

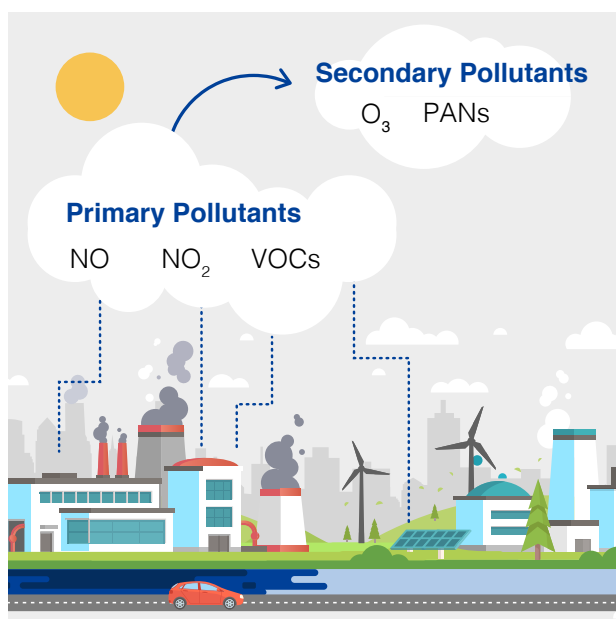
VOC in Printing: Problems and Possible Solutions

What is VOC?

VOC is short for „Volatile Organic Compounds” and encompasses a number of gases and small particles that are released during the production, use, or even storage of certain products. This is true for household objects like cleaning liquids and hairspray as well as largescale production in the printing industry, the manufacture of paints and lacquers, or the burning of gas, wood or kerosene. Released into the air, these chemicals are harmful for both people and the environment. VOC concentration is measured in ppm (parts per million).

What are the Negative Effects of VOC?

Environment



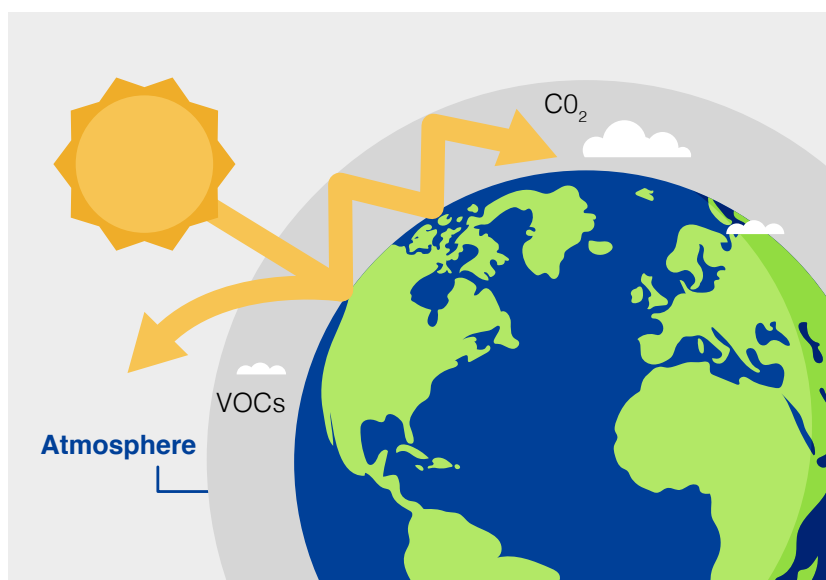
Air Pollution:

The particulates emitted e.g. during printing are in the PM2.5 range (less than 2.5 µm in diameter) and include among others soot, dust, and sulfur oxides (SOx). Combined with nitrogen oxides (NOx) in the air and sunlight, they create ground-level ozone, the main component of smog.

In May 2020, China released new standards to reduce VOCs in key industries, including the printing and packaging industry, in order to get the nation's serious smog problem under control.

Global Warming:

Some VOCs can interfere with the earth's radiation balance. The trace gases absorb part of the atmosphere's outgoing infrared radiation, thus contributing to the so-called greenhouse effect. Next to CO₂ (a component of VOCs), ground-level ozone and methane are among the main particulates driving climate change.



