



4 December 2009

**Substance name:** Anthracene oil, anthracene paste,  
distn. lights  
**EC number:** 295-278-5  
**CAS number:** 91995-17-4

**MEMBER STATE COMMITTEE  
SUPPORT DOCUMENT FOR IDENTIFICATION OF  
ANTHRACENE OIL, ANTHRACENE PASTE, DISTN. LIGHTS  
AS A SUBSTANCE OF VERY HIGH CONCERN BECAUSE OF  
ITS CMR, PBT AND vPvB PROPERTIES**

**Adopted on 4 December 2009**

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## FOREWORD

Anthracene oil, anthracene paste, distn. lights is an UVCB substance (substance of unknown or variable composition, complex reaction products or biological materials). It is characterised by a variable and high content of polycyclic aromatic hydrocarbons (PAHs) and heterocyclic compounds.

One relevant constituent present in anthracene oil, anthracene paste, distn. lights in a concentration of 0.5-25 % is anthracene, which has been identified as a PBT-substance and has been placed on the Candidate List. Additionally other PAHs are present in anthracene oil, anthracene paste, distn. lights in individual concentrations equal to or above 0.1% (weight/weight), such as phenanthrene.

The vPvB properties of the latter constituent have already been discussed in the Annex XV transitional report for coal tar pitch, high temperature and before in the Risk Assessment Report (RAR) for coal tar pitch, high temperature, indicating that the data have already been assessed for validity and relevance by a competent EU body. Therefore in the present document most data for individual PAH have been taken directly from the Annex XV transitional report and the RAR for coal tar pitch, high temperature. The data for anthracene are not discussed again in this support document, but references to the Anthracene Annex XV-Dossier are placed at appropriate positions in the text.

**Substance name: Anthracene oil, anthracene paste, distn. lights**

**EC Number: 295-278-5**

**CAS Number: 91995-17-4**

- *The substance is identified as a carcinogen (category 2, R45) according to Article 57 (a) of Regulation (EC) 1907/2006 (REACH).*
- *The substance is identified as a mutagen (category 2, R46) according to Article 57 (b) of Regulation (EC) 1907/2006 (REACH).*
- *The substance is identified as a PBT according to Article 57 (d) of Regulation (EC) 1907/2006 (REACH).*
- *The substance is identified as a vPvB according to Article 57 (e) of Regulation (EC) 1907/2006 (REACH).*

**Summary of how the substance meets the CMR (Cat 1 or 2), PBT or vPvB criteria, or is considered to be a substance of an equivalent level of concern**

Anthracene oil, anthracene paste, distn. lights is a UVCB substance composed of different constituents. Among them are various PAH. One relevant constituent is anthracene, which is present in anthracene oil, anthracene paste, distn. lights in the range of 0.5-25 %. Anthracene has been placed on the Candidate List due to its identification as a PBT-substance. Moreover, anthracene oil, anthracene paste, distn. lights consists of further PAHs such as phenanthrene above concentrations of 0.1% (w/w), which fulfils the vPvB criteria.

Hence, anthracene oil, anthracene paste, anthracene distn. lights fulfils the PBT and the vPvB-criteria according to Article 57 d) and e) of the REACH regulation.

According to Annex VI, part 3, Table 3.2 of Regulation (EC) No 1272/2008<sup>1</sup> the classification as carcinogen (Carc. Cat.2; R45)<sup>2</sup> must be applied to anthracene oil, anthracene paste, anthracene distn. lights unless it can be shown that the substance contains less than 0.1 % w/w benzene (EINECS No 200-753-7) and less than 0.005 % w/w benzo[a]pyrene (EINECS No 200-028-5).

Pursuant to Annex IV of Commission Regulation (EC) No 790/2009<sup>3</sup> as of 1 December 2010 the classification as mutagen (Muta. Cat.2; R46) must be applied to anthracene oil, anthracene paste,

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<sup>1</sup> Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

<sup>2</sup> This corresponds to a classification Carc. 1B; H350 in Annex VI, part 3, Table 3.1 of Regulation (EC) No 1272/2008.

