

# **Training on VOC Installations (Chapter V (VOC) of IED (Directive 2010/75/EC), Petrol Stage I/II Directives):**

## **Petrol Stage I Directive – Best Techniques**

### **German Country Experience**

# Directive 1994/63/EC storage of petrol and its distribution from terminals to service stations



**EUROPEAN PARLIAMENT AND COUNCIL DIRECTIVE 94/63/EC**

**of 20 December 1994**

**on the control of volatile organic compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations**

**(OJ L 365, 31.12.1994, p. 24)**

**Last amended by Regulation (EC) No 1137/2008 of 21.11.2008**

**Best Techniques and Practices – Europe and especially Germany**

## Scope of Petrol Stage I: Storage – Distribution of Petrol

“Old” Directive



**Part of EU REFIT Programme**

- 2015: Start of the evaluation of the effectiveness, efficiency, coherence, relevance and the EU added value
- Several meetings
- **Final Report: 2017**
- Results under

[https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp?FormPrincipal:\\_idcl=FormPrincipal:\\_id1&FormPrincipal\\_SUBMIT=1&id=a74500a7-7335-45d3-8867-78c625e315be&javax.faces.ViewState=BbQJ0%2FmbYPlw5ATd%2Fv5XDYpmXG8NJ2XTXru3pW7UbQc9yua4umqOWGWEHojpEgMoLHxR4zpzlu4OBu2duk31ul8xpUjUFO2QE0FWNRfDZbSnuB8okOqJnf0500oyjX3zbd5r7K8yOD600sUXIZJS%2BRj1Q4%3D](https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp?FormPrincipal:_idcl=FormPrincipal:_id1&FormPrincipal_SUBMIT=1&id=a74500a7-7335-45d3-8867-78c625e315be&javax.faces.ViewState=BbQJ0%2FmbYPlw5ATd%2Fv5XDYpmXG8NJ2XTXru3pW7UbQc9yua4umqOWGWEHojpEgMoLHxR4zpzlu4OBu2duk31ul8xpUjUFO2QE0FWNRfDZbSnuB8okOqJnf0500oyjX3zbd5r7K8yOD600sUXIZJS%2BRj1Q4%3D)

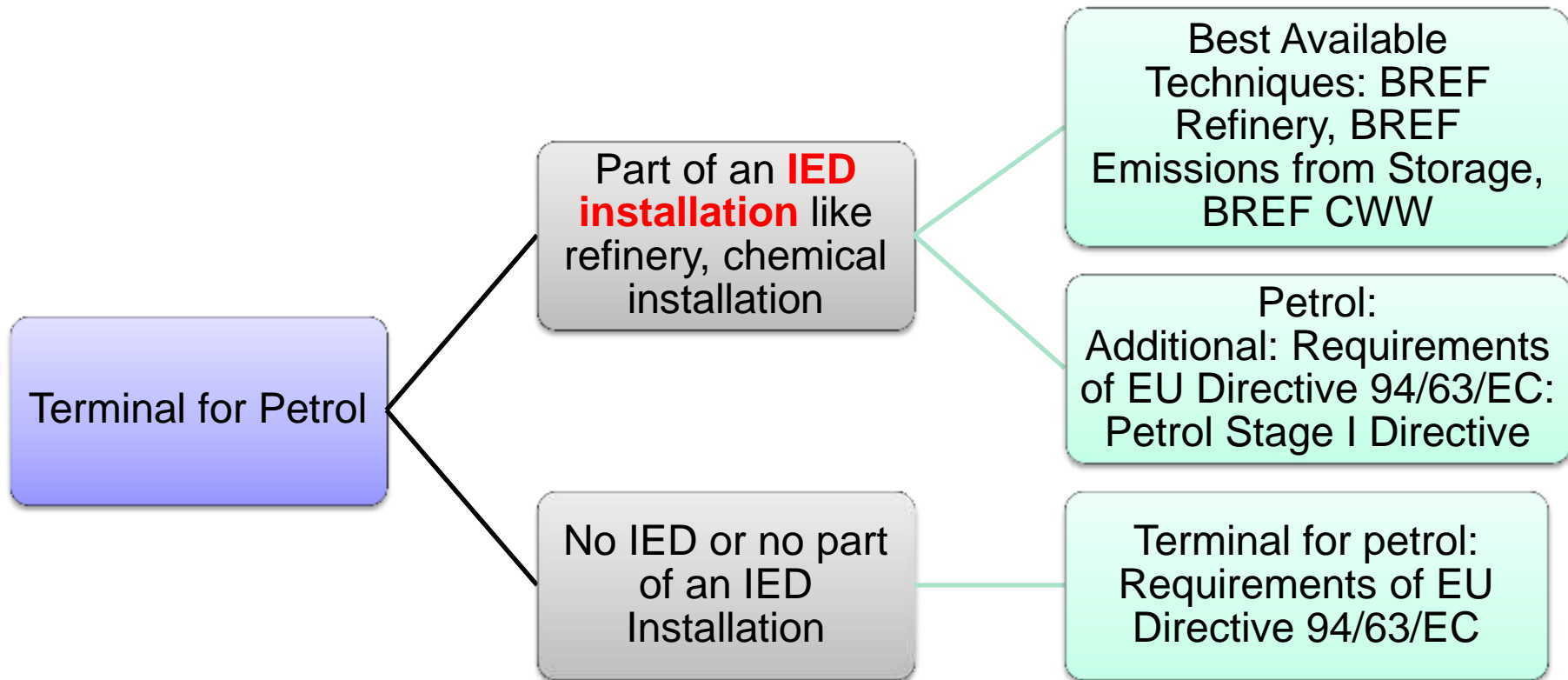
## **Best Practice for Terminals: Implementation of an environmental permitting duty**

