ABSTRACT

This study deals with the Best Available Techniques (BAT) for processing external industrial waste water and liquid/sludgy industrial waste flows.

➔ **Consult chapter 1 for a definition of BAT and its implementation in Flanders, as well as the general framework of this BAT study.**

THE AIM OF THE BAT STUDY?
The aims of the BAT study are:

- To map out processes, environmental issues, and the environmentally-friendly techniques that are available
- To select the BAT
- On the basis of the BAT, to formulate recommendations for adjusting/supplementing the current environmental requirements:
  - To formulate BAT-associated emissions levels (BAT-AEL)
  - To formulate a recommendation for sector and/or special environmental requirements (including ELV).

SCOPE OF THE BAT STUDY?
Which activities, processes?
Activities and processes that fall within the scope of the BAT study are:

- The purification of:
  - External industrial waste water,
  - And/or waste water originating in the processing of external, liquid/sludgy industrial waste flows, hereinafter referred to as pre-treatment.
- The pre-treatment of external, liquid/sludgy waste flows which gives rise to waste water

(➔ processes focussed on removing waste substances)

The purification of external industrial waste water, waste water originating in the pre-treatment of liquid/sludgy industrial waste flows and any other waste water (e.g. originating from internal cleaning of tanks and vats, contaminated rainwater, ...) is purified by means of a combination of incremental water purification steps (mechanical, physiochemical and biological). Pre-treatment comprises a combination of mechanical, physical, physiochemical and other processes.

Processes focussed solely on useful applications, including:

- The recapture/regeneration of organic substances, including solvents
- The recycling/recapture of metals and metallic compounds
- The recycling/recapture of other inorganic materials
- The regeneration of acids and bases

fall outside the scope of the BAT study.

What are the environmental aspects?

Environmental aspects that fall within the scope of the BAT study are:

- The discharge of industrial waste water
- The emission of volatile organic compounds (VOCs) and odour

FOCUS OF THE BAT STUDY?

The focus of the BAT study is the purification of waste water. The BAT study also describes the pre-treatment processes, but not in detail, i.e. not at the level of individual industrial waste flows. However, the BAT study does pay due consideration to the general environmental aspects and general environmentally-friendly techniques, i.e. environmentally-friendly techniques that are applicable to the majority of the pre-treatment processes. It is therefore not the intention to evaluate pre-treatment processes for individual industrial waste flows for their technical feasibility, environmental benefit and economic feasibility (i.e. to examine which pre-treatment processes are BAT), all the more since these pre-treatment processes do not always take place at the processors themselves.

The figure below summarises the scope and focus of the BAT study.

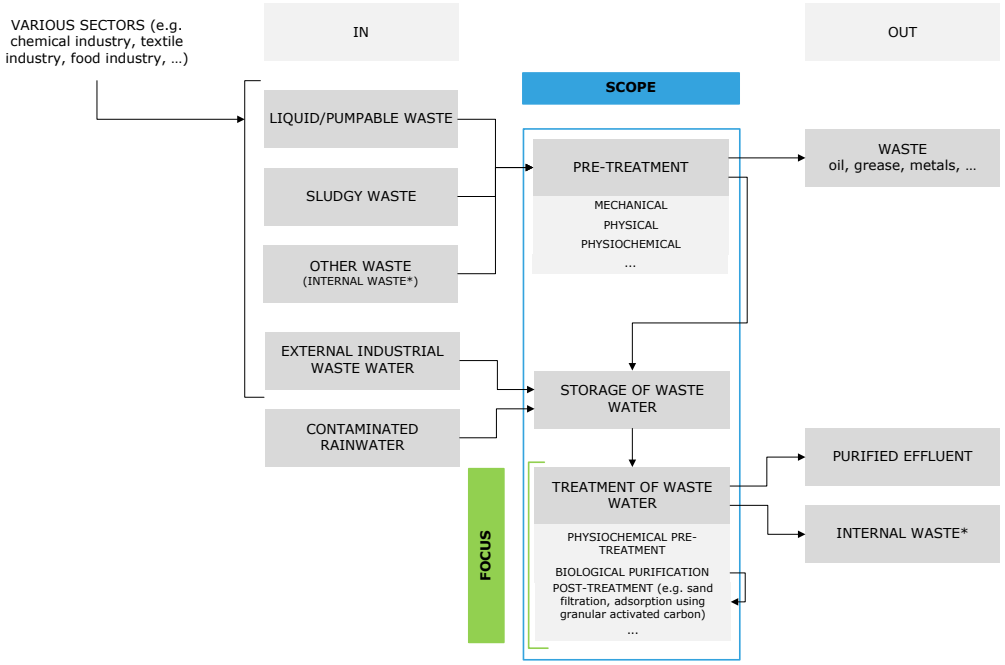

Figure: Scope and focus of BAT study for the processing of external industrial waste water & liquid/sludgy industrial waste flows

