7.22 Storage and handling of organic compounds (except petrol covered by chapters 7.5 and 7.21)

7.22.1 Coverage

This chapter address the storage and handling of organic compound (vapour pressure higher than 10 Pa at 20°C) carried in activities such as the organic chemical industry, use of solvents, fine chemical industry... Petrol storage and handling is covered by chapters 7.5 and 7.21.

7.22.2 Emission sources

Storage and handling of liquid organic compounds (vapour pressure higher than 10 Pa at 20°C) may be source of VOC emissions.

7.22.3 BAT, Associated Emission Levels (AELs)

BAT description comes from reference 1 and 2.

Storage

Tank design

BAT for a proper design is to take into account at least the following:

- the physico-chemical properties of the substance being stored
- how the storage is operated, what level of instrumentation is needed, how many operators are required, and what their workload will be
- how the operators are informed of deviations from normal process conditions (alarms)
- how the storage is protected against deviations from normal process conditions (safety instructions, interlock systems, pressure relief devices, leak detection and containment, etc.)
- what equipment has to be installed, largely taking account of past experiences of the product (construction materials, valve quality, etc.)
- which maintenance and inspection plan needs to be implemented and how to ease the maintenance and inspection work (access, layout, etc.)
- how to deal with emergency situations (distances to other tanks, facilities and to the boundary, fire protection, access for emergency services such as the fire brigade, etc.).

Inspection and maintenance

BAT is to apply a tool to determine proactive maintenance plans and to develop risk-based inspection plans such as the risk and reliability based maintenance approach.
Inspection work can be divided into routine inspections, in-service external inspections and outof-service internal inspections.

Tank colour

BAT is to apply either a tank colour with a reflectivity of thermal or light radiation of at least 70 %, or a solar shield on aboveground tanks which contain volatile substances.

Emissions minimization principle in tank storage

BAT is to abate emissions from tank storage, transfer and handling.

External floating roof tank:

The BAT associated emission reduction level for a large tank is at least 97 % (compared to a fixed roof tank without measures), which can be achieved when over at least 95 % of the circumference the gap between the roof and the wall is less than 3.2 mm and the seals are liquid mounted, mechanical shoe seals. By installing liquid mounted primary seals and rim mounted secondary seals, a reduction in air emissions of up to 99.5 % (compared to a fixed roof tank without measures) can be achieved. However, the choice of seal is related to reliability, e.g. shoe seals are preferred for longevity and, therefore, for high turnovers.

BAT is to apply direct contact floating roofs (double-deck), however, existing non-contact floating roofs (pontoon) are also BAT.
Additional measures to reduce emissions are:

- applying a float in the slotted guide pole
- applying a sleeve over the slotted guide pole, and/or
- applying 'socks' over the roof legs.

Fixed roof tanks

Fixed roof tanks are used for the storage of flammable and other liquids, such as oil products and chemicals with all levels of toxicity.
For the storage of volatile substances which are toxic (T), very toxic (T+), or carcinogenic, mutagenic and reproductive toxic (CMR) categories 1 and 2 in a fixed roof tank, BAT is to apply a vapour treatment installation.

For other substances, BAT is to apply a vapour treatment installation, or to install an internal floating roof.
The selection of the vapour treatment technology is based on criteria such as cost, toxicity of the product, abatement efficiency, quantities of rest-emissions and possibilities for product or energy recovery, and has to be decided case-by-case. The BAT associated emission reduction is at least 98 % (compared to a fixed roof tank without measures).

The achievable emission reduction for a large tank using an internal floating roof is at least 97 % (compared to a fixed roof tank without measures), which can be achieved when over at least 95 % of the circumference of the gap between the roof and wall is less than 3.2 mm and the seals are liquid mounted, mechanical shoe seals. By applying liquid mounted primary seals and rim mounted secondary seals, even higher emission reductions can be achieved. However, the smaller the tank and the smaller the number of turnovers, the less effective the floating roof is.

Transfer and handling

Inspection and maintenance
BAT is to apply a tool to determine proactive maintenance plans and to develop risk-based inspection plans such as, the risk and reliability based maintenance approach;

Leak detection and repair programme
For large storage facilities, according to the properties of the products stored, BAT is to apply a leak detection and repair programme. Focus needs to be on those situations most likely to cause emissions (such as gas/light liquid, under high pressure and/or temperature duties).

Emissions minimisation principle in tank storage
BAT is to abate emissions from tank storage, transfer and handling that have a significant negative environmental effect, This is applicable to large storage facilities, allowing a certain time frame for implementation.