<sup>3</sup> Commission Regulation (EC) No 790/2009 of 10 August 2009 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures (1<sup>st</sup> ATP)

anthracene distn. lights unless the substance contains less than 0.1 % w/w benzene (EINECS No 200-753-7).<sup>4</sup>

Hence, anthracene oil, anthracene paste, anthracene distn. lights is a substance meeting the criteria for identification as a carcinogen and mutagen according to Article 57(a) and 57 (b) of the REACH Regulation where the conditions for its classification have been met.

**Registration number(s) of the substance or of substances containing the substance:**

Not available.

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<sup>4</sup> Pursuant to the 1<sup>st</sup> ATP, the classification according to Table 3.1 of Annex VI, part 3, of Regulation (EC) No 1272/2008 will as of 1 December 2010 be mutagen category 1B, H340.

## JUSTIFICATION

### 1 IDENTITY OF THE SUBSTANCE AND PHYSICAL AND CHEMICAL PROPERTIES

#### 1.1 Name and other identifiers of the substance

Chemical Name: Anthracene oil, anthracene paste, distn. lights

EC Number: 295-278-5

CAS Number: 91995-17-4

IUPAC Name:

#### 1.2 Composition of the substance

According to the EC inventory Anthracene oil, anthracene paste, distn. lights is a complex combination of hydrocarbons from the distillation of anthracene obtained by crystallization of anthracene oil from bituminous light temperature tar and boiling in the range of approximately 290 °C to 340 °C. It contains chiefly trinuclear aromatics and their dihydro derivatives. The following composition data refers to the information provided by industry in the IUCLID files.

Chemical Name: Anthracene

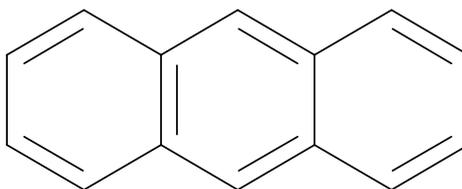
EC Number: 204-371-1

CAS Number: 120-12-7

IUPAC Name: Anthracene

Molecular Formula: C<sub>14</sub>H<sub>10</sub>

Structural Formula:

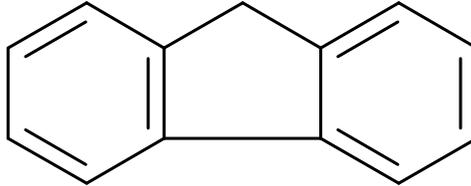


Molecular Weight: 178.23

Typical concentration (% w/w):

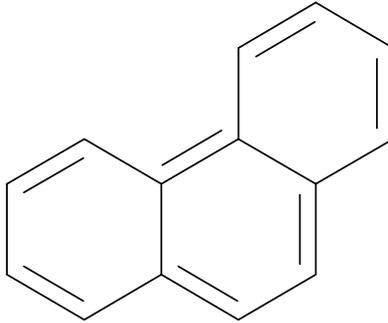
Concentration range (% w/w): 0.5-25

Chemical Name: Fluorene  
EC Number: 201-695-5  
CAS Number: 86-73-7  
IUPAC Name: 9*H*-Fluorene  
Molecular Formula: C<sub>13</sub>H<sub>10</sub>  
Structural Formula:



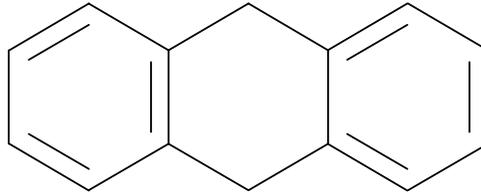
Molecular Weight: 166.22  
Typical concentration (% w/w):  
Concentration range (% w/w): 15-45

Chemical Name: Phenanthrene  
EC Number: 201-581-5  
CAS Number: 85-01-8  
IUPAC Name: Phenanthrene  
Molecular Formula: C<sub>14</sub>H<sub>10</sub>  
Structural Formula:



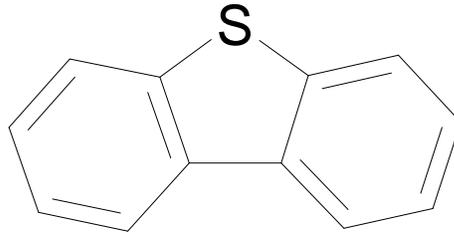
Molecular Weight: 178.23  
Typical concentration (% w/w): > 10%  
Concentration range (% w/w): 10-45

