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Hazard classification and labelling of petroleum substances in the European Economic Area – 2012

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Hazard classification and labelling of petroleum substances in the European Economic Area – 2012

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ABSTRACT

This report updates CONCAWE's classification and labelling recommendations Report No. 11/10R to reflect the publication of the 2nd and 3rd Adaptations to the EU Regulation on Classification, Labelling and Packaging (EC 1272/2008).

KEYWORDS

Hazard, health, environment, physical, flammability, petroleum substances, classification, packaging, labelling, dangerous substances directive, REACH, GHS, DSD, CLP, DPD

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SUMMARY

The CONCAWE recommendations on classification and labelling were last updated in May 2012 (CONCAWE, 2012). Since Report 11/10R was issued, two subsequent adaptations to technical progress to the Classification Labelling and Packaging (CLP) Regulation* have been published. Additional eco-toxicity data for some categories have become available and are incorporated in this report.

This updated report reflects the assessment of new data on hazardous properties of petroleum substances against the criteria of both the Dangerous Substances Directive (67/548/EEC, the DSD), up to and including the 31st Adaptation to Technical Progress (ATP), and the CLP Regulation (EC 1272/2008) up to and including the 2nd and 3rd ATPs .

Regulation on Registration, Evaluation and Authorisation of Chemicals (REACH) requires, where possible, the submission of a harmonised classification, thereby restricting the possibility for individual manufacturers to self-classify their substances. In addition REACH, through the Substance Information Exchange Fora (SIEFs), encourages the sharing of unpublished data in a wider group of stakeholders, which may impact hazard classification. CLP, based on the UN Global Harmonised System (UN GHS), has introduced further changes to the criteria for hazard classification and labelling. The combination of these developments has had the following major impacts on the classification and labelling of petroleum substances:

- When to classify and label – criteria changes for example:
  - Irritation
  - Viscosity dependent aspiration hazard
  - Systemic toxicity after repeated exposure
- How to classify and label
  - Symbols become pictograms
  - Indication of dangers become signal words “Danger” or “Warning”
  - Risk phrases become hazard statements
  - Safety phrases become precautionary statements
  - Chemicals classified as dangerous goods might need less labels on the packaging
- Less possibility for an individual manufacturer to self-classify due to the REACH requirement for harmonised classifications where possible
- Increased amount of data
  - Increased data-sharing due to REACH has led to more comprehensive evaluations of substances, which has resulted in updated classifications for many substances.

Classification and labelling recommendations are included in specific chapters of this Report. For an overview of the major classification changes since CONCAWE Report 11/10R, refer to **Appendix 1**.

* The CLP Regulation (EU, 2008) including its Annexes is a frequently cited reference throughout this report.

1. INTRODUCTION/BACKGROUND

The EU regulation on classification, labelling and packaging of substances and mixtures, known as the 'CLP' Regulation (EC No 1272/2008) entered into force on 20 January 2009 (EU, 2008). This Regulation has subsequently been subject to three legislative Adaptations to Technical Progress (ATPs). CLP applies the terminology, evaluation principles and criteria of the United Nations Globally Harmonized System (GHS) of Classification, Labelling and Packaging of Chemicals. The stated purpose of CLP is to ensure a high level of protection of human health and the environment as well as the free movement of substances, mixtures and articles.

UN GHS is intended to provide a common basis globally, to define and classify chemicals according to their hazards and to communicate this information via labels and safety data sheets. As such, target audiences include consumers, workers and emergency responders.

In 1992, the United Nations Conference on the Environment and Development (UNCED) established a programme to strengthen national and international efforts related to the environmentally sound management of chemicals. Due to the disparity of existing regional systems, the need for a globally harmonised hazard classification and labelling system for chemicals was identified. The World Summit on Sustainable Development held in 2002, encouraged implementation of the GHS as soon as possible, with a view to having the system fully operational by 2008. Work on the new 'Globally Harmonized System' resulted in publication of the third revised edition of the UN GHS document, known as the 'purple book', in 2009 (UN, 2009).

Although the UN GHS provides a common basis for hazard classification and communication for transport and supply and use, it also includes a "building block" approach. Since it is recognised that UN GHS will not be completely "harmonised" at first, these building blocks will facilitate implementation by individual countries or regions. The UN states that *"…countries are free to determine which of the building blocks will be applied in different parts of their systems . . . While the full range is available to everyone,…, the full range does not have to be adopted"*. It is intended that the UN GHS document will be updated every two years to reflect the technical changes needed. CLP applies the building block approach in seeking to align existing EU legislation as far as possible with the UN GHS, whilst maintaining some elements from existing Community legislation, that are not currently addressed in UN GHS.

Two key regulatory instruments which set out the long standing EU system on classification, packaging and labelling of chemicals have been developed over the last 40 years:

- Dangerous Substances Directive (67/548/EEC), 'DSD' (EU, 1967);
- Dangerous Preparations (i.e. mixtures of chemicals) Directive (1999/45/EC), 'DPD' (EU, 1999)

CLP was introduced alongside the REACH regulation (EU, 2006) which entered into force on 1st of June 2007 consolidating the former legislative framework on chemicals of the EU. Although REACH does not include criteria for classification and labelling, it does refer to the above EC Directives and CLP. Furthermore elements of REACH, such as registration and supply chain communication together

with the classification and labelling inventory (now part of CLP), are driven by hazard classification.

In terms of timing, the provisions of CLP are subject to a phased introduction. As from June 2015, all hazard classifications will be conducted under the provisions of CLP. In the intervening transition period, DSD/DPD and CLP will operate in parallel, with some provisions being implemented or superseded during this time. The deadline for substance classification according to CLP was 1st of December 2010 and for mixtures 1st of June 2015.

A further provision of CLP is that by 3rd of January 2011 industry had to send notifications of their classification and labelling of substances to the European Chemical Agency (ECHA). The notifications were incorporated into a Classification and Labelling Inventory ('C&L Inventory') made publicly available on ECHA's website.

Although DSD/DPD and CLP follow a similar logic, there are similarities and differences between them:

CLP is *similar* to DSD/DPD in that it:

- provides a single system for hazard classification and labelling
- covers broadly the same hazards
- for the most part uses similar or equivalent classification criteria
- sets up a similar system for hazard communication

CLP is *different* to DSD/DPD in that it:

- sets criteria for both transport, supply and use
- defines additional hazard classes, criteria and categories
- uses some different criteria for classification of preparations (mixtures)
- has different hazard warning symbols and label phrases
- requires industry to notify ECHA of their self-classification and labelling of substances

Substances that were classified, labelled and packaged in accordance with DSD and placed on the market before 1st of December 2010, are not required to be relabelled and repackaged in accordance with CLP until 1st of December 2012. Mixtures classified, labelled and packaged in accordance with DPD and placed on the market before 1st of June 2015 are not required to be relabelled and repackaged in accordance with CLP until 1st of June 2017.

A schematic, summarising the key timelines arising from REACH and CLP is shown in **Figure 1**.

Manufacturers and importers (or groups of manufacturers and importers) who place hazardous substances on the market, will also have to notify ECHA of certain information, in particular the substance identity and the classification and labelling of each hazardous substance, unless this information has already been submitted as part of a registration dossier under REACH. ECHA will then include the notified information in the C&L Inventory.

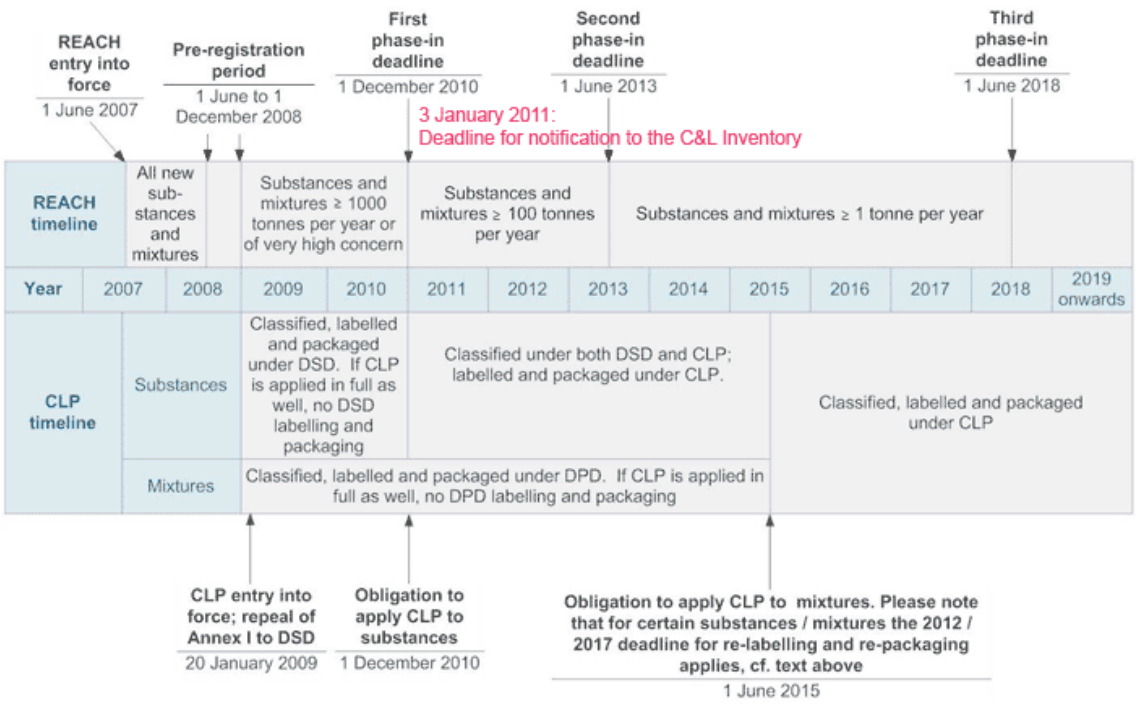
Implementation of CLP also impacts downstream legislation which relies on DSD and DPD hazard classifications. As a consequence, the EU is amending downstream legislation, such as that on worker safety, major accidents and consumer products.

Guidance on the application of CLP in the context of REACH has been developed by ECHA (ECHA, 2009a & 2009b).

The purpose of this report is to provide guidance on the classification and labelling of substances produced by the petroleum industry and placed on the market, according to the requirements of CLP. In addition, this report updates the previous DSD classification advice to take account of new and additional data and legislative ATPs.

The provisions of CLP also apply to classification, labelling and packaging of mixtures that are placed on the market. Detailed guidance regarding mixtures is not however within the scope of this report.

Figure 1 Summary of EU Process and timing for transition to CLP with links to REACH timelines



2. SCOPE OF THIS REPORT

This updated report reflects the assessment of new data on hazardous properties of petroleum substances against the criteria of both the Dangerous Substances Directive (67/548/EEC, the DSD), up to and including the 31st ATP, and the Classification Labelling & Packaging Regulation (EC 1272/2008, CLP) up to and including the 1st (EU, 2009) 2nd (EU, 2011), and 3rd ATPs (EU, 2012).

This report has been developed as industry guidance for the classification, labelling and packaging of petroleum substances under CLP, which introduces the GHS into the European legislative framework. As there is a transition period for the introduction of classifications under CLP, this report also includes updated guidance for the classification of petroleum substances under DSD criteria. In this respect, it supersedes previous CONCAWE guidance [Report no. 11/10R], which was developed for legislation that has since been changed, repealed or is in a transition phase.

This report outlines the objectives and principles of CLP and the classification and labelling requirements that it introduces; its entry and phased implementation into EU legislation; specific issues that apply to petroleum substances; and CONCAWE recommendations for classification, labelling, and packaging of petroleum substances. The classification recommendations have been updated from the previous CONCAWE guidance to reflect new information, changes in classification criteria and to accommodate REACH categories of petroleum substances. The summary of major changes in classification and labelling recommendations for petroleum substances since Report 11/10R can be found in **Appendix 1**.

These recommendations apply to petroleum substances produced in the refinery but **do not** apply to formulated petroleum products placed on the market which are considered mixtures (preparations).

Substances of similar chemical composition and/or similar hazard profiles can be collected together in categories. With the exception of a few petroleum gases, most petroleum industry substances are Substances of Unknown or Variable composition, Complex reaction products or Biological materials (UVCB). A category approach allows data on individual category members to be applied to other members of the category for which complete data may not be available or are impractical to obtain.

It is important to note that for each category, the most severe hazard classification and labelling recommendation is presented as the default recommendation in the body of the report. However, based on the application of regulatory or oil industry notes and physico-chem ical properties (e.g., flashpoint, viscosity), it is possible that several classification and labelling permutations may be possible. In those cases where EU harmonised classifications for certain endpoints exist, the EU harmonised classifications are supplemented with self-classifications for all other endpoints (see section 4.4) as required by the CLP regulation.

In addition this report covers some individual substances which are not included within a category.

The following categories are covered in this report:

- petroleum gases
- other petroleum gases
- low boiling point naphthas (gasolines)
- kerosines
- straight run gas oils
- vacuum gas oils, hydrocracked gas oils and distillate fuels
- cracked gas oils
- other gas oils
- heavy fuel oil components
- highly refined base oils
- unrefined/acid treated oils
- other lubricant base oils
- foots oils
- paraffin and hydrocarbon waxes
- slack waxes
- petrolatums
- untreated distillate aromatic extracts
- treated distillate aromatic extracts
- residual aromatic extracts
- bitumen
- petroleum coke

Classification and labelling recommendations are also provided for four substances:

- crude oil
- sulfur
- MK1 diesel fuel
- oxidized asphalt

The following categories that were included in past CONCAWE guidance documents are not covered herein: lubricant greases; used oils; re-refined oils; reclaim petroleum substances; and other petroleum substances. Manufacturers of these substances need to classify their materials according to legislative requirements.[1]

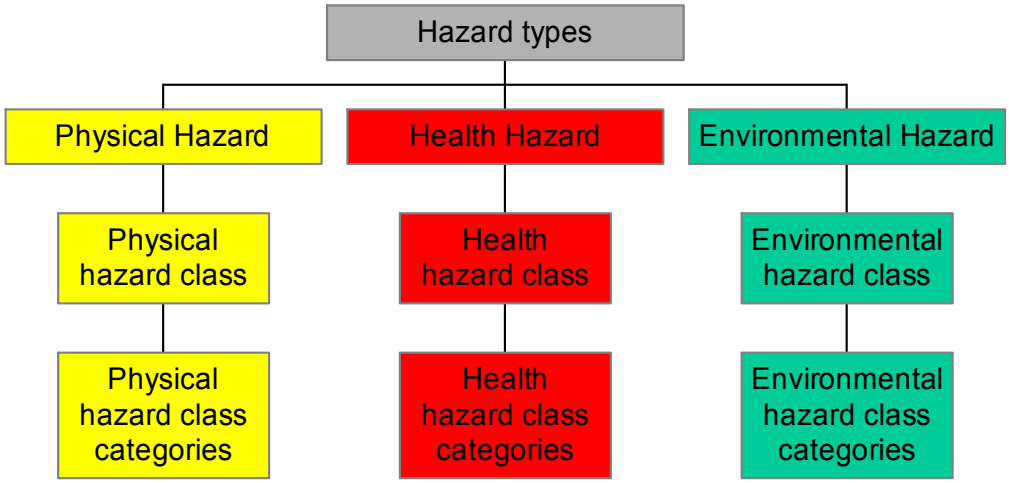
[1] This report addresses the classification and labelling of groups of substances which are the primary products of petroleum refining. It should be recognized that some of these groups contain substances which may also be identified as hydrocarbon solvents. Hydrocarbon solvents are derived, among others from refinery streams by further refining e.g. redistillation, hydrogenation, extraction. As a result, the composition of hydrocarbon solvents may differ significantly from refinery streams. The classification and labelling of hydrocarbon solvents are not considered further in this report.

3. LEGISLATIVE COMPARISON (DSD VERSUS CLP)

3.1. CLASSIFICATION OF SUBSTANCES

CLP and DSD are similar in that substances are classified according to hazard types, classes and categories based on inherent hazard. The hazard classes previously used under DSD, mostly align with counterparts under CLP.

As in DSD, CLP distinguishes 3 hazard types (physical, health and environmental hazards), with their respective "classes" (endpoints). In most cases, hazard classes are further sub-divided into hazard categories.



Not all GHS endpoints have been adopted by CLP in line with the 'Building Block' approach. Furthermore not all CLP hazard classes can be found in DSD. For example, the number of physical hazard classes in CLP has been increased in comparison to DSD, and some health hazard classes previously found under DSD do not have a GHS counterpart and were added specifically to CLP. EU specific additions are covered in CLP in Annex II, Part 1, as "Supplemental Hazard Information" (EU, 2008).

To assist in converting existing DSD (and DPD) hazard classifications for the purposes of CLP, the EC has created translation tables which map to the equivalent hazard classes and categories in CLP. The translation tables can be found in CLP Annex VII Tables 1.1 and 1.2 (EU, 2008).

The following sections describe the key differences between DSD and CLP. The differences in criteria are presented under their respective sections.

3.1.1. Physical Hazards

The following classes of physical hazards found in CLP were not previously included under DSD:

- Gases under pressure
- Self-reactive substances and mixtures
- Pyrophoric properties
- Self-heating substances and mixtures
- Substances and mixtures which in contact with water emit flammable gases
- Organic peroxides
- Corrosive to metals

The following classes of physical hazards found previously under DSD are not included under CLP:

- Forms very sensitive explosive metallic compounds
- Heating may cause an explosion
- Explosive when mixed with oxidising substances
- May form flammable/explosive vapour-air mixtures

3.1.2. Health Hazards

Under DSD health hazards were dealt with in two separate sections, one dealing with general toxicological properties, mainly acute toxicity, and one on specific effects on human health, mainly dealing with chronic toxicity. CLP addresses all health endpoints in one section “Part 3, Health Hazards” (EU, 2008).

All of the health hazard classes in DSD have been included in CLP.

3.1.3. Environmental Hazards

With the exception of ‘Harmful to aquatic organisms’, all of the environmental hazard classes from DSD have been included in CLP.

3.1.4. Hazard / Precautionary Statements and Risk / Safety Phrases

For hazard communication purposes under DSD, classification of a substance for physical, health or environmental endpoints was accompanied by a ‘risk phrase’ (commonly known as R-phrase), which identified the nature of the hazard. For example ‘Xi, R36’ means Irritant (Xi); classified as ‘irritating to the eyes’.

Following a similar approach to DSD, CLP uses hazard statements (H-statements) instead of R-phrases. For example eye irritation category 2 H319 ‘causes serious eye irritation’. CLP Annex III lists the correct wording of the hazard statements, as they should appear on the warning label.

Furthermore, labelling advice to prevent or minimise adverse effects to human health or environment is communicated under CLP through the use of precautionary statements (P-statements’), which are similar to the safety phrases (S-phrases) under DSD. CLP Annex IV lists the correct wording of the precautionary statements, as they should appear on the warning label.

Classification of a substance for a specific hazard 'class' and 'category' is thus accompanied by specific H- and P-statements. These are specified at the end of every section dealing with classification criteria.

These statements are assigned a unique alphanumerical code, which consists of one letter (H = Hazard, P = Precautionary) and three digits, as follows:

- One digit to designate the class (type) of hazard, e.g. '2' for physical hazard
- Two further digits corresponding to the sequential numbering of statements as follows:

Hazard (H)
200 – 299: Physical Hazard
300 – 399: Health Hazard
400 – 499: Env. Hazard

Precautionary (P)
100 - 199 General
200 - 299 Prevention
300 - 399 Response
400 - 499 Storage
500 - 599 Disposal

3.2. HAZARD CLASSIFICATION CRITERIA

Classification is based on comparison of test data against criteria for each of the hazard classes/categories. The criteria for classification are found in CLP Annex 1.

3.2.1. Physical Endpoints

Data are used to assess the physical hazards (e.g. flammability) and help predict possible toxicological or environmental hazards, fate and behaviour. They are used for the purposes of safe handling and to help in the identification of risks posed to humans and the environment from all stages of a substance life cycle.

For petroleum UVCB substances, some physical endpoints as required under DSD and CLP are not applicable or relevant. Instead ranges or alternative endpoints should be used,

Examples

Boiling point	→	Boiling point range
Flash point	→	Flash point range
Melting point	→	Pour point

Due to their inherent properties and chemical structure considerations, the following hazard categories do not apply or are considered irrelevant for petroleum substances:

- Explosive
- Oxidising (gas, liquid, solid)
- Pyrophoric (solid, liquid)
- Self-reactive and Self-heating
- Organic Peroxide
- Corrosive to Metal
- Substance which in contact with water emits flammable gas

Both DSD and CLP address physical hazards using similar hazard classes. These are related to explosive, oxidising and flammable properties of substances. A direct translation may not aways be possible as DSD and CLP criteria are not identical.

The differences between CLP and DSD are best illustrated by Flammability. Liquid substances assigned Flammable (R10) or Highly Flammable (R11) under DSD, could be classified as 'Flammable liquid' categories 1, 2 or 3, under CLP depending on the flash point and boiling point or ranges thereof. In classifying petroleum substances for flammability it is necessary to evaluate information on flash point and initial boiling point, since direct translation from DSD to CLP is not possible.

Flammable liquids		**Classification criteria**		
DSD		**R12**	**R11**	**R10**
	Flash point ºC	< 0	< 21	≥ 21 and ≤ 55
	Initial boiling point ºC	≤ 35	-	-
CLP		**Cat. 1**	**Cat. 2**	**Cat. 3**
	Flash point ºC	< 23	< 23	≥ 23
	Initial boiling point ºC	≤ 35	> 35	≤ 60

Note: Risk phrases are used in this and the tables which follow as they are familiar and serve to enhance the readability of the tables.

It should be recognised that under CLP, gas oils, diesel, and light heating oils having a flash point between ≥ 55°C and ≤ 75°C may be regarded as flammable liquid Category 3.

3.2.2. Health Endpoints

3.2.2.1. Acute Toxicity

Under both CLP and DSD, acute toxicity hazard is differentiated into oral, dermal and inhalation routes of exposure. Both classification systems use acute lethality e.g. LD_{50} (oral, dermal) or LC50 (inhalation) values, to assess acute toxicity. Acute lethality cut-off values determine whether a substance is classified under DSD as "very toxic (T+)", "toxic (T)" or "harmful (Xn)". CLP divides acute toxicity into 4 categories: Category 1 to 4.

Acute toxicity cut-off values in CLP are different from those in DSD as shown in the following tables.

❖ **Oral**

DSD	**R28**		**R25**		**R22**	
Dose ranges LD_{50} mg/kg bw	< 5	5-25	25-50	50-200	200-300	300-2000
CLP	**Cat.1**	**Cat.2**		**Cat.3**		**Cat.4**

❖ **Dermal**

DSD	R27	R24		R21	
Dose ranges LD_{50} mg/kg bw	< 50	50-200	200-400	400-1000	1000-2000
CLP	Cat.1	Cat.2	Cat.3		Cat.4

❖ **Inhalation**

For this route of exposure CLP and DSD have different criteria depending on the physical state of the substance. :
CLP: Gases, vapours and dusts/mists.
DSD: Gases/vapours and aerosols/particulates

Inhalation: gases

For gases the measurement units are ppmV.

It must be noted that CLP specifies that for a vapour which is near the gaseous phase, classification shall be based on ppmV. This format of classification was not covered in DSD as it classified gases and vapours using the same units.

DSD	N.A.	Not Available		Not Available
Dose ranges LC_{50} ppmV	≤ 100	100 – 500	500-2500	2500 - 20 000
CLP	Cat.1	Cat.2	Cat.3	Cat.4

Inhalation: vapours

In CLP vapours are defined as: the gaseous form of a substance or mixture released from its liquid or solid state.

DSD	R26	R23	R20	
Dose ranges LC_{50} mg/l	≤ 0.5	0.5-2.0	2.0-10	10-20
CLP	Cat.1	Cat.2	Cat.3	Cat.4

Inhalation: dusts/mists

In CLP, dust (suspended solid particles, from mechanical processes) and mist (suspended liquid droplets, from condensation of supersaturated vapours or physical shearing of liquids) are defined as generally having particle sizes in a range from >1 to ca. 100 µm.

DSD	R26		R23		R20
Dose ranges LC_{50} mg/l	≤0.05	0.05-0.25	0.25-0.5	0.5-1.0	1.0-5.0
CLP	Cat.1	Cat.2		Cat.3	Cat.4

3.2.2.2. Irritation/Corrosion

Skin

Both DSD and CLP distinguish between corrosion and irritation of the skin. Both legislative texts regard corrosion as the irreversible destruction of skin tissue within an exposure period of up to 4 hours, and irritation as a reversible effect after 4 hours exposure.

For corrosion in particular, the use of extreme pH values as a surrogate to predict corrosion for the purpose of classification is outlined and both legislative texts share the same pH range, strong acid or alkali reactions at pH $\leq$ 2 or $\geq$ 11.5 respectively. Buffering effects should be taken into account, and if data suggest the substance is unlikely to be corrosive despite the low or high pH value, then further testing should be carried out prior to assigning a classification.

In CLP, the use of validated *in vitro* tests is encouraged.

Differences between DSD and CLP lie mainly in the cut-off values for classification based on the criteria set for the exposure period and the persistence of the effect during the observation period (CLP only), as well as mean values of erythema/eschar and oedema scores

Corrosion

Legislation	**Category**	**Corrosive**	
		Exposure time: t	Observation period
CLP	**Cat.1A**	**t**$\leq$ 3 min	**$\leq$ 1 hour**
	Cat.1B	3 min <**t**$\leq$ 1 hr	**$\leq$ 14 days**
	Cat.1C	1hr <**t**$\leq$ 4 hrs	**$\leq$ 14 days**
DSD	**R35**	**t**$\leq$ 3 min	**-**
	R34	3 min <**t**$\leq$ 4 hr	**-**

Other effects such as hyperplasia, hyperkeratosis, scaling, fissures, scab formation and alopecia are also taken into account in the overall evaluation of skin effects at the end of the observation period.

Skin irritation (under DSD and CLP) for reversible effects is assessed after a semi-occluded exposure of up to 4-hours. After exposure, erythema and/or oedema are assessed according to scores after 24, 48, and 72 hours.

Skin irritation studies of some petroleum substances (e.g. distillate aromatic extracts and straight-run gas oils) have been performed under non-guideline conditions, such as exposure for up to 24 hours, under occluded conditions. The mean scores for erythema and oedema need to be assessed against the deviations in methodology. Following that, expert judgement should be used to decide whether irritation, sufficient for classification purposes would be expected, if the test had been conducted under guideline conditions. Data from repeat exposure tests can also be considered as part of a weight of evidence approach, and may be used as the basis for classification in the absence of other more definitive data.

Under CLP the major criteria for the irritant category are:

- At least 2 of 3 tested animals have a mean score of ≥ 2.3 - ≤ 4.0.
- Reversibility of skin lesions is another consideration in evaluating irritant responses. When inflammation persists to the end of the observation period in 2 or more test animals, taking into consideration alopecia (limited area), hyperkeratosis, hyperplasia and scaling, then a material shall be considered to be an irritant.

Irritation

		Erythema or oedema mean value	Reading times
DSD	**R38**	≥ 2	24, 48, 72 hours and: a) delayed reactions.
CLP	**Cat. 2**	≥ 2.3 - ≤ 4.0	24, 48, 72 hours and: a) delayed reactions on 3 consecutive days. b) persisting inflammation for 14 days

Eye

Similarities of DSD and CLP are based on the severity of the effect in the eye, namely whether they are reversible or irreversible. Differences lie in the definition of what is considered reversible or not, reflected mainly in the observation period for the persistence of the effect.

- DSD: severe or significant ocular lesions that occur within an exposure time of 72 hours and persist for at least 24 hours.
- CLP: according to OECD test guideline 405, effects are fully or not fully reversible within 21 days of application.

For classification purposes, the main differences are in the cut-off values of the criteria used to discriminate between reversible or irreversible ocular effects.

This is based on the severity of effects on either the cornea and/or iris, and/or the severity of conjunctival redness and/or oedema, which is assessed by calculating the respective mean scores at each of the reading times (24, 48, 72 hours) for that effect and taking into account the number of animals in which an effect was observed. Please refer to the legislative text for the specific criteria.

	DSD	CLP	DSD	CLP
Effect	**Irreversible**		**Reversible**	
	R41	**Cat.1**	**R36**	**Cat.1**
Cornea opacity	≥ 3.0	≥ 3.0	≥ 2.0 but < 3.0	≥ 1.0
Iris lesion	> 1.5 > 2.0	>1.5	≥ 1.0 but < 1.5	≥ 1.0
Conjuctiva redness	-	-	≥ 2.5	≥ 2.0
Oedema (chemosis)	-	-	≥ 2.0	≥ 2.0

- For classification purposes, both DSD and CLP allow the use of human experience to assess the degree of the effects.
- In both sets of legislation, materials corrosive to skin are classified as causing irreversible ocular damage, hence extreme pH values are important considerations in this respect.

3.2.2.3. Sensitisation

Through implementation of the 2nd ATP, CLP introduces the concept of potency using two new subcategories (1A – strong sensitisers, 1B – moderate sensitisers) for both respiratory and skin sensitisation using primarily animal data. Potency is the concentration at which a substance induces sensitisation and is described by dose-response relationships at either the induction or the elicitation phase.

Respiratory sensitisation

Under DSD and CLP evidence that a substance can induce specific respiratory hypersensitivity will normally be based on human experience. Although there is no validated OECD animal test for this endpoint, both legislations accept animal data with measurements on specific markers as evidence of potential hazard. When no potency data are available, criteria for classification purposes are identical in both legislations

Skin sensitisation

Animal studies for identification of skin sensitisation hazard, in contrast to respiratory sensitisation have been validated and are commonly used.

When assessing potency, cut-off values are applied to animal test results (mainly guinea pig tests or local lymph node assay). However, this subcategorisation can only be applied where sufficient data exist to make the distinction; where the data are insufficient, the classification in Category 1 should be maintained.

DSD and CLP allow the use of human data for classification purposes. It must be pointed out that according to Article 7(3) of CLP; tests on humans shall not be performed for the purposes of classification. However data obtained from other sources, such as clinical studies, can be used.

