants in the iron and steel industry;<br>(iii) Secondary aluminium production;<br>(iv) Secondary zinc production | Fossil fuel-fired utility and industrial boilers |
| | Firing installations for wood and other biomass fuels |
| | Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil |
| | Crematoria |
| | Motor vehicles, particularly those burning leaded gasoline |
| | Destruction of animal carcasses |
| | Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) |
| | Shredder plants for the treatment of end of life vehicles |
| | Smouldering of coppper cables |
| | Waste Oil Refineries |

When applying best available techniques and best environmental practices for the activities listed above, Parties should take into consideration the general guidance on prevention and release reduction measures in Annex C and guidelines on best available techniques and best environmental practices. These Guidelines were finalised by an international Expert Group in November 2006 and were adopted by the Conference of the Parties in May 2007. (UNEP 2007). Currently the Guidelines are under review.

#### 6.1.1.1 EU POP-Regulation

The main legal instrument for implementing the Stockholm Convention and the UNECE Protocol in the EU is the Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants with its amendments 756/2010/EU, 757/2010/EU, 519/2012/EU, 2015/2030/EU and 2016/293/EU.

The Regulation obliges Member States to draw up and maintain comprehensive release inventories for dioxins, furans, HCB, PCBs, PeCB and polyaromatic hydrocarbons (PAH) and to communicate their national action plans on measures to identify, characterise and minimise total releases of these substances to the Commission and to the other Member States. The action plan shall include an evaluation of the efficacy of the laws and policies related to the management of the releases.

The action plan shall also include measures to promote the development of substitute or modified materials, products and processes to prevent the formation and releases of POPs. Producers and holders of waste are obliged to undertake measures to avoid contamination of waste with POP substances. The control measures on waste follow closely those of the Stockholm Convention and provide more details in some aspects.

Amendments of the POP regulation since 2012:

2012, hexachlorbutadiene, polychlorinated napthalines, short chain chlorinated paraffines and endosulfan have been included in the POP regulation (Commission Regulation 519/2012/EU).

In 2015, the POP regulation has been amended, including setting a limit for short chain chlorinated paraffins (SCCPs) (Commission Regulation 2015/2030/EU).

2016, the EU published Regulation 2016/293/EU prohibiting the manufacture, placing on the market and use of hexabromocyclododecane (HBCDD) with certain specific exemptions for the building sector.

For detailed information on the POP Regulation please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b) and the First Review of the National Action Plan (UMWELTBUNDESAMT 2012).

### 6.1.2 UNECEConvention on Long-range Transboundary Air Pollution (LRTAP)

Since 1979 the Convention on Long-range Transboundary Air Pollution (LRTAP)[17] has addressed some of the major environmental problems of the UNECE region through scientific collaboration and policy negotiation. The Convention has been extended by eight protocols that identify specific measures to be taken by Parties to cut their emissions of air pollutants.

The aim of the Convention is that Parties shall endeavour to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution. Parties develop policies and strategies to combat the discharge of air pollutants through exchange of information, consultation, research and monitoring.

#### The 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs)

The Executive Body to the UNECE (United Nations Economic Commission for Europe) Convention on Long-Range Transboundary Air Pollution (LRTAP) adopted the Protocol on POPs[18] on 24 June 1998 in Aarhus, Denmark. The Protocol entered into force on 23 October 2003. By May 2012, 31 Parties, including the European Community had ratified the Protocol.

For detailed information on the POP Protocol please refer to the National Action Plan 2008 and the First Review of the National Action Plan 2012 (UMWELTBUNDESAMT 2008b, UMWELTBUNDESAMT 2012).

[17] http://www.unece.org/env/lrtap/welcome.html

[18] http://www.unece.org/env/lrtap/pops_h1.htm

On 18 December 2009, Parties to the Protocol on POPs adopted decisions 2009/1, 2009/2 and 2009/3 to amend the Protocol to include seven new substances: hexachlorobutadiene, octabromodiphenyl ether, pentachlorobenzene, pentabromodiphenyl ether, perfluorooctane sulfonates, polychlorinated naphthalenes and short-chain chlorinated paraffins. Furthermore, the Parties revised obligations for DDT, heptachlor, hexachlorobenzene and PCBs as well as emission limit values (ELVs) from waste incineration. Parallel to this, with a view to facilitating the Protocol's ratification by countries with economies in transition, the Parties introduced a certain amount of flexibility for these countries regarding the time frames for the application of ELVs and best available technologies (BAT). Finally, the Parties adopted Decision 2009/4 to update guidance on BAT for controlling emissions of POPs in Annex V and turned parts of it into a guidance document (ECE/EB.AIR/2009/14). The amendments to annexes V and VII entered into force for most of the Parties on 13 December 2010. In line with article 14, paragraph 3, the entry into force of the amendments to the text of the Protocol and to its annexes I, II, III, IV, VI and VIII requires ratification of two thirds of the Parties. The amendments according to decisions 2009/1 (amending the text of and annexes I, II, III, IV, VI and VIII) and 2009/2 (amending annexes I and II) require separate ratifications. Those amendments have not yet entered into force.

### 6.1.3 Industrial Emissions Directive (2010/75/EU)

Directive 2010/75/EU of the European Parliament and the Council on industrial emissions (the Industrial Emissions Directive or IED) is the main EU instrument regulating pollutant emissions from industrial installations. The IED was adopted on 24 November 2010. It is based on a Commission proposal recasting 7 previously existing directives (including the IPPC Directive, the Waste Incineration Directive, the Large Combustion Plants Directive, the VOC Directive and the three $TiO_2$-Directives). The IED entered into force on 6 January 2011 and had to be transposed by Member States by 7 January 2013.

For detailed information on the IPPC Directive and the original Directives on Waste Incineration and Large Combustion Plants please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

The Directive on Industrial Emissions is based on several principles, namely an integrated approach, use of best available techniques, flexibility, inspections and public participation.

The **integrated approach** means that the permits must take into account the whole environmental performance of the plant, covering e.g. emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, and restoration of the site upon closure. The purpose of the Directive is to ensure a high level of protection of the environment taken as a whole.

The permit conditions including emission limit values must be based on the Best Available Techniques (BAT). In order to define BAT and the BAT-associated environmental performance at EU level, the Commission organises an exchange of information with experts from Member States, industry and environmental organisations. This work is co-ordinated by the European IPPC Bureau of the Institute for Prospective Technology Studies at the EU Joint Research

Centre in Seville (Spain). This process results in BAT Reference Documents (BREFs); the BAT conclusions contained are adopted by the Commission as Implementing Decisions. The IED requires that these BAT conclusions are the reference for setting permit conditions.

It must be noted that the types of installations listed in Annex I of the Industrial Emissions Directive do not directly correspond to the source categories of Annex C of the Stockholm Convention. Annex I of the IED gives a list of major industrial activities which may give cause to general environmental impacts, whereas Annex C of the Stockholm Convention lists source categories which have the potential to release POPs. Therefore the Stockholm Convention is more specific with regard to pollutants, covering also small scale sources (e.g. residential combustion plants, crematoria, open burning).

The BAT Reference Documents (BREFs) and the BAT conclusions give a detailed overview of what represents Best Available Techniques for the sectors in question together with emission and consumption levels.

*Table 64: Type of installations listed in Annex I of the IED.*

| Name of European BREF | Corresponding Source category of Stockholm Convention (annex C) | BAT associated emission level for PCDD/F | BAT associated emission level for PAH |
|---|---|---|---|
| Waste incineration | II a (Waste incinerators, …) | air: 0.01–0.1 ng TEQ/Nm$^3$ *) (split view 0.01–0.05)<br>water: 0.01–0.1 ng TEQ/l *) (split view <0.01) | |
| Cement, lime and magnesiumoxide | II b (Cement kilns …) | air: <0.05-0.1 ng/I-TEQ Nm$^3$ | |
| Non-Ferrous Metals | II d i (Sec. copper prod.)<br>II d iii (Sec. aluminium prod.)<br>II d iv (Sec. zinc prod.)<br>III b (Thermal processes in metallurgy …) | air: ≤ 0.1 ng I-TEQ/Nm$^3$ | air: BaP 0.001-0.01 mg/Nm$^3$ |
| Iron and Steel | II d ii (Sinter Plants)<br>III b (Thermal processes …) | air: <0.05 – 0.2 ng I-TEQ/Nm$^3$ (bag-filter);<br>air: <0.2 – 0.4 ng-I-TEQ/Nm$^3$ (advanced electrostatic precipitator**)<br>air: EAF: <0.1 ng I-TEQ/Nm$^3$ | |

** BREF is under review, values will change/might be changed*

*** where bag filters are not applicable*

No specific BREF is available for the source categories III a (Open burning of waste, including burning of landfill sites), III c (Residential combustion sources), III g (Crematoria), III h (Motor vehicles, particularly those burning leaded gasoline), III i (Destruction of animal carcasses), III k (Shredder plants for the treatment of end of life vehicles) and III l (Smouldering of copper cables). For Shredder plants a BREF will have to be written according to Annex I of the new Industrial Emission Directive (2010/75/EU). Shredder plants are included and handled in the review of the BREF waste treatment.

On the other hand the relevant BREFs for the source categories II c (Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching; BREF "Pulp and Paper"), III d (Fossil fuel-fired utility and industrial boilers; BREF LCP), III j (Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction); BREF "Textile Manufacturing") and III m (Waste oil refineries; BREF "Waste Treatment") do not define BAT associated emission levels for PCDD/F or PAH.

**Large Combustion Plants**

The Large Combustion Plants Directive (LCPD, 2001/80/EC) has been integrated in the Industrial Emissions Directive (2010/75/EC). It does not cover POP emission directly. However, it has some effect on emissions of POPs as it sets definition of emission limit values for dust. Some of these values have been made stricter in the IED.

**Waste Incineration Plants**

The WID has been integrated in the Industrial Emissions Directive (2010/75/EU). Annex VI of the IED lists special provisions for cement kilns, combustion plants and for industrial sectors co-incinerating waste. In comparison to the Waste Incineration Directive 2000/76/EC some of the POP relevant air emission limit values for dust have been made stricter. The emission limit values for dioxins and furans have remained the same (0.1 ng/$Nm^3$) as well as the emission limit values for discharges of waste water from the cleaning of exhaust gases.

### 6.1.4 Medium Combustion Plants Directive MCPD (2015/2193/EU)

The Direcitve on the limitation of emissons of certain pollutant into the air from medium combustrion plants (2015/2193/EU) was adopted on Nov. 5$^{th}$, 2015. The process of implementation into national law is currently under way by amending the ordinance on combustion plants.

The MCPD does not prescribe emission limit values regarding POPs. However effects may be achieved due to concentration limits for dust into the air.

### 6.1.5 Water Framework Directive

Article 16 of the Water Framework Directive (2000/60/EC) (WFD) sets out "Strategies against pollution of water". The first step was to establish by way of Decision 2455/2001/EC a first list of priority substances to become Annex X of the WFD. These substances were selected from amongst those presenting a significant risk to or via the aquatic environment, using the approaches outlined in Article 16 of the WFD.

This first list was replaced by Annex II of the Directive on Environmental Quality Standards (Directive 2008/105/EC) (EQSD), also known as the Priority Substances Directive, which set environmental quality standards (EQS) for the substances in surface waters (river, lake, transitional and coastal) and confirmed their designation as priority or priority hazardous substances, the latter being a subset of particular concern.