Chemical Name: 9,10-dihydroanthracene  
EC Number: 210-336-1  
CAS Number: 613-31-0  
IUPAC Name: 9,10-dihydroanthracene  
Molecular Formula: C<sub>14</sub>H<sub>12</sub>  
Structural Formula:



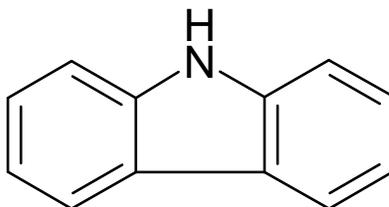
Molecular Weight: 180.25  
Typical concentration (% w/w):  
Concentration range (% w/w): 3-15

Chemical Name: Dibenzothiophene  
EC Number: 205-072-9  
CAS Number: 132-65-0  
IUPAC Name: Dibenzo[b,d]thiophene  
Molecular Formula: C<sub>12</sub>H<sub>8</sub>S  
Structural Formula:



Molecular Weight: 184.26  
Typical concentration (% w/w):  
Concentration range (% w/w): 2-7

Chemical Name: Carbazole  
EC Number: 201-696-0  
CAS Number: 86-74-8  
IUPAC Name: 9*H*-carbazole  
Molecular Formula: C<sub>12</sub>H<sub>9</sub>N  
Structural Formula:



Molecular Weight: 167.21  
Typical concentration (% w/w):  
Concentration range (% w/w): 0.1-5

### 1.3 Physico-chemical properties

**Table 1: Summary of physico-chemical properties of anthracene oil, anthracene paste, distn. lights**

REACH ref Annex, §	Property	IUCLID section	Value	[enter comment/reference or delete column]
VII, 7.1	Physical state at 20°C and 101.3 kPa	3.1	Solid	European Commission (2000)
VII, 7.2	Melting/freezing point	3.2	< 109 °C	Highest MP for a single constituent (Dibenzothiophene)
VII, 7.3	Boiling point	3.3	< 333 °C	Highest BP for a single constituent (Dibenzothiophene)
VII, 7.5	Vapour pressure	3.6	< 1 hPa at 20 °C	
VII, 7.7	Water solubility	3.8	< 1.98 mg/l	IUCLID datafile; Depending on the concentration of the different substances
VII, 7.8	Partition coefficient n-octanol/water (log value)	3.7 partition coefficient	3.84 – 4.68	IUCLID datafile; Depending on the concentration of the different substances

## 2 CLASSIFICATION AND LABELLING

### 2.1 Classification in Annex VI of Regulation (EC) No 1272/2008

Anthracene oil, anthracene paste, distn. lights has index number 648-108-00-2 in Annex VI, part 3, Tables 3.1 and 3.2 of Regulation (EC) No 1272/2008<sup>5</sup>.

Its classification has been updated under the same index number in Annex IV of Commission Regulation (EC) No 790/2009<sup>6</sup>. Classification as mutagen (Muta. Cat.2; R 46) has been added.

Pursuant to Annex IV of Commission Regulation (EC) No 790/2009 anthracene oil, anthracene paste, anthracene distn. lights will as of 1 December 2010 be listed in Table 3.2 (the list of harmonised classification and labelling of hazardous substances from Annex I to Directive 67/548/EEC) of Annex VI, part 3, of Regulation (EC) No 1272/2008 as shown in Table 2.

**Table 2: Classification and labelling of anthracene oil, anthracene paste, distn. lights according to Annex VI, part 3, Table 3.2 of Regulation (EC) No 1272/2008 as of 1 December 2010**

Name	CAS-No	Index-No	Classification	Labelling	Notes
Anthracene oil, anthracene paste, distn. lights	91995-17-4	648-108-00-2	Carc. Cat. 2; R45 Muta. Cat.2; R46	T; R45-46; S 53 – 45	HJM

**Notes:**

**H:** The classification and label shown for this substance applies to the dangerous property indicated by the risk phrases in combination with the category of danger shown. Manufacturers, importers and downstream users of this substance shall be obliged to carry out an investigation to make themselves aware of the relevant and accessible data which exists for all other properties to classify and label the substance. The final label shall follow the requirements of section 7 of Annex VI to Directive 67/548/EEC.