In the case of conflicting results with human and animal data, CLP has explicit text dealing with this issue. In brief, positive evidence from animal studies is regarded as more reliable than evidence from human studies. Evaluation of human data must be carried out with caution, since negative human data cannot normally be used to negate positive results from animal studies.

Following the criteria used in both DSD and CLP, the respective classifications for respiratory and skin sensitisation are summarised in the following table:

Sensitisation	DSD	CLP	
Respiratory sensitisation	R42	Category 1	Sub-category 1A
			Sub-category 1B
Skin Sensitisation	R43	Category 1	Sub-category 1A
			Sub-category 1B

3.2.2.4. Germ Cell Mutagenicity

Under DSD and CLP this hazard class is primarily concerned with substances that may cause mutations in the germ cells of humans that can be transmitted to the progeny.

The criteria for classification are similar between DSD and CLP. The following table provides an overview of how the two classification systems overlap.

DSD	R46		R68
	Cat. 1	Cat. 2	Cat. 3
CLP	Category 1		Category 2
	Cat. 1A	Cat. 1B	

Evaluation of the test results for petroleum substances requires expert judgement taking into account all the available data in arriving at a classification.

The “Modified Ames Test” (Blackburn G.R. et al, 1986) is often used to assess the *in vitro* mutagenic activity of petroleum substances. The test was developed to maximise detection sensitivity of mutagenic activity in petroleum substances and products that is mediated by polycyclic aromatic compounds. Results are expressed as a Mutagenicity Index (MI), which represents the slope of the mutagenic dose-response relationship. A positive result in this test indicates *in vitro* gene mutation.

Data from Mouse Lymphoma Assays (MLA) need to be evaluated with caution. Mouse lymphoma assays (MLAs) have historically exhibited a lack of performance and acceptability standards, hence the validity of MLA data has been questioned, and the possibility that the positive results in these studies are not actually evidence of *in vitro* mutagenic activity must be considered.

Some petroleum substances are classified and labelled as carcinogenic and it is generally accepted that carcinogenic activity is sometimes mediated via a genotoxic mechanism. Classification as a genotoxic carcinogen does not however automatically prompt additional classification as a germ cell mutagen since the criteria for germ cell mutagen classification require evidence of heritable damage, i.e. evidence that the substance is a somatic mutagen and the substance or a relevant metabolite can reach the germ line cells in the reproductive organs. Most petroleum carcinogenesis studies assess skin tumor induction, so any potential *in vivo* mutagenic activity is limited to the site of application and does not explicitly imply systemic effects.

As a consequence, unless there is clear evidence that germ cells are affected in germ cell assays, petroleum substances which have been classified as carcinogenic are not also classified as germ cell mutagens.

3.2.2.5. Carcinogenicity

Under DSD and CLP this hazard concerns whether a substance or a mixture of substances has the potential to induce cancer or increase its incidence. Substances that have induced benign and malignant tumours in well-performed experimental studies on animals are considered to be presumed or suspected human carcinogens unless there is strong evidence that the mechanism of tumour formation is not relevant for humans.

DSD	R45		R40
	Cat. 1	Cat. 2	Cat. 3
CLP	Category 1		Category 2
	Cat. 1A	Cat. 1B	

Translation of DSD R49, “May cause cancer by inhalation” is not found under CLP, but route of exposure is additionally stated, if it is conclusively proven that no other routes or exposures cause the hazard.

Carcinogenicity classification for petroleum substances may also be dependent on data from other predictive tests. The IP346 assay (Institute of Petroleum, 1993) is a measure of the DMSO extractables, results of which have been correlated with carcinogenic activity in mouse skin painting studies. When the weight percent of extractables is less than three percent of the total weight of the material, then the substance is not classified. When the weight percent is three or greater, then the substance becomes classified as a carcinogen. The IP346 assay is used as a predictive test for classification for some CONCAWE categories. Another predictive test that is used for carcinogenic classification is the modified Ames assay. Described above in the germ cell mutagenicity section, this test is a measure of the *in vitro* genotoxic potential. In order to assess the carcinogenic potential of Residual Aromatic Extracts, the results of the assay, namely the MI value, have been correlated with mouse skin painting data, and a classification cutpoint has been established. If the MI is less than 0.4, no classification is required.

These predictive tests and their impact on classification have been captured in EU Regulatory Notes and/or Oil Industry Notes for the appropriate categories.

A direct translation from DSD to CLP as indicated in the tables above is generally possible. However, some differences around the interpretation of the available animal data should be considered on a case by case basis. .

3.2.2.6. Reproductive Toxicity

Reproductive and developmental toxicity

Under DSD and CLP reproductive toxicity includes adverse effects on sexual function and fertility (adult males and females), as well as developmental toxicity in the offspring. The induction of genetically based heritable effects in the offspring is addressed under Germ Cell Mutagenicity and is not part of the scope of the reproductive toxicity endpoint.

The developmental effects of substances must be evaluated carefully to eliminate the possible confounding effects of maternal toxicity on the developing foetus. Generic guidance on this is given in **Appendix 7**.

Under both classification systems, reproductive toxicity is subdivided under two main headings:

- Adverse effects on sexual function and fertility.
- Adverse effects on development of the offspring.

DSD	R60 & R61		R62 & R63	R64
	Cat. 1	Cat. 2	Cat. 3	
CLP	Category 1		Category 2	Effects on or via lactation
	Cat. 1A	Cat. 1B		

Generally direct translation from one system to the other is possible.

Some differences in CLP:

- In cases where there are no clear data to the contrary, the hazard statement specifying both 'damage to fertility' AND 'damage to the unborn child' should be assigned. It is possible to omit the specific hazard statement for fertility or developmental effects, in cases where there are clearly negative results.

- Under DSD for classification of impaired fertility (Cat. 2 R60), supporting evidence was required (e.g. clear evidence in one animal species, supporting evidence on mechanism of action or site of action, etc). As currently written in CLP, such supporting evidence is not needed.

Effects during lactation

Equally under DSD and CLP, adverse effects on or via lactation are included under reproductive toxicity, but for classification purposes such effects are treated separately. This is because it is desirable to be able to classify substances specifically for an adverse effect on lactation (R64 or "Effects on or via lactation, H362") so that a specific hazard warning about this effect can be provided for lactating mothers independently of whether the substance is classified for reproductive toxicity.

Accordingly, substances classified R64 for "effects on or via lactation are not regarded as "toxic for reproduction". In the same way in CLP, the assignment of H362 ("May cause harm to breast-fed children") is independent of consideration of effects on development or fertility, and hence a substance can be assigned H362 whether or not the substance is also classified for reproductive toxicity.

3.2.2.7. Specific Target Organ Toxicity

Under CLP, reference is made to those specific effects caused by single or repeated exposure to a substance (Specific Target Organ Toxicity or STOT).

These effects refer to significant systemic effects that can impair function, that may be reversible or irreversible, immediate and/or delayed, or which are not specifically addressed by another hazard class (e.g. reproductive toxicity, irritation, carcinogenicity).

Specific target organ toxicity can occur by any route that is relevant for humans, i.e. principally oral, dermal or inhalation.

Similarly under DSD, specific adverse health effects (not covered by CMR endpoints), may be classified as 'very serious irreversible effects' (T, T+; R39), or 'serious damage to health by prolonged contact' (T, Xn; R48). For inhalation,

transient effects, classification was for irritancy and drowsiness and dizziness (R37 and R67 respectively).

Translation from DSD into CLP is possible bearing in mind that DSD classifies according to the severity of the effect and route of exposure only, whereas in CLP the length of exposure is emphasised, with severity of effect being addressed under specific categories.

Specific Target Organ Toxicity - Single Exposure (STOT-SE)

Specific target organ toxicity (single exposure) is defined as specific, non-lethal target organ toxicity arising from a single exposure to a substance or mixture. STOT-SE should only be assigned when another hazard class (e.g. irritation, acute toxicity) does not cover the observed toxicity more appropriately.

The hazard class Specific Target Organ Toxicity – Single Exposure is differentiated into:

- STOT– Single Exposure, Category 1 and 2; for non-lethal "significant and/or severe toxic effects"
- STOT – Single Exposure, Category 3; for "transient effects" after single exposure, specifically respiratory tract irritation (RTI) and narcotic effects (NE).

Translation from DSD is generally possible with review of the criteria for classification. Cut-off values to assign categories, are however different for the DSD and CLP counterparts.

Note that there are no guideline values for R37, R67 and the corresponding Category 3, as this is done on a case by case basis using human data and relevant animal studies, according to the classification criteria under CLP.

DSD		**Classification cut-off guideline (LOAEL)**			
Route of exposure	**dose unit**	**R39**	**R39**	**R68**	**R37, R67**
Oral	mg/kg bw/day	≤ 25	25 < C ≤ 200	200 < C ≤ 2000	expert judgement
Dermal	mg/kg bw/day	≤ 50	50 < C ≤ 400	400 < C ≤ 2000	
Inhalation (gas/vapour)	mg/l/4 hrs	≤ 0.5	0.5 < C ≤ 2	2 < C ≤ 20	
Inhalation (aerosols/particulates)	mg/l/4 hrs	≤ 0.25	0.25 < C ≤ 1	1 < C ≤ 5	
		Classification cut-off guideline (LOAEL)			
CLP		**Cat. 1**		**Cat. 2**	**Cat. 3**
Oral	mg/kg bw/day	≤ 300		300 < C ≤ 2000	expert judgement
Dermal	mg/kg bw/day	≤ 1000		1000 < C ≤ 2000	
Inhalation (gas)	ppm	≤ 2500		2500 < C ≤ 5000	
Inhalation (vapour)	mg/l	≤ 10		10 < C ≤ 20	
Inhalation (dust/mist/fume)	mg/l/4 hrs	≤ 1		1 < C ≤ 5	

Specific Target Organ Toxicity - Repeated Exposure (STOT-RE)

This endpoint relates to specific target organ effects arising from repeated exposure to a substance or mixture. All significant health effects that can impair function, that are reversible or irreversible, immediate and/or delayed are classified into either Category 1 or 2. Specific target organ toxicity can occur by any route that is relevant for humans, i.e. principally oral, dermal or inhalation.

According to CLP, STOT-RE should only be assigned where the observed toxicity is not covered more appropriately by another hazard class (e.g. carcinogenicity, reproductive toxicity).

The purpose of STOT-RE is to identify the primary target organ(s) of toxicity for inclusion in the hazard statement.

Classification with STOT-RE is comparable to DSD classification R48/(T,Xn). However, differences exist regarding the interpretation of data and cut-off values for classification.

The following table provides classification cut-off values for STOT-RE with their DSD counterparts.

DSD		**Classification cut-off***	
Route of exposure	**dose unit**	**R48**	**R48**
Oral	mg/kg bw/day	≦ 5	5 < C ≦ 50
Dermal	mg/kg bw/day	≦ 10	10 < C ≦ 100
Inhalation	mg/l/6 hrs/day	≦ 0.025	0.025 < C ≦ 0.25
CLP		**Cat. 1**	**Cat. 2**
Oral	mg/kg bw/day	≦ 10	10 < C ≦ 100
Dermal	mg/kg bw/day	≦ 20	20 < C ≦ 200
Inhalation (gas)	ppm/6 hrs/day	≤50	50 < C ≦ 250
Inhalation (vapour)	mg/l/6 hrs/day	≤0.2	0.2 < C ≦ 1.0
Inhalation (dust/mist/fume)	mg/l/6 hrs/day	≤ 0.02	0.02 < C ≦ 0.2

*Values based on Lowest Observed Adverse Effect Level (LOAEL)

3.2.3. Environmental Endpoints

One of the principal differences between DSD/DPD and CLP is the change relating to the evaluation of chronic environmental hazard. The combined classifications are very similar. In DSD, classification was based on a combination of the acute aquatic toxicity (R50/51/52) with a log K_{ow} ≥ 3 or not readily biodegradable (i.e. R53). In CLP, this has been amended to consider only Acute 1, Chronic Hazard 1, or Chronic 2, or Chronic 3 (dependent on a combination of the acute or chronic toxicity value with evidence to show a log K_{ow} ≥ 4 and/or not rapid biodegradability). For

substances that are not acutely toxic but meet the log K_{ow} and or biodegradability criteria, a safety net for chronic classification (Chronic Hazard 4) is incorporated in CLP.

Specific differences are as follows:

- DSD criteria refer specifically to the use of Daphnia for assessing acute aquatic toxicity whereas CLP refers to the use of crustacea.
- For plants the DSD criteria refer specifically to algae whilst in CLP this is extended to algae/aquatic plants.
- In CLP, a Multiplying (M) factor has been introduced (CLP Annex 1, Table 4.1.3) which is a weighting factor for substances which meet the criteria for classification in Acute Category 1 or Chronic Category 1. The M factor is derived from the lowest toxicity value (e.g. LC_{50} or NOEC) for the substance, and is used for the purposes of calculating the toxicity of mixtures.
- With the implementation of the 2nd ATP to CLP, chronic toxicity data are used (if available) to determine chronic classification, while in DSD chronic studies are used to support the lack of classification.

Regarding classification for chronic aquatic toxicity:

- Biodegradation: DSD criteria use the term “readily” whereas CLP refers to “rapidly” degradable. However the definition of these terms for classification purposes is identical.
- Bioaccumulation: Determined using the octanol/water partition coefficient, and reported as log “P_{ow}” under DSD, whereas CLP criteria refer to log “K_{ow}”. The definition for both terms is identical; n.b. the change in threshold value from 3 to 4, i.e. DSD criteria refer to “log $P_{ow} \geq 3$” whereas CLP refers to “log $K_{ow} \geq 4$”.
- Regarding experimental bio-concentration factors (BCF), DSD refers to a BCF of ≥100 whereas CLP refers to a BCF of ≥500. It is important to note that in both classification systems, experimental BCF data takes precedence over screening data (log K_{ow}).
- The definition of the ‘safety net’ classification has been amended from a combination of low water solubility (<1 mg/l) and log $K_{ow} \geq 3$ and not readily biodegradable (i.e. R53) to Chronic Category 4, which is used for substances which have low water solubility (< 1 mg/l), log K_{ow} values ≥ 4 and are not rapidly biodegradable.
- Justification for not classifying in Chronic Category 4 is based on measured BCF data (≤ 100 [DSD/DPD] or ≤ 500 [CLP]) or a chronic toxicity value of > 1 mg/l. Since bio-concentration studies for petroleum UVCB substances are not feasible, chronic studies at the limit of water solubility are required to support non classification.

The following table provides classification cut-off values for environmental classification with their DSD counterparts.

If chronic data are not available:

$logK_{ow}$ and biodeg. (DSD)	<3 and rapidly degradable			
$logK_{ow}$ and biodeg. (CLP)	<4 and rapidly degradable			
Toxicity	LL50 ≤1 mg/l	LL50 >1 to ≤10 mg/l	LL50 >10 to ≤100 mg/l	LL50 >100 mg/l
DSD	**R50**	**R51**	**R52**	**R53**
CLP	**Aquatic Acute 1**			

$logK_{ow}$ and biodeg. (DSD)	>3 and non rapidly degradable			
$logK_{ow}$ and biodeg. (CLP)	>4 and/**or** non rapidly degradable			
Toxicity	LL50 ≤1 mg/l	LL50 >1 to ≤10 mg/l	LL50 >10 to ≤100 mg/l	LL50 >100 mg/l
DSD	**R50/53**	**R51/53**	**R52/53**	**R53**
CLP	**Aquatic Acute 1 Chronic 1**	**Aquatic Chronic 2**	**Aquatic Chronic 3**	**Aquatic Chronic 4**

If chronic data are available for non rapidly degradable substances:

Toxicity	NOEL or EL_x ≤ 0.1 mg/l	NOEL or EL_x >0.1 to ≤1 mg/l	NOEL or EL_x ≤1 mg/l
DSD			**R53**
CLP	**Aquatic Chronic 1**	**Aquatic Chronic 2**	**Aquatic Chronic 4**

4. SPECIAL CONSIDERATIONS FOR PETROLEUM SUBSTANCES

Petroleum substances are complex combinations of individual hydrocarbons, which present a number of challenges when applying the methods and legislative criteria developed for the hazard classification of single chemical substances. The petroleum industry has developed approaches and methodologies to characterise the hazard potential of petroleum substances and products. These are described below along with other important considerations from CLP relating to the petroleum industry.

4.1. GROUPING/CATEGORY APPROACH

Crude oil (Petroleum, CAS Registry Number (CAS RN) 8002-05-9) is a complex combination of hydrocarbons extracted from the ground in its natural state. Petroleum substances are derived from crude petroleum, using one or more refinery processes, but due to their method of production, and complex composition, it is not possible to characterise petroleum substances in terms of exact chemical composition, molecular formula or structure. From a regulatory perspective, petroleum substances are recognised as UVCB substances (Substances of Unknown or Variable composition, Complex reaction products or Biological materials).

Under CLP and REACH it is possible to group substances together into categories where their physical hazards, human and environmental toxicological properties and environmental fate properties are likely to be similar or follow a regular pattern as a result of structural similarities. Petroleum substances can be grouped together according to the processes by which they are manufactured and basic physical properties.

In this report, the category approach has been applied to physical, toxicological and ecotoxicological endpoints for the purposes of hazard classification. To take account of the variable composition of petroleum UVCBs, hazard properties of the category are determined, and a precautionary approach is used to assign the most severe potential hazard classification appropriate for the category, unless specific derogation conditions (designated by Notes or classification criteria) are met.

4.2. CLASSIFICATION AND LABELLING OF PETROLEUM SUBSTANCES – 'SPECIAL TESTING CONSIDERATIONS'

The inherent compositional variability of petroleum UVCBs means that use of conventional testing methodologies may not provide the most reliable data from which to derive hazard classification. This is particularly true for physical/chemical properties which are better characterized as ranges than single point values and for environmental endpoints which are difficult due to the complex compositions of the substances and the variable water solubility of individual constituents. In contrast, the conventional toxicological testing methodologies can normally be used without modification.

For health and environmental testing of petroleum substances, the outcome depends upon the nature and concentration of the substance to which the organism or test system is exposed. Testing methodologies have been modified to take these factors into account (e.g., the modified Ames test and Water Accommodated

Fraction approach to aquatic toxicity testing). For the environment, models to predict aquatic toxicity of hydrocarbon UVCBs, based on Quantitative Structure Activity Relationships (QSARs), have recently become available. However, only experimental data are used to determine the classification of petroleum substance categories following a worst case approach.

4.3. ASPIRATION HAZARD

'Aspiration' means the entry of a liquid substance directly into the trachea and lower respiratory tract. Aspiration of certain petroleum substances may result in severe acute effects, such as chemical pneumonitis, varying degrees of pulmonary injury or death. This property relates to the potential for low viscosity material to spread quickly into the deep lung and cause severe pulmonary tissue damage.

Classification of a hydrocarbon substance for aspiration hazard is made on the basis of reliable animal test data, human evidence or on the basis of physical properties, specifically if it has a kinematic viscosity of 20.5 mm^2/s or less, measured at 40°C. Note that the viscosity criteria for this hazard endpoint under CLP are more restrictive than previous DSD criteria (7 mm^2/s or less measured at 40°C). Substances which meet these criteria are classified in Category 1 for aspiration hazard. It is important to note that classification is mandatory for substances which meet the physical/chemical property criteria, and does not require confirmation in standard toxicology studies in animals.

The classification of a substance which exists as an aerosol or mist, for example as found in pressurised cylinders, is made on the basis of whether or not the substance has the potential to form a pool of liquid in the mouth, and thereby be aspirated. A fine aerosol or mist may not form a pool of liquid and is therefore unlikely to present an aspiration hazard.

Aspiration of a substance can occur during ingestion and also if it is vomited following ingestion. Safe handling information, for example on labels or in safety data sheets, should reflect this potential hazard.

4.4. HARMONISED CLASSIFICATIONS

The EU harmonised classification of petroleum substances, where these are established, are included in tables 3.1 and 3.2 of Annex VI to CLP, which indicate the minimum mandatory classification of substances, for the specified endpoints, according to both CLP and DSD criteria respectively. The harmonised classifications must be used, except where a regulatory Note applies (Annex VI, 1.1.3).

In addition, for hazard endpoints where no EU harmonised classification exists, this report provides proposals for the self–classification of petroleum substances in Europe. This is in line with the provisions of Article 4 (3) of CLP.

4.5. SELECTION OF PRECAUTIONARY STATEMENTS

CLP requires the allocation of selected precautionary statements (P-statements) for use on labels. These are standardised phrases describing the recommended handling measures required to minimise or prevent adverse environmental, health

or physical effects resulting from exposure to a hazardous substance or mixture during its use or disposal.

Container labels should include relevant P-statements (as defined in CLP, Article 22). The complete set of P-statements associated with each specific hazard classification, can be found in CLP Annex I, parts 2 to 5.

The hazard classification of the substance determines the applicable P-statements. Normally, no more than six P-statements should appear on the label, unless necessary to reflect the nature and the severity of the hazards. Guidance on the selection of P-statements has been published by ECHA (2011). This guidance identifies each P-statement for each hazard class and category as either: Highly Recommended, Recommended or Optional, and indicates that suppliers need to allocate statements based on knowledge of substance use and hazard profile. [N.B.: It is expected that further guidance will be developed by the United Nations, in order to provide assistance with the selection of the most appropriate P-statements].

When a hazardous substance is supplied to the general public, one P-statement addressing the disposal of that substance or mixture as well as the disposal of packaging shall appear on the label. However, a P-statement addressing disposal shall not be required, when it is clear that the disposal of the substance or the packaging does not present a hazard to human health or the environment.

CLP (Annex IV) lists the correct wording of the P-statements as they should appear on the label. H- and P-statements of one language should be grouped together on the label.

In the Category specific recommendations in this report, all associated P-statements are shown for completeness. Those statements shown in bold, have been selected and recommended by CONCAWE for the label, and are applicable for the default, most severe hazard classification.

Please note that several P-statements (e.g., P210, P241, P264, P321, P501) are incomplete and require the manufacturer/supplier to supplement the phrase with the required information. This also applies to certain S-phrases (e.g., S43).

4.6. REGULATORY AND OIL INDUSTRY NOTES

The preferred method for hazard classification of petroleum substances is to use data on the UVCB substance itself, where available (see example in **Appendix 6**). For certain human health hazard endpoints classification is driven by the presence of specific ‘hazardous’ constituents that are themselves classified, and for which general or specific concentration limits exist. An example is the classification of naphtha petroleum streams as carcinogens on the basis of their benzene content.

For some categories of petroleum substances, ‘markers’ have been identified which take into account the variable compositions of petroleum substances; for these substances, human health hazard classification is addressed by the use of “Notes”. The regulatory Notes, as laid down in Annex VI to CLP, are applicable to the classification of certain petroleum substances as described in **Appendix 3**.

It is important to recognise that these regulatory Notes only apply to specific petroleum substances in Annex VI to CLP. In addition to the regulatory notes, CONCAWE has developed a series of Oil Industry Notes (OIN), which also deal with

hazardous properties which may be associated with petroleum substances and need to be considered when determining the hazard classifications. The resultant default hazards are reflected in the worst-case or most severe hazard classifications which must be applied, unless the conditions of the OIN have been met. This is consistent with the approach used with the regulatory notes. The OINs are also listed in **Appendix 3**.

For example, regulatory Note L applies to most of the CAS RNs in the Other Lubricant Base Oils Category that appear in Annex VI. OIN L was developed for the remaining CAS RNs in the Other Lubricant Base Oils Category not covered by the regulatory Note L.

4.7. SUPPLY AND TRANSPORT LABELLING

The legislation on labelling for supply and use, as set out in CLP, is very similar to the former DSD legislation. Notable differences include; the dimension and orientation of the pictograms and the provisions for combined labelling, which integrate the requirements for both CLP and the transport of dangerous goods. The label may also contain "supplemental information" as long as this does not contradict or detract from the CLP information.

N.B.: Substances classified, labelled and packaged in accordance with DSD and placed on the market before 1st of December 2010, are t required to be relabelled and repackaged in accordance with CLP as of 1st of December 2012.

4.7.1. Content of the label

A hazardous substance supplied in packaging must be labelled according to CLP rules. Anyone placing a substance on the market shall make sure that the product is correctly labelled. The label should be written in the official language(s) of the Member State(s) in which the product is sold. The overall label sizes are identical to DSD and vary according to the capacity of the container, as described in section 1.2.1 of CLP Annex I. The label shall include specific information, namely; Supplier name, address, telephone number, together with product identifier. For substances, the product identifier should be the same as that used in the SDS, as described in CLP Article 18.

In addition, the label should include hazard pictograms; the pictograms are a square set at a point (diamond) with a black symbol on a white background with a red border. Each pictogram should cover at least 1/15 of the surface area of the label but not be smaller than 1 cm^2. Associated hazard statements are also included, along with the most suitable (normally not more than six) precautionary statements. The principles of precedence for pictograms, hazard and precautionary statements are described in CLP Articles 26-28, although these are less well defined in CLP compared to DSD. The label may now contain up to six pictograms.

Specific label requirements for transported gas cylinders, gas containers intended for propane, butane or liquefied petroleum gas, aerosols and containers fitted with a sealed spray attachment and containing substances classified as hazardous if aspirated are described in section 1.3 of CLP Annex I.

Under certain circumstances there may be a need to include additional or supplemental information on the label or container. This report does not provide a

comprehensive inventory of the additional information that may be needed. Companies are encouraged to review relevant legislation for their products to identify any supplemental information requirements.

Specific examples which appear in REACH Annex XVII, and are directly relevant to petroleum substances are as follows:

- The packaging of substances that are subject to EU harmonised classifications for germ cell mutagenicity, carcinogenicity or reproductive toxicity (CLP Category 1A or 1B, DSD Category 1 or 2) that are used for non-fuel purposes "must be marked visibly, legibly and indelibly as follows: Restricted to professional users".

- Petroleum substances, such as kerosines, classified for aspiration hazard (R65 or H304) and sold as lamp oils for use by the general public must be "visibly, legibly and indelibly marked as follows: Keep lamps filled with this liquid out of the reach of children. Just a sip of lamp oil — or even sucking the wick of lamps — may lead to life- threatening lung damage".

- Petroleum substances, such as kerosines, classified for aspiration hazard (R65 or H304) and sold as grill lighter fluids for use by the general public must be "visibly, legibly and indelibly marked as follows: Just a sip of grill lighter may lead to life threatening lung damage".

4.7.2. Interaction with transport labelling

A new provision included in CLP is the possibility to combine the supply label with the transport label. Transportation of dangerous goods requires a symbol sized 10x10 cm, which in many cases may not be fulfilled by the CLP pictogram. The transport symbol can be used to replace the CLP pictogram, or both (symbol and pictogram) can be presented on the packaging. For substances that are classified as hazardous under CLP, but not classified as dangerous goods (for transport), both the inner and the outer packaging must have a CLP label.

For substances classified as dangerous goods for transport, class 9, due to the aquatic toxicity of the product, not only the class 9 label and environmentally hazardous substance mark but also the CLP pictogram GHS09 is needed on the label.

4.8. SAFETY DATA SHEET – IMPACT OF CLP

The EU requirements for Safety Data Sheets (SDS) are included in Annex II of REACH. The structure and content of the SDS is defined in a recent amendment to REACH (EU 453/2010 dated 20th May 2010). Safety data sheets for chemical substances should have been revised to comply with these requirements as of 1st of December 2010.

CLP requires that as of 1st of Dec 2010 all substances should have been classified according to CLP criteria. The hazard classification of petroleum substances must appear in section 2.1 of the SDS. Until 1st of June 2015 the SDS must include both the classification according to DSD and CLP criteria. After 1st of June 2015, only the classification according to CLP should be included.

The DSD and CLP classifications that appear on the SDS need to be consistent with the information that is included in the C&L Inventory notification and/or REACH registration dossiers.

4.9. DOWNSTREAM LEGISLATIVE IMPACT OF CLP ON OPERATIONS

Changes to the hazard classification of substances under CLP may have consequential impact via other EU legislation (downstream legislation). Therefore further legislative proposals have been adopted, or are being prepared, which will adapt classification-based provisions to reflect the new criteria and hazard classifications under CLP. These combined legislative changes will impact petroleum industry operations throughout the supply chain.

CLP will modify, or introduce, new hazard classifications for petroleum substances. These changes will require review of existing workplace health and environmental risk assessments and may result in the introduction of new risk reduction measures for health or environmental protection. Container labels will need to show new hazard information, workplace hazard signs may need to be updated and revised SDSs will need to be taken into account by operational staff. The lengthy transitional period for CLP (until 2015) means that dual hazard classifications for substances (DSD and CLP) will need to run in parallel.

Many existing pieces of Community legislation refer to “dangerous” substances or preparations, to cover those materials which meet the DSD or DPD classification criteria. A typical example is the Chemical Agents Directive 1998/24/EC. However, as CLP now identifies substances or mixtures which meet the criteria for classification as “hazardous”, existing legislation will need to be aligned with CLP terminology.

The EU concluded that effects of introducing CLP can be minimised by appropriate changes to particular downstream legislation. The necessary changes to REACH have been implemented by CLP. However, for Council Directive 1996/82/EC on the control of major-accident hazards involving dangerous substances (Seveso II Directive), the implementation of CLP is expected to have a more substantial impact. Therefore, this Directive will be amended separately.

Separate amendments to other EU downstream legislation, reflecting the introduction of CLP, were part of further Commission proposals for seven other pieces of EU downstream legislation (see **Appendix 5**).

4.10. CLASSIFICATION & LABELLING INVENTORY

The European Chemicals Agency (ECHA) was established for the purpose of managing the introduction and implementation of REACH and CLP. In addition to providing industry and Member States with guidance and tools on how to comply with the obligations of CLP, ECHA is required to:

- establish and maintain a classification and labelling inventory in the form of a database called the ‘classification and labelling inventory (C&L Inventory),
- receive notifications to the C&L Inventory,

- receive proposals for the harmonised classification of a substance from Member State Competent Authorities and suppliers, and submitting an opinion on such proposals for classification to the Commission,
- receive, evaluate and decide upon the acceptability of requests to use an alternative chemical name,
- prepare and submit to the Commission draft exemptions from the labelling and packaging requirements.

