Dioxins, or polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo furans (PCDD/Fs) are a group of persistent and extremely toxic chlorinated organic compounds. Dioxins are of a very stable nature and accumulate as they move up the food chain to humans.

Dioxin concentrations are commonly reported as toxic equivalents (TEQ), which is the sum of the congener concentrations multiplied by their specific TEQ factors. The extreme toxicity of 2,3,7,8 Tetra-CDD (also known as Seveso dioxin) is the reference and has a TEQ factor of 1. Dioxins and furans containing higher numbers of chlorine atoms (including the 2, 3, 7 and 8 positions) have lower TEQ factors. Since 1997, the World Health Organisation (WHO) has recognised 2,3,7,8 TCDD as carcinogenic for humans.

Major sources of dioxin emission and contamination are known to be processes like waste incineration, metal production, biofuel incineration and uncontrolled combustion, for example fires at landfill sites. The European regulations stipulate that air emissions should be less than 0.1 ng TEQ/Nm³. Dioxin emission has previously been used as argument towards waste incineration. In fact, waste incineration only contributes to a small extent to the total air emissions. The existing EU prohibition of depositing combustible material has resulted in increased waste incineration, thereby reducing the risk of uncontrolled landfill fires, which may cause large and diffuse dioxin emission sources. Under stable combustion conditions, dioxins are almost completely destroyed during incineration but are reformed to some extent by de-novo synthesis during the cooling of the flue gas and during dust separation at temperatures between 200-450°C. The waste incinerators act as dioxin sinks since more dioxins are destroyed than formed.

ADIOX® dioxin removal is a well established flue gas cleaning technology for reducing emissions of dioxins.

The technology has been used since 2001 and is in operation at more than 100 installations worldwide. Typical application is at wet flue gas cleaning after waste incineration, but ADIOX® can also be used in a dry flue gas and in metal and chemical industries where dioxins are present in the gas phase. The technology is very reliable and also prevents or reduces the “memory effect”.

The dioxin concentration in flue gas is reduced well below 0.1 ng TEQ/Nm³ to meet the levels defined in the new (2017) Draft WI BREF.
ADIOX® – for efficient and reliable dioxin removal

How dioxins behave in common flue gas cleaning
Dioxins are readily absorbed from flue gases into plastics such as polypropylene (PP). Dioxin molecules tend to migrate to the surface if conditions change when they are inside plastics, and so are released back into the flue gas. This increase in the dioxin content of the flue gas is known as the "memory effect".

How the ADIOX® dioxin removal process works
The ADIOX® process is based on the high affinity of dioxins for carbon – when in contact, the bond between dioxin and carbon is very strong. Dispersing small particles of carbon in PP plastics, a material ideal for dioxin removal is formed. A dioxin molecule that is present in the flue gas is first absorbed into the PP. From here, it migrates to a carbon particle, where it is very strongly adsorbed (bonded to its surface). The plastic acts as a selective filter with an affinity for dioxin molecules, among others. As the affinity for carbon is so high, there is no tendency for dioxin molecules to be released even when the concentration of dioxin molecules in the flue gas decreases. As a result, the memory effect is kept to a minimum.

Easy to introduce
ADIOX® can be applied in various processes, wherever emissions of dioxins need to be reduced. It is suitable for installation in wet scrubber systems or in other types of containers in a gas cleaning system and at thermal treatment plants for:
- Municipal solid waste
- Hazardous / chemical waste, especially chloride-based waste
- Sludge
- Biomass
- Steel and metal

Typical applications
- As “police filter” and to prevent/reduce the memory effect
- Integrated in a multi-functional scrubber for primary dioxin removal
- In a dry or semi-wet process, installed separately in an absorber
- Combined with SCR technology

Benefits
- Easy installation
- Very high availability
- Efficient dioxin removal, also during start-up conditions
- Long replacement intervals
- Cost-effective due to the integration in traditional packed bed scrubber systems
- No residue product – the dioxins are destroyed by incineration of used material

Product types
ADIOX® dioxin removal is available as different types of tower packings (Telpac or Rauschert Hiflow of various sizes) or as droplet separators (demisters) of the knitted mesh type (Begg Cousland) or the lammela type (Lechler).

Multi-functional wet scrubber with ADIOX® including a condensing and polishing stage, as part of a complete flue gas cleaning and energy recovery system installed at Filbornaverket W-t-E plant for municipal solid waste in Sweden.
**ADIOX® dioxin removal**

Babcock & Wilcox Vølund AB is an engineering and contracting company, whose core products are wet gas treatment and energy recovery by condensation, often combined with heat pumps.

B&W Vølund AB has developed flue gas treatment technologies in close cooperation with KIT (Karlsruhe Institute of Technology) in Germany. A number of processes originating from KIT have been further developed by B&W Vølund AB to commercial products for installation at incineration plants:

- **ADIOX®** for dioxin removal
- **MERCOX™** for mercury removal
- **CUTNOX®** for reduction of NO x formation
- **Sulfur Recirculation** for reduction of corrosion in boiler parts

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