**J:** The classification as a carcinogen or mutagen need not apply if it can be shown that the substance contains less than 0.1 % w/w benzene (EINECS No 200-753-7).

**M:** The classification as a carcinogen need not apply if it can be shown that the substance contains less than 0.005 % w/w benzo[a]-pyrene (EINECS No 200-028-5).

The harmonised classification and labelling of anthracene oil, anthracene paste, distn. lights as hazardous substance according to Regulation (EC) No 1272/2008 (Annex VI, part 3, Table 3.1 (the list of harmonised classification and labelling of hazardous substances)) as of 1 December 2010 is provided in Table 3.

<sup>5</sup> Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

<sup>6</sup> Commission Regulation (EC) No 790/2009 of 10 August 2009 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures (1<sup>st</sup> ATP)

**Table 3: Classification and labelling of anthracene oil, anthracene paste, distn. lights according to Annex VI, part 3, table 3.1 of Regulation (EC) No 1272/2008 as of 1 December 2010.**

Name	CAS-No	Index-No	Classification	Labelling	Notes
Anthracene oil, anthracene paste, distn. lights	91995-17-4	648-108-00-2	Carc. Cat. 1B  H350  Muta. Cat. 1B  H340	GHS08 Dgr  H350  H340	HJM

**Notes:**

**H:** The classification and labelling shown for this substance applies to the hazardous property(ies) indicated by the hazard statement(s) in combination with the hazard class(es) and category(ies) shown. The requirements of Article 4 for manufacturers, importers or downstream users of this substance apply to all other hazard classes and categories. For hazard classes where the route of exposure or the nature of the effects leads to a differentiation of the classification of the hazard class, the manufacturer, importer or downstream user is required to consider the routes of exposure or the nature of the effects not already considered.

**J:** The classification as a carcinogen or mutagen need not apply if it can be shown that the substance contains less than 0.1 % w/w benzene (EINECS No 200-753-7).

**M:** The classification as a carcinogen need not apply if it can be shown that the substance contains less than 0.005 % w/w benzo[a]-pyrene (EINECS No 200-028-5).

### 3 ENVIRONMENTAL FATE PROPERTIES

#### 3.1 Degradation

##### 3.1.1 Stability

###### 3.1.1.1 Phototransformation

Photolysis in the troposphere results in the formation of reactive hydroxyl (OH) and nitrate (NO<sub>3</sub>) radicals and ozone (O<sub>3</sub>), which react as oxidizing agents with organic compounds like PAHs. These radicals and ozone comprise the main degradation path of gas-phase PAH (Calvert *et al.*, 2002). The atmospheric behaviour of the main constituents of anthracene oil, anthracene paste, distn. lights is shown below in Table 4.

**Table 4: Phototransformation of the relevant constituents present in anthracene oil, anthracene paste, distn. lights. Data are taken form the Annex XV transitional report for coal tar pitch, high temperature (The Netherlands - Bureau REACH, 2009).**

PAH (number of rings)	Representative lifetime in air with respect to reaction with			
	OH		NO <sub>3</sub>	O <sub>3</sub>
	Summer	Winter		
Phenanthrene (2)	9.0 h	1.9 d	-	-
Carbazole (2) <sup>a)</sup>	9.6 h	-	-	-
Fluorene (3)	1.8 d	9 d	-	-

a) Specially calculated for this support document with AOPwin v1.91

For all these substances the transformation rate in particle phase is expected to be slower. Particle phase transformation is, however, not assumed to be of relevance for the overall atmospheric lifetime, because e.g. only up to 3 % of atmospheric anthracene has been observed to appear in particle phase (European Chemicals Agency, 2008d).

The constituent anthracene is stable against photochemical transformation in water and sediments. This has been observed in laboratory and “in situ” experiments. Half-lives for primary photodegradation in water have been reported in the range of 20 minutes to 125 hours depending on the experimental conditions used. The highest value corresponds to photolysis under simulated winter conditions.