CLP notifications were required to be submitted as of 3rd of January 2011 for all substances manufactured or imported in amounts greater than 1 metric tonne per annum. For substances registered in 2010, the CLP notification was automatically submitted via the registration process. Registrants of petroleum substances in 2013 and 2018, or new market entrants, will need to make a separate notification. Hazardous substances that are not subject to REACH registration and are placed on the market must also be notified. This includes hazardous petroleum substances that are manufactured / imported in quantities less than 1 tonne per annum / legal entity, or are exempt from the obligation to register according to REACH; the latter includes Crude Oil, Natural Gas and, if certain conditions are met, Liquefied Petroleum Gas. Since petroleum coke is not classified as hazardous, there is no requirement to make a notification to the C&L Inventory.

4.10.1. Obligation to notify the Agency

All of the requirements for notification to the C&L Inventory are provided in CLP (Articles 39 – 42). The obligation to notify applies to 'manufacturers' or 'importers', or a member of a group of manufacturers or importers, who place a substance on the market if that substance is:

- subject to registration under REACH (≥ 1 tonne/year) and placed on the market,
- classified as hazardous under CLP and placed on the market, irrespective of the tonnage,
- classified as hazardous under CLP and present in a mixture above the concentration limits specified in CLP or DPD, which results in the classification of the mixture as hazardous, and the mixture is placed on the market.

The following information is required for it to be included in the C&L Inventory:

(a) the identity of the notifier(s) responsible for placing the substance on the market.

(b) the identity and composition of the substance

(c) the classification of the substance in accordance with CLP

(d) where a substance has been classified in some but not all hazard classes, an indication of whether this is due to lack of data, inconclusive data, or data which are conclusive although insufficient for classification;

(e) specific concentration limits or M-factors, where applicable

(f) the label elements (hazard pictograms, signal words and hazard statements together with any supplemental hazard statements.

The information listed above, must be updated and notified to ECHA when new information becomes available that leads to a change in the classification and labelling of the substance.

4.10.2. Format for notification

The C&L Inventory notification can be provided either online using the REACH-IT tool or it can be created using IUCLID 5 (International Uniform Chemical Information Database) and submitted via REACH-IT.

4.10.3. Agreed entries

The notifiers and registrants of the same substance must make every effort to come to an agreed entry to be included in the C&L Inventory.

4.10.4. Timing – notification deadline

For substances which were on the market as of the 1st of December 2010, the deadline for notification was the 3rd of January 2011. For those substances placed on the market after 1st of December 2010, the C&L Inventory notification must be submitted within one month.

4.11. CLP UPDATING PROCESS

The work on GHS started with the aim of providing a single, globally harmonized system to address hazard classification of chemicals, development of warning labels, and safety data sheets. It was recognised however that because of the diversity of classification schemes in different countries this was not an instantly achievable goal and hence global harmonisation will be promoted over time.

The current UN GHS scheme includes the technical output from a number of working groups:

- The International Labour Organization (ILO) for the hazard communication.
- The Organization for Economic Cooperation and Development (OECD) for the classification of health and environmental hazards.
- The United Nations Sub-Committee of Experts on the Transport of Dangerous Goods (UNSCETDG) and the ILO for the physical hazards.

The first edition of GHS was published in 2003, having been adopted in December 2002. GHS documentation published by the United Nations is regarded as a living document with revision and improvements being published on a two yearly cycle. The 1st revision was published in 2005, the 2nd revision in 2007, the 3rd revision in 2009 and the 4th revision in 2011.

Since the GHS text comes from the United Nations and is the product of international negotiations, future amendments to the UN GHS 'Purple Book' will require amendment of CLP. The European Commission has committed to maintain alignment of CLP with the 'Purple Book' so regular updates are anticipated. The Commission has issued the 2nd Adaptation to Technical Progress of CLP in March 2011 which entered into force on 19 April 2011 and introduces into legislationthe provisions of the 3rd edition of the 'Purple Book' (UN GHS). The deadline for

complying with the 2nd ATP is 1 December 2012. Preparations for a 4th ATP to CLP to align with the 4th revision of the UN GHS are ongoing.

In addition, the EU will publish amendments to Annex VI (the list of harmonised classifications) through the ATP process. New or revised harmonised classifications will be subject to formal adoption dates for compliance, as published in the ATP. In this regard, the 3rd Adaptation to Technical Progress (ATP) to Regulation (EC) No 1272/2008 entered into force on 31 July 2012. The new rules apply from 1 December 2013 but may be applied voluntarily before that date. The aim is to update the list of substances with harmonised classification and labelling in Part 3 of Annex VI.

This CONCAWE report will be reviewed and updated periodically as changes to GHS are implemented in CLP.

5. CLASSIFICATION AND LABELLING RECOMMENDATIONS

The classification and labelling recommendations found in the following sections reflect the 'default' hazard classifications that are recommended for all substances in the category. CONCAWE has decided to define the default as the most severe classification for the category based on the identified hazards. In order to 'downgrade' to a less severe classification, it is necessary to ensure that the appropriate classification criteria and/or conditions specified in the applicable regulatory notes and oil industry notes have been satisfied. If a less severe classification is applied, this will reduce the number of H- and P-Statements, which will change the information that needs to appear in the safety data sheets and on the labels.

This report provides a framework to achieve an industry harmonised hazard classification for petroleum substances in the EU, where appropriate. CONCAWE recommends that Companies apply the 'default' hazard classifications included in this report and only vary the classification if the conditions of the regulatory and oil industry notes are met.

If the specific CLP hazard classification applied by a Company does not match one of the classification variants included in the REACH dossier submission (as detailed in IUCLID section 2.1) it will be necessary for the Company to make a separate C&L inventory submission; the reason for the alternative classification will need to be justified.

MAJOR CHANGES SINCE LAST VERSION

This report reflects assessment of new data on hazard properties of petroleum substances which has been become available since the issuance of report no. 11/10R. Please refer to Appendix 1 for a summary of changes in classification arising from these new data versus the recommendations provided in CONCAWE 11/10R Report).

As was the case in report no. 11/10R, the classification recommendations presented in the following pages represent the most severe hazard classification based on an assessment of data available for the category.

Since all substances now need to be labelled according to CLP, only the recommendations for classification according to the DSD are included as the recommendations for labelling according to the DSD has become obsolete.

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CRUDE OILS

Definition / Domain: Raw petroleum extracted in its natural state from the ground) and containing predominantly aliphatic, alicyclic, and aromatic hydrocarbons. It may also contain small amounts of nitrogen, oxygen, and sulphur compounds.

Part 1 – Classification Endpoint[2] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant –crude oils are liquids.

Flammable Aerosol: Not relevant – crude oils are liquids.

Flammable Liquid: Crude oils are liquids of variable flash points. Crude oils can have a flash point < 23°C and initial boiling point ≤ 35°C as well as spanning the range to flashpoints >60°C.

Flammable Solid: Not relevant – crude oils are liquids.

Oxidising Gas: Not relevant – crude oils are liquids.

Oxidising Liquid: Crude oils are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – crude oils are liquids.

Pyrophoric Liquid: Crude oils do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – crude oils are liquids.

Self-reactive Substance: Crude oils are not self reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Crude oils do not react exothermically.

Gas under Pressure: Not relevant – crude oils are liquids.

Organic Peroxide: Crude oils do not meet the definition of a peroxide.

Corrosive to Metal: Crude oils do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Crude oils do not react with water.

[2] Hazard endpoints presented are derived from the EU CLP Regulation ((EC) No1272/2008)) and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

1.2 Health Hazards

Acute Toxicity: Samples of crude oils have been tested in acute oral and dermal studies. Results indicate the following (Mobil 1984a,b,c,d,e,f; Mobil 1985a,b,c,d,e,f; Mobil 1990a,b):

Rat oral	LD_{50}>5000 mg/kg bodyweight
Rabbit dermal	LD_{50}>2000 mg/kg bodyweight

Skin Corrosion / Irritation: Skin irritation was tested in rabbits and showed no evidence of skin irritation or corrosion. Upon repeated exposure some crude oils may cause skin dryness or cracking (Mobil 1984a,b,c,d,e,f; Mobil 1985a,b,c,d,e,f; Mobil 1990a,b).

Serious Eye Damage / Irritation: Data indicate some crude oils have the potential to cause eye irritation, as evidenced in rabbit studies by the presence of redness of the conjunctiva at 24 hours with a score of 3.7 (Mobil 1985a,b,c,d,e,f; Mobil 1990a,b).

Respiratory or Skin Sensitization: Evaluation of crude oils for dermal sensitization in the guinea pig, using the Buehler method, indicate that crude oils were unlikely to cause sensitization (Mobil 1991a,b).

Germ Cell Mutagenicity: The mutagenic potential of crude oils has been tested with *in vitro* and *in vivo* assays. *In vitro* tests showed some mutagenic activity. *In vivo* results in the micronucleus assay did not demonstrate cytogenetic activity. Testing for sister chromatid exchanges did show a slight increase in genetic activity. Based on the available data, crude oils are not considered to be germ cell mutagens (Mackerer *et al*., 2003; Mobil 1984g,h,i; Mobil 1990c; Mobil 1991c,d,e; Lockhard *et al.*, 1982).

Carcinogenicity: The carcinogenicity of crude oils has been tested in mouse skin painting studies. Based on the available data crude oils are considered to be carcinogenic. (Lewis et al, 1984; Clark et al, 1988; Renne et al, 1981).

Reproductive Toxicity: Crude oils are not expected to produce significant reproductive toxicity since long-term repeated dermal exposures have not produced adverse effects in the sperm or the reproductive organs of the rats (Mobil, 1992a,b; Feuston *et al*., 1997).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity, other than a potential to cause narcosis / CNS depression at higher exposure concentrations (Mobil 1984a,b,c,d,e,f; Mobil 1985a,b,c,d,e,f: Mobil, 1990a,b).

Repeated Exposure: Repeated exposure to crude oils by the oral or dermal routes has demonstrated systemic toxicity. Target tissues were blood, liver, spleen and thymus (Leighton, 1990; Feuston *et al.*, 1994, 1997; Mobil, 1992a,b).

Aspiration: Crude oils are liquids of variable viscosity. Some crude oils can have viscosity values< 7 mm^2/s or in the range of 7 to 20.5 mm^2/s or > 20.5 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies in fish, invertebrates and algae on samples of crude oils show acute toxicity values greater than 1 mg/l and mostly in the range of 2 – >100 mg/l. These tests were carried out on the water accommodated fraction (EMBSI 2002a,b; CONCAWE 2001)

Chronic (long-term) Aquatic Hazard: There are no chronic toxicity studies available for crude oil, and QSAR toxicity predictions are not used to determine environmental classification.

Environmental fate (biodegradation / bioaccumulation): Crude Oils are hydrocarbon UVCBs. Standard tests for this endpoint are intended for single substances and are not appropriate for this complex substance. Crude oils are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of crude oils show predicted values for log K_{ow} ranging from less than 4 to greater than 6 and are considered potentially bioaccumulative.

Part 2 – Summary of Classification Recommendations – Crude Oils Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

Extremely Flammable (OIN 1)

Health:

Carcinogenic Category 2
Harmful

Environment:

Dangerous for the Environment

Risk Phrases:

R12: Extremely flammable
R45: May cause cancer
R65[3]: Harmful: may cause lung damage if swallowed
R66: Repeated exposure may cause skin dryness or cracking
R67: Vapours may cause drowsiness and dizziness
R48/21/22: Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed
R51/53: Toxic to aquatic organisms, May cause long-term adverse effects in the aquatic environment

[3] If the viscosity is >7 mm^2/s @ 40°C, the substance does not need to be classified and labelled R65 and S62 does not apply. The classification as Harmful shall still apply.

Part 3 – Summary of Classification and Labelling Recommendations – Crude Oils
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

H224 Flammable Liquid Category 1 (OIN 4)

Health:

H304 Asp. Tox. 1 (unless the kinematic viscosity is above 20.5 mm^2/s, measured at 40°C)
H336 Specific Target Organ Toxicity (single exposure) Category 3
H373 Specific Target Organ Toxicity (repeated exposure) Category 2
H319 Eye Irritation Category 2
H350 Carcinogenic Category 1B

Environment:

H411 Chronic Aquatic Toxicity Category 2

3.2 Labelling

Pictograms:

GHS02, GHS07, GHS08, GHS09

Signal Words:

Danger

Hazard Statements:

H224: Extremely flammable liquid and vapour
H304: May be fatal if swallowed and enters airways
H350: May cause cancer
H319: Causes serious eye irritation
H336: May cause drowsiness or dizziness
H373: May cause damage to blood, liver, spleen and thymus through prolonged or repeated exposure
H411: Toxic to aquatic life with long lasting effects
EUH066: Repeated exposure may cause skin dryness or cracking

Precautionary Statements: Six suggested statements for use on labels are shown in **bold text**

P201: Obtain special instructions before use
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P273: Avoid release to the environment
P280: Wear protective gloves/protective clothing/eye protection/face protection
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting

P202: Do not handle until all safety precautions have been read and understood
P233: Keep container tightly closed
P240: Ground/bond container and receiving equipment
P241: Use explosion-proof electrical/ventilating/lighting/.../equipment
P242: Use only non-sparking tools
P243: Take precautionary measures against static discharge
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P261: Avoid breathing dust/fume/gas/mist/vapours/spray
P264: Wash ... thoroughly after handling
P271: Use only outdoors or in a well-ventilated area
P281: Use personal protective equipment as required

P303 + P361 + P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes.Remove contact lenses if present and easy to do. Continue rinsing
P308 + P313: IF exposed or concerned: Get medical advice/attention
P312: Call a POISON CENTER or doctor/physician if you feel unwell.
P313: Get medical advice/attention
P337 + P313: If eye irritation persists: Get medical advice/attention
P370+P378: In case of fire: Use … for extinction
P377: Leaking gas fire: Do not extinguish unless leak can be stopped safely
P381: Eliminate all ignition sources if safe to do so
P391: Collect spillage
P403 + P235: Store in a well ventilated place. Keep cool
P403 + P233: Store in a wellventilated place. Keep container tightly closed
P405: Store locked up
P501: Dispose of contents/container to…in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users due to classification as carcinogenic Category 1B.
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

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PETROLEUM GASES

Definition / Domain: The petroleum gases category covers mono-constituent C_1-C_4 alkanes. Members of this category include LPGs and are products of hydrocarbon refining operations, such as catalytic cracking, catalytic reforming and steam-cracking, or are produced in association with natural gas processing as well as processing in chemical plants.

The majority of the members of this category are likely to contain <0.1% 1,3-butadiene.

N.B.: Concentration limits for gases are expressed as volume per volume percentage.

Part 1 – Classification Endpoint[4] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Petroleum gases have flash points which range from -104 to -60.0°C. Flammability data for the petroleum gases have maximum lower and upper explosion limits from 5-15 %.

Flammable Aerosol: Not relevant – petroleum gases are not in aerosol form.

Flammable Liquid: Not relevant – petroleum gases are not liquids.

Flammable Solid: Not relevant –petroleum gases are not solids.

Oxidising Gas: Petroleum gases are not considered oxidising based on structural considerations.

Oxidising Liquid: Not relevant – petroleum gases are not liquids.

Oxidising Solid: Not relevant –petroleum gases are not solids.

Pyrophoric Liquid: Not relevant – petroleum gasesare not liquids.

Pyrophoric Solid: Not relevant –petroleum gases are not solids.

Self-reactive Substance: Petroleum gases are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Petroleum gases do not react exothermically.

Gas under Pressure: Petroleum gases are stored under pressure.

Organic Peroxide: Petroleum gases do not meet the definition ofaperoxide.

Corrosive to Metal: Petroleum gases do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Petroleum gases do not react with water.

[4] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

1.2 Health Hazards

Acute Toxicity: Samples of petroleum gases have been tested in acute inhalation studies. Results indicate the following:

Rat inhalation LC_{50}> 20 mg/l (Clark, D.G. and Tinston, D.J.,1982)

Skin Corrosion / Irritation: Petroleum gases are highly flammable at room temperature. No studies have been conducted on skin corrosion/irritation. There are no indications from the published literature that petroleum gases cause skin corrosion/irritation. Direct skin contact with liquid forms of petroleum gases may cause burns/frostbite due to rapid evaporation and lowering of skin temperature (Cavender F, 1994).

Serious Eye Damage / Irritation: Petroleum gases are highly flammable at room temperature. No studies have been conducted to assesseye irritation. There are no indications from the published literature that petroleum gases cause eye damage or irritation. Direct eye contact with liquid forms of petroleum gases may cause burns/frostbite dues to rapid evaporation and lowering of mucous membrane temperature (Cavender F, 1994).

Respiratory or Skin Sensitization: Petroleum gases are highly flammable at room temperature. No studies have been conducted on respiratory or skin sensitization. There are no indications from the published literaturethat petroleum gases cause skin sensitization.

Germ Cell Mutagenicity: The mutagenic potential of petroleum gases has been extensively studied in a range of *invivo* and *in vitro* assays. These studies showed no evidence of mutagenic activity. Some C4 petroleum gases may contain 1,3-butadiene, a constituent that is classified as a germ cell mutagen (NTP, 1993; Kirwin CJ *et al*., 1980; NTP, 2005; Safepharm Laboratories, 2008; API, 2010).

Carcinogenicity: There are no carcinogenicity studies available for any of the C1-C4 alkane gases which comprise the petroleum gases category. Based on weight of evidence, taking into account evidence from subchronic tests, consideration of their chemical structures (which show no alerts for carcinogenic activity), together with evidence that C1-C4 alkanes are not genotoxic, it is concluded that these gases are unlikely to show carcinogenic activity. Some C4 petroleum gases may contain 1,3-butadiene, a constituent that is classified as a human carcinogen.

Reproductive Toxicity: The weight of evidence from studies on petroleum gases indicates no evidence of reproductive or developmental toxicity (Hoffman, G.M., 2008; Hoffman, G.M., 2010a,b,c,d; API, 20010).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity, other than a potential to cause narcosis / CNS depression at higher exposure concentrations (Clark, D.G. and Tinston, D.J., 1982).

Repeated Exposure: The repeat dose toxicity of petroleum gases has been studied in rats and humans, following repeated inhalation exposure for periods up to 13 weeks. No significant exposure-related target organ toxicity has been observed (Hoffman, G.M., 2008; Hoffman, G.M., 20010a,b,d; API, 2010; Stewart RD *et al.,* 1977; Stewart RD *et al*., 1978).

Aspiration: Not relevant – petroleum gases are not liquids at ambient temperatures.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: No experimental data are available on the short-term aquatic toxicity of petroleum gas category members. Due to the high volatility of the petroleum gases, effects on aquatic species are not expected (CONCAWE, 2001).

Chronic (long-term) Aquatic Hazard: No experimental data are available on the chronic aquatic toxicity of petroleum gas category members. Due to the high volatility of the petroleum gases, effects on aquatic species are not expected (CONCAWE, 2001).

Environmental fate (biodegradation / bioaccumulation): Petroleum gases partition predominantly to the atmosphere and so experimental data for their biodegradation are not appropriate. In the absence of experimental data the potential biodegradation rates in water of representative members of the category were estimated using QSAR calculations. These estimates predict that the members of the category are readily biodegradable. Petroleum gases have a low potential for bioaccumulation with log K_{ow} values <4.

Part 2 – Summary of Classification Recommendations – Petroleum Gases Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:
Extremely Flammable
Health:
Carcinogenic Category 1 (DSD Note K)
Mutagenic Category 2 (DSD Note K)
Environment:
No classification required

Risk Phrases:
R12: Extremely flammable
R45: May cause cancer
R46: May cause heritable genetic damage

Part 3 – Summary of Classification and Labelling Recommendations – Petroleum Gases EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

H220 Flammable Gas Category 1
H280 Gases under Pressure: Compressed Gas / Refrigerated Liquefied Gas / Dissolved Gas

Health:

H350 Carcinogenic Category 1A (CLP Note K)
H340 Mutagenic Category 1B (CLP Note K)

Environment:

No classification required

3.2 Labelling

Pictograms:

GHS02, GHS04, GHS08

Signal Words:

Danger

Hazard Statements:

H220: Extremely flammable gas
H280: Contains gas under pressure; may explode if heated
H340: May cause genetic defects
H350: May cause cancer

Precautionary Statements: Suggested statements for use on labels are shown in **bold text**

[P102] (only if sold to the general public): Keep out of reach of children
P202: Do not handle until all safety precautions have been read and understood
P281: Use personal protective equipment as required
P210: Keep away from heat/sparks/open flames/hot surfaces.–No smoking
P243: Take precautionary measures against static discharge
P410+P403: Protect from sunlight. Store in a well-ventilated place

P201: Obtain special instructions before use
P308+P313: IF exposed or concerned: Get medical advice/attention
P377: Leaking gas fire: Do not extinguish, unless leak can be stopped safely
P381: Eliminate all ignition sources if safe to do so
P403: Store in a well-ventilated place
P405: Store locked up
P501: Dispose of contents/container to….in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users when classified as a Category 1A or 1B carcinogen, mutagen and used for non-fuel purposes.
- If the worst case classification does not apply it will be necessary to identify the pictograms, signal words, H-statements and P-Statements that apply.

REFERENCES: PETROLEUM GASES

API (2010) Liquified petroleum gas: a 13-week whole-body inhalation toxicity study in the rats with neurotoxicity assessments and *in vivo* genotoxicity assessments. Study conducted by Huntingdon Life Sciences. Report No. 03-6141. WashingtonDC: American Petroleum Institute

Cavender, F. et al (1994) Aliphatic hydrocarbons. In: Clayton, G.D. et al (Eds). Patty's Industrial Hygiene and Toxicology, 4th ed., vol. 2, part B, p. 1221-1266. Chichester: John Wiley& Sons

Clark, D.G. and Tinston, D.J. (1982) Acute inhalation toxicity of some halogenated and non-halogenated hydrocarbons. *Human Toxicol 1, 239-247*

CONCAWE (2001) Environmental classification of petroleum substances – summary data and rationale. Report No. 01/54. Brussels: CONCAWE

Hoffman, G.M. (2008) Butane: combined repeated-exposure toxicity, reproduction and neurotoxicity screening in rats via whole-body inhalation exposures. Study conducted by Huntingdon Life Sciences. Study No. 03-4242. WashingtonDC: American Petroleum Institute

Hoffman, G.M. (2010a) Ethane: combined repeated-exposure toxicity with reproduction/developmental toxicity and neurotoxicity screening in rats via whole-body inhalation exposures. Study conducted by Huntingdon Life Sciences. Report No. 03-4243. WashingtonDC: American Petroleum Institute

Hoffman, G.M. (2010b) Isobutane: combined repeated-exposure toxicity with reproduction/developmental toxicity and neurotoxicity screening in rats via whole-body inhalation exposures. Study conducted by Huntingdon Life Sciences. Report No. 03-4244. WashingtonDC: American Petroleum Institute

Hoffman, G.M. (2010c) Liquified petroleum gas: embryo-fetal toxicity study in rats by inhalation exposure. Study conducted by Huntingdon Life Sciences. Study No. 03-4253. WashingtonDC: American Petroleum Institute

Hoffman, G.M. (2010d) Propane: combined repeated-exposure toxicity with reproduction/developmental toxicity and neurotoxicity screening in rats via whole-body inhalation exposures. Study conducted by Huntingdon Life Sciences. Study No. 03-4245. WashingtonDC: American Petroleum Institute

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NTP (1993) Genetic toxicology - *Salmonella* (297396). Research Triangle ParkNC: National Toxicology Program

NTP (2005) Butane. Research Triangle ParkNC: National Toxicology Program http://ntp.niehs.nih.gov/

SafePharm Laboratories (2008) n-Butane; chromosome aberration test in human lymphocytes *in vitro*. Study conducted for Evonik Oxeno GmbH. Study No. 1571/0015. Derbyshire UK: SafePharm Laboratories Ltd

Stewart, R.D. et al (1977) Acute and repetitive human exposure to isobutene and propane. Prepared for cosmetic, toiletry and fragrance association/Washington DC. *Scand J Work Environ Health 3, 4, 234-243*

Stewart, R.D. et al (1978) Physiological response to aerosol propellants. *Environ Health Perspect 26, 275-285*

OTHER PETROLEUM GASES

Definition / Domain: The 'Other Petroleum Gases' category covers hydrocarbon streams containing petroleum gases (alkanes/alkenes) predominantly in the C_1-C_5 range (with some carbon numbers present at levels up to C10) and includes some LPGs. Members of this category are products of refining for example distillation of crude oil, catalytic cracking and catalytic reforming, sometimes in association with steam-crackers, or they are produced in association with natural gas processing.

The majority of the members of this category are likely to contain <0.1% 1,3-butadiene.

It should be noted that some members of this category may contain 1,3-butadiene (≥0.1% up to 5%), benzene (≥0.1% but <0.3%), carbon monoxide (<1%) and hydrogen sulphide (<1%). The presence of these marker compounds at these levels will impact the hazard classification of the stream.

N-B.:Concentration limits for gases are expressed as volume to volume percentage.

Part 1 – Classification Endpoint[5] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Other Petroleum Gases have flash points which range from -104 to -60.0°C. Flammability data for the petroleum gases have maximum lower and upper explosion limits from 1.8-15 %.

Flammable Aerosol: Not relevant – Other Petroleum Gases are not in aerosol form.

Flammable Liquid: Not relevant – Other Petroleum Gases are not liquids.

Flammable Solid: Not relevant – Other Petroleum Gases are not solids.

Oxidising Gas: Other Petroleum Gases are not considered oxidising based on structural considerations.

Oxidising Liquid: Not relevant – Other Petroleum Gases are not liquids.

Oxidising Solid: Not relevant – Other Petroleum Gases are not solids.

Pyrophoric Liquid: Not relevant – Other Petroleum Gases are not liquids.

Pyrophoric Solid: Not relevant – Other Petroleum Gases are not solids

Self-reactive Substance: Other Petroleum Gases are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Other Petroleum Gases do not react exothermically.

Gas under Pressure: Other Petroleum Gases are stored under pressure.

[5] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Organic Peroxide: Other Petroleum Gases do not meet the definition of a peroxide.

Corrosive to Metal: Other Petroleum Gases do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Other Petroleum Gases do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of the main components and mixtures of Other Petroleum Gases have been tested in acute inhalation studies. Results indicate the following:
Rat inhalation: LC_{50}> 20 mg/l (Clark, DG and Tinston, DJ, 1982; Aviado DM *et al*., 1977a; Aviado DM *et al*., 1977b)

Some members of the Other Petroleum Gases category may contain carbon monoxide and/or hydrogen sulphide, which are known to present an acute toxicity hazard.

Skin Corrosion / Irritation: Other Petroleum Gases are highly flammable at room temperature. No studies have been conducted on skin corrosion/irritation. There are no indications from the published literature that other petroleum gases are likely to cause skin corrosion/irritation. Direct skin contact with liquid forms of Other Petroleum Gases may cause burns/frostbite due to rapid evaporation and lowering of skin temperature (Cavender F, 1994).

Serious Eye Damage / Irritation: Other Petroleum Gases are highly flammable at room temperature. No studies have been conducted on eye irritation. There are no indications from the published literature that Other Petroleum Gases are likely to cause eye damage or irritation. Direct eye contact with liquid forms of Other Petroleum Gases may cause burns/frostbite dues to rapid evaporation and lowering of mucous membrane temperature (Cavender F, 1994).

Respiratory or Skin Sensitization: Other Petroleum Gases are highly flammable at room temperature. No studies have been conducted on respiratory or skin sensitization. There are no indications from the published literature that Other Petroleum Gases are likely to cause skin sensitization.

Germ Cell Mutagenicity: The mutagenic potential of the main components and mixtures of Other Petroleum Gases has been extensively studied in a range of *in vivo* and *in vitro* assays. These studies showed no evidence of mutagenic activity (NTP, 1993; Kirwin CJ *et al*., 1980; NTP, 2005; Safepharm Laboratories, 2008; API, 2010; Inveresk Research, 2003; McGregor D *et al*., 1991; Walker DM *et al.,* 2004; Pottenger LH *et al.,* 2007).
Some members of the Other Petroleum Gases category may contain 1,3-butadiene or benzene, constituents classified as germ cell mutagens.

Carcinogenicity: There are no carcinogenicity studies available for Other Petroleum Gases. Based on weight of evidence, taking into account evidence from subchronic tests, consideration of their chemical structures (which do not show any alerts for genotoxic carcinogenic activity) together with evidence that Other Petroleum Gases are not genotoxic, it is concluded that these gases are unlikely to show carcinogenic activity. The above reasoning leads to the conclusion that other petroleum gases are considered to have low concern for human carcinogenicity (NTP, 1985).
Some members of the Other Petroleum Gases category may contain 1,3-butadiene or benzene, constituents classified as human carcinogens.

Reproductive Toxicity: The weight of evidence from studies on Other Petroleum Gases indicates no evidence of reproductive or developmental toxicity (Hoffman GM, 2008; Hoffman GM, 2010a, b, c, d; API, 2010; BASF, 2002).
Some members of the Other Petroleum Gases category may contain carbon monoxide, which is known to present a reproductive toxicity hazard.

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity, other than a potential to cause narcosis / CNS depression at higher exposure concentrations (Clark DG and Tinston DJ, 1982).

Repeated Exposure: The repeat dose toxicity of Other Petroleum Gases has been studied in rats and humans, following repeated inhalation exposures for periods up to 13 weeks. No significant exposure-related target organ toxicity has been observed in inhalation studies for the main components of Other Petroleum Gases (Hoffman GM, 2008; Hoffman GM, 2010a, b, d; API, 2010; NTP 1985; Stewart RD et al, 1977; Stewart RD et al, 1978).
Some members of the Other Petroleum Gases category may contain carbon monoxide, which due to its effect on the blood, may present a hazard upon repeated exposure.