The list of priority hazardous substances (PHS) includes:

- hexachlorobenzene (PHS)
- polyaromatic hydrocarbons (all PHS) (benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene)
- pentachlorobenzene (PHS)

As required by the WFD and EQSD, the Commission subsequently reviewed the list and in 2013 the WFD and the EQSD were amended by Directive 2013/39/EU. The main features are:

- 12 additional priority substances or groups of substances, 4 of them designated as priority hazardous substances;
- stricter EQS for four existing priority substances and slightly revised EQS for three others;
- the designation of two existing priority substances as priority hazardous substances;
- the introduction of biota standards for several substances;
- provisions to improve the efficiency of monitoring and clarifying reporting requirements with regard to certain substances behaving as ubiquitous persistent, bioaccumulative and toxic (uPBT) substances;
- a provision for a watch-list mechanism designed to allow targeted EU-wide monitoring of substances of possible concern to support the prioritisation process in future reviews of the priority substances list.

The environmental quality standards for hexachlorobenzene, pentachlorobenzen and PAH as defined in Annex I of Directive 2008/105/EC in the version of Directive 2013/39/EU are summarised in the two tables below:

*Table 65: Environmental quality standards (EQS) as defined in Annex I of directive 2008/105/EC.*

| Pollutant | AA-EQS* Inland surface waters | AA-EQS* Other surface waters | MAC-EQS** Inland surface waters | MAC-EQS** Other surface waters | UQN Biota |
|---|---|---|---|---|---|
| Hexachlorobenzene | - | - | 0.05 µg/l | 0.05 µg/l | 10 µg/kg |
| Pentachlorobenzene | 0.007 µg/l | 0.007 µg/l | Not applicable | Not applicable | - |
| Polyaromatic hydrocarbons (PAH) | | | | | |
| Benzo(a)pyrene | 0.05 µg/l | 0.05 µg/l | 0.1 µg/l | 0.1 µg/l | 5 µg/kg |
| Benzo(b)fluoranthene Benzo(k)fluoranthene | Σ=0.03 µg/l | Σ=0.03 µg/l | Not applicable | Not applicable | - |
| Benzo(g,h,i)perylene Indeno(1,2,3-cd)-pyrene | Σ=0.002 µg/l | Σ=0.002 µg/l | Not applicable | Not applicable | - |

* *AA-EQS … Annual average value for the EQS*

** *MAC-EQS … maximum allowable concentration*

*Table 66: Environmental quality standards (EQS) as proposed in Annex I of directive 2013/39/EU.*

| Pollutant | AA-EQS* Inland surface waters | AA-EQS* Other surface waters | MAC-EQS** Inland surface waters | MAC-EQS** Other surface waters | UQN Biota |
|---|---|---|---|---|---|
| Hexachlorobenzene | - | - | 0.05 µg/l | 0.05 µg/l | 10 µg/kg |
| Pentachlorobenzene | 0.007 µg/l | 0.007 µg/l | not applicable | not applicable | - |
| Polyaromatic hydrocarbons (PAH) | | | | | |
| Benzo(a)pyrene | $1.7*10^{-4}$ µg/l | $1.7*10^{-4}$ µg/l | 0.27 µg/l | 0.027 µg/l | 5 µg/kg |
| Benzo(b)fluoranthene | - | - | 0.017 µg/l | 0.017 µg/l | - |
| Benzo(k)fluoranthene | - | - | 0.017 µg/l | 0.017 µg/l | - |
| Benzo(g,h,i)perylene | - | - | $8.2*10^{-3}$ | $8.2*10^{-4}$ | - |
| Indeno(1,2,3-cd)-pyrene | - | - | - | - | - |

** AA-EQS … Annual average value for the EQS*

*** MAC-EQS … maximum allowable concentration*

### 6.1.6 Air Quality Directive

The **Clean Air For Europe (CAFE) Directive** (2008/50/EC) was published in May 2008.

It does not address POPs directly but might be of relevance as it covers pollutants associated with combustion processes.

The **4th Daughter Directive 2004/107/EC** deals with arsenic, nickel, cadmium, mercury and PAHs[19]. It specifies limit or target values together with deadlines for meeting these values. In addition obligations are laid down for monitoring these pollutants in ambient air.

POPs are not addressed directly with the exception of PAH. However, as unintentionally produced POPs are mostly formed during combustion processes and emitted into air either in gaseous form or bound to particles, every measure aiming at the reduction of emissions of particulate matter, metals and CO has the co-benefit of reducing POPs emissions. For benzo(a)pyrene a target value of 1 ng/m³ has been laid down in the 4th Daughter Directive. From 2013 onwards this target value shall not be exceeded. Member States shall take all necessary measures not entailing disproportionate costs to ensure this.

### 6.1.7 Pollutant Release and Transfer Register (PRTR)

Regulation No. 166/2006/EC of the European Parliament and of the Council of 18 January 2006 provided for the setting up of a Pollutant Release and Transfer Register (PRTR) at European Union (EU) level in the form of a publicly accessible electronic database. This database meets the requirements of the UNECE Protocol on Pollutant Release and Transfer Registers, signed by the Community in May 2003.

[19] Environmental targets were defined for Ni, As, Cd and benzo(a)pyrene.

The public is able to access this register free of charge on the internet and is able to find information using various search criteria (type of pollutant, geographical location, affected environment, source facility, etc.).

The register contains information on releases of pollutants to air, water and land, as well as transfers of waste and pollutants, where emissions exceed certain threshold values and result from specific activities. The register also covers releases of pollutants from diffuse sources (such as transport). Apart from their releases of pollutants to air, water, land and wastewater destined for treatment in external wastewater treatment plants, industrial facilities subject to the IED regime have to report their transfers of waste if they exceed annual threshold levels as laid down in the Regulation. Reporting obligations include also PeCB (BIPRO 2011).

### 6.1.8 Waste Framework Directive

At EU level, the basic legislation with respect to waste management is the Waste Framework Directive 2008/98/EC (replacing and repealing the former Waste Framework Directive 2006/12/EC with effect of 12 December 2010).

The Directive contains definitions for waste as well as waste categories and disposal and recovery operations; inter alia it sets criteria for end-of-waste-status of items and introduces “reuse” as favorable option within the waste hierarchy.

Furthermore properties and characteristics rendering waste hazardous as well as specific obligations for hazardous wastes are introduced in the new Waste Framework Directive.

### 6.1.9 Other relevant EU legislation

The following EU Directives or Regulations are potentially relevant for the control of POPs releases:

- Directive of the European Parliament and of the Council on the Protection of Groundwater against Pollution and Deterioration (2006/118/EG)
- Sewage sludge Directive (86/278/EEC)
- Directives concerning Motor Vehicles
- Directive on Waste Electrical and Electronic Equipment (WEEE) (2012/19/EU)
- Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast) (2011/65/EU)
- Directive on the landfill of waste (1999/31/EG)
- Council Regulation (EC) No 1013/2006 on the supervision and control of shipments of waste within, into and out of the Community

For detailed information please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

## 6.2 Developments in National Legislation since 2012

The following legislation has not undergone changes with regard to emissions of POPs. Therefore, for detailed information refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

- Industrial Code 1994 (GewO 1994), BGBl. No. 1994/194 as amended
- Ordinance on Non Ferrous and Refractory Metals Production (BGBl. II No. 2008/39)

### 6.2.1 Specific Ordinances

#### 6.2.1.1 Emission Protection Act for Steam Boilers 2013 (Fed. Law Gaz. I No. 127/2013 as amended by BGBl. I No. 81/2015)

The Emission Protection Act applies to steam boilers as well as gasturbines and gas engines with a rated thermal input of > 50 MW. It gives the legal environmental framework for operating such plants in the energy and industry sector and prescribes emission limit values for a variety of pollutants depending on the fuels used for plants with a rated thermal input of > 50 MW. For plants smaller than 50 MW rated thermals input the former Clean Air Ordinance for Steam Boilers, which expired on Dec. 31st 2013, should be used as reference for setting emission limit vales. Emissions of PCDD/F are not regulated directly. However, both documents have some effect on emissions of POPs due to the definition of emission limit values for dust, CO, $C_{org}$ and NOx.

#### 6.2.1.2 Ordinance on Combustion Plants (BGBl. No. II 1997/331 as amended by BGBl. No. II 2011/312)

The Ordinance applies to combustion installations >50 kW in the trade and industrial sector that are not connected to a steam boiler. It describes requirements concerning the monitoring of emissions, operating conditions, inspections of installations and emission limit values for certain pollutants depending on the fuels (such as coal, biomass, oil, and gas) used. Emissions of PCDD/F are not regulated directly. However, the ordinance has some effect on emissions of POPs due to the determinationof emission limit values for dust and CO regarding the combustion of gas, oil and coal. In addition to the mentioned pollutants, there is a limit value for organic carbon which applies to the combustion of biomass.

The amendment in 2011 led to some modifications: The emission limit values for dust became more stringent and the ordinance provides for the first time emission limit values for dust, CO, HC, and $NO_x$ for the combustion of biomass other than wood (such as straw or miscanthus).

#### 6.2.1.3 Ordinance on Iron and Steel Production (BGBl. II No. 54/2016)

This ordinance replaces the former ordinance on Iron and steel production (BGBl. II No. 160/1997 as amended by BGBl. II No. 2007/290. The ordinance covers air emissions from the production of iron and steel in integrated steelworks (without coke oven and sinter plants) and by electric arc furnaces (EAF) and the processing of iron/steel. For PCDD/F the following emission limit values are set:

- installations for the production of iron and steel, where the formation of PCDD/F can be expected, because of the input materials used: 0.1 ng/Nm$^3$
- installations for the production of steel in electric arc furnaces, induction furnaces and ladle furnaces: 0.1 ng/Nm$^3$.

#### 6.2.1.4 Ordinance on Sinter Plants (BGBl. II No. 1997/163)

The ordinance covered air emissions from sinter plants. For PCDD/F a limit value (0.4 ng/Nm$^3$) was set (referred to measured oxygen content), however this limit value was not applicable for installations, which were permitted before 01/2004. The ordinance has been repealed in 2014 (BGBl. II No. 303/2014). For sinter plants the BAT conclusions for iron and steel (EUROPEAN COMMISSION 2012) have to be applied. The BAT-AEL for PCDD/F from sinter plants using fabric filters is <0.005-0.2 ng/Nm$^3$, for sinter plants using high advanced electrostatic precipitators it is <0.2-0.4 ng/Nm$^3$.

#### 6.2.1.5 Ordinance on Foundries (BGBl. II No. 264/2014)

The ordinance gives limit values (mass flow and/ or concentration) for dust and organic substances for different furnace types (steel and cast iron, aluminium, lead, other metals, heat treatment). Limit values are also given for these pollutants for activities such as sand regeneration, mould production, cleaning and fettling and core production. Some general limit values are given for special organic substances and heavy metals.There is no general reference oxygen content, in most cases the oxygen content of the exhaust gas is chosen as reference value.