### **EU:**

If a terminal is a part of an IED installation (generally refinery):

- > IED permitting procedure and permit required
- > Application of BATs
- > IED Inspection procedures required

# EU legal requirements for Petrol Terminals for Air Pollution Control



## Germany: Environmental permit requirements for tank farms for the storage of fuels or inflammable substances – here Petrol

- Annex of German 4<sup>th</sup> BImSchV No 9.2 is the relevant number for the storage of fuels or other inflammable substances.
- Relevant is the maximum possible installed capacity of the site (one operator).

<b>9.2</b>	<b>Installations for the storage of liquids, except for installations that are covered by paragraph 9.3,</b>		
<b>9.2.1</b>	with a capacity of 10 000 tonnes or more, provided that the liquids have a flash point of 373.15 Kelvin or less,	G	
<b>9.2.2</b>	5 000 tonnes to less than 10 000 tonnes, provided that the liquids have a flash point below 294.15 Kelvin and their boiling point at atmospheric pressure ( 101.3 kilopascals ) over 293.15 Kelvin;	V	

## Germany: Environmental permit requirements for tank farms for the storage of fuels or inflammable substances – here Petrol

### Result:

If an installation requires an environmental permit

- **Assessment of hazardous impacts has to be carried out**
- **Emission limit values for benzene will be set for VRUs additionally to TOC**
- **Best Available Techniques have to be applied** – this is generally more stricter than Petrol Stage I – Petrol Stage I sets only minimum requirements!
- Other requirements from TA Luft like use of a flare for tank cleaning, prevention of landing of floating roofs and technical requirements for pumps, valves etc. have to be complied, too

## Best Practice: Terms – Definition of Petrol

### “Petrol” referring to Petrol Stage I:

any **petroleum derivative**, with or without additives, having a **reid vapour pressure of 27,6 kilopascals or more**, which is intended for **use as a fuel for motor vehicles**, except liquefied petroleum gas (LPG)

### “Petrol” in German 20<sup>th</sup> BImSchV: -> Reference to international Transport Regulations made in Definition -> +: use of same terminology

petroleum derivatives with a share of up to 10 percent by volume of bioethanol, corresponding to UN Number 1203 of the respective Table A in Part 3 Chapter 3.2.1 of Annexes A and B to the **ADR**, in Part 3 Chapter 3.2 of the **RID** or in Part 3 Chapter 3.2.1 of the Annex to the **ADN** and which are intended for use as fuel for petrol engines

ADR: International Carriage of Dangerous Goods by Road:

[https://www.unece.org/fileadmin/DAM/trans/danger/publi/adr/adr2015/ADR2015e\\_WEB.pdf](https://www.unece.org/fileadmin/DAM/trans/danger/publi/adr/adr2015/ADR2015e_WEB.pdf)