Operational procedures and training
BAT is to implement and follow adequate organisational measures and to enable the training and instruction of employees for safe and responsible operation of the installation

Piping
BAT is to apply aboveground closed piping in new situations. For existing underground piping it is BAT to apply a risk and reliability based maintenance approach.

Bolted flanges and gasket-sealed joints are an important source of fugitive emissions. BAT is to minimise the number of flanges by replacing them with welded connections, within the limitation of operational requirements for equipment maintenance or transfer system flexibility,

BAT for bolted flange connections include:
- fitting blind flanges to infrequently used fittings to prevent accidental opening
- using end caps or plugs on open-ended lines and not valves
- ensuring gaskets are selected appropriate to the process application
- ensuring the gasket is installed correctly
- ensuring the flange joint is assembled and loaded correctly
- where toxic, carcinogenic or other hazardous substances are transferred, fitting high integrity gaskets, such as spiral wound, kammprofile or ring joints.

Internal corrosion may be caused by the corrosive nature of the product being transferred, BAT is to prevent corrosion by:
- selecting construction material that is resistant to the product
- applying proper construction methods
- applying preventive maintenance, and
- where applicable, applying an internal coating or adding corrosion inhibitors.

To prevent the piping from external corrosion, BAT is to apply a one, two, or three layer coating system depending on the site-specific conditions (e.g. close to sea). Coating is normally not applied to plastic or stainless steel pipelines.

Vapour treatment

BAT is to apply vapour balancing or treatment on significant emissions from the loading and unloading of volatile substances to (or from) trucks, barges and ships. The significance of the emission depends on the substance and the volume that is emitted, and has to be decided on a case-by-case basis.

Valves
BAT for valves include:
- correct selection of the packing material and construction for the process application • with monitoring, focus on those valves most at risk (such as rising stem control valves in continual operation)
- applying rotating control valves or variable speed pumps instead of rising stem control valves
- where toxic, carcinogenic or other hazardous substances are involved, fit diaphragm, bellows, or double walled valves
- route relief valves back into the transfer or storage system or to a vapour treatment system.

Pumps and compressors
Installation and maintenance of pumps and compressors
The design, installation and operation of the pump or compressor heavily influence the life potential and reliability of the sealing system. The following are some of the main factors which constitute BAT:
- proper fixing of the pump or compressor unit to its base-plate or frame
- having connecting pipe forces within producers' recommendations
- proper design of suction pipework to minimise hydraulic imbalance
- alignment of shaft and casing within producers' recommendations
- alignment of driver/pump or compressor coupling within producers' recommendations when fitted
- correct level of balance of rotating parts
- effective priming of pumps and compressors prior to start-up operation of the pump and compressor within producers' recommended performance range (The optimum performance is achieved at its best efficiency point.)

- the level of net positive suction head available should always be in excess of the pump or compressor
- regular monitoring and maintenance of both rotating equipment and seal systems, combined with a repair or replacement programme.

Sealing system in pumps
BAT is to use the correct selection of pump and seal types for the process application, preferably pumps that are technologically designed to be tight such as canned motor pumps, magnetically coupled pumps, pumps with multiple mechanical seals and a quench or buffer system, pumps with multiple mechanical seals and seals dry to the atmosphere, diaphragm pumps or bellow pumps.

Sealing systems in compressors
BAT for compressors transferring non-toxic gases is to apply gas lubricated mechanical seals. BAT for compressors, transferring toxic gases is to apply double seals with a liquid or gas barrier and to purge the process side of the containment seal with an inert buffer gas. In very high pressure services, BAT is to apply a triple tandem seal system.

Table 1: Associated Emission Levels with BAT to reduce VOC emissions from storage of organic coumponds

Emission sources	Combination of BAT	BAT Associated Emissions Levels for VOCs
Storage tanks of volatile products	Internal floating roof External floating roof Other tank designs and appropriate colours	97 to 99.5 % compared to a fixed roof tank without measure*

* If the efficiency cannot be reached because of the specific characteristics of a storage tank (such as small throughput, small diameter), best available primary and secondary seals have to used.

7.22.4 Cost data for emissions reduction techniques

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No cost data are available.

7.22.5 References used for chapter 7.22

[1] European Commission - reference document on BAT in emissions from storage July 2006

[2] European Commission - reference document on BAT on emissions from storage – February 2003 – Available at: http://eipccb.jrc.es