

# Bisphenol A and the environment

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## Sources, entry pathways and options for minimisation

Bisphenol A (BPA) is the basic building block for the production of polycarbonate and epoxy resins. It can be measured in small amounts in the environment, especially in surface waters. Authorities, as well as BPA producers strive to reduce BPA in the environment as far as possible.

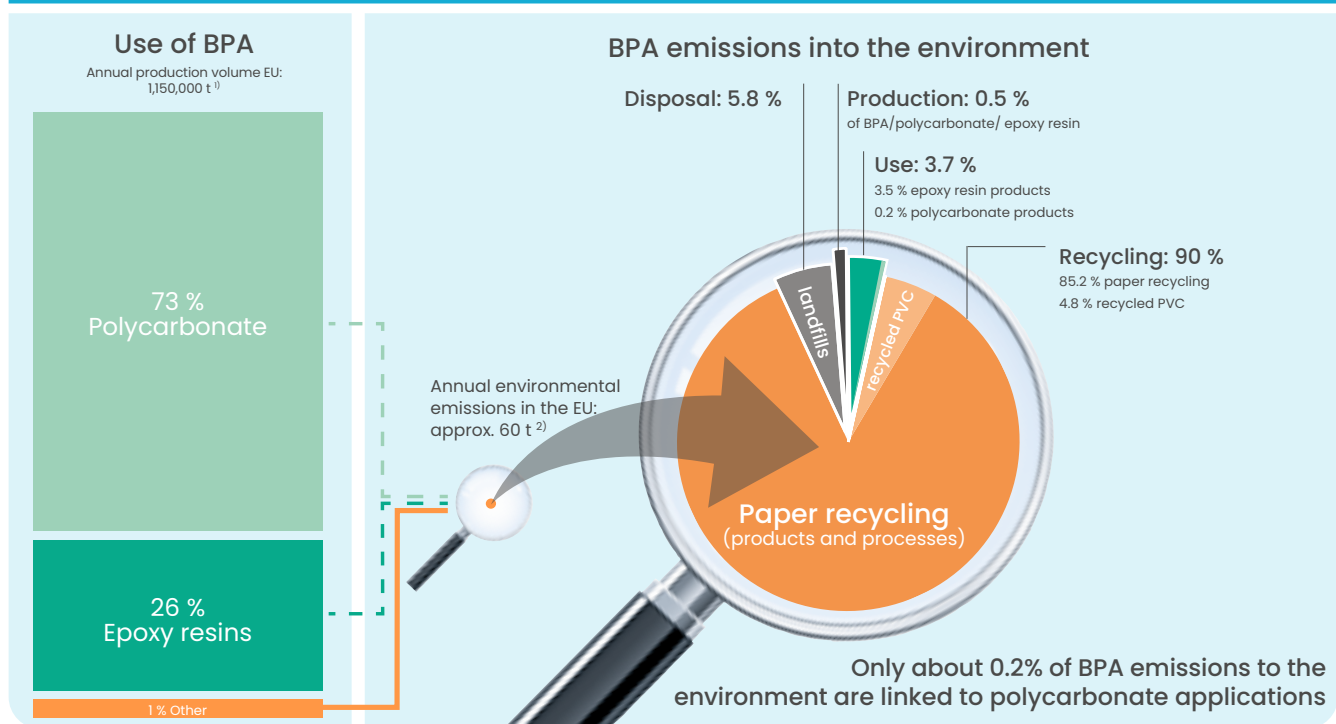
BPA is readily biodegradable in surface waters with a half-life of only a few days. BPA is also largely degraded in sewage treatment plants.

In order to trace the input pathways of BPA to the environment the producers carried out systematic analyses. The outcome: new, reliable study results with clear conclusions on the entry pathways and sources of BPA in the environment.

- Currently, paper recycling and the use of recycled paper products such as toilet paper are the main sources of BPA in the environment. Here the BPA originates mainly from thermal paper containing BPA. The use of BPA in thermal paper has de facto been banned in the EU since the beginning of 2020.
- After paper recycling, legacy landfills are the second largest source of BPA in the environment.
- Less than 0.2% of the BPA that is measurable in the environment originates from the usage of polycarbonate products.

### Status 2019:

85% of BPA entering the environment comes from paper recycling, primarily through BPA-containing thermal paper (since early 2020 the use of BPA in thermal paper is banned in the EU)



<sup>1)</sup> Production volume as reported in the joint dossier of the BPA-REACH consortium (2016).  
<sup>2)</sup> Environmental input extrapolated using population figures (Germany > EU)

## Large-volume applications are an insignificant source of emissions

Around 99% of the BPA produced in Europe is used directly for the industrial production of polycarbonate and epoxy resin. In the chemical reaction, BPA is consumed and becomes a tightly bound, integral component of the resulting polymeric materials. Free unbound BPA is present only in minimal residual amounts in these materials.