➔ **Consult chapter 2 for a description of the sector for processing external industrial waste water and liquid/sludgy industrial waste flows and the most important socio-economic aspects and environmental law aspects.**

Since the focus of the BAT study lies upon the purification of waste water, the collation of information focusses on those businesses that are considered to be representative of the sector for waste water issues. In total, 12 businesses in Flanders. Companies (or water treatment plants) that take in external industrial waste water to

optimise operation and/or to make maximum use of the capacity of the water treatment plant, also fall, strictly speaking, within the scope of the BAT study and are therefore assumed to use the BAT.

➔ **Consult chapter 3 for a description of the typical processes in the sector and the associated environmental impact.**

ENVIRONMENTAL IMPACT?

The processing of external industrial waste water and liquid/sludgy industrial waste streams is (or may be) associated with the emission of VOCs and odour. The majority of the components that give rise to odour pollution when purifying waste water and sludge arise once they have become anaerobic or septic, i.e. once all dissolved oxygen and nitrates have been used up. Under anaerobic conditions, a number of odour-producing biochemical reactions take place. The extent to which the various biochemical reactions take place will be influenced by environmental factors including the time, temperature, pH, redox potential, concentrations of substrate and nutrients, the presence of toxic components, the salt content and the composition of the waste water and sludge (in particular, the concentration of organic material and suspended matter). When purifying water and treating sludge, chemicals and additives are dosed. These additives may influence the development of odour, in particular the release of odorous components that are already present in the waste water or sludge. The use of gases by means of an end-of-pipe technology may also result in the emission of odorous components (e.g. odour of peat in a peat-bed biofilter).

The industrial waste water discharged by processors of external industrial waste water and liquid/sludgy waste consists of: (1) external (industrial) waste water (after purification), (2) waste water originating from processing (pre-treatment) of, as well as external, liquid/sludgy industrial waste flows (after purification); in addition to: (3) extinguishing water, (4) boiler feed water (drain), (5) cooling water (drain), (6) cleaning/rinsing water, (7) (contaminated) rainwater, (8) sanitary waste water and (9) water originating from other activities (processes) e.g. internal cleaning of tanks and vats. A wide range of substances may be found in the industrial waste water.

➔ **Consult chapter 4 and chapter 5 for a description of the environmentally-friendly techniques and the selection of the BAT for processing external industrial waster water and liquid/sludgy industrial waste flows.**

ENVIRONMENTALLY-FRIENDLY TECHNIQUES AND BAT?

Chapter 4 of the BAT study provides an overview of the techniques that the sector is able to apply in order to prevent and/or limit damage to the environment.

Chapter 5 of the BAT study assesses the environmentally-friendly techniques from chapter 4 for their technical feasibility, their environmental benefit and their economic feasibility. The evaluation indicates whether the listed environmentally-friendly techniques can or cannot be considered as BAT for the sector.

Around 15 techniques have been selected as BAT in this BAT study. The selection of the BAT was carried out in close consultation with representatives of the sector and management, and is based on literature review and industry information.

SOME EXAMPLES OF BAT?

The BAT for the prevention or limitation of emissions of VOCs and/or odour are: (1) good housekeeping, (2) coverage (enclosure) of process components, exhaust and post-treatment in an exhaust gas cleaning system and (3) carrying out an odour audit or drawing up an odour management plan in the event of persistent odour complaints.

The BAT for the prevention or limitation of discharges of waste water are:

- Conserve water.
- Optimise the pre-treatment of waste water, depending on the purified waste water flows.
  Pre-treatment consists of a combination of:
  - Removal of large waste (by means of a sieve, grid)
  - Removal of sand (by means of a grit channel)
  - Emulsion breaking
  - Separation of grease (by means of a static grease interceptor (grease trap))
  - Separation of oil (by means of an oil-water separator)

  Or other equivalent techniques.
- Optimise the physiochemical pre-treatment of waste water, depending on the purified waste water flows.
  Physiochemical pre-treatment consists of:
  - Detoxification of flows containing chromium (VI) and cyanide
  - Chemical precipitation, coagulation and flocculation
  - Sedimentation (using sedimentation basin or lamella sedimentation tank) or flotation (by means of air)

  Or other equivalent techniques.
- Optimise the biological purification of waste water, depending on the purified waste water flows.
  Biological purification consists of an active sludge system, with removal of nitrogen (nitrification/ denitrification), or other equivalent techniques.
- Optimise the post-treatment of waste water, on the purified waste flows.
  Post-treatment consists of:
  - Filtration (sand filtration and microfiltration)
  - Fixed-bed adsorption (adsorption using granular activated carbon)

  Or other equivalent techniques, e.g. chemical oxidation.
- The use of PACT (powdered activated carbon treatment).
- The separate purification of specific sub-flows.

