SUMMARY

The Centre for Best Available Techniques is founded by the Flemish Government and is hosted by the Flemish Institute for Technological Research (VITO). The BAT-centre collects, evaluates and distributes information on available environmentally friendly techniques. Moreover, it advises the Flemish authorities on how to translate this information into its environmental policy. Central in this translation is the concept “BAT” (Best Available Techniques).

In this study, the discharges of waste water into surface water and into the public sewer system by the large volume organic chemical sector in Flanders are studied, and the Best Available Techniques (BAT) are determined to minimise the quantity and the degree of pollution of the waste water on the one hand and to treat the waste water on the other hand. Recommendations are given with respect to BAT-associated emission levels for the large volume organic chemical sector and with respect to further research. Only the discharges of industrial waste water, this is waste water that does not meet the definition of domestic waste water, nor the definition of cooling water (art. 1, VLAREM II), are studied.

Organic chemicals are basic organic chemicals, such as:
– simple hydrocarbons (linear or cyclic, saturated or unsaturated, aliphatic or aromatic);
– oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters, acetates, ethers, peroxides, epoxy resins;
– sulphurous hydrocarbons;
– nitrogenous hydrocarbons such as amines, amides, nitrous compounds, nitro compounds or nitrate compounds, nitriles, cyanates, isocyanates;
– phosphorus-containing hydrocarbons;
– halogenic hydrocarbons;
– organometallic compounds.

Organic bulk chemicals are (usually) produced using a continuously operated process. Other typical features for organic bulk chemicals are:
– a relatively high production volume;
– the product name is the chemical name or the formula;
– a relatively low added value;
– the sales argument is price.

Basic plastic materials (polymers synthetic fibres and cellulose-based fibres), synthetic rubbers, dyes and pigments, surface-active agents and surfactants, basic inorganic chemicals, phosphorous-, nitrogen- or potassium-based fertilisers (simple or compound fertilisers), basic plant health products and biocides, basic pharmaceutical products and explosives are not considered as large volume organic chemicals.

Based on an inquiry of companies active in the chemical industry in Flanders and based on information of the sector organisations concerned (i.e. Essenscia and FEVIA) 29 companies have been identified that produced bulk organic chemicals in Flanders from 2003 to mid 2008.

For a socio-economic and an environmental-juridical description of the large volume organic chemical sector, reference is made to chapter 2 of the study.

Possible sources of waste water in the large volume organic chemical sector include:
– synthesis (e.g. use of water as reactant solvent);

– product separation and refinement (e.g. washing of products);
– emission abatement (e.g. abatement of air emissions using a wet scrubber);
– energy/utilities (e.g. bleed on boiler feed water);

but also:
– raw material supply and work-up (e.g. storage tank overflows);
– product storage and handling (e.g. spills during loading/unloading);
– infrastructure (e.g. use of fire-fighting water);
– management systems (emissions may occur from process upsets or incidents that are attributable to the inadequacies of management systems or the failure of operators to adhere to procedures).

The nature of the pollutants in the waste water of the large volume organic chemical sector is very specific to the process, but several generic effluent characteristics are encountered in large volume organic chemical processes:
– settable and suspended solids;
– oil (grease) and other organic contaminants;
– biodegradable organics (typically as measured by BOD);
– recalcitrant organics that are not amenable to conventional biological degradation. (measured by chemical oxygen demand (COD), total organic carbon (TOC), …);
– adsorbable organic halogens (AOX);
– volatile organics;
– heavy metals, e.g. resulting from the use of catalysts;
– nitrogen-compounds (ammonium, nitrite, nitrate) and phosphor-compounds;
– acids/alkalines.

For a description of the processes in the large volume organic chemical sector and their environmental impact, reference is made to chapter 3 of the study.

In chapter 4 the techniques from the Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry (BREF LVOC) are listed and described. These techniques are implemented or can be implemented in the large volume organic chemical sector to minimise the quantity and the degree of pollution of the waste water on the one hand and to treat the waste water on the other hand.

In chapter 5 the environmentally friendly techniques are evaluated according to their technical feasibility, their environmental benefit and their economic feasibility. It is indicated whether the mentioned environmentally friendly techniques can be considered as Best Available Techniques for the large volume organic chemical sector in Flanders.

The environmentally friendly techniques that are considered as Best Available Techniques in the BREF LVOC and that are generally applied in the large volume organic chemical sector in Flanders, are selected as Best Available Techniques in this study.

The environmentally friendly techniques that are considered as Best Available Techniques in the BREF LVOC are by definition considered to be technically and economically feasible in this study. They are also considered to have a global environmental benefit.

The environmentally friendly techniques that are not (always) considered as Best Available Techniques in the BREF LVOC and that are not generally applied in the large volume organic chemical sector in Flanders, are evaluated and are case by case selected as Best Available Techniques in this study.

For an overview of all Best Available Techniques, reference is made to chapter 5 of the study.

In the table below the BAT-associated emission levels for the large volume organic chemical sector in Flanders are summarized.