#### 6.2.1.6 Waste Incineration Ordinance (BGBl. II No. 389/2002 as amended BGBl. II No. 476/2010, 135/2013 and BGBl. I No. 127/2013)

The Waste Incineration Ordinance requires waste incineration and co-incineration plants (such as large combustion plants, cement kilns and industrial boilers) to be built and operated according to Best Available Techniques (= State of the Art). It defines among others operational requirements (such as the minimum temperature for combustion and the residence time of flue gas within a given temperature level), requirements for input control of waste, monitoring and reporting obligations and prescribes emission limit values for a variety of pollutants including PCDD/F. In general the ELV for PCDD/F for incineration and co-incineration plants is 0.1 ng/Nm$^3$ (11% oxygen).

Due to the limitation of emissions of dust, CO and $C_{org}$ (and to a certain extent of $NO_x$) the Waste Incineration Ordinance also has an indirect influence on the reduction of POP emissions.

Concerning PCDD/F concentrations in wastes from waste incineration or co-incineration plants the Ordinance provides for the environmentally sound disposal where the total content exceeds a limit value of 100 ng/kg PCDD (I-TEQ).

Wastes which are incinerated in co-incineration plants have to reach the limit values specified in Annex 8, for waste oils and solvents the limit value for PCB is 10 mg/kg.

#### 6.2.1.7 Implementation of MCPD

The process of implementation into national law is currently under way by amending the ordinance on combustion plants.

### 6.2.2 Austrian Water Act and Specific Ordinances

The basic document for water-related legislation is the Water Act 1959 (BGBl. No. 215/1959).

For an overview of the Austrian Water Act and its relevant ordinances please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

New developments:

Based on the requirement to define environmental quality standards (EQS) codified in §30(a) of the Austrian Water Act the Ordinance on the determination of the target state for surface waters (BGBl. No. 96/2006) prescribes environmental quality standards for 72 substances and groups of substances. These EQS determine the criteria for the good chemical status of surface waters and the chemical parameters for the good biological status. Also POPs and POP like substances are included, e.g. hexachlorobenzene, DDT, aldrin, dieldrin, endrin, heptachlor, etc. In 2010 the Ordinance was amended and the environmental quality standards according to Directive 2008/105/EC were adopted (BGBl. II No. 461/2010).

In order to continuously assess, to monitor and to adapt monitoring programmes to actual necessities the Ordinance on the monitoring of the status of water bodies (BGBl. II No. 479/2006, amended 2010 by BGBl. II No. 465/2010) (originally issued in 1991) was amended in 2006 and 2010. The aim of the monitoring programme is to assess the status of water bodies. The parameters to be considered by the monitoring programme include all pollutants for which EQS have been defined (e.g. POPs and POP like substances such as HCB, PAH, etc.). Beside surface waters, these pollutants also have to be analysed in lake samples and groundwater samples.

In 2010, the Ordinance on Chemical Quality Targets for Groundwater (“Qualitätszielverordnung Chemie Grundwasser” – Austrian Federal Law Gazette II No 98/2010) replaced the former Ordinance on groundwater threshold values. The Ordinance now fully implements the legal requirements of the new EU Groundwater Daughter Directive (2006/118/EC).

Among other things, it lays down the criteria (groundwater threshold values) and the methodology (compliance regime) for assessing the chemical status of groundwater bodies thus providing a basis for establishing necessary measures.

The ordinance gives individual threshold values for a limited number of POPs only (e.g. sum of PAHs, sum of TRI and PER, Aldrin, Dieldrin etc.) and a general groundwater threshold value for pesticides (0.1 µg/l) and the sum of pesticides (0.5 µg/l).

Furthermore, POPs are also mentioned in Annex 2 which lists those substances where direct input into groundwater has to be prevented according to Article 6.

The Ordinance on the establishment of an electronic register for the collection of relevant discharges from point sources into surface water (BGBl. II Nr. 29/2009) entered into force in 2009. The Ordinance requires industrial dischargers as well as municipal wastewater treatment plants with a capacity of more than 10,000 population equivalents to report emissions of relevant pollutants into register. For example, discharges of Pentachlorobenzene have to be measured and reported. Such discharges are attributed to the following industrial activities (classification according to E-PRTR Regulation Annex I):

- 4d, Chemical installations for the production on an industrial scale of basic plant health products and biocides
- 5a, Installations for the recovery or disposal of hazardous waste
- 5c, Installations for the disposal of non-hazardous waste
- 5d, Landfills
- 5g, independently operated industrial waste-water treatment plants
- 6b, Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)

A first evaluation of data in 2011 showed, that concentrations in industrial effluent discharges aldrin, benzo(a)pyren, polybrominated diphenylether, chlordan, chlordecon, dieldrin, endrine heptachlor and mirex are below the respective limit of detection. For benzo(g,h,i)perylen, dioxine, fluoranthen, hexachlorcyclohexane including lindane, PCB, pentachlorbenzene and toxaphen quantifiable concentrations were found in a number of waste water discharges. A more detailed analysis of these results is not possible for the time being as tools for data retrieval and assessment are still being developed.

For more information on the General Ordinance on Waste Water Emissions (BGBl. No. 186/1996) and on relevant sector specific waste water emission ordinances (e.g. ordinance on waste water emissions from flue gas treatment (BGBl. II No. 271/2003) please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

### 6.2.3 Ordinance on Landfills (BGBl. II No. 39/2008)

(Amended by BGBl. II No. 185/2009, 178/2010, 455/2011 and 104/2014)

According to the Ordinance on landfills only the disposal of waste with the lowest possible reactivity has been permitted since 2004 (or, in exceptional cases, since 1 January 2009). A large part of waste materials, among them municipal solid waste, must therefore undergo thermal and mechanical-biological pretreatment before being landfilled.

The Landfill Ordinance 2008 implements the EU Directive 1999/31/EG and Council Decision 2003/33/EG.

It determines the following classes of landfills:

1. Landfill for excavated soils
2. Landfill for inert waste
3. Landfill for non hazardous waste
   a) Landfill for demolition waste
   b) Landfill for residual materials
   c) Mass waste landfill
4. Landfill for hazardous waste (exclusively underground waste storage)

Annex 1 of the Landfill Ordinance 2008 gives limit values for the acceptance of different waste streams of landfills.The POP relevant limit valuesforthe landfill classes are listed below. PAHs are defined as the sum of 16 substances according to EPA (naphthalene; acenaphthylene; acenaphthene; fluorene; phenanthrene; anthracene; fluoranthene; pyrene; benzo(a)anthracene; chrysene; benzo-(b)fluoranthene; benzo(k)fluoranthene; benzo(a)pyrene; dibenzo(a,h)anthraxcene; indeno(1,2,3-c,d)pyrene; benzo(g,h,i)perylene).

*Table 67: Landfill classes and limit values according to Annex 1 of the Landfill Ordinance 2008*

| Landfill class | Pollutants, POP relevant | Limit value [mg/kg dry matter] |
|---|---|---|
| Landfill for excavated soils | PAH | 4 |
| | thereof benzo(a)pyrene | 0,4 |
| Landfill for inert waste | PAH | 20 |
| | thereof benzo(a)pyrene | 2 |
| Landfill for demolition waste | PAH | 30 |
| Landfill for residual materials | PAH | 300 |
| Landfill for mass waste | PAH | 300 |

For detailed information on the Compost Ordinance (BGBl. II No. 2001/292), on Ordinances on Sewage Sludge and Compost and on the protection of soil of the Federal Provinces please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

### 6.2.4 Ambient Air Quality Act (Immissionschutzgesetz – Luft, IG-L)

The legal regulations for air quality assessment and management in Austria are stipulated in Ambient Air Quality Act (IG-L; BGBl. I No. 115/1997, as amended, implementing the Air Quality Directive, Directive 2008/50/EC on ambient air quality and cleaner air for Europe and the 4$^{th}$ Daughter Directive, Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air) and its ordinances. In the case of exceedances of air quality limit values abatement measures have to be applied. Like the Air Quality Directive and the 4$^{th}$ Daughter Directive, the Ambient Air Quality Act does not cover POPs directly, with the exception of benzo(a)pyrene for which a target value (1 ng/m$^3$) is given (this target value is a limit value since 2013 in Austria). However, as unintentionally produced POPs are mostly due to combustion processes, this type of POPs is strongly related to gaseous and particle pollutants for which abatement measures have to be applied in case of exceedances. For benzo(a)pyrene obligations for monitoring are laid down in an ordinance related to the IG-L. In 2015 30 sites were operated.

### 6.2.5 Air quality plans under Air Quality Directive

In case of an exceedance of an air quality limit value or target value, plus any relevant margin of tolerance for one or more pollutants, Member States shall ensure that a plan is prepared or implemented for attaining the limit value within the specific time limit (Air Quality Directive, Article 23 (1)). In case the attainment deadline is already expired, the exceedance period has to be kept as short as possible. Plans have to be sent to the European Commission no later than two years following the year the exceedance has been observed.

Most air quality plans reported so far to the Commission deal with $PM_{10}$ and $NO_2$, some also with $SO_2$. In most cases, traffic was identified as the main source for $PM_{10}$ and $NO_2$ exceedances, followed by industry, commercial and residential sources. The abatement measures foreseen in the plans therefore also deal with these polluters.

### 6.2.6 Residential Combustion Sources

The responsibility for regulating the operation of residential combustion sources lies with the federal provinces. As a consequence requirements concerning product certificates, emission limit values, monitoring of emissions and inspections slightly vary.

An agreement pursuant to Article 15a of the Federal Constitution Act concerning the placing on the market and the inspection of combustion plants/firing installations was concluded in January 2011.

It establishes uniform minimum requirements for the operation of these types of installations in all provinces and will help to reduce environmental impacts from these sources. The agreement includes requirements concerning

- placing on the market
- type tests, conformity tests and labelling
- emission limit values for dust, $NO_x$, CO and TOC
- inspection of combustion installations
- efficiency requirements
- requirements on permitted fuels
- refurbishment
- advisory service

Another relevant agreement (agreement pursuant to Article 15a of the Federal Constitution concerning the setting of consolidated quality standards to support the establishment and refurbishment of residential buildings for the purpose of the reduction of greenhouse gases) aims to reduce energy consumption in residential buildings. It is thus intended to reduce fuel consumption and emissions from combustion installations in this source category.

### 6.2.7 Open burning of biogenic materials

The Federal Act on Air Pollution Prevention (BGBl. I No. 137/2002, as amended BGBl. I No. 50/2012 and 97/2013) imposes a ban on open burning of biomass and other materials. The provincial governor may grant exemptions from this ban in specific cases.

## 6.3 Other measures

### 6.3.1 Waste as Alternative Feedstock in Installations for Cement Production

Concerning POP emissions which arise from waste used in cement kilns not as alternative fuel, but as alternative feedstock, the Austrian Federal Ministry of Agriculture and Forestry, Environment and Water Management drew up a document concerning the "Technical Basis for the Use of Waste as Alternative Feedstock in Installations for Cement Production" (BMLFUW 2016b). It was compiled with inputs of the competent authorities and the Environment Agency Austria. The document provides recommendations for the permit conditions for the competent authorities, regarding technical conditions for the kiln and prior outgassing experiments with the waste, and includes references to the POP Regulation (EC) No 850/2004. The suggested provisions have similarity to the Swiss Ordinance on the Prevention and Disposal of Waste (VVEA) from 2016 and are along the lines of the Austrian ordinance AVV which regulates the use of waste as alternative fuel.