Aspiration: Not relevant – Other Petroleum Gases are not liquids at ambient temperatures.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: No experimental data were available on the short-term aquatic toxicity of Other Petroleum Gas category members. Due to the high volatility of the Other Petroleum Gases, effects on aquatic species are not expected. (CONCAWE, 2001)

Chronic (long-term) Aquatic Hazard: No experimental data were available on the chronic aquatic toxicity of other petroleum gas category members. Due to the high volatility of the Other Petroleum Gases, effects on aquatic species are not expected. (CONCAWE, 2001)

Environmental fate (biodegradation / bioaccumulation): Other Petroleum Gases partition predominantly to the atmosphere and so experimental data for their biodegradation are not appropriate. In the absence of experimental data the potential biodegradation rates in water of representative members of the category were estimated using QSAR calculations. These estimates predict that the members of the category are readily biodegradable. Other Petroleum Gases have a low potential for bioaccumulation with log K_{ow}values <4.

Part 2 – Summary of Classification Recommendations – Other Petroleum Gases
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

The majority of the members of this category are likely to contain <0.1% 1,3-butadiene.

It should be noted that some members of this category may contain 1,3-butadiene (≥0.1% up to 5%), benzene (≥0.1% but <0.3%), carbon monoxide (<1%) and hydrogen sulfide (<1%). The presence of these marker compounds at these levels will impact the hazard classification of the stream.

By way of example, the recommendations given below, take into consideration the possible presence of the above classification markers at the following levels; benzene or 1,3-butadiene ≥ 0.1%, hydrogen sulphide ≥ 0.2% but <1%, carbon monoxide ≥ 0.5% but <1%.

2.1 Hazard Classification

Physical:

Extremely Flammable

Health:

Carcinogenic Category 1 (EC DSD Note K)
Mutagenic Category 2 (EC DSD Note K)
Toxic to Reproduction Category 2
Toxic by inhalation
Harmful

Environment:

No classification required

Risk Phrases:

R12: Extremely flammable
R45: May cause cancer
R46: May cause heritable genetic damage
R61: May cause harm to the unborn child
R23: Toxic by inhalation
R48/20: Danger of serious damage to health by prolonged exposure through inhalation

Part 3 – Summary of Classification and Labelling Recommendations – Other Petroleum Gases
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

The majority of the members of this category are likely to contain <0.1% 1,3-butadiene.

It should be noted that some members of this category may contain 1,3-butadiene (≥0.1% up to 5%), benzene (≥0.1% but <0.3%), carbon monoxide (up to 1%) and hydrogen sulfide (<1%). The presence of these marker compounds at these levels will impact the hazard classification of the stream.

By way of example, the recommendations given below, take into consideration the possible presence of the above classification markers at the following levels; benzene or 1,3-butadiene ≥ 0.1%, hydrogen sulfide ≥ 0.5% but <1%, carbon monoxide 1%.

3.1 Hazard Classification

Physical:

H220 Flammable Gas Category 1
H280 Gases under Pressure: Compressed Gas / Refrigerated Liquefied Gas / Dissolved Gas

Health:

H350 Carcinogenic Category 1A (CLP Note K)
H340 Mutagenic Category 1B (CLP Note K)
H332 Acute toxicity (inhalation) Category 4
H373 Specific Target Organ Toxicity (repeated exposure) Category 2
H360d Reproductive toxicity Category 1A

Environment:

No classification required

3.2 Labelling

Pictograms:

GHS02, GHS04, GHS08, GHS07

Signal Word:

Danger

Hazard Statements:

H220: Extremely flammable gas
H280: Contains gas under pressure; may explode if heated
H340: May cause genetic defects
H350: May cause cancer
H360d: May damage fertility or the unborn child
H332: Harmful if inhaled
H373: May cause damage to organs through prolonged or repeated exposure

Precautionary Statements: Suggested statements for use on labels are shown in **bold text**

[P102] (only if sold to the general public): Keep out of reach of children
P202: Do not handle until all safety precautions have been read and understood
P281: Use personal protective equipment as required

P210: Keep away from heat/sparks/open flames/hot surfaces.–No smoking
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P410+P403: Protect from sunlight. Store in a well-ventilated place

P201: Obtain special instructions before use
P243: Take precautionary measures against static discharge
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P261: Avoid breathing dust/fume/gas/mist/vapours/spray
P271: Use only outdoors or in a well-ventilated area
P308+P313: IF exposed or concerned: Get medical advice/attention
P312: Call a POISON CENTER or doctor/physician if you feel unwell
P314: Get medical advice/attention if you feel unwell
P377: Leaking gas fire: Do not extinguish, unless leak can be stopped safely
P381: Eliminate all ignition sources if safe to do so
P403: Store in a well-ventilated place
P405: Store locked up
P501: Dispose of contents/container to…in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information:

EC CLP Note U
EC CLP Note S
Consult CLP legistation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users (when classified as a Category 1A or 1B carcinogen, mutagen or reproductive toxicant and used for non-fuel purposes).
- If the above classification does not apply it will be necessary to identify the pictograms, signal words, H-statements and P-Statements that apply.

REFERENCES: OTHER PETROLEUM GASES

API (2010) Liquified petroleum gas: A 13-week whole-body inhalation toxicity study in the rats with neurotoxicity assessments and *in vivo* genotoxicity assessments. Report No. 03-6141. WashingtonDC: American Petroleum Institute

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Aviado, D.M. et al (1977b) Isobutane. In: Non-fluorinated propellants and solvents for aerosols. Chapter 6, p. 61-72. ClevelandOH: CRC Press

BASF (2002) Propylene - prenatal developmental inhalation toxicity study in Wistar rats; vapor exposure. Project No. 31R0416/01019. Ludwigshafen: BASF AG

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Clark, D.G. and Tinston, D.J. (1982) Acute inhalation toxicity of some halogenated and non-halogenated hydrocarbons. *Hum Exp Toxicol 1, 3, 239-247*

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Hoffman, G.M. (2008) Butane: combined repeated-exposure toxicity, reproduction and neurotoxicity screening in rats via whole-body inhalation exposures. Study conducted by Huntingdon Life Sciences. Study No. 03-4242. WashingtonDC: American Petroleum Institute

Hoffman, G.M. (2010a) Ethane: combined repeated-exposure toxicity with reproduction/developmental toxicity and neurotoxicity screening in rats via whole-body inhalation exposures. Study conducted by Huntingdon Life Sciences. Report No. 03-4243. WashingtonDC: American Petroleum Institute

Hoffman, G.M. (2010b) Isobutane: combined repeated-exposure toxicity with reproduction/developmental toxicity and neurotoxicity screening in rats via whole-body inhalation exposures. Study conducted by Huntingdon Life Sciences. Report No. 03-4244. WashingtonDC: American Petroleum Institute

Hoffman, G.M. (2010c) Liquified petroleum gas: embryo-fetal toxicity study in rats by inhalation exposure. Study conducted by Huntingdon Life Sciences. Study No. 03-4253. WashingtonDC: American Petroleum Institute

Hoffman, G.M. (2010d) Propane: combined repeated-exposure toxicity with reproduction/developmental toxicity and neurotoxicity screening in rats via whole-body inhalation exposures. Study conducted by Huntingdon Life Sciences. Study No. 03-4245. WashingtonDC: American Petroleum Institute

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Kirwin, C.J. et al (1980) *In vitro* microbiological mutagenicity studies of hydrocarbon propellants. *J Soc Cosmet Chem 31, 7, 367-370*

McGregor, D. et al (1991) Responses of the L5178Y mouse lymphoma forward mutation assay: V. gases and vapors. *Environ Molecular Mutagen 17, 2, 122-129*

NTP (1985) Toxicology and carcinogenesis studies of propylene (CAS No. 115-07-1) in F344/N rats and B6C3F1 mice (inhalation studies). NTP Technical Report No. 272. Research Triangle ParkNC: National Toxicology Program

NTP (1993) Genetic toxicology - *Salmonella* (297396). Research Triangle ParkNC: National Toxicology Program

NTP (2005) Butane. Research Triangle ParkNC: National Toxicology Program http://ntp.niehs.nih.gov/

Pottenger, L.H. et al (2007) Evaluation of effects from repeated inhalation exposure of F344 rats to high concentrations of propylene. *Toxicol Sci 97, 2, 336-347*

SafePharm Laboratories (2008) n-Butane; chromosome aberration test in human lymphocytes *in vitro*. Study conducted for Evonik Oxeno GmbH. Study No. 1571/0015. Derbyshire UK: SafePharm Laboratories Ltd

Stewart, R.D. et al (1977) Acute and repetitive human exposure to isobutane. *Scand J Work Environ Health 3, 4, 234-243*

Stewart, R.D. et al (1978) Physiological response to aerosol propellants. *Environ Health Perspect 26, 275-285*

Walker, D.M. et al (2004) Hprt mutant frequencies in splenic T-cells of male F344 rats exposed by inhalation to propylene. *Environ Molecular Mutagen 43, 4, 265-272*

LOW BOILING POINT NAPHTHAS (GASOLINES)

Definition / Domain: The domain of this category is established by the refining processes by which the category members are produced, the predominant hydrocarbon classes present, the boiling point range and the carbon number range as follows:

- Derived from crude petroleum or separated as a liquid from natural gas.
- Refinery processes
  - atmospheric distillation
  - alkylation
  - isomerisation
  - catalytic cracking
  - thermal cracking
  - catalytic reforming
  - catalytic polymerisation
  - hydrotreatment / hydrodesulfurization
  - hydrocracking
  - coking
- Hydrocarbon types: saturated, olefinic, aromatic
- Typical boiling point range: approximately -88°C to 260°C
- Typical carbon number range: predominantly C_4 to C_{12}

Part 1 – Classification Endpoint[6] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – low boiling point naphthas are liquids.

Flammable Aerosol: Not relevant – low boiling point naphthas are not in aerosol form.

Flammable Liquid: Low boiling point naphthas are liquids of variable flash point / initial boiling points. Typical value for flash point is < 0°C, Initial boiling point < 35°C.

Flammable Solid: Not relevant – low boiling point naphthas are liquids.

Oxidising Gas: Not relevant – low boiling point naphthas are liquids.

Oxidising Liquid: Low boiling point naphthas are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – low boiling point naphthas are liquids.

Pyrophoric Liquid: Low boiling point naphthas do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – low boiling point naphthas are liquids.

Self-reactive Substance: Low boiling point naphthas are not self-reactive. They do not undergo exothermic decomposition when heated.

[6]Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Self-heating Substance: Low boiling point naphthas do not react exothermically.

Gas under Pressure: Not relevant – low boiling point naphthas are liquids.

Organic Peroxide: Low boiling point naphthas do not meet the definition of a peroxide.

Corrosive to Metal: Low boiling point naphthas are liquids and do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Low boiling point naphthas do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of gasoline and a number of low boiling point naphtha streams have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50} > 5000 mg/kg bodyweight (ARCO, 1986b)
Rat inhalation	LC_{50}> 5.2 mg/l (ARCO, 1992)
Rabbit dermal	LD_{50} > 2000 mg/kg bodyweight (ARCO, 1986a)

Skin Corrosion / Irritation: Samples of gasoline and a number of low boiling point naphtha streams have been tested in rabbit skin irritation studies. The majority of the data were derived using a 24 hour occluded exposure protocol. The degree of dermal irritation observed was variable, ranging from slight to moderate/severe, normally persisting for up to 14 days. There was no evidence of skin corrosion. Heavier, aromatic materials caused more irritation than lighter, paraffinic streams (API, 1995).

Serious Eye Damage / Irritation: The effects of gasoline and low boiling point naphtha streams on the eye have been investigated in rabbits using a number of samples. None of the samples tested showed more than minimal redness and swelling, which resolved quickly (ARCO, 1986d).

Respiratory or Skin Sensitization: Tests in guinea pigs with gasoline and a number of low boiling point naphtha streams showed no evidence of skin sensitization (ARCO, 1986c). There are no reports available to indicate that gasoline or low boiling point naphthas have the potential to cause respiratory sensitization.

Germ Cell Mutagenicity: The mutagenic potential of gasoline and low boiling point naphthas has been extensively studied in a range of *in vivo* and *in vitro* assays. The majority of the studies showed no evidence of mutagenic activity. Gasoline and low boiling point naphthas can contain benzene, a constituent that is classified as a germ cell mutagen (API, 1977; API, 2005).

Carcinogenicity: The carcinogenic potential of gasoline has been investigated in rats and mice following inhalation exposure for 2 years. In rats, there was an increased incidence of kidney tumours in males and in mice there was an increased incidence of liver tumours in females; further work has shown that these tumours are sex and species specific and are not considered relevant to humans (Short BG *et al.,* 1989). Results of 2 year skin painting studies with gasoline or low boiling point naphthas have shown either no, or weak potential (low incidence and long latent period) for the development of skin tumours. Additional work has shown that where tumours arise they are most likely a result of a non-genotoxic response due to dermal irritation (API, 1983). Gasoline and low boiling point naphthas can contain benzene, a constituent that is classified as a human carcinogen.

Reproductive Toxicity: Results of guideline developmental toxicity studies on gasolines and OECD developmental toxicity screening studies with low boiling point naphtha streams showed

no evidence of developmental toxicity in rats (Roberts L et al, 2001). Similarly, studies in rats with gasoline did not show any effect on reproductive performance (McKee RH et al, 2000). Gasoline and low boiling point naphthas can contain amounts of toluene and/or n-hexane, constituents that are classified as reprotoxicants.

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity, other than a potential to cause narcosis / CNS depression at higher exposure concentrations (Drinker P et al, 1943; Davis A et al 1960).

Repeated Exposure: The repeat dose toxicity of gasoline and low boiling point naphthas has been studied in rats following dermal and inhalation exposure for periods between 10 days and up to 2 years. The effects of repeated inhalation exposure of primates to gasoline have also been studied. In dermal studies, no systemic toxicity has been seen; the only effect observed was moderate to severe dermal irritation. Repeated inhalation exposure causes 'light hydrocarbon nephropathy' in male rats, an effect which is considered to be both sex and species specific (Halder CA et al, 1985; API, 2005; ARCO, 1986e)

See also **Appendix 6**, which provides some additional context relating to the lack of classification of naphthas for STOT Repeated Exposure.

Aspiration: Gasoline and low boiling point naphthas are low viscosity, mobile hydrocarbon liquids with a viscosity at 40°C of <7 mm^2/s.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies with fish, invertebrates and algae on samples of gasoline and low boiling point naphtha streams show acute toxicity values in the range 1-10 mg/l. These tests were carried out on water accommodated fractions, and in closed systems to prevent evaporative loss (EBSI 1995a,b,c; CONCAWE, 1996; Petroleum Product Steward Council, 1995).

Chronic (long-term) Aquatic Hazard: Chronic toxicity studies on fish and daphnids exposed tolow boiling point naphtha samples are available, with a lowest NOEL value of 2.6 mg/l (Springborn Laboratories, 1999).

Environmental fate (biodegradation / bioaccumulation): Low Boiling Point Napthas are hydrocarbon UVCBs. Standard tests for biodegradation / bioaccumulation are intended for single substances and are not appropriate for complex substances. Based on compositional information available and measured or predicted data on key constituents, gasoline and gasoline naphthas are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of low boiling point naphthas show measured or predicted values for log K_{ow} greater than 4 and are considered potentially bioaccumulative.

Part 2 – Summary of Classification Recommendations - Low Boiling Point Naphthas (gasolines)
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

Extremely Flammable (OIN 1)

Health:

Carcinogenic Category 2 (EC DSD Note P, OIN P (DSD))
Mutagenic Category 2 (EC DSD Note P, OIN P DSD))
Toxic to Reproduction Category 3 (OIN 2, OIN 3)
Irritant
Harmful

Environment:

Dangerous for the Environment

Risk Phrases:

R12: Extremely flammable
R38: Irritating to skin
R45: May cause cancer
R46: May cause heritable genetic damage
R62: Possible risk of impaired fertility
R63: Possible risk of harm to the unborn child
R65: Harmful: may cause lung damage if swallowed
R67: Vapours may cause drowsiness and dizziness
R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Part 3 – Summary of Classification and Labelling Recommendations- <u>Low Boiling Point Naphthas (gasolines)</u>
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

H224 Flammable Liquid Category 1 (OIN 4)

Health:

H336 Specific Target Organ Toxicity (single exposure) Category 3
H304 Asp. Tox. 1
H315 Skin Corrosion/Irritation Category 2
H350 Carcinogenic Category 1B (EC CLP Note P, OIN P (CLP))
H340 Mutagenic Category 1B (EC CLP Note P, OIN P CLP)
H361fd Reproductive Toxicity Category 2 (OIN 5, OIN 6)

Environment:

H411 Chronic Aquatic Toxicity Category 2

3.2 Labelling

Pictograms:

GHS02, GHS07, GHS08, GHS09

Signal Word:

Danger

Hazard Statements:

H224: Extremely flammable liquid and vapour
H304: May be fatal if swallowed and enters airways
H315: Causes skin irritation
H336: May cause drowsiness or dizziness
H340: May cause genetic defects
H350: May cause cancer
H361fd: Suspected of damaging fertility. Suspected of damaging the unborn child
H411: Toxic to aquatic life with long lasting effects

Precautionary Statements: Six suggested statements for use on labels are shown in **bold text**

P201: Obtain special instructions before use
P210: Keep away from heat/sparks/open flames/hot surfaces. – No smoking
P273: Avoid release to the environment
P280: Wear protective gloves/protective clothing/eye protection/face protection
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting
P403 + P233: Store in a well-ventilated place. Keep container tightly closed

P202: Do not handle until all safety precautions have been read and understood
P233: Keep container tightly closed
P240: Ground/bond container and receiving equipment
P241: Use explosion-proof electrical/ventilating/lighting/.../equipment

P242: Use only non-sparking tools
P243: Take precautionary measures against static discharge
P261: Avoid breathing dust/fume/gas/mist/vapours/spray
P264: Wash... thoroughly after handling
P271: Use only outdoors or in a well-ventilated area
P281: Use personal protective equipment as required
P302 + P352: IF ON SKIN: Wash with plenty of soap and water
P303 + P361 + P353: IF ON SKIN (or hair):Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P308 + P313: IF exposed or concerned: Get medical advice/ attention
P312: Call a POISON CENTER or doctor/physician if you feel unwell
P321: Specific treatment (see ... on this label)
P331: Do NOT induce vomiting
P332 + P313: If skin irritation occurs: Get medical advice/attention
P362: Take off contaminated clothing and wash before reuse
P370 + P378: In case of fire: Use ... for extinction
P391: Collect spillage
P403 + P235: Store in a well-ventilated place. Keep cool
P405: Store locked up
P501: Dispose of contents/container to...in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users when classified as a Category 1A or 1B carcinogen, mutagen or reproductive toxicant and used for non-fuel purposes.
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

REFERENCES: LOW BOILING POINT NAPHTHAS (GASOLINES)

API (1977) Mutagenicity evaluation of unleaded gasoline. Study conducted by Litton Bionetics. API Med. Res. Publ. 28-30173. WashingtonDC: American Petroleum Institute

API (1983) Carcinogenic potential of key petroleum products. Study conducted by Eppley Institute for Research in Cancer, University of Nebraska Medical School. API Med. Res. Publ. 30-31646. WashingtonDC: American Petroleum Institute

API (1995) Primary skin irritation study in rabbits of API 91-01 and PS-6.Unleaded test gasolines. Study conducted by Hill Top Biolabs Inc. API Toxicology Report No. 409. WashingtonDC: American Petroleum Institute

API (2005) Baseline gasoline vapor condensate: a 13-week whole-body inhalation toxicity study in rats with neurotoxicity assessments and 4-week *in vivo* genotoxicity and immunotoxicity assessments. Study conducted by Huntingdon Life Sciences. Study No. 00-6125. WashingtonDC: American Petroleum Institute

ARCO (1986a) Acute dermal toxicity study in rabbits administered test article F-64-01 unleaded premium gasoline. UBTL Study No. 60553. Los AngelesCA: ARCO

ARCO (1986b) Acute oral toxicity study in rats administered test article F-64-01 unleaded premium gasoline. UBTL Study No. 60598. Los AngelesCA: ARCO

ARCO (1986c) Dermal sensitization study in guinea pigs administered test article F-64-01 unleaded premium gasoline. UBTL Study No. 60613. Los AngelesCA: ARCO

ARCO (1986d) Primary eye irritation study in rabbits administered test article F-64-01 unleaded Watson premium gasoline. UBTL Study No. 60583. Los AngelesCA: ARCO

ARCO (1986e) Twenty-eight (28) day dermal toxicity study in rats on test article F-64-01 unleaded Watson premium gasoline. UBTL Study No. 60761. Los AngelesCA: ARCO

ARCO (1992) Acute inhalation toxicity study (limit test) in rats administered test article F-101. UBTL Study No. 65798. Los AngelesCA: ARCO

CONCAWE (1996) Acute aquatic toxicity of gasolines. Report No. 96/57. Brussels: CONCAWE

Davis, A. et al (1960) The effects on human volunteers of exposure to air containing gasoline vapor. *Arch Environ Health 1, 548-554*

Drinker, P. et al (1943) The threshold toxicity of gasoline vapor. *J Ind HygToxicol 25, 6, 225-232*

EBSI (1995a) Alga, growth inhibition test. MRD-95-048 gasoline W94/813, blend.Study performed for CONCAWE. EBSI Study No. 104867.East MillstoneNJ: Exxon Biomedical Sciences Inc.

EBSI (1995b) Daphnia, acute toxicity test.MRD-95-044 gasoline W94/809, medium naphtha. Study performed for CONCAWE. EBSI Study No. 104442.East MillstoneNJ: Exxon Biomedical Sciences Inc.

EBSI (1995c) Fish, acute toxicity test -rainbow trout. MRD-95-045 gasoline W94/810, isomerate.Study performed for CONCAWE. EBSI Study No. 104558.East MillstoneNJ: Exxon Biomedical Sciences Inc.

Halder, C.A. et al (1985) Hydrocarbon nephropathy in male rats: identification of the nephrotoxic components of unleaded gasoline. *ToxicolInd Health 1, 3, 67-87*

McKee, R.H. et al (2000) Assessment in rats of the reproductive toxicity of gasoline from a gasoline vapor recovery unit. *Reprod Toxicol 14, 4, 337-353*

Petroleum Product Stewardship Council (1995) Static-renewal 96-hour acute toxicity study of the water accommodated fraction (WAF) of whole light alkylate product to fathead minnow. Study conducted by Stonybrook Laboratories Inc. Study No. 65908. WashingtonDC: Petroleum Product Stewardship Council

Roberts, L. et al (2001) Developmental toxicity evaluation of unleaded gasoline vapor in the rat. *Reprod Toxicol 15, 5, 487-494*

Short, B.G. et al (1989) Promoting effects of unleaded gasoline and 2,2,4-trimethylpentane on the development of atypical cell foci and renal tubular cell tumors in rats exposed to *N*-ethyl-*N*-hydroxy-ethylnitrosamine. *Cancer Research 49, 22, 6369-6378*

Springborn Laboratories (1999) Light alkylate naphtha - full life cycle toxicity test with water fleas, *Daphnia magna*, under static-renewal conditions following OECD Guideline 211. Study No. 13687.0598.6105.130. WarehamMA: Springborn Laboratories Inc.

KEROSINES

Definition / Domain: The domain of this category is established by the refining processes by which the category members are produced. The distillation range of kerosines is such that components of specific toxicologicalconcern such as benzene (boiling point 80°C) and n-hexane (boiling point 69°C) are typically only present at trace concentrations. The boiling points of 3 to 7 fused-ring polycyclic aromatic hydrocarbons (PAHs) are above the boiling range of straight-run kerosine streams.

- Derived from crude petroleum
- Refinery processes:
  - atmospheric distillation
  - catalytic cracking
  - thermal cracking
  - hydrocracking
  - hydrotreatment / hydrodesulfurization
  - catalytic reforming
  - coking
- Hydrocarbon types: the major components include branched and straight chain paraffins and naphthenes (cycloparaffins), and aromatic hydrocarbons (alkylbenzenes and alkylnaphthalenes).
- Typical boiling point range: approximately 90°C to 320°C
- Typical carbon number range: predominantly C_6 to C_{17}

Part 1 – Classification Endpoint[7] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – kerosines are liquids.

Flammable Aerosol: Not relevant – kerosines are not in aerosol form.

Flammable Liquid: Kerosines are liquids of variable flash point. Typically with a flash point range of ≥23°C and ≤70°C,

Flammable Solid: Not relevant – kerosines are liquids.

Oxidising Gas: Not relevant – kerosines are liquids.

Oxidising Liquid: Kerosines are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – kerosines are liquids.

Pyrophoric Liquid: Kerosines do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – kerosines are liquids.

Self-reactive Substance: Kerosines are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Kerosines do not react exothermically.

[7] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Gas under Pressure: Not relevant – kerosines are liquids.

Organic Peroxide: Kerosines do not meet the definition of a peroxide.

Corrosive to Metal: Kerosines are liquids and do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Kerosines do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of jet fuel and a number of kerosine streams have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50} > 5000 mg/kg bodyweight (ARCO; 1992c)
Rat inhalation	LC_{50}> 5.28 mg/l (API; 1987)
Rabbit dermal	LD_{50} > 2000 mg/kg bodyweight (ARCO; 1992b)

Skin Corrosion / Irritation: Samples of jet fuel and a number of kerosine streams have been tested in rabbit skin irritation studies. Data were derived using a 24 hour occluded exposure protocol or a 4 hour semi-occluded exposure protocol. The degree of dermal irritation observed was variable depending on the study protocol, ranging from essentially non-irritating to moderate/severe irritation. There was no evidence of skin corrosion (Shell; 1991).

Serious Eye Damage / Irritation: The effects of jet fuel and kerosine streams on the eye have been investigated in rabbits using a number of samples. None of the samples tested showed more than minimal redness and swelling, which resolved within 48 hrs (ARCO; 1992e).

Respiratory or Skin Sensitization: Tests in guinea pigs with jet fuel and a number of kerosine streams showed no evidence of skin sensitization. There are no reports available to indicate that jet fuel or kerosines have the potential to cause respiratory sensitization (ARCO; 1992d).

Germ Cell Mutagenicity: The mutagenic potential of jet fuel and kerosine has been extensively studied in a range of *invivo* and *in vitro* assays. *In vivo* studies with straight-run kerosine gave a clearly negative result. Based on the available data, kerosines are not considered germ cell mutagens (CONCAWE, 1991; API, 1977; API, 1984; API, 1973; API, 1980; API 1985; API 1988).

Carcinogenicity: The carcinogenic potential of jet fuel and kerosine has been investigated in mice following dermal exposure for 2 years. There was an increased incidence of dermal tumours (papillomas and squamous cell carcinomas). Additional work has shown that where tumours arise they are a result of a non-genotoxic response due to dermal irritation (Freeman JJ et al, 1993; Clark CR et al, 1988; API, 1989a; API, 1989b; NTP, 1986; Blackburn GR et al, 1986; CONCAWE, 1996).

Reproductive Toxicity: Results of guideline developmental toxicity studies on jet fuel or kerosines and OECD developmental toxicity screening studies with kerosine streams showed no evidence of developmental toxicity in rats. Similarly, studies in rats with jet fuel and kerosines did not show any effect on reproductive performance (Schreiner C et al, 1997; Mattie DR et al, 2000; Cooper JR and Mattie DR, 1996; API 1979).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of target organ toxicity (ARCO, 1992c; API, 1987; ARCO 1992b). Human experience indicates that exposure to high concentrations of kerosines or similar substances in some situations may cause drowsiness and/or dizziness (e.g. ATSDR, 1998).

Repeated Exposure: The repeat dose toxicity of jet fuel and kerosines has been studied in rats following dermal, oral and inhalation exposure for periods between 4 days and 21 weeks. In dermal studies, no systemic toxicity has been seen; the only effect observed was moderate to severe dermal irritation. Repeated inhalation exposure causes 'hydrocarbon nephropathy' in male rats, an effect which is considered to be both sex and species specific and hence not relevant for humans (API 1986; Mattie DR et al, 1991; ARCO 1992a).

Aspiration: Jet fuel and kerosines are low viscosity, mobile hydrocarbon liquids with a viscosity of < 7 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies on samples of kerosine streams show values greater than 1 mg/l and in the range 1-20 mg/l. These tests were carried out on water accommodated fractions, and in closed systems to prevent evaporative loss (Toy R and Gray A, 1994; EBSI, 1995).

Chronic (long-term) Aquatic Hazard: A chronic toxicity study on *Daphnia magna* exposed to a hydrodesulfurised kerosine using WAF methodology gave a NOEL value of 0.48 mg/l based on reproduction (EMBSI, 2010).

Environmental fate (biodegradation / bioaccumulation): Kerosines are hydrocarbon UVCBs. Standard tests for biodegradation / bioaccumulation are intended for single substances and are not appropriate for complex substances. Based on compositional information available and measured or predicted data on key constituents, jet fuel and kerosines are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of kerosines show measured or predicted values for log K_{ow} greater than 4 and are considered potentially bioaccumulative.

Part 2 – Summary of Classification Recommendations - Kerosines
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

Flammable (OIN 11)

Health:

Irritant
Harmful

Environment:

Dangerous for the Environment.