RID = International Carriage of Dangerous Goods by Rail

[http://otif.org/en/?page\\_id=174](http://otif.org/en/?page_id=174)

ADN: International Carriage of Dangerous Goods by Inland Waterways

[https://www.unece.org/trans/danger/publi/adn/adn2015/15files\\_e.html](https://www.unece.org/trans/danger/publi/adn/adn2015/15files_e.html)



# Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals

## Tank colour for over ground tanks

**BAT is** to paint the external walls and roofs in a colour with a total radiant reflectance as high as possible (minimum: 70 %)

- **BREF EFS 5.1.1.1**
- **EU Petrol Stage I Annex I**
- **TA Luft 2002 No 5.2.6.7**

**White – total radiant heat reflectance of 84 %**

Colour	Coating factor [1]	Total radiant heat reflectance
white	1,0	84 %
aluminium	1,1	72 %
silver		
light grey	1,3	51 %
mouse grey	1,6	13 %

## Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals

### But: Note “wording” of requirements e.g. Petrol Stage I Annex I and German Ordinance:

- The external wall and roof of tanks above ground must be painted in a colour with a total radiant heat reflectance of 70 % or more.
  - These operations may be **programmed so as to be carried out as part of the usual maintenance cycles of the tanks within a period of three years.** Member States may grant a **derogation** from this provision where required for the protection of special landscape areas which have been designated by national authority.
  - This provision shall **not apply to tanks linked to a vapour recovery unit** which conforms with the requirements set out in Annex II, point 2.
- 20<sup>th</sup> BImSchV:** The operator shall construct and operate above-ground storage tanks in such a way that the outer wall and the roof are painted in a colour with a total radiant heat reflectance of at least 70 per cent.

## **Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals**

### **Result:**

- **In Germany every tank must have the heat radiance efficiency permanently**
- **All tanks – independent if connected to a VRU - must have the heat radiance efficiency to prevent VOC emissions!**
- **No derogations -> easier for the enforcement for authorities**

## **Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals**

**Further measures to prevent the increase of storage temperature and breathing emissions are for example**

- improvement of wall isolation,
- application of sun shields in the area of sun exposed tank walls,
- natural cooling of floating roof by evaporation of rain water

Reference BREF ESB

## Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals – Seal efficiencies

### Tanks with external floating roofs:

**BREF EFS 5.1.1.2**

**BAT is** to reduce the emissions of a **floating-roof tank** to **97% and more** of the emissions of a fixed-roof tank without further measures.

Total efficiencies of the floating roof tank of approx. **99,5%** achievable by:

- A threefold sealing system
- together with a complete guide pole cover and seal
- and with roof leg seals

### **BREF Ref BAT 49:**

**BAT is** to use **floating roof storage tanks** equipped with high efficiency seals **or** a **fixed roof tank connected to a vapour recovery system**.

**BREF EFS 5.1.1.2:** A **dome** can be **BAT** for adverse weather conditions, such as high winds, rain or snowfall.

## Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals – Seal efficiencies

### Example: German 20<sup>th</sup> BImSchV – external floating roof tanks

- Tanks with external floating roofs must be equipped with **annular gap sealings according to the Best Available Techniques.**
- The seals should be designed to achieve an overall containment of vapours of **97 %** or more as compared to a comparable **inoperative** fixed-roof tank with no vapour containment controls (that is a fixed-roof tank with only vacuum/pressure relief valve **and no turnovers**)

#### Note:

A emission reduction ratio of less than 97 % can be permitted for tanks with a diameter less of 40 m by the competent authority.