Environmentally relevant exposure occurs in the whole water column and, in the case of anthracene oil, anthracene paste, distn. lights, especially in sediment and soil. Photodegradation of anthracene oil, anthracene paste, distn. lights can be expected to be a relevant removal pathway in the environment only in very shallow clear waters and in the first few centimetres layer of the water column. Therefore aquatic photodegradation is not considered to have relevant impact on the overall persistency of anthracene in the environment.

### 3.1.1.2 Hydrolysis

Hydrolysis as a way of abiotic degradation can be considered as not relevant for the main constituents of anthracene oil, anthracene paste, distn. lights because of their chemical structures. The constituent anthracene is stable against hydrolysis. Anthraquinone has been identified as the main abiotic degradation product of anthracene (European Chemicals Agency, 2008d). Because of the similar chemical structure (consisting of aromatic rings) similar assumptions for hydrolytic behaviour of the other constituents of anthracene oil, anthracene paste, distn. lights can be made (MITI-List, 2002).

### 3.1.2 Biodegradation

#### 3.1.2.1 Biodegradation estimation

The PAH listed in **Error! Reference source not found.**table below were allocated to persistence classes on the basis of model calculations (Mackay *et al.*, 1992). These half-lives were used in the Annex XV transitional report of coal tar pitch, high temperature (The Netherlands - Bureau REACH, 2009).

**Table 5: Half-life classes of Phenanthrene (The Netherlands - Bureau REACH, 2009)**

Substance	Water		Soil		Sediment	
	class	Half-life [d]	class	Half-life [d]	class	Half-life [d]
Phenanthrene	4	13 – 42	6	125 – 420	7	420 – 1250
Fluorene	4	13 – 42	6	125 – 420	7	420 – 1250

#### 3.1.2.2 Screening tests

In a 28 day ready biodegradability test (MITI I, OECD 301C) using 100 mg l<sup>-1</sup> PAH and 30 mg l<sup>-1</sup> sludge no ready biodegradation was detected for phenanthrene, fluorene and carbazole (MITI-List, 2002). The data obtained are presented in Table 6. According to the MITI test, which is suitable for substances with low water solubility, these PAH are not readily biodegradable.

**Table 6: Biodegradation of several PAH according to the test method MITI I (OECD TG 301C).**

Compound	BOD	Judgement
Phenanthrene	54 %	Not-readily biodegradable
Fluorene	0 %	Not-readily biodegradable
Carbazole	0 %	Not-readily biodegradable

Coover and Sims tested the persistence of PAHs in an unacclimated agricultural sandy loam soil in dependence of the temperature (Coover and Sims, 1987). Due to the method used for extraction and analysis, it remains unclear to which extent evaporation, adsorption and biodegradation may have contributed to the

elimination process. The soil was spiked with a standard solution of 16 PAHs and incubated for 240 days. At 10°C 36% of phenanthrene was remaining. With increasing temperature the elimination increased to 19% (2%) of remaining phenanthrene, at 20°C (30°C).

### 3.1.2.3 Simulation tests

#### Biodegradation in soil

Biodegradation rates of several PAHs in soil depend on several factors like soil type, pH, moisture content, oxygen and nutrient contents and soil microbial population. In addition, vegetation has been observed to enhance microbial biodegradation in the rhizosphere. Some of these factors may also explain why the half-lives observed under laboratory conditions are much shorter than those obtained from long-term field-based experiments (The Netherlands - Bureau REACH, 2009). The results of Wild et al. (1991) and Wild and Jones (1993) demonstrate the difference of tests conducted for several PAHs in field conditions compared to laboratory tests. Wild et al. (1991) observed an elimination half-life of 5.7 years for phenanthrene. In this field experiment soils were enriched with PAH-contaminated sludge (Wild *et al.*, 1991).

In another study Wild and Jones (1993) derived different half-lives in a microcosm study with four soil types (Wild and Jones, 1993). The elimination half-lives for phenanthrene were 83 – 193 days. It has to be noted that the latter results are derived from a greenhouse study and should therefore not be used for the P-assessment. Various studies on PAH-contaminated soils have shown that the number of PAH-degrading microorganisms and the degrading capacity are much higher in PAH-contaminated soils than in pristine soils indicating that adaptation has occurred (European Commission, 2008; The Netherlands - Bureau REACH, 2009).