Risk Phrases:

R10: Flammable
R38: Irritating to skin
R65: Harmful: may cause lung damage if swallowed
R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Part 3 – Summary of Classification and Labelling Recommendations – Kerosines
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

H226 Flammable Liquid Category 3 (OIN 12)

Health:

H304 Asp. Tox. 1
H315 Skin Corrosion/Irritation Category 2
H336 Specific Target Organ Toxicity (single exposure) Category 3

Environment:

H411 Chronic Aquatic Toxicity Category 2

3.2 Labelling

Pictograms: GHS02, GHS07, GHS08, GHS09

Signal Words: Danger

Hazard Statements:

H226: Flammable liquid and vapour
H304: May be fatal if swallowed and enters airways
H315: Causes skin irritation
H336: May cause drowsiness or dizziness
H411: Toxic to aquatic life with long lasting effects

Precautionary Statements: six suggested statements for use on labels shown in **bold text**

P102: Keep out of reach of children
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P273: Avoid release to the environment
P280: Wear protective gloves/protective clothing/eye protection/face protection
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting

P233: Keep container tightly closed
P240: Ground/bond container and receiving equipment
P241: Use explosion-proof electrical/ventilating/lighting/.../equipment
P242: Use only non-sparking tools
P243: Take precautionary measures against static discharge
P261: Avoid breathing dust/fume/gas/mist/vapours/spray
P264: Wash ... thoroughly after handling
P271: Use only outdoors or in a well-ventilated area
P302 + P352: IF ON SKIN: Wash with plenty of soap and water
P303 + P361 + P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P312: Call a POISON CENTER or doctor/physician if you feel unwell
P321: Specific treatment (see ... on this label)
P332 + P313: If skin irritation occurs: Get medical advice/attention

P362: Take off contaminated clothing and wash before reuse
P391: Collect spillage
P403 + P235: Store in a well-ventilated place. Keep cool
P403 + P233: Store in a well-ventilated place. Keep container tightly closed
P405: Store locked up
P501: Dispose of contents/container to….in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.
- Where the substance is sold to the general public (Consumers) for use in lamp oils and grill lighters, then container labels should be visibly, legibly and indelibly marked as follows, in accordance with REACH Annex XVII update of 31.3.2010:
    - Keep lamps filled with this liquid out of the reach of children.
    - Just a sip of lamp oil – or even sucking the wick of lamps may lead to life threatening lung damage.

REFERENCES: KEROSINES

API (1973) Mutagenicity study of thirteen petroleum fractions – report no. 4. Study conducted by Hine Laboratories Inc. API Health Environ. Sci. Dep.Rep. 26-60098. WashingtonDC: American Petroleum Institute

API (1977) Mutagenicity evaluation of kerosene. Study conducted by Litton Bionetics Inc. API Med. Res. Publ. 26-60017. WashingtonDC: American Petroleum Institute

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API (1985) The acute *in-vivo* cytogenetics assay in male and female rats of API 83-09 straight-run kerosine (CAS 8008-20-6). Study conducted by Microbiological Associates Inc. API Med. Res. Publ. 32-31769. WashingtonDC: American Petroleum Institute

API (1986) Four week subchronic inhalation toxicity study in rats with API 81-07 hydrodesulfurized kerosine (petroleum) (CAS 64742-81-0), API 81-09 hydrodesulfurized middle distillate (petroleum) (CAS 64742-80-9), API 81-10 hydrodesulfurized middle distillate (petroleum) (CAS 64742-80-9). Study conducted by International Research and Development Corp.API Health Environ. Sci. Dep.Rep.33-32724. WashingtonDC: American Petroleum Institute

API (1987) Acute inhalation toxicity evaluation of a petroleum derived hydrocarbon in rats. API 83-09 straight-run kerosine (CAS 8008-20-6). Study conducted by Hazleton Laboratories America Inc. API Health Environ. Sci. Dep.Rep.34-30634. WashingtonDC: American Petroleum Institute

API (1988) *In vivo* sister chromatid exchange assay with API 81-07 hydrodesulfurized kerosine. Study conducted by Microbiological Associates Inc. API Med. Res. Publ. 36-30043. WashingtonDC: American Petroleum Institute

API (1989a) Lifetime dermal carcinogenesis/chronic toxicity screening bioassay of refinery streams in C_3H/HeJ mice. Study conducted by Primate Research Institute. API Health Environ. Sci. Dep.Rep.36-31364. WashingtonDC: American Petroleum Institute

API (1989b) Twenty-four month dermal carcinogenesis/chronic toxicity screening bioassay of refinery streams in C_3H/HeJ mice. Study conducted by Primate Research Institute. API Health Environ. Sci. Dep.Rep.36-33220. WashingtonDC: American Petroleum Institute

ARCO (1992a) 28-day dermal toxicity study in rats administered test article F-133 thermocracked kerosene. UBTL Study No. 65895. Los AngelesCA: ARCO

ARCO (1992b) Acute dermal toxicity study in rabbits administered test article F-133 thermocracked kerosene. UBTL Study No. 65986.Los AngelesCA: ARCO

ARCO (1992c) Acute oral toxicity study in rats administered test article F-133 thermocracked kerosene. UBTL Study No. 65978. Los AngelesCA: ARCO

ARCO (1992d) Dermal sensitization study in guinea pigs administered test article F-133 thermocracked kerosene. UBTL Study No. 66010. Los AngelesCA: ARCO

ARCO (1992e) Primary eye irritation study in rabbits administered test article F-133 thermocracked kerosene. UBTL Study No. 65994.Los AngelesCA: ARCO

ATSDR (1998) Toxicological profile for jet fuels (JP-5 and JP-8). Study conducted by Research Triangle Institute. NTIS Report No. PB 99-102550. AtlantaGA: Agency for Toxic Substances and Disease Registry

Blackburn, G.R. et al (1986) Predicting carcinogenicity of petroleum distillation fractions using a modified *Salmonella* mutagenicity assay. *Cell Biology and Toxicology 2, 1, 63-84*

Clark, C.R. et al (1988) Comparative dermal carcinogenesis of shale and petroleum-derived distillates. *Toxicol and Health 4, 1, 11-22*

CONCAWE (1991) Middle distillates - a review of the results of a CONCAWE programme of short-term biological studies. Report No. 91/51. Brussels: CONCAWE

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Cooper, J.R. and Mattie, D.R. (1996) Developmental toxicity of JP-8 jet fuel in the rat. *J Appl Toxicol 16, 3, 197-200*

EBSI (1995) Daphnia, acute toxicity test. Test substance MRD-94-885. Study No. 188542. East MillstoneNJ: Exxon Biomedical Sciences Inc.

EMBSI (2010) *Daphnia magna*, reproduction test on kerosene. Report No. 10TP2. AnnandaleNJ: ExxonMobil Biomedical Sciences Inc.

Freeman, J.J. et al (1993) Evaluation of the contribution of chronic skin irritation and selected compositional parameters to the tumorigenicity of petroleum middle distillates in mouse skin. *Toxicology 81, 103-112*

Mattie, D.R. et al (1991) A 90-day continuous vapor inhalation toxicity study of JP-8 jet fuel followed by 20 or 21 months of recovery in Fischer 344 rats and C57BL/6 mice. *Toxicologic Pathology 19, 2, 77-87*

Mattie, D.R. et al (2000) Reproductive effects of JP-8 jet fuel on male and female Sprague-Dawley rats after exposure by oral gavage. Study conducted by ManTech-Geo Centers Joint Venture. Report No. AFRL-HE-WP-TR-2000-0067. Wright Patterson Air Force Base OH: US Air Force Research Laboratory

NTP (1986) Toxicology and carcinogenesis studies of marine diesel fuel and JP-5 navy fuel (CAS No. 8008-20-6) in B6C3F1 mice (dermal studies). NTP Technical Report No. 310. Research Triangle ParkNC: National Toxicology Program

Redman, A. and Yadav, B. (2010) Aquatic toxicity predictions using the PETROTOX model for petroleum substance categories. Report prepared for CONCAWE. MahwahNJ: HydroQual Inc.

Schreiner, C. et al (1997) Toxicity evaluation of petroleum blending streams: reproductive and developmental effects of hydrodesulfurized kerosine. *J Toxicol Environ Health 52, 211-229*

Shell (1991) Toxicology of petroleum products: the skin irritancy of odourless kerosine (white spirit). Report No. SBER.91.001. Sittingbourne: Shell Research Ltd

Toy, R. and Gray, A. (1994) SHELLSOL AD: acute toxicity of aqueous extracts to *Oncorhynchus mykiss*, *Daphnia magna* and *Raphidocelis subcapitata*. Report No. SBGR.93.175. Sittingbourne: Shell Research Ltd

MK1 DIESEL FUEL

Definition / Domain: MK1 diesel fuel is a light petroleum distillate derived from crude petroleum, manufactured by treatment of a petroleum fraction with hydrogen in the presence of a catalyst. Given the similarity in carbon number distribution and distillation temperature range to kerosine, MK1 diesel fuel is often described as a kerosine rather than a gas oil. MK1 diesel fuel properties are defined by the predominant hydrocarbon classes present, the boiling point range and the carbon number range as follows:

- Derived from crude petroleum
- Refinery processes:
    - atmospheric distillation
    - catalytic cracking
    - thermal cracking
    - hydrocracking
    - hydrotreatment / hydrodesulfurization
    - catalytic reforming
    - coking
- Hydrocarbon types: Branched and straight chain paraffins and cycloparaffins
- Typical boiling point range: approximately 180°C to 295°C
- Typical carbon number range: predominantly C_{10} to C_{18}

Part 1 – Classification Endpoint[8] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – MK1 diesel fuel is a liquid.

Flammable Aerosol: Not relevant – MK1 diesel fuel is not in aerosol form.

Flammable Liquid: MK1 diesel fuel is a liquid of variable flash point / initial boiling points. Flash point is ≈ 67°C and initial boiling point ≈180°C.

Flammable Solid: Not relevant – MK1 diesel fuel is a liquid.

Oxidising Gas: Not relevant – MK1 diesel fuel is a liquid.

Oxidising Liquid: MK1 diesel fuel is not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – MK1 diesel fuel is a liquid.

Pyrophoric Liquid: MK1 diesel fuel does not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – MK1 diesel fuel is a liquid.

Self-reactive Substance: MK1 diesel fuel is not self-reactive. It does not undergo exothermic decomposition when heated.

Self-heating Substance: MK1 diesel fuel does not react exothermically.

[8] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Gas under Pressure: Not relevant – MK1 diesel fuel is a liquid.

Organic Peroxide: MK1 diesel fuel does not meet the definition of a peroxide.

Corrosive to Metal: MK1 diesel fuel does not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: MK1 diesel fuel does not react with water.

1.2 Health Hazards

For MK1 diesel fuel there is no specific experimental data available. Compositional and physical-chemical data show that MK1 diesel fuel is very similar to kerosine. It is considered appropriate, therefore, to read across from the kerosine data to MK1 diesel fuel.

Acute Toxicity: Samples of jet fuel and a number of kerosine streams have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50} > 5000 mg/kg bodyweight (ARCO; 1992c)
Rat inhalation	LC_{50}> 5.28 mg/l (API; 1987)
Rabbit dermal	LD_{50} > 2000 mg/kg bodyweight (ARCO; 1992b)

Skin Corrosion / Irritation: Samples of jet fuel and a number of kerosine streams have been tested in rabbit skin irritation studies. Data were derived using a 24 hour occluded exposure protocol or a 4 hour semi-occluded exposure protocol. The degree of dermal irritation observed was variable depending on the study protocol, ranging from essentially non-irritating to moderate/severe irritation. There was no evidence of skin corrosion (Shell; 1991).

Serious Eye Damage / Irritation: The effects of jet fuel and kerosine streams on the eye have been investigated in rabbits using a number of samples. None of the samples tested showed more than minimal redness and swelling, which resolved within 48 hrs (ARCO; 1992e).

Respiratory or Skin Sensitization: Tests in guinea pigs with jet fuel and a number of kerosine streams showed no evidence of skin sensitization. There are no reports available to indicate that jet fuel or kerosines have the potential to cause respiratory sensitization (ARCO; 1992d).

Germ Cell Mutagenicity: The mutagenic potential of jet fuel and kerosine has been extensively studied in a range of *in vivo* and *in vitro* assays. *In vivo* studies with straight-run kerosine gave a clearly negative result. Based on the data available, kerosines are not considered germ cell mutagens. (CONCAWE, 1991; API, 1977; API, 1984; API, 1973; API, 1980; API 1985; API 1988)

Carcinogenicity: The carcinogenic potential of jet fuel and kerosine has been investigated in mice following dermal exposure for 2 years. There was an increased incidence of dermal tumours (papillomas and squamous cell carcinomas). Additional work has shown that where tumours arise they are a result of a non-genotoxic response due to dermal irritation (Freeman JJ et al, 1993; Clark CR et al, 1988; API, 1989a; API, 1989b; NTP, 1986; Blackburn GR et al, 1986; CONCAWE, 1996).

Reproductive Toxicity: Results of guideline developmental toxicity studies on jet fuel or kerosines and OECD developmental toxicity screening studies with kerosine streams showed no evidence of developmental toxicity in rats. Similarly, studies in rats with jet fuel and kerosines did not show any effect on reproductive performance (Schreiner C et al, 1997; Mattie DR et al, 2000; Cooper JR and Mattie DR, 1996; API 1979).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of target organ toxicity (ARCO 1992a; API 1987a; ARCO 1992g). Human experience indicates that exposure to high concentrations of kerosines or similar substances in some situations may cause drowsiness and/or dizziness (e.g. ATSDR, 1998).

Repeated Exposure: The repeat dose toxicity of jet fuel and kerosines has been studied in rats following dermal, oral and inhalation exposure for periods between 4 days and 21 weeks. In dermal studies, no systemic toxicity has been seen; the only effect observed was moderate to severe dermal irritation. Repeated inhalation exposure causes 'hydrocarbon nephropathy' in male rats, an effect which is considered to be both sex and species specific and hence not relevant for humans. (API, 1986; Mattie DR et al, 1991; ARCO, 1992a)

Aspiration: MK1 diesel fuel is a low viscosity, mobile hydrocarbon liquid with a viscosity at 40°C of < 7 mm^2/s.

1.3 Environmental Hazards

There are no specific experimental data available for MK1 diesel fuel. Compositional and physical chemical data show that MK1 diesel fuel is very similar to kerosine. It is considered appropriate, therefore, to read across from the kerosine data to MK1 diesel fuel. Further discussion on ecological toxicity will concern kerosine, and data endpoints that are waived for kerosine will be waived for MK1 diesel fuel.

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies on samples of kerosine streams show values greater than 1 mg/l and in the range 1-20 mg/l. These tests were carried out on water accommodated fractions, and in closed systems to prevent evaporative loss (Toy R and Gray A, 1994; EBSI, 1995). Results for kerosine are consistent with the predicted aquatic toxicity of MK 1 diesel fuel based on its hydrocarbon composition (Redman A et al, 2010).

Chronic (long-term) Aquatic Hazard: A chronic toxicity study on *Daphnia magna* exposed to a hydrodesulfurised kerosine using WAF methodology, gave a NOEL value of 0.48 mg/l based on reproduction (EMBSI, 2010). Results for kerosine are consistent with the predicted aquatic toxicity of MK 1 diesel fuel based on its hydrocarbon composition (Redman A et al, 2010).

Environmental fate (biodegradation / bioaccumulation): MK1 diesel fuel is a hydrocarbon UVCB. Standard tests for biodegradation/ bioaccumulation are intended for single substances and are not appropriate for complex substances. Based on compositional information available and measured or predicted data on key constituents, jet fuel and kerosines are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of kerosines show measured or predicted values for log K_{ow} greater than 4 and are considered potentially bioaccumulative.

Part 2 – Summary of Classification Recommendations – MK1 Diesel Fuel Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

No classification required

Health:

Irritant
Harmful

Environment:

Dangerous for the Environment.

Risk Phrases:

R38: Irritating to skin
R65: Harmful; may cause lung damage if swallowed
R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Part 3 – Summary of Classification and Labelling Recommendations – MK1 Diesel Fuel
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:
No classification required

Health:
H304 Asp. Tox. 1
H315 Skin Corrosion/Irritation Category 2
H336 Specific Target Organ Toxicity (single exposure) Category 3

Environment:
H411 Chronic Aquatic Toxicity Category 2

3.2 Labelling

Pictograms: GHS07, GHS08, GHS09

Signal Words: Danger

Hazard Statements:
H304: May be fatal if swallowed and enters airways
H315: Causes skinirritation
H336: May cause drowsiness or dizziness
H411: Toxic to aquatic life with long lasting effects

Precautionary Statements: Six suggested statements for use on labels shown in **bold text**
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting
P332 + P313: If skin irritation occurs: Get medical advice/attention
P501: Dispose of contents/container to….in accordance with local/regional /national/international regulations (to be specified)

P261: Avoid breathing dust/fume/gas/mist/vapours/spray
P264: Wash … thoroughly after handling
P271: Use only outdoors or in a well-ventilated area
P273: Avoid release to the environment
P302 + P352: IF ON SKIN: Wash with plenty of soap and water
P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312: Call a POISON CENTER or doctor/physician if you feel unwell
P321: Specific treatment (see ... on this label)
P362: Take off contaminated clothing and wash before reuse
P391: Collect spillage
P403 + P233: Store in a well-ventilated place. Keep container tightly closed
P405: Store locked up

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:
- None

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STRAIGHT- RUN GAS OILS

Definition / Domain: The domain of this category is established by the refining process by which the category members are produced and the boiling point and the carbon number ranges, as follows:

- Derived from crude petroleum
- Refinery process
  - Atmospheric distillation
- Hydrocarbon types: straight and branched alkanes and alkenes, cycloalkanes and cycloalkenes, aromatics and mixed aromatic cycloalkanes.
- Boiling point range: 150 – 471°C
- Carbon number range: predominantly C_9 to C_{25}

Part 1 – Classification Endpoint[9] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – straight-run gas oils are liquids.

Flammable Aerosol: Not relevant – straight-run gas oils are liquids.

Flammable Liquid: Straight-run gas oils are liquids of variable flash points with typical values > 56°C. For liquids, only flash point data are required to characterise flammability.

Flammable Solid: Not relevant – straight-run gas oils are liquids.

Oxidising Gas: Not relevant – straight-run gas oils are liquids.

Oxidising Liquid: Straight-run gas oils are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – straight-run gas oils are liquids.

Pyrophoric Liquid: Straight-run gas oils do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – straight-run gas oils are liquids.

Self-reactive Substance: Straight-run gas oils are not self reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Straight-run gas oils do not react exothermically.

Gas under Pressure: Not relevant – straight-run gas oils are liquids.

Organic Peroxide: Straight-run gas oils do not meet the definition of a peroxide.

Corrosive to Metal: Straight-run gas oils do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Straight-run gas oils do not react with water.

[9] Hazard endpoints presented are derived from the EU CLP Regulation ((EC) No 1272/2008) and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

1.2 Health Hazards

Acute Toxicity: Samples of straight-run gas oils have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50}> 5000 mg/kg bodyweight (API, 1985c)
Rat inhalation	LC_{50} = 1.78 mg/l (API, 1987)
Rabbit dermal	LD_{50}> 2000 mg/kg bodyweight (API, 1985c)

Skin Corrosion / Irritation: Samples of straight-run gas oils have been tested in rabbit skin irritation studies. Data was derived from studies in which 24 hour occluded exposure was employed. The degree of dermal irritation was variable but they are not expected to be irritating had animals been exposed for only 4 hours (API, 1985c). Upon repeated exposure straight-run gas oils may cause skin dryness or cracking.

Serious Eye Damage / Irritation: The ability of straight-run gas oils to elicit eye irritation in rabbits has been investigated. None of the samples resulted in more than temporary redness or swelling (API, 1985c).

Respiratory or Skin Sensitization: No studies were located for respiratory sensitization. For skin sensitization, straight-run gas oil tested in a Beuhler assay showed no evidence of skin sensitization (API, 1985c).

Germ Cell Mutagenicity: The mutagenic potential of straight-run gas oils has been extensively tested in both *in vivo* and *in vitro* tests. Based on the available data, straight-run gas oils are not considered to be germ cell mutagens (Deininger G. et al, 1991; API, 1985b).

Carcinogenicity: Results of two year skin painting studies have shown weak carcinogenic potential. Although tumours were observed after dermal application, these were the consequence of prolonged severe irritation, rather than due to the intrinsic properties of the straight-run gas oil tested. Data indicate that prevention of dermal irritation would prevent tumour development (API, 1989; CONCAWE, 1996).

Reproductive Toxicity: No guideline or near-guideline studies were located that have examined the potential impact of gas oils on reproductive function, however gonadal histopathology and/or sperm parameters (counts; morphology) were among endpoints routinely included in sub-chronic dermal evaluations of some gas oils. Based on the available data, straight-run gas oils are not considered to be reproductive toxicants (Mobil, 1991).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies do not indicate any specific organ toxicity following single exposure to straight-run gas oils (API, 1985c; API, 1987).

Repeated Exposure: The repeat dose toxicity of straight-run gas oils has been studied in rabbits through dermal exposure and in rats by both dermal and inhalation exposure. Results from dermal exposure indicate irritation at the application site in addition to systemic effects observed in rats at 125 mg/kg bw/day. Effects observed include increased liver and spleen weights, altered bone marrow function, and liver histopathology. Repeated dose inhalation studies show hydrocarbon nephropathy in male rats which is considered to be both sex and species specific which is not relevant to man (ORNL, 1984; Mobil, 1992; Feuston MH et al, 1994; API, 1985a).

Aspiration: Straight-run gas oils span a range of viscosities with values reported as 2.1 – 27 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies on samples of straight-run gas oils are not available; however suitable read across information from vacuum gas oils, hydrocracked oils and distillate fuels is available (Girling A. and Cann B, 1996a,b). These studies, carried out using the WAF methodology, show acute toxicity values for fish, crustaceans and algae greater than 1 mg/l and mostly in the range of 2–100 mg/l. Results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon composition (Redman A et al, 2010).

Chronic (long-term) Aquatic Hazard: There are no chronic toxicity studies available for straight run gas oils, and QSAR toxicity predictions are not used to determine environmental classification.

Environmental fate (biodegradation / bioaccumulation): Straight-run gas oils are hydrocarbon UVCBs. Based on the known or expected properties of individual constituents, category members are not predicted to be readily biodegradable but are inherently biodegradable (Lee C, 1993; The Petroleum HPV Testing Group, 2003; Mobil, 1999). Hydrocarbon constituents of straight-run gas oils are are likely to bioaccumulate (log K_{ow} values ≥ than 4).

Part 2 – Summary of Classification Recommendations – Straight-Run Gas Oils
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:
No classification required

Health:
Harmful

Environment:
Dangerous for the Environment

Risk Phrases:
R20: Harmful by inhalation
R65[10]: Harmful: may cause lung damage if swallowed
R66: Repeated exposure may cause skin dryness or cracking
R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

[10] If the viscosity is >7 mm^2/s @ 40°C, the substance does not need to be classified and labelled R65 and S62 does not apply. The classification as Harmful shall still apply.

Part 3 – Summary of Classification and Labelling Recommendations – Straight-Run Gas Oils
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

H226 Flammable Liquid Category 3[11] (OIN 12).

Health:

H304 Asp. Tox. 1 (unless the kinematic viscosity is above 20.5 mm^2/s @ 40°C)
H332 Acute Toxicity Category 4 (Inhalation)
H373 Specific Target Organ Toxicity (repeated exposure) Category 2

Environment:

H411 Chronic Aquatic Toxicity Category 2

3.2 Labelling

Pictograms: GHS02, GHS07, GHS08, GHS09
Signal Words: Danger

Hazard Statements:

H226: Flammable liquid andvapour
H304: May be fatal if swallowed and enters airways
H332: Harmful if inhaled
H373: May cause damage to liver, spleen and bone marrow through prolonged or repeated exposure
EUH066: Repeated exposure may cause skin dryness or cracking
H411: Toxic to aquatic life with long lasting effects

Precautionary Statements: Six suggested statements for use on labels are shown in **bold text**

P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P273: Avoid release to the environment
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting

P233: Keep container tightly closed
P240: Ground/bond container and receiving equipment
P241: Use explosion-proof electrical/ventilating/lighting/.../equipment
P242: Use only non-sparking tools
P243: Take precautionary measures against static discharge
P271: Use only outdoors or in a well-ventilated area
P501: Dispose of contents/container to….in accordance with local/regional /national/international regulations (to be specified)
P280: Wear protective gloves/protective clothing/eye protection/face protection
P303 + P361 + P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower

[11] For the purpose of CLP gas oils, diesel and light heating oils having a flash point between ≥ 55 °C and ≤ 75 °C may be regarded as Category 3.

P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P308: IF exposed or concerned:
P312: Call a POISON CENTER or doctor/physician if you feel unwell
P314: Get medical advice/attention if you feel unwell
P332 + P313: If skin irritation occurs: Get medical advice/attention
P362: Take off contaminated clothing and wash before reuse
P370 + P378: In case of fire: Use … for extinction
P391: Collect spillage
P403 + P233: Store in a well-ventilated place. Keep container tightly closed
P403 + P235: Store in a well-ventilated place. Keep cool
P405: Store locked up

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

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CRACKED GAS OILS

Definition / Domain: The domain of this category is established by the refining processes by which the category members are produced and the boiling point and the carbon number range as follows:

- Derived from crude petroleum
- Refinery processes
  - atmospheric distillation
  - vacuum distillation
  - catalytic cracking
- Hydrocarbon types: aromatics, alkylated aromatics, mixed aromatic cycloalkanes, straight and branched alkanes and alkenes, cycloalkanes and cycloalkenes.
- Boiling point range: 150 - 450°C
- Carbon number range: predominantly C_9 to C_{30}

Part 1 – Classification Endpoint[12] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive based on structural and oxygen balance considerations.

Flammable Gas: Not relevant –cracked gas oils are liquids.

Flammable Aerosol: Not relevant – cracked gas oils are liquids.

Flammable Liquid: Cracked gas oils are liquids of variable flash points typically > 56°C. For liquids, only flash point data are required to characterise flammability.

Flammable Solid: Not relevant – cracked gas oils are liquids.

Oxidising Gas: Not relevant – cracked gas oils are liquids.

Oxidising Liquid: Cracked gas oils are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – cracked gas oils are liquids.

Pyrophoric Liquid: Cracked gas oils do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – cracked gas oils are liquids.

Self-reactive Substance: Cracked gas oils are not self reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Cracked gas oils do not react exothermically.

Gas under Pressure: Not relevant – cracked gas oils are liquids.

Organic Peroxide: Cracked gas oils do not meet the definition of a peroxide.

Corrosive to Metal: Cracked gas oils do not meet the criteria for corrosion of metal.

[12] Hazard endpoints presented are derived from the EU CLP Regulation ((EC) No 1272/2008) and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Substance which in contact with water emits flammable gas: Cracked gas oils do not react with water

1.2 Health Hazards

Acute Toxicity: Samples of cracked gas oils have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50}> 3200 mg/kg bodyweight (API, 1985c)
Rat inhalation	LC_{50}= 4.65 mg/l (API, 1986)
Rabbit dermal	LD_{50}> 2000 mg/kg bodyweight (API, 1985c)

Skin Corrosion / Irritation: Samples of cracked gas oils were tested in rabbit skin irritation studies. Results obtained indicate that exposure to cracked gas oils results in skin irritation. There was no evidence of skin corrosion (EBSI, 1996a).

Serious Eye Damage / Irritation: The ability of cracked gas oils to elicit eye irritation in rabbits has been investigated. None of the samples were irritating to the eye (API, 1985c).

Respiratory or Skin Sensitization: No studies were located for respiratory sensitization. For skin sensitization cracked gas oils were tested and showed no evidence of skin sensitization (API 1985d).

Germ Cell Mutagenicity: The mutagenic potential of cracked gas oils has been extensively tested in both *in vivo* and *in vitro* tests. The results of the studies were ambiguous *in vitro* and showed no evidence of *in vivo* mutagenic activity (Deininger G et al, 1991; API, 1985b). Based on the available data, cracked gas oils are not considered to be germ cell mutagens.

Carcinogenicity: Repeated dermal application of cracked gas oils to animals resulted in tumor formation. Based on data from the experiments conducted with cracked gas oils they are considered to be carcinogens (EBSI, 1996b).

Reproductive Toxicity: No guideline or near-guideline studies were located that have examined the potential impact of gas oils on fertility, however gonadal histopathology and/or sperm parameters (counts; morphology) were among endpoints routinely included in sub-chronic dermal evaluations of some gas oils. There was evidence of developmental effects in animals but these were considered minor and were observed in the presence of maternal toxicity which is a confounding factor in determining toxicity (ARCO, 1994a; ARCO, 1994b; Mobil, 1990; ARCO, 1994c; Mobil, 1994; ARCO, 1993; Mobil, 1989; Mobil, 1987). Based on the available data cracked gas oils are not considered to be developmental toxicants.

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies do not indicate any specific organ toxicity following single exposure to cracked gas oils (API, 1985c; API, 1986).

Repeated Exposure: The repeat dose toxicity of cracked gas oils has been studied. Target organ toxicity has been observed in blood, thymus, and liver (ORNL, 1984; Cruzan G, 1985; Mobil 1990; API, 1985a).

Aspiration: Cracked gas oils span a range of viscosities with values reported as 1.1 – 4.5 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies on samples of cracked gas oils show LL50 values ranging from 0.22 mg/l for crustaceans to 8.82 mg/l for algae (EMBSI, 2011a-d; EMBSI, 2012a-d; EMBSI, 2012f-h).
Chronic (long-term) Aquatic Hazard: Chronic aquatic toxicity: Chronic aquatic toxicity studies on samples of cracked gas oils show NOELR vales ranging from 0.05 mg/l for crustaceans and algae to 0.93 for algae (EMBSI, 2012e-h).

Environmental fate (biodegradation / bioaccumulation): Cracked gas oils are hydrocarbon UVCBs. Based on the known or expected properties of individual constituents, category members are not predicted to be readily biodegradable but are inherently biodegradable. Components of cracked gas oils are likely to bioaccumulate (log K_{ow} ≥4).