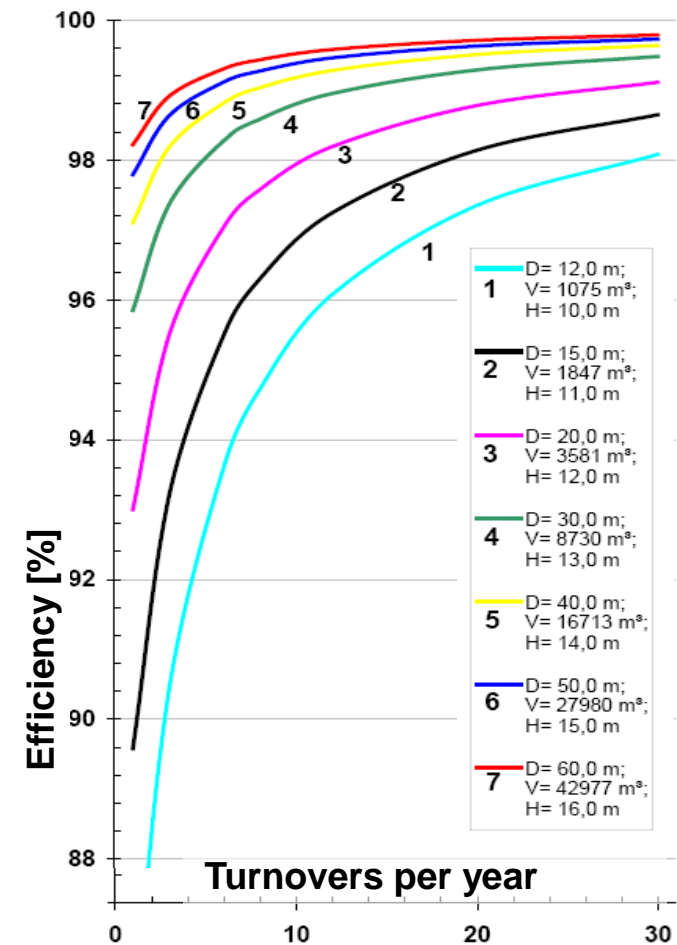
## Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals – Seal efficiencies

Influence of the number of turn-overs on the calculated efficiency of the seal

**More turnovers increase calculated efficiency!**

-> To compare technical quality of seals the emission reduction efficiency must **be referred to an inoperative comparable fixed-roof tank with no vapour containment controls** (that is a fixed-roof tank with only vacuum/pressure relief valve and no turnovers).

Storage of petrol 600 mbar (Reid), average wind speed 3 m/s, daily average temperature 10 °C, all floating roof tanks with the same sealings (rim, pole guide, roof legs)



## Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals – Seal efficiencies

### German 20<sup>th</sup> BImSchV – Fixed roof tanks

- Fixed-roof tanks must have an internal floating roof **equipped with annular gap sealings according to Best Available Techniques**
- Overall containment of vapours of **≥ 97** % in relation to a comparable **inoperative** fixed-roof tank with no vapour controls **and no turnovers**.



## Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals – Seal efficiencies

For demonstration of **emission reduction efficiencies** for

- a) external floating roof tanks
- b) fixed roof tanks

**calculation of emissions** should be applied.

On hand of emission calculation the application of BAT can be shown by the operator

-> See IE Directive Art. 14 1 d) – annual information by operator to demonstrate compliance to competent authority

### **Calculation techniques:**

- a) US API Standards
- b) VDI 3479

## Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals – Seal efficiencies

### BREF EFS (Chapter 5.1.1.1.): **Monitoring of VOC from Storage**

On sites where significant VOC emissions are to be expected,

**BAT includes calculating the VOC emissions regularly.**

The calculation model may occasionally need to be validated by applying a measurement method.

***Split view** from 3 Member States, because in their view, on sites where significant VOC emissions are to be expected (e.g. refineries, petrochemical plants and oil terminals), **BAT is to calculate the VOC emissions regularly with validated calculation methods, and because of uncertainties in the calculation methods, emissions from the plants should be monitored occasionally in order to quantify the emissions and to give basic data for refining calculation methods. This can be carried out by using DIAL techniques. The necessity and frequency of emission monitoring needs to be decided on a case-by-case basis.***

## **Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals – Seal efficiencies**

Comparison of reduction efficiencies  
Imhof Tanktechnik

The expected efficiencies are e.g.:

	<b>External Floating Roof Tank</b>	<b>Internal Floating Roof Tank</b>
<b>Primary seal</b>	eff. ~ 88 %	eff. ~ 95 %
<b>Double seal</b>	eff. ~ 93 %	eff. ~ 98 %
<b>Double seal + guide pole seal</b>	eff. ~ 97,5 %	eff. ~ 99 %
<b>Triple seal + guide pole cover</b>	eff. ~ 99,5 %	eff. ~ 99,8 %

## Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals – Fixed roof tanks - PVRV

### Fixed roof tanks: Prevention of VOC losses by breathing

BAT is to prevent VOC losses by using pressure and vacuum relief valves.