VOC Emission around the world:

USA

Overall
12.2 Mil tons
/ year (2014)¹

Australia

Overall
1.3 K tons
/ year (2018/19)²

Germany

Overall
325 K tons
/ year (2015)³

Europe

Overall
1981 K tons
/ year (2015)³

Health



The negative effects of VOCs are especially harmful for people with asthma, young children, and the elderly, as well as workers in prolonged contact with these trace gases. Concentrations of most volatile organic compounds tend to be higher indoors than outside.

¹ <https://cfpub.epa.gov/roe/indicator.cfm?i=23>

² <http://www.npi.gov.au/npdata/action/load/summary-result/criteria/source-type/ALL/subthreshold-data/Yes/substance/85/substance-name/Total%20Volatile%20Organic%20Compounds/destination/ALL>

³ https://www.esig.org/wp-content/uploads/2018/03/201802_ESVOC_techncial-paper-solvent-VOC-emissions-2015_final-1.pdf

VOCs include a variety of chemicals that, even in small doses, can cause health damage. Effects include:

Short-term Exposure

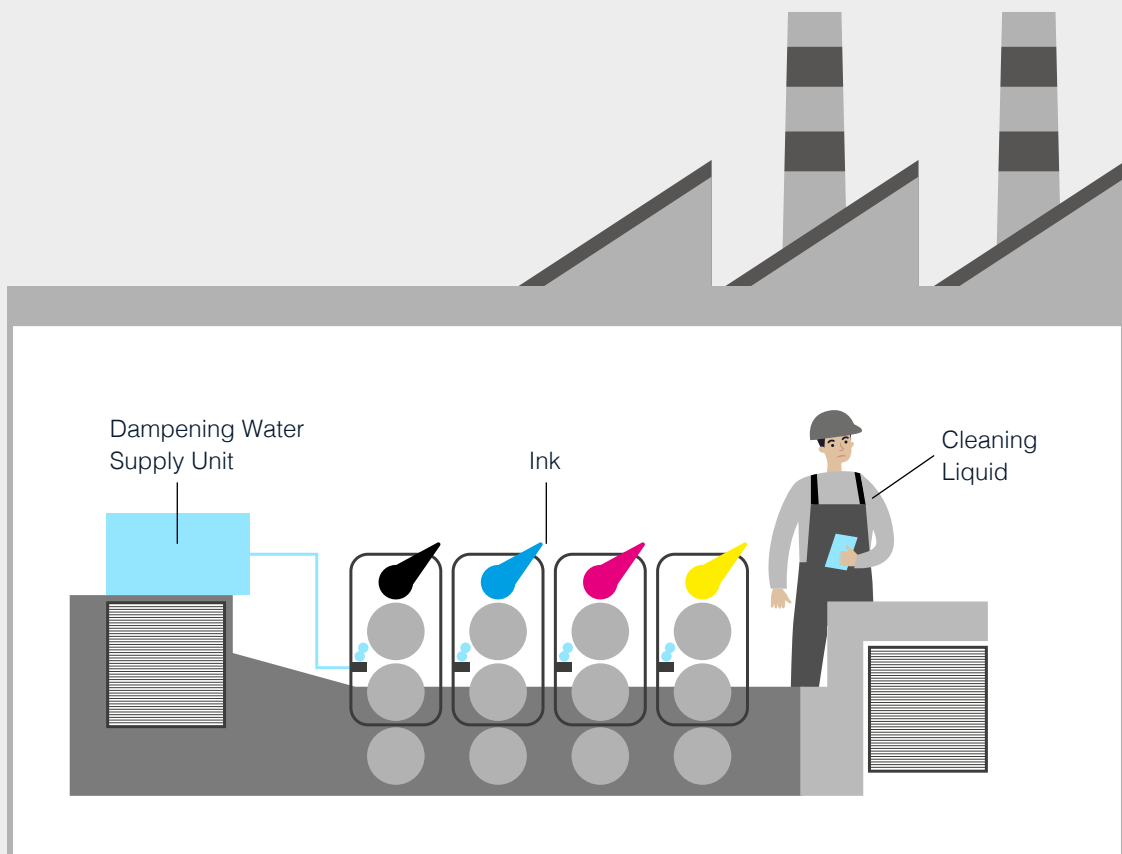
- Irritation of the eyes and respiratory tract
- Headaches
- Dizziness
- Visual disorders
- Memory problems