### 6.3.2 Paper, paper board and packaging paper

The German Federal Institute for Risk Assessment has published recommendations concerning input, used auxiliary materials, filling agents and additives for paper, paper boards and packaging papers which get in contact with food (BfR-Recommendation No. XXXVI, No. XXXVI/1 and No. XXXVI/2). These recommendations comprise a list of materials which can be used for the described purposes, in line with upper concentration limits for a wide range of chemicals. However, Annex C POPs are not regulated here.

### 6.3.3 Biomass plants serving the purpose of centralised district heating

Biomass plants serving the purpose of centralised district heating are funded by environmental support schemes when certain requirements with regard to energy efficiency, operating conditions, emissions and reporting of emissions are fulfilled. Plants subject to this funding scheme have to meet ELVs for dust, $NO_x$, CO and $C_{org}$ depending on their size. However, since most ELVs are the same as prescribed in e.g. the Ordinance on combustion installations any additional effect on reduction of POPs emissions is caused by requirements concerning energy efficiency.

## 6.4 Overview on Monitoring activities and Surveys on federal level since 2012

### 6.4.1 Ambient Air Monitoring

As described in chapter 6.2.4 benzo(a)pyrene in $PM_{10}$ is required at 30 monitoring sites at least. At several sites in Upper Austria and Styria and the rural background site Illmitz in addition to benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene and dibenz(a,h)anthracene as well as the deposition of benzo(a)pyrene are monitored. Results of all monitoring activities are published in an annual air quality report (see e.g. UMWELTBUNDESAMT 2016, d). Mobile stations are operated by the government of Styria at varying locations[20]. The target value of the 4th Daughter Directive of 1 ng/m³ for benzo(a)pyrene which 2013 has become a limit value was exceeded in recent years at various locations in valleys and basins south of the main Alpine ridge and in the hilly region south-east of the Alps. The reasons for these exceedances are high emissions from wood burning in domestic combustion, in combination with adverse dispersion conditions in winter due to the topographic and climatic situation (UMWELTBUNDESAMT 2014b, 2016e, 2017a).

B(a)P comprises about 65 to 75% of the total TEF weighted PAH sum.

The few available long-term monitoring series of B(a)P show a slowly decreasing trend with high inter-annual variations. The trend does not correspond to $PM_{10}$ concentrations and to winter temperatures.

Atmospheric dispersion modelling of B(a)P for Styria shows a highly variable concentration pattern with levels above the limit value in many villages and towns (UMWELTBUNDESAMT 2016e). Overall about 700,000 people are living in areas in Styria where the limit value was exceeded in 2015, and about 6,000 in Carinthia.

In 1997 a monitoring programme started with the objective to observe long term trends of PCDD/F and additionally PCB in the air. The monitoring programme comprised eight sampling sites representing urban, rural, industrial and remote locations. (MOCHE & THANNER 2002).

Datasets of 1992/93 compared with those of the monitoring programme showed a slight decrease of PCDD/F in the air during winter, whereas the summer levels are almost equal. The monitoring programme shows that there is still a clear seasonal trend for ambient air concentrations of PCDD/F with a maximum during the winter season. PCDD/F-data compared with ambient temperatures clearly indicates that domestic heating is the major source for increasing dioxin levels in ambient air during winter. Also PCBs show a seasonal trend, but contrary to PCDD/F the PCBs show highest concentrations during the summer season. This observation indicates different sources for PCB in ambient air than for PCDD/F. Since the start of the monitoring programme no significant change, neither increase nor decline of the annual PCDD/F and PCB levels in ambient air could be observed. The last monitoring cycle has been completed in 2010.

[20] http://www.umwelt.steiermark.at/cms/ziel/19221975/DE/

Since 2005 and with the international project MONARPOP (see 6.4.6) the concentrations of all POPs of the Stockholm Convention and the POPs Protocol and of some emerging POPs in ambient air and deposition at three Alpine summits (in Austria: Sonnblick, in Germany: Zugspitze, in Switzerland: Weißfluhjoch) have been monitored (OFFENTHALER et al. 2008). Air sampling is carried out continuously throughout the year (in subsequent three-months sampling periods) but separately according to source regions of the arriving air masses. Sampling is distributed between separate filters assigned to one of four source regions. Filters are switched according to daily trajectory forecasts.The selected source regions (possibly important for the Alps) are

1. the industrial regions of Germany, Great Britain, Belgium, The Netherlands in the Northwest of the Alps,
2. the industrial region of Czech Republic, Slovakia and Poland in the North East of the Alps,
3. the industrial region of the Po basin in Italy and
4. the remaining source regions.

With its ambient air monitoring activities for POPs at remote sites, MONARPOP has been included in the "Global Monitoring Plan" for the "Effectiveness Evaluation" of the "Stockholm Convention". The results of the air measurements at remote summits were included in the 1st and 2nd Global Monitoring Report under the UN Stockholm Convention (UNEP 2009, 2015).

The detected active air concentrations of POPs at the Alpine summits document well that an air transport of these compounds exists across the Alps – even though it is reduced according to the enhanced deposition of POPs at the peripheral parts. All SOCs (OCPs, PCDD/F, PCB, PBDE, PAH), and even compounds that have been banned in Europe for decades (e.g. DDT) or have not even been used in significant amounts in Central Europe (e.g. mirex), have been detected in air and deposition indicating their steady deposition at the remote summits by atmospheric transport.

Air concentrations at the summits were similar or slightly higher to Arctic values (compiled in UNEP 2009, 2015), but clearly lower than in source regions (UMWELTBUNDESAMT 2015, KIRCHNER et al. 2016). For PCB and DDT the means are higher in the Alps than at sites of the northern latitudes. Air concentrations of OCPs at these summit stations were definitely lower than those from source regions, but higher than in the Arctic region. The PCDD/F air concentrations at the three summits in the European Alps are similar to those of remote sites in the USA as measured by the NDAMN monitoring program and one to two orders of magnitude lower than in conurbations. The PCB concentrations are about one order of magnitude lower than in conurbations. The PCB air concentrations from the western site (Weissfluhjoch, CH) are higher than those of to the most eastern site (Sonnblick, A), a result that is confirmed by the regional distribution of PCB concentrations in the forest soil and needles of the numerous MONARPOP sites.

However, deposition of PCDD/F and PCB at the summits reaches magnitudes as reported for sites close to sources. This result gives evidence for the significant input of POPs in the Alps region. The deposition of compounds gives a better indication for the pollutant input to vegetation and soil, and should deserve more attention than the air concentration.

With very few exceptions (see below) no significant trend in the air concentrations and deposition of POPs could be assessed at the three summits (UMWELTBUNDESAMT 2015, Kirchner et al. 2016). Only some of the studied pesticides showed a significant trend of air concentration decrease at all, one or two of the three sites: Endosulfan at all three sites, heptachlor at Sonnblick, α-HCH at Weissfluhjoch, PeCB and trans-chlordane at Zugspitze (KIRCHNER et al. 2016).

A seasonal trend with higher OCP air concentrations and deposition in summer and lower ones in winter could be detected for some compounds (JAKOBI et al. 2014, KIRCHNER et al. 2016). For PCDD/F and PCB such trend did not occur (UMWELTBUNDESAMT 2015).

For only very few compounds higher POP air concentrations could be detected at the Alpine sites in correlation with the source region of the air masses, namely for air masses originating from the North-East-European source region. However, air masses from this source region are significantly lower (about half as) frequent at the summits than air masses originating from the other studied source regions (UMWELTBUNDESAMT 2015, KIRCHNER et al. 2016). Consequently, air masses from the North-East-European source region are not responsible for higher POP loads in the Alps.

In 2010 to 2013 RECETOX (Masaryk University, Brno) and the Environment Agency Austria carried out the EU-funded MONAIRNET project at 20 sites of the Austrian/Czech border region (http://www.monairnet.eu/index-de.php). The project used the same monitoring methods as in MONARPOP (active and passive air sampling, deposition sampling, needle sampling). The project should allow for a cross border comparison of the POPs load of this region with different emission history. The two rural active air monitoring sites of MONAIRNET (Grünbach in Northern Austria and the EMEP site Košetice in the Czech Republic) showed significant higher air concentrations for PCDD/F, DDX (only Košetice), similar air concentrations for PCB, HCB, lindane, DDX (only Grünbach) and lower air concentrations for PBDE than the average from the three MONARPOP summit sites in the Alps. The southern Czech region showed significant higher air concentrations of DDX (particular the Eastern Czech sites) than the Northern Austrian study region, while the northern Austrian region showed significant higher pentachlorobenzene (particularly in Upper Austria), PCB and lindane air concentrations than the southern Czech study region of MONAIRNET. The results for deposition partly deviate from the results for the air concentration: Deposition of PCB and sum HCH were higher at the southern Czech sites than at the Northern Austrian sites. For PCDD/F the regional differences were also not so clear and depended on the studied medium. Seasonal differences were detected: The highest air concentrations and depositions of most OCPs and of perfluorinated compounds (PFxC) were detected in summer. Regarding deposition, even PCDD/F and PCB showed the higher input in the warmer periods than in winter. Some source regions of the air masses were frequently correlated with higher POPs air concentrations detected at the MONAIRNET sites (near range N region for Grünbach, near range S/SE/SW region and long range NE/E/SE region for Košetice). However, similar to the Alpine sites the source regions with higher concentrations were not the predominant source regions for the arriving air masses (but the long range SW/W/NW region for both sites). Therefore, sources responsible for the POP concentrations of the air masses originating from this most frequent source region may have a higher impact on the POPs load of the studied MONAIRNET sites.

2017 a new project called “PureAlps”[21] has been started. PureAlps is designed to protect the Alps from persistent chemicals which have a potential for accumulation in organisms and which are toxic. It is funded by the Bavarian State Ministry of Environment and Consumer Protection and by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management.

This follow up project from MONARPOP uses measurement devices at the highest research sites in Germany (Mount Zugspitze) and Austria (Hoher Sonnblick).

Substances which are focus of PureAlps are:

Mercury, Per- and polyfluorinated chemicals (PFC), brominated flame retardants such as HBCD (Hexabromocyclododecane) and PBDEs (Polybrominated diphenyl ethers). Additionally PureAlps extends the time series for atmospheric concentrations and deposition of dioxins and furans, PCB and organochloropesticides (OCP).

### 6.4.2 Emissions Monitoring

For monitoring measures undertaken in previous years please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

### 6.4.3 Food and feed monitoring

The Austrian Agency for Health and Food Safety, competent authority for food safety and control, carries out a food monitoring programme once a year. Samples are collected from all nine provinces of Austria covering all components of average Austrian diet.

In order to evaluate the contamination levels in various food products on the Austrian market and to assess the dietary exposure of the Austrian population for the first time, a national monitoring programme was conducted from 2005 to 2011. The 235 food products comprised meat, poultry, game and offal, fish and fish products, milk and dairy products, eggs, animal fats and vegetable oils. Lowerbound and upperbound concentrations of PCCD/F and DL-PCBs (in WHO TEQ pg/g fat or fresh weight) were e.g. 0.79-1.16 in meat, poultry, game and offal; 0.96-1.33 in ruminants; 3.86-4.39 in livers from terrestrial animals, 0.49-0.51 in fish and fish products, 0.73-1.20 in milk and 0.81-1.15 in cheese. To estimate the dietary intakes of PCDD/Fs and dl-PCBs, mean concentrations in food were combined with the respective food consumption data from the Austrian food consumption survey. Estimated dietary intakes were expressed as toxic equivalents (WHO-TEQs 1998). The mean intakes for PCDD/Fs and dl-PCBs were estimated as 0.77, 0.75 and 0.61 pg WHO-TEQ/kg bw day for children, women and men, respectively. The main contributors to total intake were milk and dairy products followed by fish and fish products for children and women, and meat, poultry, game and offal for men (65% and 15% for children, 67% and 14% for women, and 63% and 19% for men, respectively). (Rauscher Gabernig et al. 2013).