The goal of the application of Vacuum/Pressure Relief Valves (V/P valves) is the reduction of breathing losses during the storage of VOC

Setting of the valves to an overpressure of **+ 0,02 bar** and a vacuum of **0,01 bar** (see No 3.3.2.1 of VDI 2440):

valve response pressure: ca. + 0,014/-0,007 bar

-> Until the response pressure the V/P valves are kept close although the tank vapour space volume achieve changes by warming/cooling or air pressure fluctuations.

## **Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals – Seal efficiencies**

### **Summary:**

- 1. Set requirements on the seal efficiency for new storage tanks according to BAT – for new ones: BAT is currently  $\geq 97\%$**
- 2. Require qualified assessments on the sealing efficiencies by independent experts/expert bodies**

## **Petrol Stage I – Best Practice on Article 3 and Annex I – Storage at terminals – Seal efficiencies**

### **Assessment of efficiency of seals – possible procedure:**

**Verification by calculation** with appropriate programme by a specified company or expert body:

a) new installations: before putting into operation to be submitted to authority giving license

b) existing installations: three month before deadline for retrofitting ends to be submitted to authority giving license

## **Petrol Stage I – Best Practice on Article 4 with Annex II – Loading and unloading of mobile containers**

*Displacement vapours from the mobile container being loaded must be returned through a vapour-tight connection line to a vapour recovery unit for regeneration at the terminal.*

....

*Where top-loading of mobile containers is permissible:  
the outlet of the loading arm must be kept near the bottom of the mobile container,  
in order to avoid splash loading*

**Here: Top-loading of railway wagons**

# Petrol Stage I – Best Practice on Article 4 with Annex II – Loading and unloading of mobile containers

## German 20<sup>th</sup> BImSchV – Transfer and handling liquids

**Gas (vapour) balancing** according to BAT is **permitted** for:

- Loading of fixed roof storage tanks at terminals
  - Loading of mobile containers (vessels, road tankers, railway tank waggons)
- if same emission reduction is achieved as by the use of a vapour recovery unit!

**Vapour balance systems** comply to the **Best Available Techniques** if

especially

1. the petrol flow is unblocked only if the vapour recovery system is connected and
2. the vapour recovery system together with connected devices don't release vapours into the atmosphere during operation of vapour recovery (besides emissions caused by reasons of safety)



# Petrol Stage I – Best Practice on Article 4 with Annex II – Loading and unloading of mobile containers

## German 20<sup>th</sup> BImSchV – Transfer and handling liquids

Verification of tightness of the gas balance system by an authorized institute:

**Total system check including functioning and tightness**

First time before putting system into operation and than every 5 years

-> report of expert body has to be submitted to competent authority by operator

**Basis for the verification and regularly inspection:**

**VDI 2291 (June 2016): Emission control: Test criteria for monitoring vapour recovery systems**

ICS 13.040.40	VDI-RICHTLINIEN	June 2016 June 2016
VEREIN DEUTSCHER INGENIEURE	Emissionsminderung Prüfkriterien für die Überwachung von Gaspandelsystemen  Emission control Test criteria for monitoring vapour recovery systems	VDI 2291  Ausg. deutsch/englisch Issue German/English

## **German 20<sup>th</sup> BImSchV – Transfer and handling liquids**

The **inspection** includes the vapour balancing system from **vapour balance coupling at gantry via corresponding lines up to an existing vapour storage tank as well as components of inter-locking device**, as far as existing. The check includes following control steps:

- Visual check of connectors and components of vapour recovery as well as interlocking device especially according to correct installation and damages
- Check of compliance of incidental provisions of permits, licences etc.
- As part of inspection before taking into operation check of tightness of lines with an overpressure of 1 bar
- As part of periodical inspections tightness checks of detachably joining lines
- Check on system according to specification of manufacturer

## **Petrol Stage I – Best Practice on Article 4 – Loading and unloading of mobile containers**

### **Summary:**

- 1. Implement the possibility for gas balancing at terminals**
- 2. Implement an electronic interlock that allows loading/unloading only if the vapour recovery line is connected**
- 3. Implement an inspection of the vapour balancing system by an independent expert/expert body – use VDI 2290 as a base**