Long-term Exposure

- Irritation of the eyes, nose, and throat
- Nausea
- Fatigue
- Loss of coordination
- Dizziness
- Damage to the liver, kidneys, and central nervous system
- Cancer

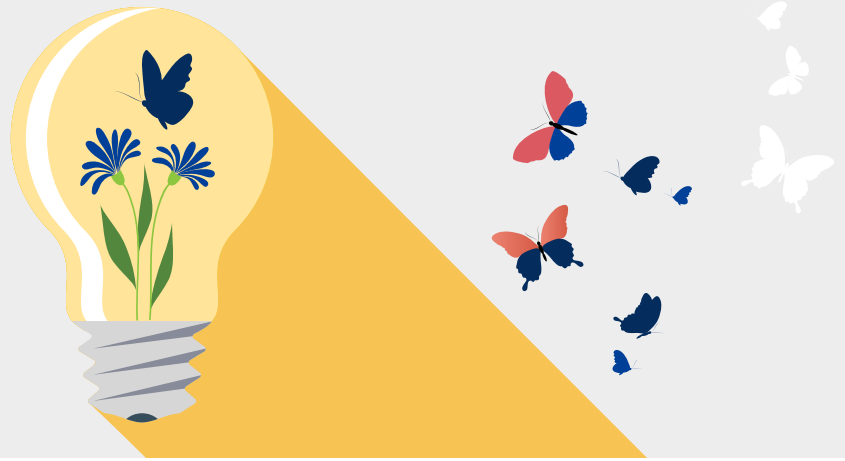
In the years between 2012 and 2014, printing plants in Osaka, Tokyo, Hokkaido and Miyagi all reported cases of employees getting biliary cancer. Dichloropropane, a chemical used to clean printing presses, was found to be the cause in all cases. It was subsequently declared as carcinogenic (Carc 1B) by the European Chemicals Agency (ECHA) and is gradually being withdrawn from use.

Where Workers Come in Contact with VOCs



What Are Possible

Solutions?



The amount of VOC is influenced by the printing method, the inks, and the cleaning liquid used. Over the years, various solutions have been developed to cut down VOC emissions. In flexographic printing, for example, huge strides have been made to bring down VOC emissions during the printing process – but a residue of VOC remains. The Japanese material technology expert Toray Industries, Inc. has launched an initiative for **100% VOC-free printing called P4E**. So far, the company has worked out one system to completely avoid VOCs in all three relevant aspects of the printing process. This includes:

Waterless Offset Printing

Waterless offset printing does not require any dampening or cleaning water, thus already reducing overall VOC emissions by 60-80%.

Water-washable UV/EB inks

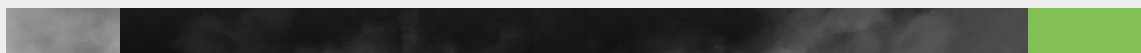
Both the water-washable inks themselves and the ultraviolet light (UV) or electron beam (EB) used for curing them are solvent-free, producing no VOC emissions.

Water-based ink cleaner

Major components for cleaning liquids include toluene and alcoholic ester. Water-based ink cleaners get rid of these substances, reducing VOC Emission from 700 ppm to zero.

Overall VOC Emissions for Different Printing Methods

Gravure with Solvent Ink



Flexo with Solvent Ink



Flexo with Water-washable Ink



Wet Offset with UV/EB Ink



Waterless Offset with UV/EB, Water-washable Ink



100 % VOC-free