Grosser et al. studied the mineralization of <sup>14</sup>C-labelled carbazole in three different soils (Grosser *et al.*, 1991). The mineralization was measured by application of serum bottle radiorespirometry. The incubation was set up for 184 days, but after 60 days the curves had become asymptotic. The mineralization for carbazole was calculated between undetectable and 46% within the test duration.

The fate of several PAHs in two different soils were tested by Park et al. (Park *et al.*, 1990). The half-life of phenanthrene was calculated as being in the range of 27 and 53 days (second soil: 13 – 18 days).

**Table 7: Half-lives for PAHs in soil (of relevant constituents of anthracene oil, anthracene paste, distn. lights)**

Substance	Result	Reference
Phenanthrene	DisDT <sub>50</sub> = 5.7 years (field study)	(Wild <i>et al.</i> , 1991)
	DisDT <sub>50</sub> = 83 – 193 d (microcosm study)	(Wild and Jones, 1993)
	Elimination half- life in two different soils: DisDT <sub>50</sub> = 27 – 53 d DisDT <sub>50</sub> = 13 – 18 d	(Park <i>et al.</i> , 1990)
Carbazole	Degradation half-life: DegDT <sub>50</sub> > 184 d (undetectable – 46% mineralization in 184 d)	(Grosser <i>et al.</i> , 1991)

### 3.1.3 Summary and discussion of persistence

Anthracene, which is one relevant constituent of anthracene oil, anthracene paste, distn. lights has been placed on the Candidate List due to the identification as a PBT-substance (European Chemicals Agency, 2008d).

Moreover, anthracene oil, anthracene paste, distn. lights consists of further not readily biodegradable PAH constituents. The model calculations by Mackay et al. (1992) indicate that phenanthrene and fluorene show a half-life in sediment more than 180 days.

Screening studies (OECD TG 301C) show, that phenanthrene, carbazole and fluorene as representative constituents of anthracene oil, anthracene paste, distn. lights are not readily biodegradable (MITI-List, 2002).

Further studies showed relatively long dissipation times for carbazole in soil ( $\text{DegDT}_{50} > 184$  d) (Grosser *et al.*, 1991).

Additionally, in a field study, half-lives of 5.7 years for phenanthrene have been measured in soil (Wild *et al.*, 1991).

Hence, several constituents of anthracene oil, anthracene paste, distn. lights fulfil the P and the vP criteria according to Annex XIII of the REACH regulation.

## 3.2 Environmental distribution

### 3.2.1 Adsorption/desorption

The organic carbon partitioning coefficient  $\log K_{OC}$  was calculated for the main constituents using the equation  $\log K_{OC} = 0.81 * \log K_{OW} + 0.10$  (European Chemicals Agency, 2008b). The results are shown in Table 8.

**Table 8: Log  $K_{OW}$  and log  $K_{OC}$  data of the relevant constituents present in anthracene oil, anthracene paste, distn. lights.**

Substance	CAS-No.	log $K_{OW}$ <sup>a)</sup>	log $K_{OC}$	$K_{OC}$ (l/kg) <sup>b)</sup>
Phenanthrene	85-01-8	4.57	3.80	6,309
Carbazole	86-74-8	3.84	3.21	1,621
Fluorene	86-73-7	4.22	3.52	3,311

a) Values were taken from Annex XV transitional report – CTPHT (The Netherlands - Bureau REACH, 2009); b) calculation of  $K_{OC}$  according to Guidance document R.7a

It can be concluded that anthracene oil, anthracene paste, distn. lights has a high potential to adsorb to organic matter and that it is not or only little mobile in soil and sediment.

### 3.2.2 Volatilisation

For the substance anthracene oil, anthracene paste, distn. lights no measured data are available at the moment. According to the constituents` Henry`s Law constants anthracene oil, anthracene paste, distn. lights is appreciated to be moderately volatile. The calculated values are shown in Table 9

using the equation for Henry's Law constant documented in Guidance Document R.16 (European Chemicals Agency, 2008b).