[21] https://www.lfu.bayern.de/analytik_stoffe/purealps/english/index.htm

Feed and food monitoring for PCDD/F and dioxinlike-PCBs is an ongoing process undertaken with the aim to comply with obligations arising from EC- and national legislation.

**HCB**

Within accidentially contaminated area in Austria a total of 771 samples of food originating from the area were analysed for HCB. HCB was frequently quantified in foods of animal origin. Especially in high-fat containing food groups such as fats, oils and butter, meat, processed meat, milk and milk products measurable HCB concentrations were found. The highest content was found in beef with a maximum of 625 µg/kg. But also plants such as pumpkins in the oil-rich pumpkin seeds and various herbs with large leaf surface, e.g. peppermint and thyme, may accumulate HCB. In vegetable oils the highest detected concentration was 111 µg/kg (Mihats et al. 2016).

**Other POPs**

Dietary exposure to non-dioxin-like PCBs of different population groups in Austria has been assessed (Mithats et al. 2015) as well as to PFOS and PFOA (Mihats et al. 2014).

### 6.4.4 Water Monitoring

#### 6.4.4.1 Surface water bodies

All large surface water bodies are tested for pollutants – including POPs. Analyses are carried out mostly in water but also biota samples are investigated. The monitoring programmes are constantly updated and focus increasingly on the substances (substances, that describe the ecological and chemical status of the water bodies) listed in the Water Framework Directive and in the respective national implementation (e.g. *Ordinance on the determination of the target state for surface waters, BGBl. II No. 2006/96*). The list of priority substances (Annex X of WFD – chemical status) and the Directive on environmental quality standards (2008/105/EC; 2013/39/EU) include a number of POPs and other chemicals with POP-like properties. POPs and POP-like substances must be taken into consideration in evaluating the chemical and the ecological status of a specific water body.

Monitoring is predominantly based on the *Ordinance on the monitoring of the status of water bodies (BGBl. II No. 2006/479).* In addition to the regular monitoring activities on large surface water bodies, several operative programmes were performed on behalf of the Austrian Federal Ministry of Agriculture and Forestry, Environment and Water Management in the course of the analysis of the current status in line with Art. 5 of the WFD. These monitoring programmes are pressure specific and include pollutants such as hexachlorobenzene and PAH, as well as DDT, aldrin, dieldrin endrin, heptachlor and others.

Concentrations of pollutants in surface water bodies – including a number of substances of the Stockholm Convention – are measured in Austria in the context of various obligations and monitoring programmes and are available to the public on the Internet (http://wisa.lebensministerium.at). The monitoring results for PCDD/PCDF, hexachlorobenzene (HCB), polychlorinated biphenyles (PCBs), pentachlorobenzene (PeCB) as well as for polycyclic hydrocarbons (ben-

zo(a)pyren B(a)P, benzo(b)fluoranthen B(b)F, benzo(k)fluoranthen (B(k)F, benzo(g,h,i)perylen (BP), indeno(1,2,3-c,d)pyren IP) are summarized in the following table:

*Table 68: Summary of the monitoring results for surface waters for hexachlorobenzene (HCB), PAHs and pentachlorobenzene (PeCB).*

| | **2000** | | | **2003** | | | **2013** | | |
|---|---|---|---|---|---|---|---|---|---|
| | n | n>LOQ | max [µg/l] | n | n>LOQ | max [µg/l] | n | n>LOQ | max [µg/l] |
| HCB | 68 | 0 | - | 341 | 0 | - | - | - | - |
| PeCB | 97 | 0 | - | 341 | 0 | - | - | - | - |
| B(a)P | 133 | 4 | 0.009 | 356 | 127 | 0.019 | 304 | 26 | 0,023 |
| B(b)F | 133 | 5 | 0.01 | 356 | 57 | 0.019 | 304 | 10 | 0,0083 |
| B(k)F | 133 | 3 | 0.006 | 356 | 14 | 0.012 | 304 | 5 | 0,0048 |
| BP | 133 | 2 | 0.005 | 356 | 45 | 0.014 | 304 | 22 | 0,0088 |
| IP | 133 | 1 | 0.001 | 356 | 48 | 0.016 | 304 | 12 | 0,0098 |

Additionally to the monitoring in water also biota samples are investigated. Due to the EQS directive (2008/105/EC and 2013/39/EU) defined substances have to be monitored in biota for compliance assessment and for trend analysis. Biota analyses were performed in the years 2008 (BMLFUW 2010), 2010 (BMLFUW 2012) and 2013 (BMLFUW 2015b) considering single fish samples as well as pooled fish samples. These fish investigations include a variety of substances as organochlorine compounds (e.g. HCB, HCH, DDT and others), polybrominated compounds (PBDE), fluorinated compounds (PFOS and PFOA) and others. The results for hexachlorobenzene, pentachlorobenzene as well as for dioxins, furans and dioxin-like PCBs are summarized in the table below

*Table 69: HCB, PeCB and PCDD/PCDF and dioxin-like PCBs in fish samples from Austrian rivers.*

| | **2008** | | | **2010** | | | **2013** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **n** | **n>LOQ** | **max [µg/kg]** | **n** | **n>LOQ** | **max [µg/kg]** | **n** | **n>LOQ** | **max [µg/kg]** |
| HCB | 10 | - | 6,3 | 32 | 28 | 5,4 | 42 | 6 | 34 |
| PeCB | - | - | - | 32 | 23 | 3,3 | 42 | 31 | 42 |
| PCDD/PCDF and DL-PCB* | - | - | - | - | - | - | 58 | 58 | 0,016** |

* *including 7 polychlorinated dibenzoparadioxines (PCDD), 10 polychlorinated dibenzofuranes (PCDF) und 12 dioxine-like polychlorinated biphenyles (PCB)*

** *refered to TEQ, toxicity equivalents according to WHO 2005.*

Results of the monitoring programme are published as bi-annual reports. Access to data as well as to the reports is provided via the webpage of the Environment Agency Austria – http://www.umweltbundesamt.at/en/umweltschutz/wasser/.

Furthermore, specific substances are analysed in investigative monitoring programmes (run by i.e. regional authorities) and as part of measuring obligations prescribed by international river basin commissions (e.g. ICPDR, Joint Danube Survey). The measuring programmes are constantly updated and increasingly focused on the priority substances specified in the Water Framework Directive.

#### 6.4.4.2 Municipal Wastewater Treatment Plants

Currently no continuous monitoring of effluents of municipal wastewater treatment plants for POPs or POP like substances is performed and the database on emissions of these substances from wastewater treatment plants is limited. In order to improve the knowledge basis and to generate data on those emissions, a monitoring programme was performed in 2007 and 2008. Besides dioxins and PCBs the relevant POPs hexachlorobenzene, polycyclic aromatic hydrocarbons as well as pentachlorobenzene were investigated. None of these pollutants were detectable in the effluents of municipal wastewater treatment plants (UMWELTBUNDESAMT 2009).

In 2012 a few municipal wastewater treatment plants were investigated for the occurrence of polycyclic aromatic hydrocarbons beside other parameters (e.g. polybrominated diphenyl ethers (PBDE), phthalates, PFOS and PFOA, organotin compounds and others). The results for PAHs are presented in the following table. Both investigated wastewater treatment plants are equipped with tertiary treatment including phosphorus and nitrogen removal (BMLFUW 2014). Benzo(p)pyren as well as benzo(b,k)fluoranthen are not detected in the effluent samples. Benzo(g,h,i)perylen and indeno(1,2,3-cd)pyren are detected in few effluent samples.

| Pollutant | n [-] | LOQ [µg/l] | n>LOQ [-] | Max [µg/l] |
|---|---|---|---|---|
| Benzo(a)pyren | 6 | 0,02 | 0 | - |
| Benzo(b)fluoranthen | 6 | 0,0066 | 0 | - |
| Benzo(k)fluoranthen | 6 | 0,0066 | 0 | - |
| Benzo(g,h,i)perylen | 6 | 0,001 | 1 | 0,0017 |
| Indeno(1,2,3-c,d)pyren | 6 | 0,001 | 2 | 0,0015 |

*Table 70: occurence and maximum concentrations [µg/l] of PAH in the effluents of two municipal wastewater treatment plants.*

#### 6.4.4.3 Discharges from urbanized areas via diffuse pathways

Beside emissions via treated wastewater also discharges via diffuse pathways occur. In urbanised areas discharges from combined sewer overflows, urban runoff from separate sewer systems as well as road runoff are of relevance. In 2012 these diffuse pathways were investigated in a few urban areas for the occurrence of polycyclic aromatic hydrocarbons and other parameters (e.g. polybrominated diphenyl ethers (PBDE), phthalates, PFOS and PFOA, organotin compounds and others). Occurence and concentrations of PAH in these diffuse emission pathways are summarised in Table 71. As in the treated effluent samples also in these wastewaters mainly benzo(g,h,i)perylen and indeno(1,2,3-cd)pyren are found, whereas benzo(p)pyren as well as benzo(b,k)fluoranthen are only scarsely detected.

*Table 71: Occurrence and concentrations [µg/l] of benzo(a)pyrene (BaP), benzo(b)fluoranthen (BbF), benzo(k)fluoranthen (BkF), benzo(g,h,i)perylene (BP) and indeno(1,2,3-cd)pyren (IP) in combined sewer overflows (CSO), urban runoff from separate sewer systems and road runoff.*

| | | BaP | BbF | BkF | BP | IP |
|---|---|---|---|---|---|---|
| CSO | n | 7 | 7 | 7 | 7 | 7 |
| | n>LOQ | 0 | 0 | 0 | 6 | 6 |
| | max | - | - | - | 0,0085 | 0,0039 |
| Urban runoff from SSS | n | 6 | 6 | 6 | 6 | 6 |
| | n>LOQ | 0 | 0 | 0 | 2 | 1 |
| | max | - | - | - | 0,0027 | 0,0021 |
| Road runoff | n | 9 | 9 | 9 | 9 | 9 |
| | n>LOQ | 1 | 1 | 1 | 8 | 6 |
| | max | 0,035 | 0,034 | 0,019 | 0,026 | 0,021 |

#### 6.4.4.4 Industrial Dischargers

According to the Austrian Federal Ordinance on the establishment of an emission register industrial dischargers have to measure and report emissions of defined pollutants. The Ordinance entered into force in 2009 and the first measurements were performed in 2010. Since 2010 discharges are reported for a number of substances including POPs. Discharged loads are reported on an annual basis and the calculation of the discharges is based on measured concentrations. For load calculations all measurements below the limit of quantification (LOQ) are set equal to zero. Several facilities reported direct discharges for hexachlorobenzene and pentachlorobenzene to surface waters equal to zero.

Direct discharges to surface waters are reported by several facilities for PCB, PCDD/PCDF and PAH. The reported emissions for the reporting year 2014 are summarized in the table below.