## Petrol Stage I – Best Practice on Article 4 with Annex II – Vapour Recovery Unit (VRU)

### Transfer and handling of liquids – Vapour Recovery Units VRU

**BREF REF No 52 / BATC 10/2014 BAT 52:**

**BAT is** in order to prevent or reduce VOC emissions to air from loading and unloading operations,

to use one or a combination of techniques

to reach a **recovery rate of at least 95 %.**

## Petrol Stage I – Best Practice on Article 4 with Annex II – Vapour Recovery Unit (VRU) BREF Ref – see Table 4.104

Plant type	Recovery <sup>(1)</sup> rates (%)	Average values attainable in continuous operation <sup>(2)</sup> <sup>(3)</sup>	
		NMVOC <sup>(4)</sup> (g/Nm <sup>3</sup> )	Benzene (mg/Nm <sup>3</sup> )
Single-stage condensation plant	80 – 95	50	1
Single-stage absorption plant	90 – 97	35	50
Single-stage adsorption and membrane separation plants	90 – 99.5	<10 <sup>(5)</sup>	1
Single-stage adsorption plants with supplementary blower	99.98	0.15	1
Compression, absorption and membrane separation <sup>(6)</sup>	90 – 95	NA	NA
Two-stage plants	99.98	0.15	1

<sup>(1)</sup> As an indicator of performance level.  
<sup>(2)</sup> Expressed as an hourly average in continuous operation for consistency with 94/63/EC (Annex II).  
<sup>(3)</sup> These values are given for a HC concentration in the uncleaned gas of approx. 1 000 g/Nm<sup>3</sup>.  
<sup>(4)</sup> NMVOC: Non-methane volatile organic compounds. The methane contents in the vapours of the substances to be loaded can vary considerably. Absorption and adsorption processes cannot notably reduce methane emissions.  
<sup>(5)</sup> If single-stage plants are used as a preliminary stage for gas engines, a concentration of approx. 60 g/m<sup>3</sup> is necessary for operation of the gas engine.  
<sup>(6)</sup> Compression followed by a two-stage recovery section: reabsorption of the VOCs into a fraction of the condensate being loaded followed by a membrane separation stage.

*Source: Updated TWG 2010 ([ 36. CONCAWE 4/09 2009 ]), TWG- NO*

## BREF Ref – see BAT No 52

Technique	Description	Applicability <sup>(1)</sup>
Vapour recovery by: i. Condensation ii. Absorption iii. Adsorption iv. Membrane separation v. Hybrid systems	See Section 5.20.6	Generally applicable to loading/unloading operations where annual throughput is >5 000 m <sup>3</sup> /yr. Not applicable to loading/unloading operations for sea-going vessels with an annual throughput <1 million m <sup>3</sup> /yr
<sup>(1)</sup> A vapour destruction unit (e.g. by incineration) may be substituted for a vapour recovery unit, if vapour recovery is unsafe or technically impossible because of the volume of return vapour.		

**Table 5.16: BAT-associated emission levels for non-methane VOC and benzene emissions to air from loading and unloading operations of volatile liquid hydrocarbon compounds**

Parameter	BAT-AEL (hourly average) <sup>(1)</sup>
NMVOC	0.15 – 10 g/Nm <sup>3</sup> <sup>(2)</sup> <sup>(3)</sup>
Benzene <sup>(3)</sup>	<1 mg/Nm <sup>3</sup>
<sup>(1)</sup> Hourly values in continuous operation expressed and measured according to European Parliament and Council Directive 94/63/EC (OJ L 365, 31.12.1994, p. 24). <sup>(2)</sup> Lower value achievable with two-stage hybrid systems. Upper value achievable with single-stage adsorption or membrane system. <sup>(3)</sup> Benzene monitoring may not be necessary where emissions of NMVOC are at the lower end of the range.	

## German 20<sup>th</sup> BImSchV – Emission limit values VRU

### 1. Installations not requiring an environmental permit:

- Waste gas abatement unit with an emission reduction efficiency  $\geq 97\%$  and emission mass concentration of organic substances **without methane**, expressed as total carbon,  
 $\leq 1.7 \text{ g C/m}^3$  if mass flow of installation  $\geq 0.50 \text{ kg C/h}$  (**without methane**).