### 3.2.3 Distribution modelling

For the main constituents of anthracene oil, anthracene paste, distn. lights the behaviour in the wastewater treatment plant was calculated under the assumption that no biodegradation occurs ( $k=0/h$ ). The results are shown in Table 9.

**Table 9: Henry constants and volatilisation of main constituents in municipal waste water treatment plants.**

Substance	Henry-constant <sup>a</sup> (Pa*m <sup>3</sup> /mol)	Distribution of PAH in STP <sup>b</sup>			
		% to air	% to water	% to sludge	% degraded
Phenanthrene	4.76	4.4	53.5	42.1	0.0
Carbazole	0.01	0.0	83.3	16.7	0.0
Fluorene	7.57	8.5	63.6	27.9	0.0

<sup>a</sup> calculation of Henry's Law coefficient according to Guidance Document R.16 (European Chemicals Agency, 2008c); <sup>b</sup> values for distribution in STP calculated with SimpleTreat 3.0 (debugged version, 7 Feb 97)

Due to the partitioning to solids, low to medium concentrations of these PAHs in aqueous solutions are expected. The share of volatilised anthracene oil, anthracene paste, distn. lights constituents depends on the composition of the oil. Nevertheless volatilisation is not considered as a relevant route of distribution for anthracene oil, anthracene paste, distn. lights.

## 3.3 Bioaccumulation

### 3.3.1 Aquatic bioaccumulation

#### 3.3.1.1 Bioaccumulation estimation

Based on the substance's log  $K_{OW}$  range from 3.84 to 4.68, anthracene oil, anthracene paste, distn. lights is expected to bioaccumulate.

#### 3.3.1.2 Measured bioaccumulation data

Bioaccumulation of various PAH has been measured in various species. Several studies have been discussed in detail in the risk assessment report of anthracene (de Voogt et al., 1991; Djomo et al., 1996; de Maagd, 1996) and in the Annex XV transitional report for coal tar pitch, high temperature (McLeese et al., 1987; Bruner et al., 1994; Petersen and Kristensen, 1998). The most relevant studies and results are summarized in the following table.

**Table 10: Bioaccumulation factors in fish and mollusca for fluorene and phenanthrene (The Netherlands - Bureau REACH, 2009)**

Substance	Species	BCF	Ra)	Test system	Type c)	References
<b>Fluorene</b>	<b>Fish</b>					
	Poecilia reticulata	1050	2	R	equilibrium (parent)	(de Voogt <i>et al.</i> , 1991)
	Poecilia reticulata	3500	2	S	equilibrium (parent)	(de Voogt <i>et al.</i> , 1991)
<b>Phenanthrene</b>	<b>Mollusca</b>					
	Mytilus edulis	1240	1	F	k1/k2	(McLeese <i>et al.</i> , 1987)
	Mya arenaria	1280	1	F	k1/k2	(McLeese <i>et al.</i> , 1987)
	<b>Fish</b>					
	Cyprinodon variegatus	810 <sup>d)</sup>	1	F	k1/k2 (parent)	(Jonsson <i>et al.</i> , 2004)
	Cyprinodon variegatus	2229 <sup>e)</sup>	1	F	k1/k2 (parent)	(Jonsson <i>et al.</i> , 2004)
	Cyprinodon variegatus	700 <sup>d)</sup>	1	F	equilibrium (parent)	(Jonsson <i>et al.</i> , 2004)
	Cyprinodon variegatus	1623 <sup>e)</sup>	1	F	equilibrium (parent)	(Jonsson <i>et al.</i> , 2004)
	Pimephales promelas	6760	2	S	k1/k2 (parent)	(de Maagd, 1996)

a) Reliability score: 1-reliable without restrictions, 2-reliable with restrictions, 3-unreliable, 4-not assignable; b) S: static exposure system, F: flow-through system, R: static renewal system; c) k1/k2: uptake rate/depuration rate, total: total compound concentration (including transformation products), parent: parent compound concentration, NS, not steady state; d) low exposure concentrations; e) high exposure concentrations.