*Table 72: direct discharges [kg/a] to surface waters for PCB, PCDD/PCDF and PAH reported for the year 2014.*

| | | 2014 |
|---|---|---|
| PCB | [kg/a] | 0,0011 |
| PCDD/F | [kg/a] | 0,0063 |
| PAH* | [kg/a] | 1,3 |

* *sum of benzo(a)pyren, benzo(b)fluoranthen, benzo(k)fluoranthen, benzo(g,h,i)perylene and indeno(1,2,3-cd)pyren.*

#### 6.4.4.5 Groundwater

In Austria standardised groundwater quality monitoring, based on legal provisions, was established in 1991. Its aim was to ensure the collection of consistent and reliable data to assess the current status of Austrian groundwaters and detect increasing concentrations at an early stage. This information was also to be used as a basis for designing and implementing measures for the protection of groundwater.

The resulting monitoring programme covers groundwater in porous media and in karst and fractured (fissured) rock systems. In total about 2000 groundwater sites are investigated and monitored. Groundwater areas were delineated as monitoring units and the monitoring was carried out on a quarterly basis (up to four times per year) for the whole of Austria.

To comply with the new requirements of the WFD the Austrian Federal Water Act was amended and provided the basis for a new Ordinance for Water Quality Monitoring (BGBl. No. 479/2006). Consequently the groundwater quality monitoring network in Austria was assessed for compliance with the new requirements and, where necessary, the network was amended accordingly. The most important impact resulted from the introduction of WFD groundwater bodies as groundwater management units.

To comply with the WFD and the Austrian Ordinance on Water Quality groundwater monitoring is carried out according to a six year cycle. The cycle starts with an 'initial investigation' under a surveillance monitoring programme. This includes monitoring of an extensive number of parameters.

The parameters listed in the Ordinance for Water Quality Monitoring which are mandatory to groundwater monitoring, 129 in total, are grouped into two parts:

- part 1: important inorganic parameters with relevance to the environment, e.g. nitrate, nitrite, ammonium, phosphate, boron, alkali metaland alkaline earth metal (e.g. potassium, calcium, magnesium);
- part 2: the metal group (e.g. arsenic, mercury, cadmium) and lightly volatile halogenated hydrocarbons (e.g. tetrachloroethylene) and the broad group of pesticide substances (e.g. triazine, phenoxy alkane carbon acids).

For the following substances of concern PCDD and PCDF, PCBs and PAHs there are no monitoring data available, however there are data on HCB in groundwater available. Most of the values are below the limit of detection and below the limit of quantification. In addition the Monitoring programme includes the following POPs as aldrin, chlordan, DDT, dieldrin, endrin, heptachlor and lindan.

In addition the option for "extra-investigations" exists. This is intended to allow for consideration of chemical parameters not mentioned in the Ordinance on Water Quality Monitoring but identified relevant. Accordingly, within the assessment period 2012-2014 in total about 180 substances/indicators were subject to groundwater monitoring.

Various elements of quality assurance have been integrated in the monitoring programme to ensure confidence in the analytical results. The implementation of the Austrian Water Quality Monitoring System is a shared responsibility between the Federal and Provincial Authorities.

Results of the monitoring programme are published as bi-annual reports. Access to the data as well as to the reports is provided via the webpage of the Environment Agency Austria – http://www.umweltbundesamt.at/en/umweltschutz/wasser/.

### 6.4.5 Soil Monitoring

There is no common soil monitoring system on organic substances established in Austria. However, several studies were carried out which aim to determine the contents of selected POPs in soil (according to different land uses).

Currently the Austrian wide project "AustroPOPs" is under discussion between the Federal Ministry of Agriculture, Forestry, Environment and Water Management, the federal provinces and soil institutions (lead: Environment Agency Austria) aiming at implementing a national soil POPs monitoring system to close gaps in collecting, assessing and providing POPs data in Austria. Results of this project would serve NAP and NIP as well as other European and Austrian requirements on soil protection related to POPs issues.

Within the environmental soil surveys of the federal provinces in Austria, some organochlorine pesticides and herbicides were partly analysed in 3 federal provinces (Carinthia, Styria, Upper Austria). These studies were carried out in the 1990ies. Styria was the first federal state in Austria with a soil protecting law. From 1986 to 2006 1000 sites were selected in the frame of the Styrian soil protection programme. A periodic sampling in an interval of 10 years takes place. The following organic chemicals are analysed: HCB, DDT, lindane, PAH, atrazin, simazin, cyanazin, terbutylazin und propazin[22].

Repetitions are also routinely made according to the Soil Protection Law of Upper Austria. Also in the province Tyrol rural sites are routinely analysed for selected POPs (PAH, PCCD/F, PCB, PAH, organochlorine pesticides). The following table depicts mean concentrations of certain POPs (DM) in soil at 0-5 cm depth from selected sites in Tyrol[23].

*Table 73: Mean concentrations of certain POPs in soil at 0-5 cm depth from selected sites.*

| Site | PCDD/F ng/kg | PCDD/F TEQ ng/kg | DI PCB ng/kg | DI PCB TEQ ng/kg | PAH (16 EPA) µg/kg | HCB µg/kg | PeCB µg/kg |
|---|---|---|---|---|---|---|---|
| 1/grassland | 140 | 33.12 | - | - | 416 | <0.10 | - |
| 2/grassland | 82 | 1.4 | 0.16 | 0.3 | 180 | <0.10 | <0.10 |
| 2/forest | 188 | 4.6 | 1.03 | 2.1 | 400 | 0.12 | 0.36 |
| 3/grassland | 31.8 | 0.34 | 0.04 | 0.17 | 31 | 0.04 | <0.05 |
| 3/forest | 27.2 | 1.04 | 0.19 | 0.45 | 63 | 0.06 | <0.05 |
| 4/grassland | 32 | 0.12 | 0.11 | 0.1 | 28 | <0.05 | 0.16 |
| 4/forest | 18 | 0.32 | 0.8 | 0.7 | 54 | 0.12 | 0.08 |
| 5/grassland | 129.5 | 2.0 | 0.27 | 0.5 | 363 | <0.1 | 0.26 |
| 5/forest | 170.0 | 2.6 | 0.36 | 0.78 | 618 | 0.16 | 0.25 |

*Sources: 1: personal communication, 2: UMWELTBUNDESAMT 2012B; 3: UMWELTBUNDESAMT, 2013, 4: UMWELTBUNDESAMT 2014a; 5: BFW 2015*

[22] http://www.umwelt.steiermark.at/cms/beitrag/10215574/2998692/

[23] https://www.tirol.gv.at/umwelt/boden/

The aim of the programme of the Austrian provinces is also to classify the soils according their quality; quality criteria are also based on the content of selected anorganic and organic pollutants. The influence of industrial emissions is clearly visible; site 1 is strongly influenced by copper smelting, site 2 by molybdenum production, site 3 and site 4 are inner alpine rural sites and site 5 is influenced by accumulation due to the geographical conditions (see Table 72).

Further data are provided by a study on POPs in grassland soils far away from emission sources. At the moment results from 24 grassland sites under extensive use are available (UMWELTBUNDESAMT 2008a and 2010). Soil samples were taken at depths of 0–5 cm and 5–10 cm and the range of analysed parameters covers the following substances or groups of substances: organochlorine compounds (aldrin, cis- and trans-chlordane, dieldrin, endrine, mirexe, heptachlorine, hexachlorobutadien, endosulfan, DDX, α-, β-, γ-, δ-HCH, HCB), polychlorinated biphenyls (PCBs), dioxins, furans and dl-PCBs, polycyclic aromatic hydrocarbons (PAHs), polybrominated diphenyl ether (PBDE), nonylphenol and bisphenol A, nitrophenols, chlorophenols, phthalates, organotin compounds, hydrocarbon index, perfluorinated tensides (PFTs)inorganic pollutants, general soil parameters (pH value, humus content, texture, carbonate content).

Overview of the results for PCBs, doxins and furans and PAHs:

Polychlorinated biphenyls (PCBs): Contents of individual PCB congeners are above the chosen limits of determination for all samples. The range for the total content from the sum of the six congeners according to Ballschmiter is between 0.13 and 3.52 μg/kg DS and all values can therefore be considered background concentrations.

DL-PCBs: Contents of coplanar and mono-ortho-substituted PCBs were detected in most of the soil samples. They are within the range of a few nanograms. What is noticeable is that either low chlorinated PCBs are found together on a few sites, or higher chlorinated PCBs. Total values from the sum of PCBs TE-WHO for the sampled grassland sites are between 0.01 and 0.74 ngTE WHO/kg.

Polychlorinated dibenzo-p-dioxins and furans (PCDD/Fs): Total contents from the sum of PCDD/Fs in grassland samples range between 12.5 and 298 ng/kg DS. In order to take into account the varying toxicity of the congeners, PCDD/F contents are assessed according to international toxicity equivalents (I-TEQs). These are between 0.16 and 9.33 ng I-TEQ/kg DS. The upper values are considered high and need further clarification.

Polycyclic aromatic hydrocarbons (PAHs): Contents of EPA PAHs range between 2.4 and 1818.3 μg/kg DS. On 11 sites, values below 100 μg/kg DS were determined. Although none of the grassland sampling sites used for this study showed PAH contents above international background or intervention values, further clarification appears to be necessary with respect to ΣEPA PAH and BaP contents on three sites. For all other sites, PAH contents can be classified as background values.

The results of this study show that persistent organic pollutants can be detected, occasionally in considerable concentrations (e.g. PCDD/F), even in grassland soils under extensive use. On the one hand the substances concerned are those whose use and production have been banned in many countries for several years or decades (e.g. certain pesticides), and on the other hand these substances are so-called upcoming pollutants (e.g. flame retardants, phthalates, chlorophenols), whose environmental relevance is gaining more and more importance at international level.

The study thus provides an initial overview of the verifiability and magnitudes of the levels of selected organic pollutants. Although a more detailed analysis in the light of a correlation between individual soil parameters, or pollutant groups, has not been possible here, it would be an important next step allowing for a better description of the fate and behaviour of these substances in grassland soils.

In general, the data on organic pollutants in soils are considered incomplete. Only a few pollutant groups such as PAHs, PCBs or PCDD/Fs are well documented in the literature. For many other substances however, hardly any comparable data on background values in soils are available. In other mediums such as sewage sludge, sediments and surface waters, these pollutant groups have already been analysed in several studies.

The next part of the study will include further sampling sites throughout Austria and a focus on flame retardants like PBDEs and PFOS.

### 6.4.6 Bioindication with tree needles and forest ecosystems

Two major earlier studies (UMWELTBUNDESAMT 1998, 2001) focused on POP concentrations in remote forest ecosystems. The international project "MONARPOP", (an initiative of ministries and institutes in Austria, Germany, Italy, Slovenia and Switzerland started the project MONARPOP in 2004[24]) investigated POPs in Norway spruce needles and soils of remote forests in alpine regions of Europe (Austria, Germany, Italy, Slovenia, Switzerland) from 2004 to 2007. The studies focused on POP background levels at remote sites. The investigations provide information about the following compounds – formerly or still – intentionally produced POPs (organochloropesticides = OCP, PCB, PBDE, chloroparaffins, PFOS and related compounds) and unintentionally released organic pollutants (PCDD/F, PAH). The MONARPOP project also includes extensive air and deposition monitoring (see chapter 6.4.1). The MONARPOP survey on needle and soil concentrations had been finished by end of December 2007, while air and deposition monitoring is still carried out on a continuous basis.