Part 2 – Summary of Classification Recommendations – Cracked Gas Oils Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

No classification required

Health:

Carcinogenic Category 2
Harmful
Irritant

Environment: Dangerous for the Environment

Risk Phrases:

R20: Harmful by inhalation
R38: Irritating to skin
R45: May cause cancer
R48/21: Harmful: danger of serious damage to health by prolonged exposure in contact with skin
R65 Harmful: may cause lung damage if swallowed
R50/53: Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Part 3 – Summary of Classification and Labelling Recommendations – Cracked Gas Oils
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

H226 Flammable Liquid Category 3[13] (OIN 12)

Health:

H304 Asp. Tox. 1
H350 Carcinogenicity Hazard 1B
H315 Skin corrosion/irritation Category 2
H332 Acute Toxicity Category 4 (Inhalation)
H373 Specific Target Organ Toxicity (repeated exposure) Category 2

Environment:

H400 Acute Aquatic Toxicity Category 1(M-factor =1)
H410 Chronic Aquatic Toxicity Category 1 (M-factor =1)

3.2 Labelling

Pictograms: GHS02, GHS07, GHS08, GHS09

Signal Words: Danger

Hazard Statements:

H226: Flammable liquid and vapour
H304: May be fatal if swallowed and enters airways
H350: May cause cancer
H315: Causes skin irritation
H332: Harmful if inhaled
H373: May cause damage to blood, thymus and liver through prolonged or repeated exposure
H410: Very toxic to aquatic life with long lasting effects (M Factor =1)

Precautionary Statements: Six suggested statements for use on labels are shown in **bold text**

P201: Obtain special instructions before use
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P273: Avoid release to the environment
P280: Wear protective gloves/protective clothing/eye protection/face protection
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting

P202: Do not handle until all safety precautions have been read and understood
P233: Keep container tightly closed
P240: Ground/bond container and receiving equipment
P241: Use explosion-proof electrical/ventilating/lighting/.../equipment
P242: Use only non-sparking tools
P243: Take precautionary measures against static discharge
P260: Do not breathe dust/fume/gas/mist/vapours/spray

[13] For the purpose of CLP gas oils, diesel and light heating oils having a flash point between ≥ 55 °C and ≤ 75 °C may be regarded as Category 3.

P261: Avoid breathing dust/fume/gas/mist/vapours/spray
P264: Wash ... thoroughly after handling
P270: Do not eat, drink or smoke when using this product
P281: Use personal protective equipment as required
P301 + P312: IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
P302 + P352: IF ON SKIN: Wash with plenty of soap and water
P303 + P361 + P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P308 + P313: IF exposed or concerned: Get medical advice/attention
P314: Get medical advice/attention if you feel unwell
P321: Specific treatment (see ... on this label)
P330: Rinse mouth
P332 + P313: If skin irritation occurs: Get medical advice/attention
P362: Take off contaminated clothing and wash before reuse
P370 + P378: In case of fire: Use … for extinction
P391: Collect spillage
P403 + P235: Store in a well-ventilated place. Keep cool
P405: Store locked up
P501: Dispose of contents/container to….in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users due to classification as a Category 1B Carcinogen and when used for non-fuel purposes.
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

REFERENCES: CRACKED GAS OILS

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API (1985b) Acute *in vivo* cytogenetics assay in male and female rats of API 83-11. Study conducted by Microbiological Associates Inc. API Med. Res. Publ. 32-32408. WashingtonDC: American Petroleum Institute

API (1985c) Acute oral toxicity study in rats. Acute dermal toxicity study in rabbits. Primary dermal irritation study in rabbits. Primary eye irritation study in rabbits. Dermal sensitization study in guinea pigs. API 83-07 light catalytically cracked distillate (CAS 64741-59-9). Study conducted by Hazleton Laboratories America Inc. API Health Environ. Sci. Dep.Rep. 33-30162. WashingtonDC: American Petroleum Institute

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ExxonMobil Biomedical Sciences Inc. (2011d). Alga, growth inhibition test on water accommodated fractions of a light catalytic cracked gas oil. Testing laboratory: ExxonMobil Biomedical Sciences Inc., 1545 Route 22 East, Annandale, New Jersey 08801-3059. Report no.: 11TP16. Owner company: American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070. Study number: 1057667. Report date: 2011-12-22.

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ExxonMobil Biomedical Sciences Inc. (2012e). Daphnia magna, Reproduction Test on Water Accommodated Fractions of a Light Catalytic Cracked Gas Oil. Testing laboratory: ExxonMobil Biomedical Sciences Inc., 1545 US Highway 22 East, Annandale, New Jersey 08801-3059. Report no.: 12TP2. Owner company: American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070. Study number: 1057646. Report date: 2012-03-28.

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ExxonMobil Biomedical Sciences Inc. (2012g). Alga, growth inhibition test on light cracked gas oil. Testing laboratory: ExxonMobil Biomedical Sciences Inc., Laboratory Operations, 1545 Route 22 East, PO Box 971, Annandale, New Jersey 08801-0971. Report no.: 2010TP20. Owner company: CONCAWE, Boulevard du Souverain 165, B1160 Brussels, Belgium. Study number: 1059567. Report date: 2012-02-23.

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VACUUM GAS OILS, HYDROCRACKED GAS OILS, AND DISTILLATE FUELS

Definition / Domain: The domain of this category is established by the refining processes by which the category members are produced and the boiling point and the carbon number range as follows:

- Derived from crude petroleum
- Refinery processes
  - Atmospheric distillation
  - Vacuum distillation
  - Hydrocracking
  - Blending of petroleum substances to produce the following CASRNs
    - 68334-30-5 Fuels, Diesel
    - 68476-30-2 Fuel Oil No. 2
    - 68476-31-3 Fuel Oil No 4
    - 68476-34-6 Fuels Diesel No 2
- Hydrocarbon types: straight and branched alkanes and alkenes, cycloalkanes and cycloalkenes, aromatics and mixed aromatic cycloalkanes.
- Boiling point range: 141- 500°C
- Carbon number range: predominantly C_9 to C_{30}

Part 1 – Classification Endpoint[14] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – vacuum or hydrocracked gas oils and distillate fuels are liquids.

Flammable Aerosol: Not relevant – vacuum or hydrocracked gas oils and distillate fuels are liquids.

Flammable Liquid: Vacuum gas oils, hydrocracked gas oils, and distillate fuels are liquids of variable flash points with values > 56°C. For liquids, only flash point data are required to characterise flammability.

Flammable Solid: Not relevant – vacuum or hydrocracked gas oils and distillate fuels are liquids.

Oxidising Gas: Not relevant – vacuum or hydrocracked gas oils and distillate fuels are liquids.

Oxidising Liquid: Vacuum or hydrocracked gas oils are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – vacuum or hydrocracked gas oils and distillate fuels are liquids.

Pyrophoric Liquid: Vacuum or hydrocracked gas oils and distillate fuels do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – vacuum or hydrocracked gas oils and distillate fuels are liquids.

[14] Hazard endpoints presented are derived from the EU CLP Regulation ((EC) No 1272/2008) and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Self-reactive Substance: Vacuum or hydrocracked gas oils and distillate fuels are not self reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Vacuum or hydrocracked gas oils and distillate fuels do not react exothermically.

Gas under Pressure: Not relevant – vacuum or hydrocracked gas oils and distillate fuels are liquids.

Organic Peroxide: Vacuum or hydrocracked gas oils and distillate fuels do not meet the definition of a peroxide.

Corrosive to Metal: Vacuum or hydrocracked gas oils and distillate fuels do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Vacuum or hydrocracked gas oils and distillate fuels do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of vacuum or hydrocracked gas oils and distillate fuels have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50}> 9 ml/kg bodyweight (approx 7600 mg/kg bw) (API, 1980a,b)
Rat inhalation	LC_{50} ≥ 4.1 mg/l (ARCO, 1988)
Rabbit dermal	LD_{50}> 5 ml/kg bodyweight (approx 4300 mg/kg bw) (API, 1980a,b)

Skin Corrosion / Irritation: Samples of vacuum or hydrocracked gas oils and distillate fuels were tested in rabbit skin irritation studies (24 hour occluded). These data indicate that exposure to distillate fuels can cause skin irritation (API, 1980a; API, 1980b). There was no evidence of skin corrosion.

Serious Eye Damage / Irritation: The ability of vacuum or hydrocracked gas oils and distillate fuels to elicit eye irritation in rabbits has been investigated. None of the samples were irritating to the eye (API, 1980a; API, 1980b).

Respiratory or Skin Sensitization: No studies were located for respiratory sensitization. For skin sensitization distillate fuel samples were tested and showed no evidence of skin sensitization (API, 1980a; API, 1980b).

Germ Cell Mutagenicity: The mutagenic potential of vacuum gas oils, hydrocracked gas oils, and distillate fuels have been extensively tested in both *in vivo* and *in vitro* tests. The *in vitro* results were ambiguous while the *in vivo* studies showed a lack of mutagenic activity. Based on the data available vacuum gas oils, hydrocracked gas oils, and distillate fuels are not considered to be germ cell mutagens (Deininger, G, et al, 1991; McKee, RH et al, 1994; API, 1985).

Carcinogenicity: Samples of vacuum gas oils, hydrocracked gas oils, and distillate fuels show variable activity in skin painting bioassays. Skin irritation has been shown to contribute to the development of tumors. Based on the data available these substances are considered as potentially carcinogenic (Biles RW et al, 1988).

Reproductive Toxicity: No guideline or near-guideline studies were located that have examined the potential impact of gas oils on reproductive function, however gonadal histopathology and/or sperm parameters (counts; morphology) were among endpoints routinely included in sub-chronic

dermal evaluations of some gas oils. The data indicate these substances are not reproductive toxicants (Mobil, 1989a; API, 1979a; API, 1979b).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies do not indicate any specific organ toxicity following single exposure to vacuum or hydrocracked gas oils and distillate fuels (API, 1980a; API, 1980b; ARCO, 1988)

Repeated Exposure: The repeat dose toxicity of vacuum or hydrocracked gas oils and distillate fuels has been tested. Following 13 week dermal exposure in Sprague-Dawley rats, thymus, liver, and bone marrow changes were noted in a dose dependent manner (ARCO, 1992; Mobil, 1989b).

Aspiration: Vacuum or hydrocracked gas oils and distillate fuels span a range of viscosities with values reported as ≥1.5 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies on samples of vacuum or hydrocracked gas oils and distillate fuels, carried out using the WAF methodology, report acute toxicity values for fish, crustaceans and algae greater than 1 mg/l and mostly in the range of 2–100 mg/l (Girling A. and Cann B, 1996a,b). The lowest LL50 was 2 mg/l for *Daphnia magna* (Febbo et al., 2007).

Chronic (long-term) Aquatic Hazard: There are no chronic toxicity studies available for vacuum or hydrocracked gas oils and distillate fuels, and QSAR toxicity predictions are not used to determine environmental classification.

Environmental fate (biodegradation / bioaccumulation): Vacuum or hydrocracked gas oils and distillate fuels are hydrocarbon UVCBs. Based on the known or expected properties of individual constituents, category members are not predicted to be readily biodegradable but they are inherently biodegradable (The Petroleum HPV Testing Group, 2003; Mobil, 1999; Lee C, 1993). Hydrocarbon constituents of vacuum or hydrocracked gas oils and distillate fuels are predicted to bioaccumulate (log K_{ow} values above 4.0).

Part 2 – Summary of Classification Recommendations – Vacuum Gas Oils, Hydrocracked Gas Oils, and Distillate Fuels
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

No classification required

Health:

Harmful
Carcinogenic Category 3
Irritant

Environment:

Dangerous for the Environment

Risk Phrases:

R20: Harmful by Inhalation
R38: Irritating to skin
R40: Limited evidence of a carcinogenic effect
R65[15]: Harmful: may cause lung damage if swallowed
R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

[15] If the viscosity is >7 mm^2/s @ 40°C, the substance does not need to be classified and labelled R65 and S62 does not apply. The classification as Harmful shall still apply.

Part 3 – Summary of Classification and Labelling Recommendations - Vacuum Gas Oils, Hydrocracked Gas Oils, and Distillate Fuels
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

H226 Flammable Liquid Category 3[16] (OIN 12)

Health:

H315 Skin Corrosion/Irritation Category 2
H332 Acute Toxicity Category 4 (Inhalation)
H304 Asp. Tox. 1 (unless the kinematic viscosity is above 20.5 mm^2/s @ 40°C)
H351 Carcinogenicity Category 2
H373 Specific Target Organ Toxicity (repeated exposure) Category 2

Environment:

H411 Chronic Aquatic Toxicity Category 2

3.2 Labelling

Pictograms: GHS02, GHS07, GHS08, GHS09

Signal Words: Danger

Hazard Statements:

H226: Flammable liquid andvapour
H304: May be fatal if swallowed and enters airways
H315: Causes skin irritation
H332: Harmful if inhaled
H351: Suspected of causing cancer
H373: May cause damage to thymus, liver, and bone marrow through prolonged or repeated exposure
H411: Toxic to aquatic life with long lasting effects

Precautionary Statements: Six suggested statements for use on labels are shown in **bold text**.

P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P273: Avoid release to the environment
P280: Wear protective gloves/protective clothing/eye protection/face protection
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting

P201: Obtain special instructions before use
P202: Do not handle until all safety precautions have been read and understood
P233: Keep container tightly closed
P240: Ground/bond container and receiving equipment
P241: Use explosion-proof electrical/ventilating/lighting/.../equipment
P242: Use only non-sparking tools
P243: Take precautionary measures against static discharge

[16] For the purpose of CLP gas oils, diesel and light heating oils having a flash point between ≥ 55 °C and ≤ 75 °C may be regarded as Category 3.

P264: Wash ... thoroughly after handling
P270: Do not eat, drink or smoke when using this product
P271: Use only outdoors or in a well-ventilated area
P281: Use personal protective equipment as required
P301 + P312: IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
P302 + P352: IF ON SKIN: Wash with plenty of soap and water
P303 + P361 + P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P308: IF exposed or concerned:
P308 + P313: IF exposed or concerned: Get medical advice/attention
P312: Call a POISON CENTER or doctor/physician if you feel unwell
P313: Get medical advice/attention
P314: Get medical advice/attention if you feel unwell
P321: Specific treatment (see ... on this label)
P330: Rinse mouth
P332 + P313: If skin irritation occurs: Get medical advice/attention
P362: Take off contaminated clothing and wash before reuse
P370 + P378: In case of fire: Use … for extinction
P391: Collect spillage
P403 + P235: Store in a well-ventilated place. Keep cool
P403 + P233: Store in a well-ventilated place. Keep container tightly closed
P405: Store locked up
P501: Dispose of contents/container to….in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

REFERENCES: VACUUM, HYDROCRACKED GAS OILS AND DISTILLATE FUELS

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Redman, A. and Yadav, B. (2010) Aquatic toxicity predictions using the PETROTOX model for petroleum substance categories. Report prepared for CONCAWE. MahwahNJ: HydroQual Inc.

The Petroleum HPV Testing Group (2003) High production volume (HPV) chemical challenge program. Test plan gas oils category. HPV Consortium No. 1100997. Administered by API. WashingtonDC: American Petroleum Institute

OTHER GAS OILS

Definition / Domain: The domain of this category is established by the refining process by which the category members are produced and the boiling point and the carbon number range as follows:

- Derived from crude petroleum
- Refinery processes
  - atmospheric distillation
  - vacuum distillation
  - catalytic cracking
  - thermal cracking
  - hydrotreating
- Hydrocarbon types: aromatics, alkylated aromatics, mixed aromatic cycloalkanes. straight and branched alkanes and alkenes, cycloalkanes and cycloalkenes
- Boiling point range: 150°C - 400°C
- Carbon number range: predominantly C_9 to C_{36}

Part 1 – Classification Endpoint[17] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – Other Gas Oils are liquids.

Flammable Aerosol: Not relevant – Other Gas Oils are liquids.

Flammable Liquid: Other Gas Oils are liquids of variable flash pointswith values > 56 °C. For liquids, only flash point data are required to characterise flammability.

Flammable Solid: Not relevant – Other Gas Oils are liquids.

Oxidising Gas: Not relevant – Other Gas Oils are liquids.

Oxidising Liquid: Other Gas Oils are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – Other Gas Oils are liquids.

Pyrophoric Liquid: Other Gas Oils do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – Other Gas Oils are liquids.

Self-reactive Substance: Other Gas Oils are not self reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Other Gas Oils do not react exothermically.

Gas under Pressure: Not relevant – Other gas oils are liquids.

Organic Peroxide: Other Gas Oils do not meet the definition of a peroxide.

[17] Hazard endpoints presented are derived from the EU CLP Regulation ((EC) No 1272/2008) and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Corrosive to Metal: Other Gas Oils do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Other Gas Oils do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of Other Gas Oils have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50}>5000 mg/kg bodyweight (API, 1982a; API, 1982b)
Rat inhalation	LC_{50} ≥ 1.78 mg/l (API, 1983c; API, 1987)
Rabbit dermal	LD_{50}> 2000 mg/kg bodyweight (API, 1982a; API, 1982b)

Skin Corrosion / Irritation: Samples of Other Gas Oils were tested in rabbit skin irritation studies. Results obtained were from 24h occlusion tests, and indicate that exposure to hydrodesulphurised middle distillates results in skin irritation that when extrapolated to a 4 hour exposure is expected to be irritating (API, 1982a; API, 1982b) There was no evidence of skin corrosion.

Serious Eye Damage / Irritation: The ability of Other Gas Oils to elicit eye irritation in rabbits has been investigated. None of the samples resulted in lasting irritation to the eye (API, 1982a; API, 1982b).

Respiratory or Skin Sensitization: No studies were located for respiratory sensitization. For skin sensitization samples were tested and showed no evidence of skin sensitization (API, 1984a, API, 1984b).

Germ Cell Mutagenicity: The mutagenic potential of Other Gas Oils has been extensively tested in both *in vivo* and *in vitro* tests. The *in vitro* results were ambiguous while the *in vivo* studies showed a lack of mutagenic activity. Based on the data available, Other Gas Oils are not considered to be germ cell mutagens (Deininger G, et al, 1991; API, 1985).

Carcinogenicity: Based on data available, Other Gas Oils may be considered carcinogenic dependent upon refining process (EBSI, 1996; CONCAWE, 1996).

Reproductive Toxicity: No guideline studies were located that have examined the potential impact of Other Gas Oils on reproductive function. Although data from a non-guideline developmental study with heavy atmospheric gas oil indicates foetal toxicity, this occurred at the same dose as maternal toxicity, and was considered to be a secondary effect (Mobil, 1991a). Based on the data available other gas oils are not considered reproductive toxicants.

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies do not indicate any specific organ toxicity following single exposure to Other Gas Oils (API, 1982a; API, 1982b; API, 1983; API, 1987).

Repeated Exposure: The repeat dose toxicity of Other Gas Oils has been studied. Target organ toxicity has been observed in blood, thymus, and liver (API, 1986; ORNL, 1984; Mobil, 1992; Mobil 1990; Cruzan G, 1985; API, 1983a; API, 1983b).

Aspiration: Other Gas Oils span a range of viscosities with values reported as 2.0 – 8.1mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies on samples of other gas oils are unavailable; however suitable read across information from vacuum gas oils, hydrocracked oils and distillate fuels is available (Girling A. and Cann B, 1996a,b). These studies, carried out using the WAF methodology, show acute toxicity values for fish, crustaceans and algae greater than 1 mg/l and mostly in the range of 2–100 mg/l. Results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon composition (Redman A et al, 2010).

Chronic (long-term) Aquatic Hazard: There are no chronic toxicity studies available for straight run gas oils, and QSAR toxicity predictions are not used to determine environmental classification.

Environmental fate (biodegradation / bioaccumulation): Other Gas Oils are hydrocarbon UVCBs. Based on the known or expected properties of individual constituents, category members are not predicted to be readily biodegradable but are inherently biodegradable (Lee C, 1993; The Petroleum HPV Testing Group, 2003; Mobil, 1999). Components oh other gas oils are likely to bioaccumulate (log K_{ow} values ≥ 4.0).

Part 2 – Summary of Classification Recommendations – Other Gas Oils Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

No classification required

Health:

Harmful
Carcinogenic Category 2 (EC DSD Note N)
Irritant

Environment:

Dangerous for the Environment

Risk Phrases:

R20: Harmful by inhalation
R38: Irritating to skin
R45: May cause cancer
R48/21[18]: Harmful: danger of serious damage to health by prolonged exposure in contact with skin
R65[19]: Harmful: may cause lung damage if swallowed
R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

[18] If OIN 13 is fulfilled, this substance shall not be labeled R48/21. The classification as Harmful shall still apply.

[19] If the viscosity is >7 mm^2/s @ 40°C, the substance does not need to be classified and labelled R65 and S62 does not apply. The classification as Harmful shall still apply.

Part 3 – Summary of Classification and Labelling Recommendations – Other Gas Oils
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

H226 Flammable Liquid Category 3[20] (OIN 12),

Health:

H332 Acute Toxicity Category 4 (Inhalation)
H304 Asp. Tox. 1
H315 Skin corrosion/irritation Category 2
H350 Carcinogenicity Category 1B (EC CLP Note N)
H373 Specific Target Organ Toxicity (repeated exposure) Category 2 (OIN 14)

Environment:

H411 Chronic Aquatic Toxicity Category 2

3.2 Labelling

Pictograms: GHS02, GHS07, GHS08, GHS09

Signal Words: Danger

Hazard Statements:

H226: Flammable liquid and vapour
H332: Harmful if inhaled
H304: May be fatal if swallowed and enters airways
H315: Causes skin irritation
H350: May cause cancer
H373: May cause damage to blood, thymus, and liver through prolonged or repeated exposure
H411: Toxic to aquatic life with long lasting effects

Precautionary Statements: Six suggested statements for use on labels are shown in **bold text**

P201: Obtain special instructions before use.
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P273: Avoid release to the environment
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting

P202: Do not handle until all safety precautions have been read and understood
P233: Keep container tightly closed
P240: Ground/bond container and receiving equipment
P241: Use explosion-proof electrical/ventilating/lighting/.../equipment
P242: Use only non-sparking tools
P243: Take precautionary measures against static discharge
P261: Avoid breathing dust/fume/gas/mist/vapours/spray
P264: Wash ... thoroughly after handling
P270: Do not eat, drink or smoke when using this product
P280: Wear protective gloves/protective clothing/eye protection/face protection

[20] For the purpose of CLP gas oils, diesel and light heating oils having a flash point between ≥ 55 °C and ≤ 75 °C may be regarded as Category 3.

P281: Use personal protective equipment as required
P301 + P312: IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
P302 + P352: IF ON SKIN: Wash with plenty of soap and water
P303 + P361 + P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P308 + P313: IF exposed or concerned: Get medical advice/attention
P314: Get medical advice/attention if you feel unwell
P321: Specific treatment (see ... on this label)
P330: Rinse mouth
P332 + P313: If skin irritation occurs: Get medical advice/attention
P362: Take off contaminated clothing and wash before reuse
P370 + P378: In case of fire: Use … for extinction
P391: Collect spillage
P403 + P235: Store in a well-ventilated place. Keep cool
P405: Store locked up
P501: Dispose of contents/container to …in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users when classified as carcinogenic Category 1B and when used for non-fuel purposes.
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

REFERENCES: OTHER GAS OILS

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API (1984b) Dermal sensitization study in guinea pigs -closed patch technique. API 81-09 hydrodesulfurized middle distillate. Study conducted by Hazleton Laboratories America Inc. API Med. Res. Publ. 31-31352. WashingtonDC: American Petroleum Institute

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Mobil (1992) Thirteen-week dermal administration of heavy atmospheric gas oil to rats (CAS 68915-97-9). Mobil Environ. and Health Sci. Lab. Study No. 63456. PrincetonNJ: Mobil Oil Corporation

Mobil (1995) Developmental toxicity study in rats exposed dermally to heavy atmospheric gas oil. Mobil Environ. and Health Sci. Lab. Study No. 64146. PrincetonNJ: Mobil Oil Corporation

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The Petroleum HPV Testing Group (2003) High production volume (HPV) chemical challenge program. Test plan gas oils category. HPV Consortium No. 1100997. Administered by API. WashingtonDC: American Petroleum Institute

HEAVY FUEL OIL COMPONENTS

Definition / Domain: The domain of this category is defined as streams obtained as either distillates or residues from distillation and cracking processes and containing saturated, aromatic and olefinic hydrocarbons, with carbon numbers $>C_8$ and boiling point range of 150 to >750°C.

Heavy Fuel Oil Components (HFO) are produced using various refinery distillation and cracking processes. The most common components are:

- Long residue: the residue from the atmospheric distillation of crude oil.
- Short residue: the residue from the vacuum distillation of crude oil.
- Thermal cracker or visbreaker residue: the residue from thermal cracking processes.
- Cat cracker slurry oil (clarified oil): a heavy fraction from a catalytic cracking.
- Thermally cracked or visbreaker gas oil: a middle distillate fraction from thermal cracker or visbreaker units.
- Vacuum gas oil: a heavy gas oil fraction (vacuum distillate) from the vacuum column.
- Cat cracker cycle oil: a middle distillate fraction from the catalytic cracking unit.
- Gas oil: a heavier middle distillate fraction from the atmospheric column

Part 1 – Classification Endpoint[21] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – Heavy Fuel Oil Components oils are liquids.

Flammable Aerosol: Not relevant – Heavy Fuel Oil ComponentsHeavy Fuel Oil Components oils are not in aerosol form.

Flammable Liquid: Heavy Fuel Oil Components are liquids of variable flash point. Typical values reported are > 60°C.

Flammable Solid: Not relevant – Heavy Fuel Oil Components are liquids.

Oxidising Gas: Not relevant – Heavy Fuel Oil Components are liquids.

Oxidising Liquid: Heavy Fuel Oil Components are not considered oxidising based on structural considerations

Oxidising Solid: Not relevant – Heavy Fuel Oil Components are liquids.

Pyrophoric Liquid: Heavy Fuel Oil Components do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – Heavy Fuel Oil Components are liquids.

Self-reactive Substance: Heavy Fuel Oil Components are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Heavy Fuel Oil Components do not react exothermically.

[21] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Gas under Pressure: Not relevant – Heavy Fuel Oil Components are liquids.

Organic Peroxide: Heavy Fuel Oil Components do not meet the definition of a peroxide.

Corrosive to Metal: Heavy Fuel Oil Components do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Heavy Fuel Oil Components do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of Heavy Fuel Oil Components have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50} > 5000 mg/kg bodyweight (ARCO, 1987b)
Rat inhalation	LC_{50} = 4 mg/l (API, 1982)
Rabbit dermal	LD_{50} > 2000 mg/kg bodyweight (API 1982, ARCO 1987a)

Skin Corrosion / Irritation: Samples Heavy Fuel Oil Components have been tested in rabbit skin irritation studies. The majority of the data were derived using a 24 hour occluded exposure protocol. Based on these non-guideline studies Heavy Fuel Oil Components cause no more than moderate irritation. Upon repeated exposure some Heavy Fuel Oil Components may cause skin dryness or cracking. There was no evidence of skin corrosion (ARCO 1992a, ARCO 1992b).

Serious Eye Damage / Irritation: The effects of Heavy Fuel Oil Components on the eye have been investigated in rabbits using a number of samples. None of the samples tested showed more than transient, fully reversible eye irritation (ARCO 1991).

Respiratory or Skin Sensitization: Samples of Heavy Fuel Oil Components have been tested in the guinea pig using a closed patch technique (Buehler method). These data show no evidence of skin sensitization (ARCO, 1992c, ARCO, 1989). There are no reports available to indicate a potential to cause respiratory sensitization.

Germ Cell Mutagenicity: The mutagenic potential of Heavy Fuel Oil Components has been extensively studied in a range of *invivo* and *in vitro* assays. (API 1985a; API 1985c; API 1985b; API 1986a) In general, the *invitro* studies showed evidence of mutagenic activity whereas *in vivo* studies showed no activity. Based on the available data, Heavy Fuel Oil Components are not considered to be germ cell mutagens.

Carcinogenicity: The carcinogenic potential of Heavy Fuel Oil Components has been investigated in animals following dermal exposure. These data indicate that Heavy Fuel Oil Components are carcinogenic (API 1989).

Reproductive Toxicity: Results of developmental and reproductive toxicity studies on Heavy Fuel Oil Components showed evidence of developmental toxicity (Hoberman AM et al, 1995, ARCO 1994).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity.

Repeated Exposure: The repeat dose toxicity of Heavy Fuel Oil Components has been investigated following dermal exposure (ARCO 1993a, ARCO 1993b). These

data indicate a potential to cause systemic injury, with the blood, thymus and liver being key target tissues.

Aspiration: Heavy Fuel Oil Components are hydrocarbon liquids of variable viscosity. Reported values for some Heavy Fuel Oil Components are between 7 mm^2/s and 20.5 mm^2/s at 40°C, while others may be above 20.5 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies with fish, invertebrates and algae on samples of Heavy Fuel Oil Components show variable acute toxicity, with the most sensitive species (algae) giving values less than 1 mg/l. These tests were carried out on water accommodated fractions (EMBSI 2008a, 2008b, 2008c).

Chronic (long-term) Aquatic Hazard: Chronic aquatic toxicity studies on *Daphnia magna* exposed to samples of Heavy Fuel Oil Components show variable chronic toxicity, with a lowest NOEL value of 0.1 mg/l (EMBSI 2012i).

Environmental fate (biodegradation / bioaccumulation): Heavy Fuel Oil Components are hydrocarbon UVCBs. Based on compositional information available and measured or predicted data, key constituents are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of heavy fuel oil show measured or predicted values for log K_{ow} ranging from 4 to greater than 6 and are thus considered potentially bioaccumulative.

Part 2 – Summary of Classification Recommendations – Heavy Fuel Oil Components
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

No classification required.

Health:

Carcinogenic Category 2
Toxic to Reproduction Category 3
Harmful

Environment:

Dangerous for the Environment.