### 3.3.2 Terrestrial bioaccumulation

### 3.3.3 Summary and discussion of bioaccumulation

The bioaccumulation potential of anthracene has been described in the Annex XV-Dossier for identifying anthracene as a SVHC. Anthracene has been placed on the Candidate List due to the identification as PBT-substance (European Chemicals Agency, 2008a).

Moreover, further constituents of anthracene oil, anthracene paste, distn. lights show bioaccumulation potential, too. The BCFs of fluorene and phenanthrene show values >2000 and >5000, respectively.

In summary, several constituents of anthracene oil, anthracene paste, distn. lights fulfil the B and/or the vB criteria according to Annex XIII of the REACH regulation.

## 4 HUMAN HEALTH HAZARD ASSESSMENT

Not considered in this document.

## **5 ENVIRONMENTAL HAZARD ASSESSMENT**

### **5.1 Aquatic compartment (including sediment)**

Anthracene oil, anthracene paste, distn. lights consists of anthracene (>0.1 %) which has already been identified as PBT-substance and has been added to the Candidate List (European Chemicals Agency, 2008d). Therefore, the toxicity data are not presented here, again.

According to the data available, the long-term aquatic no effect levels for phenanthrene and fluorene are higher than the environmental threshold level for T of  $\leq 0.01$  mg/l.

## **6 PBT AND vPvB ASSESSMENT**

### **6.1 Comparison with criteria from annex XIII**

Anthracene oil, anthracene paste, distn. lights is a UVCB substance consisting of a variety of different constituents. One main constituent is anthracene (0.5-25 %) which has already been identified as a PBT-substance and has been added to the Candidate List (European Chemicals Agency, 2008d).

Moreover, anthracene oil, anthracene paste, distn. lights consists of phenanthrene (10-45%) which also fulfils the criteria of Annex XIII:

In a field study a half-live of 5.7 year for phenanthrene, has been measured in soil (Wild et al., 1991). Therefore, the P and the vP criteria are fulfilled

In one study conducted with fish (*Pimephales promelas*) a BCF value > 5000 was measured (de Maagd, 1996). This means that the B and the vB criteria are fulfilled, too.

### **6.2 Summary and overall conclusions on PBT, vPvB or equivalent level of concern properties**

In accordance with the guidance available for assessment of multi-constituent and UVCB substances, the PBT assessment for anthracene oil, anthracene paste, distn. lights focuses on the assessment of its PAH-constituents present in concentrations  $\geq 0.1\%$ <sup>7</sup> such as anthracene (presence 0.5-25%), phenanthrene (10-45%) and fluorene (15-45%).

An overview on the conclusions drawn on persistence, potential for bioaccumulation and toxicity to human health and/or the environment based on comparison of the data presented for the three indicator PAH-constituents of anthracene oil, anthracene paste, distn. lights with the PBT/vPvB criteria of Annex XIII of the REACH Regulation is provided in Table 11.

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<sup>7</sup> Chapter R.11 (PBT assessment) of the guidance on information requirements and chemical safety assessment (ECHA)

<b>Table 11: Overview on conclusions on fulfilment of the (v)P-, (v)B- or T-criteria of Annex XIII of the REACH Regulation for the three indicator PAH-constituents of anthracene oil</b>					
<b>Substance</b>	<b>Persistence</b>	<b>Bioaccumulation</b>	<b>Toxicity Human health</b>	<b>Toxicity Aquatic Environment</b>	<b>Conclusion</b>
Anthracene	vP	B	-	T	PBT
Phenanthrene	vP	vB	-	-	vPvB
Fluorene	No experimental data	B	-	-	-

Based on the data available, it is concluded that

- phenanthrene fulfils the vPvB criteria, but not the PBT criteria
- anthracene fulfils the PBT criteria, but not the vPvB criteria.

Fluorene does not fulfil either the PBT or vPvB criteria.

In summary, anthracene oil, anthracene paste, distn. lights needs to be considered as a substance with both vPvB and PBT properties because of the above conclusions on the vPvB and PBT properties of its constituents anthracene and phenanthrene. It is concluded that anthracene oil, anthracene paste, distn. lights is a substance containing at least 10,5 % of PAH constituents with vPvB or PBT properties.

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