Additionally, a number of techniques were selected as conditional BAT.

➔ **Consult chapter 6 for recommendations, based upon the BAT.**

Chapter 6 provides recommendations based upon the BAT, recommendations for environmental regulations and recommendations for further research and technological development.

WHAT RECOMMENDATIONS ARE THERE WITH REGARD TO ENVIRONMENTAL REGULATIONS FOR THE WASTE WATER ASPECT?

The table below contains the recommendation for ELV for the discharge of industrial waste water when processing external industrial waste water and liquid/sludgy industrial waste flows.

Table: Recommendation for ELV (instantaneous values) for the discharge of industrial waste water when processing external industrial waste water and liquid/sludgy industrial waste flows.

	ELV (instantaneous value) for the discharge of industrial waste water	
SS	60	[mg/l]
F^- (dissolved)	15	[mg/l]
N t	No recommendation	[mg/l]
P t	2	[mg/l]
BOD_5	25	[mg O_2/l]
COD	No recommendation	[mg O_2/l]
Ag t	0.01	[mg/l]
As t	0.03	[mg/l]
B t	10	[mg/l]
Ba t	0.14	[mg/l]
Cd t	0.002	[mg/l]
Co t	0.03	[mg/l]
Fe t	5	[mg/l]
Mn t	1	[mg/l]
Mo t	0.7	[mg/l]
Ni t	0.3	[mg/l]
Se t	0.015	[mg/l]
V t	0.04	[mg/l]
Zn t	0.4	[mg/l]
AOX	No recommendation	[µg Cl/l]
Acenaft	100	[ng/l]
B(a)P	100	[ng/l]
B(b)Flu + B(k)Flu	200	[ng/l]
B(ghi)Pe + IP	200	[ng/l]
Pyr	100	[ng/l]
Styrene	1	[µg/l]
4tOyFol	0.1	[µg/l]
123CBz + 124CBz +135CBz	1.2	[µg/l]
AISurf	2	[mg/l]

The BAT study does not formulate ELV for the parameters COD, N t and AOX in anticipation of further research.

The ELVs for PAHs are usually considered feasible, continuing the analysis of the available discharge data. In some cases, it may be necessary to set less strict ELVs in the permit. A relaxation can, in our opinion, only be allowed if the company can show, by means of a feasibility study, that the proposed ELVs are not feasible using at least two activated carbon filters in series, preceded by sand filtration, and optimal management of the processing and treatment plant.

RECOMMENDATIONS FOR ENVIRONMENTAL REGULATIONS FOR THE AIR ASPECT?

Supplementary to the current sector environmental requirements, the BAT study formulates a proposal for sector ELV for VOCs of 20 mg/Nm^3 and a recommendation for a medium requirement to limit emissions of VOCs and odour:

"When processing external industrial waste water and/or liquid sludgy industrial waste flows, in which volatile organic products with a vapour tension of more than 13.3 kPa at a temperature of 35°C, or strongly odorous substances are released, the air is treated with a selection or combination of a bio(trickling) filter, an activated carbon filter, a gas scrubber, an afterburner or other similar treatment system.

Parts of the process (treatments) which, as a minimum, must be covered (enclosed), fitted with an extraction system and post-treated are:

- The loading of odorous and/or VOC-emitting waste substances, including sludge, including loading and unloading of tanks
- The mixing and bulking up of odorous and/or VOC-emitting waste substances
- The storage of odorous and/or VOC-emitting waste substances, including sludge
- Reservoirs (e.g. receiving basins), storage tanks, pre-treatment zones and mixture/reaction tanks
- Sedimentation tanks
- Physiochemical treatment/reaction vats (including those for neutralisation, redox reactions and treatment of waste water containing nitrites and ammonia)
- Sludge thickening, conditioning and dewatering installations (via chamber filter press, decanter centrifuge, ...)."

WHAT RECOMMENDATIONS ARE THERE WITH REGARD TO FURTHER RESEARCH AND TECHNOLOGICAL DEVELOPMENT?

A number of relevant topics in which further research and technological development is desirable, are: (1) The environmental benefit of an intensive activated carbon treatment and (2) additional standards on the basis of persistence, bioaccumulability and toxicity.