Risk Phrases:

R20: Harmful by inhalation
R45: May cause cancer
R48/21: Harmful: danger of serious damage to health by prolonged exposure in contact with skin
R63 Possible risk of harm to the unborn child
R66: Repeated exposure may cause skin dryness or cracking
R50/53: Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Part 3 – Summary of Classification and Labelling Recommendations – Heavy Fuel Oil Components
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

No classification required

Health:

H350 Carcinogenic Category 1B
H361d Reproductive Toxicity Category 2
H332 Acute Toxicity Category 4
H373 Specific Target Organ Toxicity (repeated exposure) Category 2
H304 Asp. Tox. 1 (unless the kinematic viscosity is above 20.5 mm^2/s, @ 40°C)

Environment:

H400 Acute Aquatic Toxicity Category 1 (M-factor = 1)
H410 Chronic Aquatic Toxicity Category 1 (M-factor = 1)

3.2 Labelling

Pictograms: GHS07, GHS08, GHS09

Signal Words: Danger

Hazard Statements:

H304: May be fatal if swallowed and enters airways.
H332: Harmful if inhaled
H350: May cause cancer
H361d: Suspected of damaging the unborn child
H373: May cause damage to blood, thymus and liver through prolonged or repeated exposure
H410: Very Toxic to aquatic life with long lasting effects (M Factor = 1)
EUH066: Repeated exposure may cause skin dryness or cracking

Precautionary Statements: Six suggested statementsfor use on labels are shown in **bold text**

P201: Obtain special instructions before use
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P273: Avoid release to the environment
P281: Use personal protective equipment as required
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting

P202: Do not handle until all safety precautions have been read and understood
P261: Avoid breathing dust/fume/gas/mist/vapours/spray
P271: Use only outdoors or in a well-ventilated area
P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P308 + P313: IF exposed or concerned: Get medical advice/attention
P312: Call a POISON CENTER or doctor/physician if you feel unwell
P314: Get medical advice/attention if you feel unwell
P391: Collect spillage

P405: Store locked up
P501: Dispose of contents/container to...in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users when classified as carcinogenic Category 1B and used for non-fuel purposes.
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

REFERENCES: HEAVY FUEL OIL COMPONENTS

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UNREFINED/ACID TREATED OILS

Definition / Domain: The unrefined base oils, or vacuum distillate fractions, are complex aliphatic and aromatic hydrocarbon substances. They mostly comprise highly alkylated multi-ring structures and branched alkane constituents, along with some heteroatom (nitrogen, oxygen, sulphur) – containing species, including some gums and resins. The unrefined base oil fractions are subject to further refinery process (chemical or physical) steps to convert them into lubricating oils for commercial use. Treatment with sulphuric acid partially removes aromatics and sulphur-containing species, precipitate asphaltenes and gums, and improve colour and stability.

The category domain of Unrefined/acid treated oils (UATO) is established by the refining processes by which the category members are produced, the predominant hydrocarbon classes present, the boiling point range and the carbon number rages as follows.

- Derived from crude petroleum
- Refinery process
  - Produced by vacuum distillation of the residuum from atmospheric distillation
  - Vacuum distillation fractions with no further treatment (unrefined oils)
  - Vacuum distillate fractions with slight to moderate treatment with sulphuric acid to partially remove aromatics (acid treated oils).
  - Further treatment with sodium hydroxide to neutralize acid residues.
- Hydrocarbon types: highly alkylated multi ring structures, branched alkanes, aromatic hydrocarbons.
- Typical boiling range: 210°C to 800°C
- Typical carbon number range: C_{15} to C_{50}

Part 1 – Classification Endpoint[22] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant **–** UATO are liquids.

Flammable Aerosol: Not relevant **–** UATO are not in aerosol form.

Flammable Liquid: Non flammable **–** UATO flash point >98°C.

Flammable Solid: Not relevant **–** UATO are liquids.

Oxidising Gas: Not relevant **–** UATO are liquids.

Oxidising Liquid: UATO are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant **–** UATO are liquids.

Pyrophoric Liquid: UATO do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant **–** UATO are liquids.

[22] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Self-reactive Substance: UATO are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: UATO do not react exothermically.

Gas under Pressure: Not relevant **–** UATO are liquids.

Organic Peroxide: UATO do not meet the definition of a peroxide.

Corrosive to Metal: UATO are liquids and do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: UATO do not react with water.

1.2 Health Hazards

Acute Toxicity: UATO has been tested in acute oral, dermal studies. Results indicate the following:

Rat oral	LD_{50} > 5000 mg /kg bodyweight (API 1986b)
Rat inhalation	LC_{50}> 5000 mg/m^3 (ARCO 1983)
Rabbit dermal	LD_{50} > 2000 mg/kg bodyweight (API 1986b)

Skin Corrosion / Irritation: Samples of UATO have been tested in rabbit skin irritation non-guideline tests (24h exposure, occluded), which over predicted irritation due to occluded conditions. Only slight irritation would be expected if tested under guideline conditions. Upon repeated exposure some UATO may cause skin dryness or cracking (API 1986b).

Serious Eye Damage / Irritation: A sample of UATO tested in rabbits showed minimal redness which resolved quickly (API 1986b).

Respiratory or Skin Sensitization: A sample of UATO showed no evidence of skin sensitization in guinea pigs. There are no reports available to indicate that UATO have the potential to cause respiratory sensitization (API 1986b).

Germ Cell Mutagenicity: The mutagenic potential of UATO has been extensively studied in a range of *invivo* and *invitro* assays (Blackburn GR et al, 1984, 1986; API 1986c; ARCO 1987; Przygoda RT et al, 1999). Based on the available data, UATOs are not considered to be germ cell mutagens.

Carcinogenicity: The carcinogenic potential of UATO has been investigated in mouse skin painting studies. Results show that UATOs are carcinogenic (Chasey KL and McKee RH, 1993).

Reproductive Toxicity: There are no developmental toxicity data for UATO, but their hazards are assumed to be similar to those of distillate aromatic extracts. In a read-across developmental study from distillate aromatic extracts, heavy paraffinic distillate furfural extract produced maternal, reproductive, and foetal toxicity in Sprague-Dawley rats (Mobil 1989). There are no data on fertility but based on evidence from repeated dose toxicity studies, no effects on reproductive organs are expected (Mobil, 1990, Chasey KL and McKee RH, 1993).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity (API 1986b; ARCO 1983).

Repeated Exposure: The repeat dose toxicity of UATO has been studied in a 28-day sub-acute study. No effects were observed (API 1986a). Read-across subchronic studies performed on distillate aromatic extracts (DAEs) resulted in specific target organ toxicity in the following tissues: adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus (Mobil, 1990, Chasey KL and McKee RH, 1993).

Aspiration: UATO span a range of viscosities with values reported as >2 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: No acute toxicity studies are available for Unrefined/Acid Treated Oils, but suitable read across data is available for Distillate Aromatic Extracts. Read-across studies on acute aquatic toxicity with samples of Distillate Aromatic Extracts show acute toxicity values greater than 1000 mg/l to fish (BP, 1994), 35.9 mg/l to Daphnia (EMBSI, 2010b) and for 18.8 mg/l for algae (EMBSI, 2010a). Tests were carried out on the water accommodated fraction. Results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon composition (Redman A et al, 2010).

Chronic (long-term) Aquatic Hazard: Chronic aquatic toxicity studies on *Daphnia magna* exposed to samples of Unrefined/Acid Treated Oils show variable chronic toxicity, with NOEL values between 0.1 and 1 mg/l (EMBSI 2012j and 2012k).

Environmental fate (biodegradation / bioaccumulation): Unrefined/Acid Treated Oils are hydrocarbon UVCBs. Based on the known or expected properties of individual constituents, category members are not predicted to be readily biodegradable, but are inherently biodegradable. Constituents of Unrefined/Acid Treated Oils show measured or predicted values for $\log K_{ow}$ greater than 4 and are considered potentially bioaccumulative.

Part 2 – Summary of Classification Recommendations – Unrefined / Acid Treated Oils
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

No classification required

Health:

Carcinogenic Category 1
Toxic to Reproduction Category 3
Harmful

Environment:

Dangerous for the Environment.

Risk Phrases:

R45: May cause cancer
R48/21: Danger of serious damage to health by prolonged exposure in contact with skin
R63: Possible risk of harm to the unborn child
R65[23]: Harmful: may cause lung damage if swallowed
R66: Repeated exposure may cause skin dryness or cracking
R51/53: Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment

[23] If the viscosity is >7 mm^2/s @ 40°C, the substance does not need to be classified and labelled R65 and S62 does not apply. The classification as Harmful shall still apply.

Part 3 – Summary of Classification and Labelling Recommendations – Unrefined / Acid Treated Oils
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:
No classification required

Health:
H350 Carcinogenic Category 1A
H361d Reproductive Toxicity Category 2
H372 Specific Target Organ Toxicity (repeated exposure) Category 1
H304 Asp. Tox. 1 (unless the kinematic viscosity is above 20.5 mm^2/s@ 40°C)

Environment:
H411 Chronic aquatic toxicity category 2

3.2 Labelling

Pictograms: GHS08, GHS09

Signal Words: Danger

Hazard Statements:
H304: May be fatal if swallowed and enters airways
H350: May cause cancer
H361d: Suspected of damaging the unborn child
H372: Causes damage to adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus through prolonged or repeated exposure
H411: Toxic to aquatic life with long lasting effects
EUH066: Repeated exposure may cause skin dryness or cracking

Precautionary Statements: S*ix suggested statements for use on labels are shown in* ***bold*** *text*
P201: Obtain special instructions before use
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P273: Avoid release to the environment
P281: Use personal protective equipment as required
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting

P202: Do not handle until all safety precautions have been read and understood
P264: Wash... thoroughly after handling
P270: Do not eat, drink or smoke when using this product
P308 + P313: IF exposed or concerned: Get medical advice/attention
P314: Get medical advice/attention if you feel unwell
P391: Collect spillage
P405: Store locked up
P501: Dispose of contents/container to...in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- **Restricted to professional users due to classification as a carcinogen Category 1A.**
- **If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.**

REFERENCES: UNREFINED / ACID TREATED OILS (UATO)

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API (1986b) Acute oral toxicity study in rats. Acute dermal toxicity study in rabbits. Primary dermal irritation study in rabbits. Primary eye irritation study in rabbits. Dermal sensitization study in guinea pigs. API 84-01 light paraffinic distillate (CAS 64741-50-0). Study conducted by Hazleton Laboratories America Inc. API Med. Res. Publ. 33-30595. WashingtonDC: American Petroleum Institute

API (1986c) Mutagenicity of API 84-01, light paraffinic distillate (CAS 64741-50-0), in a mouse lymphoma mutation assay. Study conducted by Litton Bionetics Inc. API Med. Res. Publ. 33-32801. WashingtonDC: American Petroleum Institute

ARCO (1983) Acute inhalation toxicity study in rats administered test article F-30-02. Study conducted by Bio-Research Laboratories Ltd. Study No. 81677. Los AngelesCA: ARCO

ARCO (1987) Evaluation of chromosome aberrations in Chinese hamster ovary (CHO) cells. Study conducted by Microbiological Associates Inc. ARCO Study No. ATX-85-0059. Los AngelesCA: ARCO

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BP (1994) The acute toxicity of PSG 1860 to rainbow trout (*Oncorhynchus mykiss*). Study conducted by Safepharm Laboratories Ltd. Report No. 692/11. Brussels: BP Oil Europe

BP (1995) Assessment of the effect of PSG 1860 on the reproduction of *Daphnia magna*. Study conducted by Safepharm Laboratories Ltd. Report No. 692/12. Brussels: BP Oil Europe

Chasey, K.L. and McKee, R.H. (1993) Evaluation of the dermal carcinogenicity of lubricant base oils by the mouse skin painting bioassay and other proposed methods. *J Appl Toxicol 13, 1, 57-65*

EMBSI (2010a) Alga- growth inhibition test. Study performed for CONCAWE. EMBSI Study No.0834667. AnnandaleNJ: ExxonMobil Biomedical Sciences Inc.

EMBSI (2010b) Daphnia - acute toxicity test. Study performed for CONCAWE. EMBSI Study No. 0834642A. AnnandaleNJ: ExxonMobil Biomedical Sciences Inc.

EMBSI (2012j). Daphnia sp, reproduction test. MRD-08-346 DAE #2 and MRD-08-385 UATO. Study performed for CONCAWE. EMBSI study No. 0834346. Annandale NJ. ExxonMobil Biomedical Sciences Inc.

EMBSI (2012k). Daphnia sp, reproduction test. MRD-08-346 DAE #2 and MRD-08-385 UATO. Study performed for CONCAWE. EMBSI study No. 0834346A. Annandale NJ. ExxonMobil Biomedical Sciences Inc.

Mobil (1989) Developmental toxicity study in rats exposed dermally to 318 isthmus furfural extract. Mobil Environ. and Health Sci. Lab. Study No. 62884. PrincetonNJ: Mobil Oil Corporation

Mobil (1990) Thirteen-week administration of 318 isthmus furfural extract to rats. Mobil Environ. and Health Sci. Lab. Study No. 61737. PrincetonNJ: Mobil OilCorporation

Przygoda, R.T. et al (1999) Assessment of the utility of the micronucleus test for petroleum-derived materials. *Mutation Research 438, 145-153*

Redman, A. and Yadav, B. (2010) Aquatic toxicity predictions using the PETROTOX model for petroleum substance categories. Report prepared for CONCAWE. MahwahNJ: HydroQual Inc.

HIGHLY REFINED BASE OILS

Definition / Domain: The domain of this category is established by the refining processes by which the category members are produced and the low level of polyaromatic content present in the oils. Additionally, the boiling point range and the carbon number range are as follows:

- Derived from crude petroleum
- Refinery processes
  - vacuum distillation
  - severe solvent extraction
  - dewaxing (solvent or catalytic)
  - severe hydrotreatment or oleum treatment

  N.B.: *some category members are subject to further intermediate processing such as chemical sweetening and/or chemical neutralisation to remove or convert residues of odorous sulphur compounds.*
- At a minimum, satisfies the requirements of the FDA 178.3620 B test elements:
  - UV Absorbance
  - Hot acid test
- Hydrocarbon types: saturated, naphthenic, isoparaffinic
- Boiling point range: 200 to < 600°C
- Carbon number range: predominantly C_{12} to C_{50}
- Very low aromatic and sulphur content

Part 1 – Classification Endpoint[24] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – highly refined base oils are liquids.

Flammable Aerosol: Not relevant – highly refined base oils are liquids.

Flammable Liquid: Flashpoints >112°C.

Flammable Solid: Not relevant – highly refined base oils are liquids.

Oxidising Gas: Not relevant – highly refined base oils are liquids.

Oxidising Liquid: Highly refined base oils are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – highly refined base oils are liquids.

Pyrophoric Liquid: Highly refined base oils do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – highly refined base oils are liquids.

Self-reactive Substance: Highly refined base oils are not self reactive. They do not undergo exothermic decomposition when heated.

[24] Hazard endpoints presented are derived from the EU CLP Regulation ((EC) No 1272/2008) and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Self-heating Substance: Highly refined base oils do not react exothermically.

Gas under Pressure: Not relevant – highly refined base oils are liquids.

Organic Peroxide: Highly refined base oils do not meet the definition of a peroxide.

Corrosive to Metal: Highly refined base oils do not satisfy the requirement for classification as they are not corrosive to metal.

Substance which in contact with water emits flammable gas: Highly refined base oils do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of highly refined base oils have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50}> 5000 mg/kg bodyweight (ARCO 1987a)
Rat inhalation	LC_{50}> 5 mg/l (ARCO, 1988)
Rabbit dermal	LD_{50}> 2000 mg/kg bodyweight (ARCO, 1987a)

Skin Corrosion / Irritation: Samples of highly refined base oils were tested in rabbit skin irritation studies. Results obtained indicate that exposure to highly refined base oils does not results in skin irritation (ARCO, 1987d). There was no evidence of skin corrosion.

Serious Eye Damage / Irritation: Highly refined base oils were not irritating in a guideline test for eye irritation (ARCO, 1987e).

Respiratory or Skin Sensitization: No studies were located for respiratory sensitization. For skin sensitization highly refined base oils were tested and showed no evidence of skin sensitization (ARCO, 1987b).

Germ Cell Mutagenicity: The mutagenic potential of highly refined base oils has been tested via *in vitro* and *in vivo* tests. Results showed no evidence of mutagenic activity (EMBSI, 2003; EBSI, 1985; ARCO, 1987c; McKee RH et al, 1990). Based on the available data, highly refined base oils are not considered to be germ cell mutagens.

Carcinogenicity: Carcinogenic bioassays have been conducted and confirm that highly refined base oils are non-carcinogenic (EMBSI, 2001; Chasey KL et al, 1993).

Reproductive Toxicity: Highly refined base oil was not a reproductive toxicant (OECD 421). The NOAEL for oral exposure is greater than or equal to 1000 mg/kg bw/day and the NOAEL for dermal exposure is greater than or equal to 2000 mg/kg bw/day (Mobil, 1987b; Schreiner C et al, 1997; WIL Research Laboratories, 1995; Mobil, 1987c; McKee RH et al, 1987; Mobil, 1987a).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies do not indicate any specific organ toxicity following single exposure to highly refined base oils (ARCO, 1987a, ARCO, 1988).

Repeated Exposure: The repeat dose toxicity of highly refined base oils has been studied. There is no toxicity associated with these materials, therefore there is no specific target organ toxicity following exposure (Smith J et al, 1996; Firriolo JM et al, 1995; Trimmer GW et al, 2004; Dalbey W et al, 1991; Mobil, 1988; API, 1987).

Aspiration: Highly refined base oils span a range of viscosities reported as >3mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies on WAF of highly refined base oils report LL50 (96h) at >10,000 mg/l for fish (IWL, 1992). For aquatic invertebrates the LL50 (48h) was >100 mg/l (Petro-Canada, 2008a) and the weight of evidence indicates no toxicity to aquatic algae (Petro-Canada, 2008b).

Chronic (long-term) Aquatic Hazard: No chronic toxicity data is available for highly refined base oils, but appropriate read across data are available for the other lubricating base oil category. The key study indicates a NOEL of 3 mg/l based on reproduction for aquatic invertebrates (EMBSI, 2012l). This is supported by a QSAR prediction using PETROTOX, which indicates no chronic toxicity (Redman et al, 2010).

Environmental fate (biodegradation / bioaccumulation): Highly refined base oils are hydrocarbon UVCBs. Based on compositional information available and measured or predicted data on key constituents, highly refined base oils are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of highly refined base oils show measured or predicted values for log K_{ow} greater than 4 and are considered potentially bioaccumulative.

Part 2 – Summary of Classification Recommendations – Highly Refined Base Oils
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:
No classification required.

Health:
Harmful

Environment:
No classification required.

Risk Phrases:
R65 Harmful: may cause lung damage if swallowed (only if viscosity is < 7mm^2/s @40°C)

Part 3 – Summary of Classification and Labelling Recommendations - Highly Refined Base Oils
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:
No classification required.

Health:
H304 Asp. Tox. 1 (unless the kinematic viscosity is above 20.5 mm^2/s @ 40°C)

Environment:
No classification required.

3.2 Labelling

Pictograms: GHS08
Signal Words: Danger

Hazard Statements:
H304: May be fatal if swallowed and enters airways

Precautionary Statements: Suggested statements for use on labels are shown in **bold text**
P102: Keep out of reach of children*
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P331: Do NOT induce vomiting.
P501: Dispose of contents/container to… in accordance with local/regional /national/international regulations (to be specified)
P405*: Store locked up.

Supplemental Hazard Information: Consult CLP legislation as appropriate

***This P-statement is not automatically triggered by the classification and labelling rules for these substances, however based on its physical chemical properties having a viscosity ≤20.5 mm^2/s @40°C it is advised when used in consumer products.**

REFERENCES: HIGHLY REFINED BASE OILS

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ARCO (1987b) Dermal sensitization study in albino guinea pigs administered test article F-52-01 ARCOprime 70. Mideco Study No. 55925. Los AngelesCA: ARCO

ARCO (1987c) Evaluation of chromosome aberrations in Chinese hamster ovary (CHO) cells. Study conducted by Microbiological Associates Inc. ARCO Study No. ATX-85-0054. Los AngelesCA: ARCO

ARCO (1987d) Primary dermal irritation study in rabbits administered test article F-52-01 ARCOprime 70. Mideco Study No. 55923. Los AngelesCA: ARCO

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Trimmer, G.W. et al (2004) Results of chronic dietary toxicity studies of high viscosity (P70H and P100H) white mineral oils in Fischer 344 rats. *Toxicologic Pathology 32, 439-447*

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OTHER LUBRICANT BASE OILS

Definition / Domain: The domain of this category is established by the refining processes by which the category members are produced, the predominant hydrocarbon classes present, the boiling point range and the carbon number range as follows:

- Derived from crude petroleum which is refined by atmospheric and vacuum distillation
- Refinery processes
  - solvent extraction (phenol, furfural and N-methyl pyrrolidone)
  - solvent deasphalting (precipitation with propane)
  - solvent dewaxing or precipitation with methyl ethyl ketone)
  - catalyst dewaxing (isomerisation)
  - acid treatment (sulphuric acid or oleum)
  - hydrocracking (hydrogenation and cracking combined)
  - hydrogen treatment
  - hydrofinishing
  - clay treatment
  - isodewaxing
- Hydrocarbon types: aromatics, paraffins, naphthenics
- Typical boiling ranges of 200ºC to 800ºC
- Typical carbon number range: predominantly C_{12} to C_{120}

Part 1 – Classification Endpoint[25] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – Other Lubricant Base Oils are liquids.

Flammable Aerosol: Not relevant – Other Lubricant Base Oils are not in aerosol form.

Flammable Liquid: Other Lubricant Base Oils typically have flash points >98°C.

Flammable Solid: Not relevant – Other Lubricant Base Oils are liquids.

Oxidising Gas: Not relevant – Other Lubricant Base Oils are liquids.

Oxidising Liquid: Other Lubricant Base Oils are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – Other Lubricant Base Oils are liquids.

Pyrophoric Liquid: Other Lubricant Base Oils do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – Other Lubricant Base Oils are liquids.

Self-reactive Substance: Other Lubricant Base Oils are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Other Lubricant Base Oils do not react exothermically.

[25] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Gas under Pressure: Not relevant – Other Lubricant Base Oils are liquids.

Organic Peroxide: Other Lubricant Base Oils do not meet the definition of a peroxide.

Corrosive to Metal: Other Lubricant Base Oils are liquids and do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Other Lubricant Base Oils do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of Other Lubricant Base Oils have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50}> 5000 mg/kg bodyweight (API, 1982; API,1986b)
Rat inhalation	LC_{50}> 5.53 mg/l (EBSI, 1988)
Rabbit dermal	LD_{50}> 2000 mg/kg bodyweight (API, 1982; API,1986b)

Skin Corrosion / Irritation: Samples of Other Lubricant Base Oils have been tested in rabbit skin irritation studies. The majority of the data were derived using a 24 hour occluded exposure protocol. The study performed on the “insufficiently refined” Other Lubricant Base Oils showed moderate irritation. The study was performed for 24 hours rather than 4 hours and consequently the result from a shorter exposure time is not expected to cause irritation. In studies on “sufficiently refined” Other Lubricant Base Oils no irritation was observed. There was no evidence of skin corrosion (API, 1982; API, 1986b).

Serious Eye Damage / Irritation: The effects of Other Lubricant Base Oils on the eye have been investigated in rabbits using a number of samples. All of the Other Lubricant Base Oils tested were non-irritating to the eyes (API, 1982; API,1986b).

Respiratory or Skin Sensitization: Tests in guinea pig with Other Lubricant Base Oils showed no evidence of skin sensitization (API, 1982; API, 1986b). There are no reports available to indicate a potential to cause respiratory sensitization.

Germ Cell Mutagenicity: The mutagenic potential of Other Lubricant Base Oils has been extensively studied in a range of *in vivo* and *in vitro* assays. The majority of the studies showed no evidence of mutagenic activity (Blackburn et al ,1984; Blackburn et al, 1986; API, 1986d; API, 1986c; ARCO,1987a; ARCO, 1987b, Przygodaet al, 1999; McKee RH, et al, 1990). Based on the available data, Other Lubricant Base Oils are not considered to be germ cell mutagens.

Carcinogenicity: The carcinogenic potential of Other Lubricant Base Oils has been investigated in animals following dermal exposure. Based on these finding, “insufficiently refined” Other Lubricant Base Oils are carcinogenic and the “sufficiently refined” Other Lubricant Base Oils are not carcinogenic (Doak, S.M.A., et al, 1983; Chasey& McKee, 1993).

Reproductive Toxicity: Results of developmental and reproductive toxicity studies on “sufficiently refined” Other Lubricant Base Oils show no evidence of developmental or reproductive toxicity in rats. (WIL Research Laboratories, 1995; Mobil, 1987) There are no developmental toxicity data for "insufficiently refined" Other Lubricant Base Oils, but their hazards are assumed to be similar to those of distillate aromatic extracts. In a read-across developmental study from distillate aromatic extracts, heavy paraffinic distillate furfural extract produced maternal, reproductive, and foetal toxicity in rats (Schreiner, C., et al, 1997; Mobil, 1989). For the “insufficiently refined” Other Lubricant Base Oils, there are no data on fertility but

based on evidence from repeated dose toxicity studies, no effects on reproductive organs are expected.

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity (API, 1982; API, 1986b; API, 1987b; EBSI, 1988).

Repeated Exposure: The repeat dose toxicity of Other Lubricant Base Oils has been investigated by dermal and inhalation routes for periods between 4 weeks and up to 2 years.
"Insufficiently refined" Other Lubricant Base Oils: Read-across subchronic studies performed on distillate aromatic extracts (DAEs) resulted inspecific target organ toxicity in the following tissues: adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus (Mobil, 1990; Chasey & McKee, 1993; API, 1986a).
"Sufficiently refined" Other Lubricant Base Oils: Repeat dose inhalation and dermal studies showed no systemic effects (Dalbey, et al., 1991, API, 1987a; Mobil, 1983, EBSI, 1991).

Aspiration: Other Lubricant Base Oils span a range of viscosities with values reported as >2 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: All acute aquatic toxicity studies with fish, invertebrates and algae on samples of other lubricant base oil show acute toxicity values greater than 100 mg/l. These tests were carried out on water accommodated fractions (Exxon, 1995, Petro Canada 2008, Croucher, E.A. and Girling, A.E.1988).

Chronic (long-term) Aquatic Hazard: Chronic aquatic toxicity studies on samples of Other Lubricant Base Oils show chronic toxicity values greater than 1 mg/l for invertebrates. These tests were carried out on water accommodated fractions (EMBSI, 2012l, Girling, A.E., 1995).

Environmental fate (biodegradation / bioaccumulation): Other Lubricant Base Oils are hydrocarbon UVCBs. Based on compositional information available and measured or predicted data, key constituents are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of Other Lubricant Base Oils show predicted values for log K_{ow} ranging from 2 to greater than 6 and are considered potentially bioaccumulative (HydroQual 2010).

Part 2 – Summary of Classification Recommendations – Other Lubricant Base Oils
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

No classification required.

Health:

Carcinogenic Category 2 (EC DSD Note L; OIN L (DSD))
Harmful (OIN7)

Environment:

No classification required.

Risk Phrases:

R45: May cause cancer
R48/21: Harmful: danger of serious damage to health by prolonged exposure in contact with skin
R63: Possible risk of harm to the unborn child
R65[26]: Harmful: may cause lung damage if swallowed

[26] If the viscosity is >7 mm^2/s @ 40°C, the substance does not need to be classified and labelled R65 and S62 does not apply. The classification as Harmful shall still apply.

Part 3 – Summary of Classification and Labelling Recommendations – Other Lubricant Base Oils
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

No classification required.

Health:

H372 Specific Target Organ Toxicity (repeated exposure) Category 1 (OIN 8)
H350 Carcinogenicity Category 1B (EC CLP Note L; OIN L (CLP))
H361d Reproductive Toxicity Category 2 (OIN 8)
H304 Asp. Tox. 1 (unless the kinematic viscosity is above 20.5 mm^2/s @ 40°C)

Environment:

No classification required.

3.2 Labelling

Pictograms: GHS08
Signal Words: Danger

Hazard Statements:

H304: May be fatal if swallowed and enters airways
H350: May cause cancer
H361d: Suspected of damaging the unborn child.
H372: Causes damage to adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus through prolonged or repeated exposure

Precautionary Statements: Six suggested statements for use on labels are shown in **bold text**

P201: Obtain special instructions before use
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P281: Use personal protective equipment as required
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting
P501: Dispose of contents/container to...in accordance with local/regional /national/international regulations (to be specified)

P202: Do not handle until all safety precautions have been read and understood
P264: Wash... thoroughly after handling
P270: Do not eat, drink or smoke when using this product
P308 + P313: If exposed or concerned: Get medical advice/attention
P314: Get medical advice/attention if you feel unwell
P405: Store locked up

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users when classified as a carcinogen Category1B.
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

REFERENCES: OTHER LUBRICANT BASE OILS

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API (1986c) Mutagenicity of API 83-12, hydrotreated light naphthenic distillate (CAS 64742-53-6), in a mouse lymphoma mutation assay. Study conducted by Litton Bionetics Inc. API Med. Res. Publ. 33-32802. WashingtonDC: American Petroleum Institute

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Mobil (1987) 100 SUS solvent refined base oil developmental toxicity screen in rats. Mobil Environ. and Health Sci. Lab.Study No. 51841. PrincetonNJ: Mobil Oil Corporation

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UNTREATED DISTILLATE AROMATIC EXTRACTS

Definition / Domain: Distillate aromatic extracts is the generic name for extracts of a vacuum distillate produced as by-products in the refining of lube base oils and waxes. Vacuum distillates (lubricating oil basestocks) are extracted with a solvent to selectively remove the aromatic compounds (especially 3-7 fused ring PAC). The solvent is then stripped from the resulting extract, and the remaining aromatic concentrate (aromatic extract) is the untreated distillate aromatic extract (DAE). This may be further processed and the result is a treated DAE (TDAE), which are included in a separate category. DAEs are not intentional mixtures of chemicals but are complex combinations of hydrocarbon species.

The category domain is established by the refining processes by which the category members are produced, the predominant hydrocarbon classes present, the boiling point range and the carbon number range as follows:

- Derived from crude petroleum
- Refinery process:
  - Solvent extraction of vacuum distillate fractions (without further processing)
- Hydrocarbon types: mostly alkylated PAC, naphthenic and isoparaffinic
- Typical Boiling range: 250ºC to 640ºC
- Typical carbon number range: C_{15} to C_{50}

Part 1 – Classification Endpoint[27] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – DAEs are liquids.