One of the most significant results of MONARPOP is the clear documentation of the barrier effect of the Alps for the long range transport of POPs. Concentrations were higher in the peripheral parts of the Alps than in the more shielded central parts. The location of the lateral parts with higher concentrations (northern, western, southern and/or eastern parts of the Alps) could vary from compound to compound and between the studied matrices (soil, needles). For some compounds like PCDD/F, sites with higher soil concentrations were located in areas of higher precipitation (OFFENTHALER et al. 2009), while the observed regional concentration gradients for other compounds (e.g. single PBDEs, KNOTH et al. 2008) showed no correlation with precipitation and are likely the result of different

[24] http://www.monarpop.at; co-founded by the EU INTERREG IIIb "Alpine Space Programme", the Austrian Ministry for Agriculture, Forestry, Environment and Water Ressources; Bavarian State Ministry of the Environment, Public Health and Consumer Protection; Regional Agency for Environmental Protection of Lombardia; Regional Agency for Environmental Prevention and Protection of Veneto; Swiss Federal Office for the Environment; Swiss Federal Institute for Forest, Snow and Landscape Research; German Helmholtz Research Center for Environmental Health, Munich; German Federal Environment Agency; Environment Agency Austria; Slovenian Forestry Institute

emission gradients in the neighboring regions of the Alps. These findings from the Alps, given their location in the centre of Europe, may give some general indications of similar differences on a larger geographic scale.

A comparison between POPs bound in the forests of the Alps and their emissions in this region supports the assumption that significant contributions to the POPs load in the Alps comes from sources outside the Alps and suggests that the Alps represent a net sink for these compounds (BELIS et al. 2009).

Industrial chemicals like chlorinated paraffins were detected at remote sites of the Alps, in similar concentration ranges as unintentionally emitted SOCs like PAHs (IOZZA et al. 2009).

Selected MONARPOP sites, which were also studied in previous studies, showed significantly lower loads of some compounds in needles and soil than approximately ten years ago.

Along the remote vertical MONARPOP profiles of the northern and central Alps, marked altitudinal increases in soil concentrations of organochlorine pesticides (including those with suspected faraway sources like mirex) have been detected (e.g. up to 10-fold for DDT). The statistical results suggest temperature as the key parameter for this increase, while it has been found that precipitation is not correlated with the observed gradients (KIRCHNER et al. 2009). Other compounds like chlorinated paraffins (IOZZA et al. 2009), PCDD/F and PCB (OFFENTHALER et al. 2009), PBDE (KNOTH et al. 2008) and PAH (BELIS et al. 2007) have not shown a uniform trend along or among these slopes. Other than with pesticides, local sources as well as the impact of meteorological phenomena like temperature inversions are assumed to be responsible for these findings.

Apart from surveys in remote forest ecosystem, POP levels (PAH, PCB, PCDD/F, OCPs) close to local pollution sources were obtained by some bioindication studies in industrial areas or conurbations using Norway spruce needles (e.g. UMWELTBUNDESAMT 2009). The Austrian Umweltbundesamt also has an archive of perennial spruce needle samples from selected industrial neighborhoods.

More recent data has been derived in the frame of the EU-funded MONAIRNET project[25], which is described in more detail in chapter 6.4.1.

Spruce needles were analysed at 4 Austrian sites; dioxinlike PCBs were measured in concentrations at ~ 0.025-0.054 ng/kg dm (TEQ DL-PCBs); PCDD/F:~0.35-3.1 (TEQ PCDD/Fs) and PAHs ~20-31 ng/kg dm (29 congeners).

[25] http://www.monairnet.eu/index-de.php

# 7 EVALUATION OF THE EFFICACY OF NATIONAL LAWS AND POLICIES AND STRATEGIES FOR MEETING THE OBLIGATIONS OF THE STOCKHOLM CONVENTION AND THE EU POP-REGULATION

Considering the findings of this report for POPs release inventories, availability of data, measures already implemented or planned, it can be concluded that Austria complies to a great extent with the provisions of the Stockholm Convention and the EU POP Regulation. Nevertheless, as one of the goals of the Convention is the “continuous minimization and, where feasible, ultimate elimination of POPs releases” further efforts are necessary.

PCDD/F and PAH emissions of major (industrial) sources decreased steadily in the years 1990-2014 with a significant drop between the years 1990 and 1994. Emissions of PCB declined significantly from 1990 to 1993, then increased slowly from 1994 to 2014 and, at 180 kg/a, are now 7% lower than in 1990 (but 11% higher than in 1995). Emissions of HCB declined from 1990 to 2011, and then increased strongly in the years 2012, 2013 and 2014. This increase was due to an unintentional release of HCB in an Austrian cement installation which was caused by the input of HCB containing waste and imcomplete destruction of HCB.

If there are changes in the best available techniques allowing for lower or zero emissions from relevant sources, policy makers have to react and to adapt the relevant legal provisions accordingly (e.g. by laying down stricter emission limit values).

The NAPs 2008 and 2012 identify small residential combustion plants as an important target area. In 2014 they still are responsible for 58% of the PCDD/F emissions, 79% of the PAH emissions and 26% of the PeCB emissions into air. All possible measures have to be investigated and explored to reduce POP emissions from these sources.

PCDD/F emissions from biomass combustion have more than doubled from 2004 to 2014 and are responsible for 13% of the overall PCDD/F emissions. PAH emissions from biomass combustion almost tripled from 2004 to 2014, but are still only responsible for 3% of the overall PAH emissions.

It should be mentioned that in order to comply with certain national and international obligations a variety of comprehensive and to some extent cross-sectoral measures and instruments are being developed in Austria. These measures are aimed at the reduction of greenhouse gases, $NO_x$ and (fine) particulate matter. Some of these measures (described e.g. in the Climate Strategy 2007 (FEDERAL MINISTRY OF AGRICULTURE, FORESTRY, ENVIRONMENT AND WATER MANAGEMENT 2007) or in the Programme of the Federal Government (FEDERAL GOVERNMENT 2007)) will lead to an indirect reduction of POPs releases (e.g. by reducing energy consumption or by prescribing stricter air emission limit values for dust), others (such as the increased use of biomass in small scale firing installations) will lead to an increase in POP releases.

Moreover, it is important to gain more in-depth knowledge in fields where reliable data are limited or missing. Specific studies e.g. of POP concentrations in certain wastes as well as further POP related monitoring activities are formulated below.

#### Evaluation of Measures proposed in NAP 2012 (according to § 20 (2) Chemicals Act 1996)

NAP 2008 and NAP 2012 list a variety of measures which help to lower POP emissions from relevant sources on the one hand, and would improve the availability of data on POPs in the environment on the other hand.

#### Releases of POPs from source categories

The following table gives an overview of measures proposed in the NAP 2012 and implemented in the period 2012-2016.

| National legislation | Contents relating to POPs | Measures proposed in NAP 2012 | Current status |
|---|---|---|---|
| Industrial Code 1994 and specific ordinances according to § 82 para 1 | ELV for various air pollutants, eg dust, PCDD/F | Continuous evaluation with regard to BAT | Amendment of Iron and Steel Ordinance (Fed. Law Gaz. II No. 54/2016)<br>Repeal of ordinance for Sinter Plants (Fed. Law Gaz. II No. 303/2014)<br>Ordinance on Foundries (Fed. Law Gaz. II No. 264/2014) |
| Ordinance on combustion plants (Fed. Law Gaz. II No. 331/1997) | ELVs for dust, CO, Corg, $NO_x$ | Adaptation to BAT necessary (stricter ELVs for dust) | The process of implementation of the MCPD into national law is currently (2017) under way by amending the ordinance on combustion plants. |
| Waste incineration ordinance (Fed. Law Gaz. II No. 2002/389) | ELVs for dust, CO, Corg, $NO_x$, heavy metals, PCDD/F | stricter ELVs for dust for co-incineration plants | Revised ordinance (Fed. Law Gaz. II No. 135/2013) |
| Austrian Water Act and specific Ordinances: | ELVs for AOX and POX in the sector specific ordinances | | |
| Ordinance on the limitation of waste water emissions from flue gas treatment (Fed. Law Gaz. II No. 271/2003) | ELVs for PCDD/F | Continuous evaluation with regard to BAT | Amendment (Fed. Law Gaz. II No. 201/2014) |
| Ordinance on the limitation of waste water emissions from processing of coal (Fed. Law Gaz. II No. 346/1997) | ELVs for PAHs | Continuous evaluation with regard to BAT | Amendment in preparation |
| Ordinance on the limitation of waste water emissions from the production of plant protecting agents and crop sprayings (Fed. Law Gaz. No. 668/1996) | ELVs for AOX and specific POPs | Continuous evaluation with regard to BAT | None |

| ***National legislation*** | ***Contents relating to POPs*** | ***Measures proposed in NAP 2012*** | ***Current status*** |
|---|---|---|---|
| *Ordinance on the determination of the target state for surface waters (Fed. Law Gaz. II No. 96/2006)* | *Environmental quality standard for HCB* | *For PAHs community environmental quality standards were determined (in 2008)* | *ordinance was amended in 2010 according to directive 2008/105/EC (Fed. Law Gaz. II No. 461/2010) and in 2016 (Fed. Law Gaz. II No. 363/2016)* |
| *Ordinance on landfills (Fed. Law Gaz. II No. 39/2008)* | *Limit values for the content of PAH in wastes* | | *Amended with Fed. Law Gaz. II No. 291/2016* |
| *Compost ordinance (Fed. Law Gaz. II No. 292/2001)* | *Limit values for the content of POPs in composts* | *Continuous evaluation of the limit values necessary* | *none* |
| ***Other relevant legal provisions*** | ***Contents with respect to POPs*** | ***Measures proposed in NAP 2012*** | ***Current status*** |
| *BAT Conclusions, already published in the Officical Journal of the European Commission:* | *limit values for POPs* | *new measure* | *implementation in national law (ordinances, permits)* |
| *cement, lime and magnesia* | *ELV for POPs* | *new measure* | *Implemented via waste incineration ordinance (Fed. Law Gaz. II No. 135/2013)* |
| *non ferrous metals* | *ELV for POPs* | *new measure* | *Implementation for air-emissions in non ferrous metals ordinance (Fed. Law Gaz.II No.86/2008), for water emissions in AEV non ferrous metals (Fed. Law Gaz. II No. 889/1995) and/or in individual permits required by 30 June 2020* |
| *iron and steel* | *ELV for POPs* | *new measure* | *implemented for air emissions with amendment to iron and steel ordinance (Fed. Law Gaz. II No. 54/2016) and for water emissions with amendment to AEV iron metal industry (Fed. Law Gaz. II No. 202/2014)* |
| *Ordinances on sewage sludge and compost of the Federal Provinces* | *Limit values for POP* | *Continuous evaluation of the limit values necessary* | *some Austrian provinces limit POPs in sewage sludge* |
| *Ambient Air Quality Act (IG-L)* | *§ 21 IG-L: Legal basis for an ordinance* | *Evaluation whether generally binding ELVs for crematoria in an ordinance according to § 21 IG-L are necessary* | *Not implemented, no general binding rule for crematoria* |
| *Laws of the Federal Provinces concerning residential combustion sources* | *PM emission thresholds for new installation of small scale combustion equipment* | *Agreement pursuant to Art. 15a Federal Constitution Law concerning the placing on the market and the inspection of combustion installations, rapid transposition of the requirements of this agreement into the law of the federal provinces* | *Signed by governors of federal provinces in 2011*<br>*Amended by Federal provinces individually by ordinance or law starting from 2012* |
| *Act on Air Pollution Prevention (Fed. Law Gaz. I No. 137/2002, as amended (Fed. Law Gaz. I No. 50/2012))* | *Prohibition of burning of biogenic materials, many exemptions possible* | *Evaluation with respect to the exemptions* | *Prohibition integrated in Act on Air Pollution Prevention* |

| *Other relevant legal provisions* | *Contents with respect to POPs* | *Measures proposed in NAP 2012* | *Current status* |
|---|---|---|---|
| *Permitting process* | *Contents relating to POPs* | *Comments/Specific Steps* | *ongoing* |
| *Landfill sites* | *Fire protection requirements* | *Implementation of effective fire protection requirements for landfills and intermediate storage sites for waste* | *No new information* |

**Implemented measures for residential combustion plants**

Standard eco-design emission requirements for the placing on the market and putting into service of solid fuel local space heaters[26] and solid fuel boilers[27] will enter into force on 1 January 2020 (2015/1189) and on 1 January 2022 (2015/1185) and gradually repeal the current national standard emission requirements (Article 15a Agreement).