Polycarbonate and epoxy resins are extremely stable and durable. Therefore, they contribute very little to the BPA emissions into surface waters - despite their production in large quantities. Also recycling of polycarbonate articles, whether by thermal, mechanical or chemical processes, is not expected to result in environmental releases of BPA.

According to the studies, the majority of environmental discharges of BPA is attributable to products in which BPA is freely present in unreacted form, such as in thermal paper, where it served as a color developer until 2020.

### Data basis unless otherwise noted:

Ramboll (2021). Substance Flow Analysis (SFA) and Regionalized Pathway Analysis (RPA) for Emissions of Bisphenol A (BPA) into the Environment, 2021 Update. Key results of these studies have been published in IEAM - Integrated Environmental Assessment and Management in 2023; the scientific papers are accessible under the following links: <http://doi.org/10.1002/ieam.4805> and <http://doi.org/10.1002/ieam.4804>.

# Six-year research project identifies sources and entry pathways

A series of studies was commissioned by the BPA and polycarbonate producers starting in 2015. The goal of the studies was to identify the sources and entry pathways of BPA to the environment. The research project was executed with the support of the independent scientific consultant Ramboll, and in exchange with the German Federal Environment Agency.

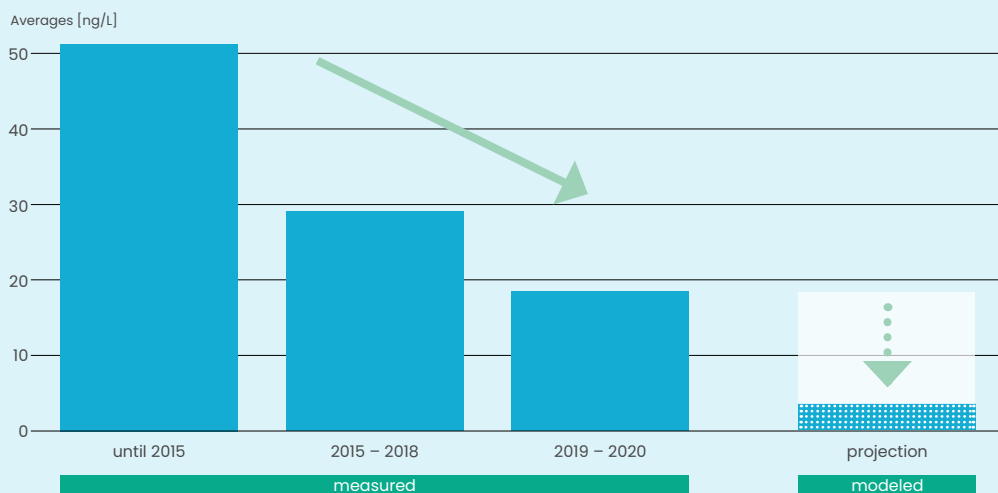
A model previously developed for the German authorities to analyse substance inputs into German surface waters was adapted and further developed by Ramboll to be used for BPA. Currently available data, including data collected by the authorities and own measurements, have been incorporated into the modelling.

An additional study on the release of BPA from polycarbonate and epoxy resin products under realistic weathering conditions is currently ongoing in cooperation with the German Federal Institute for Materials Research and Testing (Bundesanstalt für Materialforschung und -prüfung, BAM). Final results are expected at the end of 2022.

## Key results of the studies to date in chronological order:

- The main pathway for BPA into the environment is municipal wastewater (2015).
- Polycarbonate and epoxy resins are very minor contributors of BPA in the environment (2017)
- Recycled material (paper and PVC) and wastewater from legacy landfills are the biggest sources (2018-2019)
- Paper recycling and products made from recycled paper are by far the major contributors (approx. 85%) to environmental releases (BPA comes from thermal paper); use of polycarbonate products contributes only approx. 0.2% (2020-2021)

## Significant decrease of BPA concentrations in surface waters in Germany



Data on BPA concentrations in surface waters from publicly accessible databases until 2015 form the baseline for the study.

Since then, a significant decrease in BPA concentrations in surface waters has been measured.

In Europe, the use of BPA in thermal paper has been de facto banned in 2020. Until now, this use constitutes the main source of BPA in the environment, namely via paper recycling.

An estimated 80% reduction in surface water BPA is predicted by the modelling, under the assumption of no future BPA contributions from paper recycling activities and respective recycled products.

## Findings of the research project on the minimisation of BPA environmental emissions



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