### 2. Installations requiring an environmental permit:

- a) if mass flow organic substances **without methane**  $\geq 0.50 \text{ kg C/h}$ :  
emission limit mass concentration for organic substances **without methane**:  
 $50 \text{ mg C/m}^3$
- b) if mass flow organic substances **without methane**  $< 0.50 \text{ kg C/h}$ :  
emission limit mass concentration for organic substances **without methane**:  
 $1.7 \text{ g C/m}^3$

## German 20<sup>th</sup> BImSchV – Emission limit values VRU

Constructions	Degree of Purification at least:	Max. emission mass concentration of organic matter without Methane
For storage < 5.000 t	97%	12 g C/m <sub>N</sub> <sup>3</sup> (hourly average)
For storage ≥ 5.000 t		
With emission mass flow < 0,50 kg organic matter/h:	-	1.7 g C/m <sub>N</sub> <sup>3</sup>
With emission mass flow ≥ 0,50 kg organic matter/h:	-	50 <u>mg</u> C/m <sub>N</sub> <sup>3</sup>



## **Petrol Stage I – Best Practice on Article 4 with Annex II – Vapour Recovery Unit (VRU)**

### **Goal of the Vapour Recovery:**

Liquefaction of hydrocarbons from vapour phase

### **2 Processes take place:**

- a) Separation of the hydrocarbons from air
- b) Liquefaction of the separated hydrocarbon vapours

## **Petrol Stage I – Best Practice on Article 4 with Annex II – Vapour Recovery Unit (VRU)**

### **Examples of separation processes:**

- Pressure swing adsorption on activated carbon
- Absorption by washing in a low volatility absorbent fluid
- Selective membrane separation
- Condensation by cooling or compression (separation and liquefaction are combined in a single process)

### **Examples of liquefaction processes:**

- Absorption, normally into their own product
- Condensation
- Compression.

# **Petrol Stage I – Best Practice on Article 4 with Annex II – Vapour Recovery Unit (VRU)**

## Applied VRU systems:

- Absorption in a cold lean oil stream
- Adsorption in twin bed pressure swing operation
- Indirect liquid condensation in a refrigerant heat exchanger
- Membrane separation by passage through a hydrocarbon selective surface

## **Petrol Stage I – Best Practice on Article 4 – Vapour Recovery Unit (VRU)**

### **Liquefaction of hydrocarbons from vapour phase**

#### **a) Condensation**

Cooling in a heat exchanger

#### Problem:

Air humidity leads to a freezing of heat exchanger -> design in 2 stages and/or alternating operation

#### **b) Absorption**

Washing out of vapours in counter-flow

**BAT is**

**to use a dry vacuum compressor instead of a liquid ring vacuum pump!**

**Example:**

DryVAC™ VRS by Symex Americas

<http://www.symextech.com/technical-papers/>

<http://www.buschusa.com/products/product-portfolio/cobra/downloads/>

## Examples of manufacturers of VRUs

### John Zink

<https://www.johnzink.com/wp-content/uploads/carbon-adsorption-vapor.pdf>

### Borsig Membrane VRU

<http://mt.borsig.de/en/products/membrane-units-for-emission-control/borsig-vapour-recovery-unit.html>

<http://mt.borsig.de/en/products/membrane-units-for-emission-control/borsig-carbon-retrofit-unit.html>

### ZEECO VRU

<http://www.zeeco.com/vapor/vapor-recovery.php>

### Symex

[http://www.symextech.com/wp-content/uploads/2015/03/DRYVacUS\\_Presentation1.pdf](http://www.symextech.com/wp-content/uploads/2015/03/DRYVacUS_Presentation1.pdf)

<https://www.youtube.com/watch?v=wvYqAPMUjUc>

### Aereon

<http://www.aereon.com/gas-vapor-recovery-systems>

Carbovac <http://www.carbovac.com/>

## **Summary: Recommendations**

**1. ELV for Benzene should be set (“1 mg/Nm<sup>3</sup><sub>dry</sub> “) additionally for VRU emissions**

**2. For emission monitoring:**

**The use of a flame ionisation detector should be applied for the determination of Total Organic Carbon. The method should be DIN EN 12619**

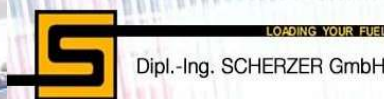
**Requirements for sampling should be referred on DIN EN 15259**

**3. Stack height: Minimum requirements according to VDI 2280**

# Petrol Stage I – Best Practice on Annex IV – Bottom Loading of Road Tankers at Terminals

## Loading of road tankers

**BAT is**  
to apply **bottom loading** for road tankers



## BREF Refineries No 4.21.17

- The loading/unloading pipe is flange-connected to a nozzle situated at the lowest point of the tank.
- A vent pipe on the tank can be connected to a gas balancing line, VRU
- The flange connection in the filling line has a special design ('dry connection') which enables it to be disconnected with minimum spillage/emissions.