However, the Austrian Ecolabel N°37 on biomass heating[28] sets more ambitious PM emission thresholds for new installations, as well as defining other environment-friendly criteria. The Ecolabel is a mandatory requirement for new installations with biomass combustion systems, if they are supported by funding programmes promoting the exchange of old fossil-fuel based heating systems.

Another set of measures is concerned with awareness raising to encourage low-emission incineration in wood stoves in households or the use of ashes from these stoves for fertilising purposes.

An initiative of the Federal Ministry of Agriculture and Forestry, Environment and Water Management “Richtig heizen” (“Proper Heating”) was launched in 2009 and is still running in 2017. An important output is a booklet published in 2010 containing information on the effects of emissions from household stoves on human health and the environment as well as tips and advice on how heating with low emissions can be achieved by simple measures (e.g. lighting from above). The booklet has been distributed to the public by doctors and chimney sweepers.

Furthermore, an internet site has been created where the proper use of household wood stoves as well as legal considerations are described. The internet site was further developed in 2013 by adding an interactive online calculator that allows users to calculate their energy demand, PM emissions and solid fuel used for heating. Subsequently, it gives advice on possible measures for reducing energy consumption and emissions (wood drying, thermal insulation, exchange of heating system). Information on Ecodesign provisions and PM filter systems for small scale heating appliances will be added in 2017.

[26] Commission Regulation (EU) 2015/1185 of 24 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel local space heaters.

[27] Commission Regulation (EU) 2015/1189 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel boilers.

[28] Österreichisches Umweltzeichen Richtlinie UZ 37 Holzheizungen, Version 6.0 vom 1. Jänner 2017

**Proposed measures for residential combustion plants and biomass plants**

- Effective financial funding for the replacement of coal-fired small scale combustion systems and old (probably high emission) biomass heating systems with modern, low emission biomass heating systems, district heating or renewable energy systems.
- Periodic reviews and improvements of the criteria for the funding of biomass plants (including biomass plants operated in the agricultural sector) with respect to operating conditions, energy efficiency (including district heating systems), quality of fuels and emission limit values for dust .
- Providing further information (awareness raising) conerning the prevention of co-incineration of waste in small scale firing installations.
- Providing further information (awareness raising) concerning the final disposal of ashes/soot from small scale firing installations.
- Emission behaviour of small scale combustion installations (esp. in case of firing cereals): → still partly unknown for POPs, a literature study is currently underway.

**Data availability on POP releases into the environment**

For the following sources the availability of data is still limited or missing. Therefore, to assess whether releases of POPs are relevant and to improve and complete Austrian inventories on POPs, the following specific steps are desirable/necessary to improve data quality. However, the implementation of these measures often depends on available budget resources.

- Improvement of data quality with respect to releases of HCB, PCB, PeCB and, if feasible, PCN into air (e.g. by planning and carrying out measurement programmes for sources with a high priority, such as residential combustion sources, industrial processes).
- Verification of the emission factor for PCB in the source category Part III “thermal processes in the metallurgical industry” (especially for the sector secondary lead production).
- Establishment of emission monitoring programmes in the neighbourhood of POP relevant emitters: identification of relevant sites for sampling and measurements campaigns (winter/summer).
- Continuation of ambient air and deposition monitoring for POPs
- Continuation of monitoring programmes in food (meat, milk,..).
- Food and Feed Monitoring in the neighbourhood of POP relevant emitters, identification of relevant sites for sampling.
- Implementation of a national monitoring programme to investigate the distribution of deposited POPs.
- Continuation of monitoring programmes in soil and bioindicators (Norway spruce needles and/or grass) close to POP sources.
- Improvement of data quality with respect to releases of POPs from landfills and abandoned industrial sites and known contaminated sites (e.g. PAH content of landfill gases).

- Determination of POP-concentrations in waste streams from small scale combustion installations in the sectors residential combustion, services and agriculture which have a high probability of being released into the environment (e.g. bottom ash and fly ash).
- Determination of POP-concentrations in waste streams from fossil fuel fired utilities and industrial boilers (including co-incineration of waste) which are recovered in other production processes or which have a high probability of being released into the environment (e.g. fly ash from co-incineration plants).
- Determination of POP-concentrations in waste streams from biomass fired combustion installations which are recovered in other production processes or which have a high probability of being released into the environment (e.g. bottom ash).
- Quantification of POPs emissions (esp. PCDD/F and PCB) from Platformer 3 of the OMV refinery in Schwechat.
- Measurement of emissions from motor vehicles and update of emission factors to improve the quality of forecasts.

  → The Handbook on Emission Factors for Road Transport (HBEFA) provides emission factors for all current vehicle categories (PC, LDV, HGV, urban buses, coaches and motor cycles), each divided into different categories, for a wide variety of traffic situations. Emission factors for all regulated and the most important non-regulated pollutants as well as fuel consumption and $CO_2$ are included. The latest HBEFA version 3.2 was updated in 2014. All emission factors have been recalculated (based on a broader set of emission data, new measurements of motor vehicle emissions; and new emission factor models have been applied). For calibrating the model, a broad set of emission measurements up to Euro 6 has been used.

**Proposed measures with regard to industrial plants**

- Limitation of POP contaminated waste/residues in co-incineration plants and industrial plants. Representative sampling of individual batches of POP contaminated waste/residues is necessary before using them as input material.
- Avoid/prohibit highly contaminated waste/residues in co-incineration plants.
- Before treating POP contaminated waste/residues in industrial plants, test runs (including monitoring of POP emissions) have to be conducted.
- If POP contaminated waste/residues are used as input materials in industrial plants, regular/continuous monitoring of the emissions of POP emissions is necessary. If a destruction of these POPs cannot be ensured in the industrial plant, the POP residues/waste must not be used as input material.
- If there are any changes in the process involving POP contaminated waste/residues, test runs (including monitoring of the POP emissions) have to be conducted.

**Proposed other measures**

- Successive reduction of diesel powered vehicles through increased market penetration of electrically vehicles.

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|---|---|---|
| Soil Protection Laws of the Federal Provinces:<br>Burgenländisches Bodenschutzgesetz (LGBl. Nr. 87/1990)<br>Niederösterreichisches Bodenschutzgesetz (LGBl. Nr. 6160-0)<br>Oberösterreichisches Bodenschutzgesetz (LGBl. Nr. 63/1997)<br>Bodenschutzgesetz Salzburg (LGBl Nr. 80/2001)<br>Steiermärkisches landwirtschaftliches Bodenschutzgesetz (LGBl. Nr. 66/1987) | Setting of target values for organic pollutants (including polybrominated diphenylethers, perfluorinated tensides and pesticides) with the aim to reduce pollution of soils | AustroPOPs project aiming at implementing a national soil POPs monitoring system is under discusssion |

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# 9 ABBREVIATIONS

AVV……..... Abfallverbrennungsverordnung (Waste Incineration Ordinance, BGBl. II No. 2002/389, latest amendment by BGBl. I No. 127/2013)

CORINAIR..... Core Inventory Air

CORINE ..... Coordination d´information Environmentale

CRF..... Common Reporting Format

DKDB ..... DampfkesseldatenbankAustrian annual steam boiler inventory

DL-PCB..... Dioxinlike polychlorinated biphenyls

DM ..... Dry Mass

EEA..... European Environment Agency

EIONET..... European Environment Information and Observation NETwork

EMEP..... Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

EPER ..... European Pollutant Emission Register

GLOBEMI..... Globale Modellbildung für Emissions- und Verbrauchsszenarien im Verkehrssektor (Global Modelling for Emission- and Fuel consumption Scenarios of the Transport Sector) see Hausberger 1997

GPG..... Good Practice Guidance (of the IPCC)

HCB ..... Hexachlorobenzene

HM ..... Heavy Metals

IEA ..... International Energy Agency

IEF ..... Implied emission factor

IIR ..... Informative Inventory Report

IPCC ..... Intergovernmental Panel on Climate Change

NACE ..... Nomenclature des activites economiques de la Communaute Europeenne

NEC ..... National Emissions Ceiling (Directive 2001/81/EC of The European Parliament And Of The Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants – NEC Directive)

NFR..... Nomenclature for Reporting (Format of Reporting under the UNECE/CLRTAP Convention)

NIR..... National Inventory Report (Submission under the United Nations Framework Convention on Climate Change)

NISA..... National Inventory System Austria

OECD..... Organisation for Economic Co-operation and Development

OLI ..... Österreichische Luftschadstoff InventurAustrian Air Emission Inventory

PAH..... Polycyclic Aromatic Hydrocarbons

PCDD/F .....Polychlorinated Dibenzodioxins and Dibenzofurans

PeCB .....Pentachlorobenzene

PM .....Particular Matter

POP .....Persistent Organic Pollutants

PRTR.....Pollution Release and Transfer Register

SNAP.....Selected Nomenclature on Air Pollutants

TEQ .....Toxicity equivalents according to WHO

UNECE/CLRTAP ...United Nations Economic Commission for Europe.Convention on Long-range Transboundary Air Pollution

UNFCCC .....United Nations Framework Convention on Climate Change

WFD .....Waste Framework Directive 2000/60/EC6

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**This report is the second review of the National Action Plan pursuant to Article 5 of the Stockholm Convention on Persistent Organic Pollutants (POPs). Emissions from relevant source categories in different environmental media are updated and compared with data from the National Action Plans of 2008 and 2012. The efficacy of national legal regulations has been assessed again and it has been investigated if Best Available Techniques (BAT) in combination with Best Environmental Practices (BEP) have already been applied. Current recommended procedures are developed in order to reduce emissions of POPs in the future.**

**In general, the findings of the NAP 2008 and 2012 remain valid for the near future.**

**Measures to reduce emissions from residential combustion sources should be continued. Monitoring programmes should be carried on. Data availability on POP releases should be improved.**



ISBN 978-3-99004-450-6