Table: *BAT-associated emission levels for discharge of industrial waste water into surface water and into public sewer system*

Parameter	BAT-associated emission level (Flanders) (day result)	Unit
Only for discharge of industrial waste water into surface water		
Biochemical oxygen demand (BOD)	≤ 25-≤ 50	[mg O_2/l]
Suspended solids	≤ 60	[mg/l]
Chemical oxygen demand (COD)	≤ 125-≤ 500	[mg O_2/l]
Nitrogen, total	≤ 15 production of nitrogenous hydrocarbons: ≤ 15-≤ 50	[mg N/l]
Phosphorus, total	≤ 2-≤ 5, except if phosphorus is present in form of phosphites	[mg P/l]
For discharge of industrial waste water into surface water and into public sewer system		
Adsorbable organic halogens (AOX)	≤ 400 production of halogenic hydrocarbons/use of halogenic compounds as raw or auxiliary materials in process: ≤ 1 000	[µg Cl/l]
Arsenic, total	/ (< BEQS) (BEQS: a. ≤ 0.030)	[mg As/l]
Chromium, total	/ (< BEQS) (BEQS: a. ≤ 0.050)	[mg Cr/l]
Cyanides, total	/ (< BEQS) (BEQS: a. < 0.05), except for production of citrique acid	[mg/l]
Iron, total	≤ 3	[mg Fe/l]
Cupper, total	/ (< BEQS) (BEQS: a. ≤ 0.050) use of raw or auxiliary materials containing cupper: ≤ 0.2	[mg Cu/l]
Manganese, total	≤ 0.4	[mg Mn/l]
Benzene, toluene, ethylbenzene, xylene, individual (BTEX, individual)	≤ 5-≤ 35	[µg/l]
Styrene	≤ 5	[µg/l]
Nickel, total	≤ 0.1	[mg Ni/l]
Polycyclic aromatic hydrocarbons, 16 of EPA (PAH-16)	≤ 1 000 catalytic dehydrogenation/steam cracking: ≤ 5 000	[ng/l]
Selenium, total	≤ 0.03	[mg Se/l]
Zinc, total	≤ 1	[mg Zn/l]
Cadmium, total	≤ 0.005	[mg Cd/l]
Mercury, total	/ (< BEQS)(BEQS (y.): 0.0005)	[mg Hg/l]

Parameter	BAT-associated emission level (Flanders) (day result)	Unit
Trichlorobenzene	/ (most likely < BEQS)(BEQS (y.): 0.4)	[µg/l]
Hexachlorobutadiene	≤ 0.2	[µg/l]
Tin, total	≤ 0.1	[mg Sn/l]

a.: Absolute.
y.: Yearly average.
BEQS: Basic environmental quality standard for surface water (VLAREM II, Appendix 2.3.1).

Source: Flemish Institute for Technological Research (VITO)

The BAT-associated emission levels are considered to be feasible (for a typical company) with the application of the Best Available Techniques. The BAT-associated emission levels apply to the industrial waste water of all installations inside fence of the chemical company and of which the operation is inextricably bound up with the production of organic bulk chemicals (e.g. the installations for storage of raw materials, auxiliary materials, intermediary products and end products on site, the filling stations on site, …).

The current sectoral emission limit values for the large volume organic chemical sector (VLAREM II, Appendix 5.3.2) are out of date and not in line with the Best Available Techniques any longer.

A translation of the BAT-associated emission values to sectoral emission limit values for the large volume organic chemical sector is (currently) not considered desirable by the advisory committee of this study because of the heterogeneity of the large volume organic chemical sector, in term of products produced, and the large variations in emissions as a consequence of this. In addition the companies active in the large volume organic chemical sector are often active in other sub sectors of the chemical industry.

The permitting authorities can however use the BAT-associated emission values when determining special environmental permit conditions (emission limit values). The company's specific circumstances e.g. the production of new products (i.e. products that are not mentioned in Annex 3 to the study), the presence of activities other than the production of organic bulk chemicals and their impact on the industrial waste water (its quantity and its quality), the presence of recalcitrant substances in the industrial waste water, the application of advanced water saving measures, … and also the potential link between the different parameters (e.g. the dosage of $FeCl_3$ for the physicochemical reduction of phosphorus, total can have an impact on the concentration iron, total in the effluent) have to be taken into account.

For dangerous substances the basic principle of the Flemish Government is a progressive reduction and the obtainment of the basic environmental quality standards. For most dangerous substances the basic principle of the Flemish Government is the prevention or the termination of the pollution. The Flemish Government judges an emission limit value lower than the BAT-associated emission level to be desirable for a number of parameters (within a certain time).

The technical and the economic feasibility of more stringent emission limit values can however not be proven at this moment for a number of (most) dangerous substances. Therefore additional research on additional environmentally friendly techniques and their feasibility is recommended by the BAT-centre. Based on the results of this research additional environmentally friendly techniques can be selected as Best Available Techniques and a more stringent BAT-associated emission level can be proposed for these substances.

For an overview of all the recommendations based on the Best Available Techniques and a more detailed discussion on these recommendations, reference is made to chapter 6 of the study.

The selection of the Best Available Techniques and the formulation of the recommendations based on the Best Available Techniques are the results of an intensive search for literature, amongst others the BREF LVOC, company visits, extensive contacts with environmental and corporate responsibles and officials, … It goes without saying that the selected Best Available Techniques are a snapshot and that not all Best Available Techniques – now and in the future – can be included in this study.

The formal consultation of the sector and the Flemish authorities took place in an advisory committee. The members of the committee are included in annex 1 to the study.