# Petrol Stage I – Best Practice on Annex IV – Bottom Loading of Road Tankers at Terminals

## Requirements in Annex IV FOR BOTTOM-LOADING, VAPOUR COLLECTION AND OVERFILL PROTECTION OF EUROPEAN ROAD TANKERS

- **Couplings** for liquid throughput and vapour recovery have to comply to **certain API norms**

Equipment for couplings, connection of vehicle earth/overflow detection and safety interlocks are nowadays standard

-> many suppliers available

Example for API Dry Coupling: [EMCO Wheaton](http://www.emcowheaton.com/api-couplings/)

<http://www.emcowheaton.com/api-couplings/>

Example of the equipment of a road tanker with bottom loading:

[FMC Technologies](http://www.fmctechnologies.com/en/MeasurementSolutions/Technologies/LiquidProducts/TruckMeterPkgs/SeningHandbook.aspx?LibFolder=%7b28FD765C-AA2E-4487-A981-D7D7AE7DC3D8%7d)

<http://www.fmctechnologies.com/en/MeasurementSolutions/Technologies/LiquidProducts/TruckMeterPkgs/SeningHandbook.aspx?LibFolder=%7b28FD765C-AA2E-4487-A981-D7D7AE7DC3D8%7d>

## Petrol Stage I – Best Practice on Annex IV – Bottom Loading of Road Tankers – here: Requirements for Road Tankers

### Verification of requirements of Annex IV referring to the mobile containers

Technical requirements for **mobile containers** e.g. connectors



**Certificate by manufacturer**

-> this point should be under the scope of authorities competent for transport of hazardous goods

## Petrol Stage I – Best Practice on Article 5 Mobile Containers

- After unloading of petrol all vapours shall be retained in the mobile container
- Mobile containers shall accept and retain displaced vapours from service station during loading of the storage tank

### See German 20<sup>th</sup> BImSchV:

“Operator shall ensure that the mandatory inspections according **to legislation on transport of dangerous goods = ADR** are taken regularly:

1. the overpressure/vacuum valves of mobile containers and
2. the vapour tightness with a pressure test at road tankers.”

## Petrol Stage I – Best Practice – other topics

### Emissions during Inspections or Tank Cleaning

**BREF REF No 50 / BATC 10/2014 BAT 50:**

**BAT is** to use one or a combination of the techniques given below:

Technique	Description	Applicability
i. Manual crude oil tank cleaning	Oil tank cleaning is performed by workers entering the tank and removing sludge manually	Generally applicable
ii. Use of a closed-loop system	For internal inspections, tanks have to be periodically emptied, cleaned and rendered gas-free. This cleaning includes dissolving the tank bottom. Closed-loop systems that can be combined with end-of-pipe mobile abatement techniques prevent or reduce VOC emissions	The applicability may be limited by e.g. the type of residues, tank roof construction or tank materials

## Petrol Stage I – Best Practice – other topics

### Emissions during Inspections or Tank Cleaning German TA Luft and amended 20<sup>th</sup> BImSchV

- **Waste gases** occurring during inspection or while the **storage tanks are cleaned** shall be fed to a **post-combustion system** or **similar measures** shall be applied to reduce emissions.

## **Petrol Stage I – Best Practice in Terminals – other topics**

### **Summary:**

- 1. Set requirements for tank cleaning**
- 2. Set requirements for avoiding of tank landing for floating roof tanks**
- 3. Set requirements for technical tightness of pumps, flanges, sealing of flange joints etc. – use TA Luft**

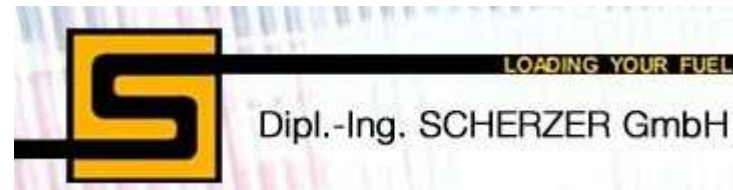
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