Flammable Aerosol: Not relevant – DAEs are not in aerosol form.

Flammable Liquid: DAE typically have flash points > 140°C

Flammable Solid: Not relevant – DAEs are liquids.

Oxidising Gas: Not relevant – DAEs are liquids.

Oxidising Liquid: DAE are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – DAEs are liquids.

Pyrophoric Liquid: DAEs do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – DAEs are liquids.

Self-reactive Substance: DAEs are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: DAEs do not react exothermically.

Gas under Pressure: Not relevant – DAEs are liquids.

[27] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Organic Peroxide: DAEs do not meet the definition of a peroxide

Corrosive to Metal: DAEs do not meet the criteria for corrosion of metal

Substance which in contact with water emits flammable gas: DAEs do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of DAEs have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD50 > 5000 mg/kg bodyweight (API 1986b)
Rat inhalation	LC50> 5 mg/l (ARCO 1983)
Rabbit dermal	LD50 > 3000 mg/kg bodyweight (API 1986b)

Skin Corrosion / Irritation: Samples of DAEs have been tested in rabbit skin irritation non-guideline tests (24h exposure, occluded), which over predict irritation due to occluded conditions. No more than slight irritation would be expected in a guideline study (API 1986b). Upon repeated exposure some DAEs may cause skin dryness or cracking.

Serious Eye Damage / Irritation: The effects of DAEs on the eye have been investigated in rabbits. Results showed minimal redness which resolved quickly (API 1986b).

Respiratory or Skin Sensitization: Tested in guinea pigs, samples of DAEs showed no evidence of skin sensitization (API 1986b). There are no reports available to indicate DAE have the potential to cause respiratory sensitization.

Germ Cell Mutagenicity: The mutagenic potential of DAEs has been extensively studied in a range of *in vivo* and *in vitro* assays (Blackburn et al. 1984, 1986; API 1986c; Mobil 1987). Based on the available data, DAE are not considered germ cell mutagens.

Carcinogenicity: The carcinogenic potential of DAEs has been investigated in mouse skin painting studies. Results show that DAEs are carcinogenic (Gradiski et al. 1983).

Reproductive Toxicity:
In a developmental study a distillate aromatic extract caused maternal, reproductive, and foetal toxicity in rats (Mobil, 1989). There are no data on fertility but based on evidence from repeated dose toxicity studies, no effects on reproductive organs are expected (Mobil, 1990).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity (API, 1986b; ARCO, 1983).

Repeated Exposure: The repeat dose toxicity of DAE has been studied in a 28-day sub-acute study. No evident effects were observed (API, 1986a). However, results from subchronic studies performed on DAE resulted in specific target organ toxicity in the following tissues: adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus. The NOAEL was < 30 mg/kg bodyweight (Mobil, 1990).

Aspiration: DAEs span a range of viscosities with values reported as >10 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Studies on acute aquatic toxicity with samples of DAEs show acute toxicity values greater than 1000 mg/l for fish, 35.9 mg/L (BP, 1994) for Daphnia (EMBSI, 2010b) and 18.8 mg/l for algae (EMBSI, 2010a). Tests were carried out on water accommodated fractions.

Chronic (long-term) Aquatic Hazard: Chronic aquatic toxicity studies on *Daphnia magna* exposed to samples of DAEs show variable chronic toxicity, with NOEL values between 0.1 and 1 mg/l (EMBSI 2012j and 2012k).

Environmental fate (biodegradation / bioaccumulation): DAEs are hydrocarbon UVCBs. Based on the known or expected properties of individual constituents, category members are not predicted to be readily biodegradable but are inherently biodegradable. Constituents of DAEs show measured or predicted values for log K_{ow} ≥ 4 and are considered potentially bioaccumulative.

Part 2 – Summary of Classification Recommendations – Untreated Distillate Aromatic Extracts
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:
No classification required

Health:
Carcinogenic Category 2
Toxic to Reproduction Category 3
Harmful

Environment:
Dangerous for the Environment.

Risk Phrases:
R45: May cause cancer
R48/21: Danger of serious damage to health by prolonged exposure in contact with skin
R63: Possible risk of harm to the unborn child
R66: Repeated exposure may cause skin dryness or cracking
R51/53: Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Part 3 – Summary of Classification and Labelling Recommendations – Untreated Distillate Aromatic Extracts
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

No classification required

Health:

H350 Carcinogenic Category 1B
H361d Reproductive Toxicity Category 2
H372 Specific Target Organ Toxicity (repeated exposure) Category 1
H304 Asp. Tox. 1 (unless the kinematic viscosity is above 20.5 mm^2/s, @ 40°C).

Environment:

H411 Chronic Aquatic Toxicity Category 2

3.2 Labelling

Pictograms: GHS08, GHS09

Signal Words: Danger

Hazard Statements:

H304: May be fatal if swallowed and enters airways
H350: May cause cancer
H361d: Suspected of damaging the unborn child
H372: Causes damage to adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus through prolonged or repeated exposure
H411: Toxic to aquatic life with long lasting effects
EUH066: Repeated exposure may cause skin dryness or cracking

Precautionary Statements: Six suggested statements for use on labels are shown in **bold text**

P201: Obtain special instructions before use
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P273: Avoid release to the environment
P281: Use personal protective equipment as required
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician ( )
P331: Do NOT induce vomiting ( )

P202: Do not handle until all safety precautions have been read and understood
P264: Wash... thoroughly after handling
P270: Do not eat, drink or smoke when using this product
P308 + P313: IF exposed or concerned:Get medical advice/attention
P314: Get medical advice/attention if you feel unwell
P405: Store locked up
P501: Dispose of contents/container to...in accordance with local/regional /national/international regulations (to be specified)

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users as a result of classification as carcinogenic Category 1B
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

REFERENCES: UNTREATED DISTILLATE AROMATIC EXTRACTS

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Mobil (1989) Developmental toxicity study in rats exposed dermally to 318 isthmus furfural extract. Mobil Environ. and Health Sci. Lab. Study No. 62884. PrincetonNJ: Mobil Oil Corporation

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TREATED DISTILLATE AROMATIC EXTRACTS (TDAE)

Definition / Domain: Distillate aromatic extracts is the generic name for extracts of a vacuum distillate produced as by-products in the refining of lube base oils and waxes. Vacuum distillates (lubricating oil basestocks) are extracted with a solvent to selectively remove the aromatic compounds (especially 3-7 fused ring PAC). The solvent is then stripped from the resulting extract, and the remaining aromatic concentrate (aromatic extract) is the untreated distillate aromatic extract (DAE), which are included in a separate category.
The distillate aromatic extract may be further processed and the result is a treated DAE (TDAE) produced to meet physical-chemical and technical specifications, rather than chemical composition. TDAEs are not intentional mixtures of chemicals but are complex combinations of hydrocarbon species.

The category domain of TDAE is established by the refining processes by which the category members are produced, the predominant hydrocarbon classes present, the boiling point range and the carbon number rages as follows:

- Derived from crude petroleum
- Refinery process:
  - Solvent extraction of vacuum distillate fractions and further processing such as:
    - Hydrotreatment
    - Hydrodesulphurization
    - Clay-treatment
    - Acid-treatment
    - Carbon-treatment
    - Further solvent extraction
- Hydrocarbon types: mostly alkylated PAC, naphthenic and isoparaffinic. TDAE subjected to hydrotreatment may significantly decrease levels of PAC contained in them.
- Typical boiling range: 250ºC to 640ºC
- Typical carbon number range: C_{13} to C_{50}

Part 1 – Classification Endpoint[28] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant –TDAEs are liquids.

Flammable Aerosol: Not relevant –TDAEs are not in aerosol form.

Flammable Liquid: TDAEs typically have flash points>140°C.

Flammable Solid: Not relevant –TDAEs are liquids.

Oxidising Gas: Not relevant –TDAEs are liquids.

Oxidising Liquid: TDAEs are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant –TDAEs are liquids.

[28] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Pyrophoric Liquid: TDAEs do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant –TDAEs are liquids.

Self-reactive Substance: TDAEs are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: TDAEs do not react exothermically.

Gas under Pressure: Not relevant –TDAEs are liquids.

Organic Peroxide: TDAEs do not meet the definition of a peroxide.

Corrosive to Metal: TDAEs are liquids and do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: TDAEs do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples representative of TDAE have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50} > 5000 mg/kg bodyweight (API 1986b, API 1982)
Rat inhalation	LC_{50}> 5 mg/l (ARCO 1983, EMBSI 1988)
Rabbit dermal	LD_{50} >3000mg/kg bodyweight (API 1986b, API 1982)

Skin Corrosion / Irritation: Samples representative of TDAE have been tested in rabbit skin irritation non-guideline tests (24h exposure, occluded), which over predict irritation due to occluded conditions. No more than slight irritation would be expected in a guideline study. Upon repeated exposure some TDAE may cause skin dryness or cracking (API 1986b; API 1982).

Serious Eye Damage / Irritation: The irritating potential of samples representative of TDAE has been investigated in rabbits. Results showed minimal eye redness which resolved quickly (API 1986b; API 1982).

Respiratory or Skin Sensitization: Tested in guinea pigs, samples representative of TDAE showed no evidence of skin sensitization. There are no reports available to indicate TDAE have the potential to cause respiratory sensitization (API 1986b; API 1982).

Germ Cell Mutagenicity: The mutagenic potential of samples representative of TDAE has been extensively studied in a range of *in vivo* and *in vitro* assays. Based on the available data, TDAE are not considered germ cell mutagens (Blackburn et al. 1984, 1986; API 1986c,d; Mobil 1987a; Mckee, et al, 1990).

Carcinogenicity: The carcinogenic potential of samples representative of TDAE has been investigated in mouse skin painting studies. Results suggest that TDAE with ≥ 3% DMSO extractables as measured by IP346 have the potential to cause skin tumours (Gradiski et al. 1983). Samples representative of TDAE with lower levels of polycyclic aromatic compounds (PAC) (with < 3% DMSO extractables) are not carcinogenic (Doak, S.M.A. et al, 1983).

Reproductive Toxicity: The reproductive toxicity of TDAE with less than 3% DMSO extractables is read across to Other Lubricant Base Oils. Results of developmental and reproductive toxicity studies on “sufficiently refined” Other Lubricant Base Oils did not show any evidence of developmental or reproductive toxicity in rats (WIL Research Laboratories, 1995; Mobil, 1987b).

There are no developmental toxicity data for TDAE, but their hazards are assumed to be similar to those of distillate aromatic extracts. In a read-across developmental study from distillate aromatic extracts, heavy paraffinic distillate furfural extract produced maternal, reproductive, and foetal toxicity in rats (Mobil, 1989). For TDAE with ≥ 3% DMSO extractables, there are no data on fertility but based on evidence from repeated dose toxicity studies of representative samples, no effects on reproductive organs are expected (Mobil 1987b).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity (API 1986b, API 1982; ARCO 1983; EBSI 1988).

Repeated Exposure: The repeat dose toxicity of representative samples of TDAE has been investigated by dermal and inhalation routes for periods between 4 weeks and up to 2 years.
TDAE (≥3% DMSO extractables): Read-across subchronic studies resulted in specific target organ toxicity in the following tissues: adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus (Mobil, 1990; API 1986a).
TDAE (<3% DMSO extractables): Repeat dose inhalation and dermal studies showed no systemic effects (Dalbey, et al., 1991, API, 1987; Mobil, 1983; EBSI, 1991a,b).

Aspiration: TDAEs span a range of viscosities with values reported as >10 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute aquatic toxicity studies on samples of TDAEs, carried out using the WAF methodology, report acute toxicity values for fish, crustaceans and algae greater than 100 mg/l (BP, 1994; BP, 1995, EMBSI, 2010a and 2010b).

Chronic (long-term) Aquatic Hazard: Chronic aquatic toxicity studies on *Daphnia magna* exposed to a sample of TDAE show a NOEL value above 1000 mg/l (BP, 1995).

Environmental fate (biodegradation / bioaccumulation): Treated Distillate Aromatic Extracts are hydrocarbon UVCBs. Based on the known or expected properties of individual constituents, category members are not predicted to be readily biodegradable but are inherently biodegradable. Constituents of treated distillate aromatic extracts show measured or predicted values for log K_{ow} ≥4 and are therefore considered potentially bioaccumulative.

Part 2 – Summary of Classification Recommendations – Treated Distillate Aromatic Extracts
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:
No classification required

Health:
Carcinogenic Category 2 (EC DSD Note L)
Toxic to Reproduction Category 3 (OIN 7)
Harmful (OIN 7).

Environment:
No classification required.

Risk Phrases:
R45: May cause cancer
R48/21: Danger of serious damage to health by prolonged exposure in contact with skin
R63: Possible risk of harm to the unborn child
R66: Repeated exposure may cause skin dryness or cracking

Part 3 – Summary of Classification and Labelling Recommendations – Treated Distillate Aromatic Extracts
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:
No classification required.

Health:
H350 Carcinogenic Category 1B (EC CLP Note L)
H361d Reproductive Toxicity Category 2 (OIN 8)
H372 Specific Target Organ Toxicity (repeated exposure) Category 1 (OIN 8)
H304 Asp. Tox. 1 (unless the kinematic viscosity is above 20.5 mm^2/s, @ 40°C).

Environment:
No classification required.

3.2 Labelling

Pictograms: GHS08, GHS09

Signal Words: Danger

Hazard Statements:
H304: May be fatal if swallowed and enters airways H350: May cause cancer
H361d: Suspected of damaging the unborn child
H372: Causes damage to adrenals, bone marrow, liver, lymph nodes, kidney, stomach, thymus through prolonged or repeated exposure
EUH066: Repeated exposure may cause skin dryness or cracking

Precautionary Statements: Six suggested statements for use on labels shown in **bold text**
P201: Obtain special instructions before use
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P281: Use personal protective equipment as required
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER ordoctor/physician P331: Do NOT induce vomiting
P501: Dispose of contents/container to….in accordance with local/regional /national/international regulations (to be specified)

P202: Do not handle until all safety precautions have been read and understood
P264: Wash ... thoroughly after handling
P270: Do not eat, drink or smoke when using this product
P308 + P313: IF exposed or concerned: Get medical advice/attention
P314: Get medical advice/attention if you feel unwell
P405: Store locked up

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:
- Restricted to professional users when classified as a carcinogen Category1B.
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.
- If the substance is not classified, then use of the supplemental phrase EUH066 is not required.

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BP (1995) Assessment of the effect of PSG 1861 on the reproduction of *Daphnia magna*. Study conducted by Safepharm Laboratories Ltd. Report No. 692/15. Brussels: BP Oil Europe

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Mobil (1983) Thirteen-week toxicity study by dermal application of metalworking fluid components to rats. Mobil Environ. and Health Sci. Lab. Study No. 1451-81. PrincetonNJ: Mobil Oil Corporation

Mobil (1987a) Micronucleus assay of bone marrow red blood cells from rats treated for thirteen weeks with 318 isthmus furfural extract. Mobil Environ. and Health Sci. Lab. Study No. 61738. PrincetonNJ: Mobil Oil Corporation

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RESIDUAL AROMATIC EXTRACTS

Definition / Domain: The domain of this category is established by the refining process by which the category members are produced and the boiling point range and the carbon number range as follows:

- Derived from crude petroleum
- Refinery processes
  - Atmospheric distillation
  - Vacuum distillation
  - Propane extraction (deasphalting)
  - Solvent extraction
- Hydrocarbon types: alkylated aromatics, mixed aromatic cycloalkanes, and cycloparaffins
- Boiling point range: >380°C
- Carbon number range: predominantly > C_{25}

Part 1 – Classification Endpoint[29] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – residual aromatic extracts are liquids.

Flammable Aerosol: Not relevant – residual aromatic extracts are not in aerosol form.

Flammable Liquid: Residual aromatic extracts typically have flash points greater than 250°C.

Flammable Solid: Not relevant – residual aromatic extracts are liquids.

Oxidising Gas: Not relevant – residual aromatic extracts are liquids.

Oxidising Liquid: Residual aromatic extracts are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – residual aromatic extracts are liquids.

Pyrophoric Liquid: Residual aromatic extracts do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – residual aromatic extracts are liquids.

Self-reactive Substance: Residual aromatic extracts are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Residual aromatic extracts do not react exothermically.

Gas under Pressure: Not relevant – residual aromatic extracts are liquids.

Organic Peroxide: Residual aromatic extracts do not meet the definition of a peroxide.

Corrosive to Metal: Residual aromatic extracts do not meet the criteria for corrosionof metal.

[29] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Substance which in contact with water emits flammable gas: Residual aromatic extracts do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of residual aromatic extracts have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50}	>5000 mg/kg bodyweight (API, 1986)
Rat inhalation	LC_{50}	>5 mg/l (ARCO, 1983)
Rabbit dermal	LD_{50}	>2000 mg/kg bodyweight (API, 1986)

Skin Corrosion / Irritation: No primary skin irritation studies were located for residual aromatic extracts; however, a read-across skin irritation study from distillate aromatic extract was identified which was conducted under occluded conditions for 24 hours instead of semi-occluded conditions for 4 hours (API 1986). No more that slight irritation is expected in a guideline study. Additionally, residual aromatic extracts did not elicit skin irritation based on observations made during repeated dermal exposure studies (API, 1986). There was no evidence of skin corrosion.

Serious Eye Damage / Irritation: Based on read across to studies conducted with distillate aromatic extracts, results indicate that residual aromatic extracts would not be expected to cause irritation (API, 1986).

Respiratory or Skin Sensitization: No studies were located for respiratory sensitization. Based on a read-across study from distillate aromatic extract, residual aromatic extracts are not expected to be skin sensitisers (API, 1986).

Germ Cell Mutagenicity: The mutagenic potential of residual aromatic extracts has been studied in both *in vitro* and *in vivo* investigations. Based on the available data, residual aromatic extracts are not considered to be germ cell mutagens (Blackburn GR et al, 1996; Mobil, 1998a,b,c; EBSI, 1997a,b; Institut Pasteur de Lille, 2000; CIT, 2001; Mobil, 1988).

Carcinogenicity: Residual aromatic extracts have been tested in mouse skin painting assays. Results indicate that some residual aromatic extracts can cause dermal carcinogenic lesions. Carcinogenic activity is likely related to the content of biologically active polycyclic aromatic hydrocarbons, which can be predicted based on results from modified Ames tests. Based on the limited evidence available, the relevance of these data for humans remains inconclusive; therefore, residual aromatic extracts should be considered a possible human carcinogen (EMBSI, 2005; Mobil, 2001; Kane M et al, 1984; King DJ, 1991; Mobil, 1991).

Reproductive Toxicity: In a key read across fertility study with roofing asphalt fume condensate, no reproductive effects were noted (Fraunhofer, 2009). In a developmental toxicity study conducted with residual aromatic extract, no effects were observed (Mobil, 1989).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity. (API, 1986; ARCO, 1983).

Repeated Exposure: There was no systemic toxicity in repeat dose toxicity studies. The results from 2 year dermal carcinogenic studies indicate only dermal effects are likely (Mobil, 1990; EMBSI, 2005; Mobil, 2001; Kane M et al, 1984; King DJ, 1991; Mobil, 1991).

Aspiration: Residual aromatic extracts span a range of viscosities with values reported as >2000 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Samples of Residual Aromatic Extracts have been tested in acute studies with fish and Daphnia. Results show the LL50 was >1000 mg/l for fish and Daphnia (BP, 1994a; BP, 1994b). To assess the impact on alga a PETROTOX QSAR prediction was used, with an EL_{50} (72h) of >1000 mg/l based on growth rate (Redman, 2010).

Chronic (long-term) Aquatic Hazard: Samples of Residual Aromatic Extracts have been tested in 21-day *Daphnia magna* reproduction toxicity tests, and the EL_{50} was > 1,000 mg/l (BP, 1995).

Environmental fate (biodegradation / bioaccumulation): Residual aromatic extracts are hydrocarbon UVCBs. Based on the known or expected properties of individual constituents, category members are not predicted to be readily biodegradable but are inherently biodegradable. Constituents of residual aromatic extracts show measured or predicted values for log $K_{ow} \geq 4$ and are considered potentially bioaccumulative.

Part 2 – Summary of Classification Recommendations – Residual Aromatic Extracts
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:
No classification required.

Health:
Carcinogenic Category 3 (OIN 9)

Environment:
No classification required.

Risk Phrases:
R40: Limited evidence of a carcinogenic effect

Part 3 – Summary of Classification and Labelling Recommendations – Residual Aromatic Extracts
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:
No classification required.
Health:
H351 Carcinogenic Category 2 (OIN 10)
Environment:
No classification required.

3.2 Labelling

Pictograms: GHS08
Signal Words: Warning

Hazard Statements:
H351: Suspected of causing cancer

Precautionary Statements: Suggested statements for use on labels are shown in **bold text**
P201: Obtain special instructions before use
P281: Use personal protective equipment as required
P308 + P313: IF exposed or concerned: Get medical advice/attention
P501: Dispose of contents/container to…in accordance with local/regional /national/international regulations (to be specified)

P202: Do not handle until all safety precautions have been read and understood
P405: Store locked up

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- If the worst case classification does not apply, the material is not classified as hazardous.

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SLACK WAXES

Definition / Domain: The domain of this category is established by the refining processes by which the category members are produced, the predominant hydrocarbon classes present, the melting point range and the carbon number range as follows:

- Derived from vacuum distilled fractions and separated as a semi-solid by chilling
- Refinery processes
  - atmospheric distillation
  - vacuum distillation
  - hydrotreatment / hydrodesulfurization
  - solvent extraction
  - chilling

N-B.: *some category members are subject to further intermediate processing such as de-oiling or treatment with acid, clay, active carbon or hydrogenation but without changing their hydrocarbon composition significantly.*

- Hydrocarbon types: The major components of all slack waxes are branched and straight chair paraffin's and naphthenes (cycloparaffins), which normally account for at least 85% by volume of a wax process stream. Aromatic hydrocarbons, mainly alkylbenzenes and alkylnaphthalenes will not normally exceed 15% by volume of slack wax streams. The boiling points of hazardous, 3 to 7 fused-ring polycyclic aromatic hydrocarbons (PAHs) are in the boiling range of the petroleum waxes, but they are removed by solvent extraction before chilling and wax separation.
- Typical melting point range: predominantly 43°C to 76°C
- Typical boiling point range: predominantly 300°C to 800°C
- Typical carbon number range: predominantly C_{12} to C_{120}

Part 1 – Classification Endpoint[30] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – slack waxes are solids.

Flammable Aerosol: Not relevant – slack waxes are solids.

Flammable Liquid: Not relevant – slack waxes are solids.

Flammable Solid: Slack waxes do not meet the requirement for classification as a flammable solid.

Oxidising Gas: Not relevant – slack waxes are solids.

Oxidising Liquid: Not relevant – slack waxes are solids.

Oxidising Solid: Slack waxes are not considered oxidising based on structural considerations.

Pyrophoric Liquid: Not relevant – slack waxes are solids.

[30] Hazard endpoints presented are derived from the EU CLP Regulation ((EC) No 1272/2008) and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Pyrophoric Solid: Slack waxes do not spontaneously ignite in contact with air.

Self-reactive Substance: Slack waxes are not self reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Slack waxes do not react exothermically.

Gas under Pressure: Not relevant – slack waxes are solids.

Organic Peroxide: Slack waxes do not meet the definition of a peroxide.

Corrosive to Metal: Slack waxes do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Slack waxes do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of substances representative of slack waxes have been tested in acute oral and dermal studies. Results indicate the following:

Rat oral	LD_{50}>5000 mg/kg bodyweight (API, 1982; API, 1986b)
Rabbit dermal	LD_{50}>2000 mg/kg bodyweight (API, 1982; API, 1986b)

Skin Corrosion / Irritation: Slack waxes from carcinogenic or unknown feed stock were tested in rabbit skin irritation studies (API, 1986b). Studies were conducted with a non-guideline 24 hour test with occlusive dressing. If a 4 hour test with semi-occlusive dressing was conducted the material would not be expected to be irritating to skin. Slack wax from non-carcinogenic feed stock was tested in human volunteers and showed no evidence of irritation (EBSI, 1988). There was no evidence of irritation or corrosion.

Serious Eye Damage / Irritation: Eye irritation potential of a substance representative of slack wax (from carcinogenic or unknown feed stock) was evaluated in rabbits. Based on the results, the material is not considered to be an eye irritant (API, 1986b).
Read across from a sufficiently refined other lubricant base oil showed no evidence of irritation indicating that slack waxes from non-carcinogenic feedstock are not irritating to the eye (API, 1982).

Respiratory or Skin Sensitization: No studies were available for respiratory sensitization. For skin sensitizationa slack waxes from carcinogenic or unknown feed stocks was evaluated by read across and determined to be non-sensitising (API, 1986b). For slack waxes from a non-carcinogenic feed stock, read across studies from Other Lubricant Base Oils indicate that dermal sensitization was not observed (API, 1982, EBSI, 1988).

Germ Cell Mutagenicity: Samples representative of slack waxes produced mixed results in *in vitro* assays. In *in vivo* assays the samples did not produce any clastogenetic effects in the mouse micronucleus assay. Based on the available data, slack waxes are not considered to be germ cell mutagens (Blackburn, CR et al, 1984; Blackburn GR et al, 1986; Petrolabs, 2004; API, 1986d; API, 1986c; ARCO, 1987a; ARCO, 1987b; Przygoda RT et al, 1999; McKee RH, 1990).

Carcinogenicity: The carcinogenic potential of slack waxes is determined by the feedstock from which the slack wax is derived. Based on the available data, studies with slack waxes from insufficiently refined feedstock were carcinogenic, while those from sufficiently refined feedstocks were not (Smith WE et al, 1951; Kane ML et al, 1984).

Reproductive Toxicity: The reproductive toxicity potential of slack waxes is determined by the feedstock from which the slack wax is derived. For slack waxes from non carcinogenic feed-stock, a key read across screening study indicated no reproductive or developmental effects. An additional developmental toxicity study showed no effects (WIL Research Laboratories, 1995; Mobil, 1987).
For slack wax derived from carcinogenic feedstock a read across study from distillate aromatic extracts indicates developmental effects are likely (Mobil, 1989).

Specific Target Organ Toxicity

Single Exposure: Acute exposure studies show no specific organ toxicity following single exposure to slack waxes (API, 1982; API, 1986b).

Repeated Exposure: The repeat dose toxicity of slack waxes from carcinogenic or unknown feed stocks was assessed using read across. Results indicate that oral and dermal exposure is likely to result in target organ toxicity (adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus) (Mobil, 1990; Chasey & McKee, 1993).
For slack waxes from non carcinogenic feed-stocks, dermal repeat dose read across studies showed no evidence of target organ toxicity (Mobil, 1983; API, 1986a; API, 1987; EBSI, 1991).

Aspiration: Viscosity of slack waxes at 40°C is not determined and in most cases the melting point is above this temperature. Viscosity for slack wax ranges from 2.2 to 30 mm^2/s at 100°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: All acute aquatic toxicity studies with fish, invertebrates and algae on samples representative of slack waxes (read across from Other Lubricant Base Oils) show acute toxicity values greater than 100 mg/l. These tests were carried out on water accommodated fractions (EBSI, 1995; Petro-Canada 2008; Croucher, E.A. and Girling, A.E., 1988). Supporting acute toxicity QSAR predictions for fish, invertebrates and algae show toxicity above 1000 mg/l (Redman 2010).

Chronic (long-term) Aquatic Hazard: Chronic aquatic toxicity studies on samples representative of slack waxes (reading across from Other Lubricant Base Oils) show chronic toxicity values greater than 1 mg/l for invertebrates. These tests were carried out on water accommodated fractions (Girling, A.E., 1995). A supporting QSAR prediction for chronic fish toxicity is greater than 1000 mg/l (Redman, 2010).

Environmental fate (biodegradation / bioaccumulation): Slack waxes are hydrocarbon UVCBs. Based on compositional information available and measured or predicted data, key constituents are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of slack waxes show predicted values for log K_{ow} ranging from 2 to greater than 6 and are therefore considered potentially bioaccumulative. (HydroQual, 2010)

Part 2 – Summary of Classification Recommendations – Slack Waxes Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

No classification required.

Health:

Carcinogenic Category 2 (EC DSD Note N)
Reproductive Hazard Category 3 (OIN 7)
Harmful

Environment:

No classification required.

Risk Phrases:

R45: May cause cancer
R63: Possible risk of harm to the unborn child
R48/21: Harmful: danger of serious damage to health by prolonged exposure in contact with skin

Part 3 – Summary of Classification and Labelling Recommendations – Slack Waxes
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

No classification required.

Health:

H350 Carcinogen Category 1B (EC CLP Note N)
H372 Specific Target Organ Toxicity (repeated exposure) Category 1 (OIN 8)
H361d Reproductive Toxicity Category 2 (OIN 8)

Environment:

No classification required.

3.2 Labelling

Pictograms: GHS08

Signal Words: Danger

Hazard Statements:

H350: May cause cancer
H372: Causes damage to organs adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus, through prolonged or repeated exposure
H361d: Suspected of damaging the unborn child

Precautionary Statements: Suggested statements for use on labels are shown in **bold text**

P201: Obtain special instructions before use
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P281: Use personal protective equipment as required
P308 + P313: IF exposed or concerned: Get medical advice/attention
P501: Dispose of contents/container to….in accordance with local/regional /national/international regulations (to be specified)

P202: Do not handle until all safety precautions have been read and understood
P264: Wash ... thoroughly after handling
P270: Do not eat, drink or smoke when using this product
P314: Get medical advice/attention if you feel unwell
P405: Store locked up

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users when classified as carcinogen Category 1B.
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

REFERENCES: SLACK WAXES

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API (1986a) 28-day dermal toxicity study in the rabbit of API 84-01. Light paraffinic distillate (CAS 64741-50-0). Study conducted by Tegeris Laboratories Inc. API Med. Res. Publ. 33-31642. WashingtonDC: American Petroleum Institute

API (1986b) Acute oral toxicity study in rats. Acute dermal toxicity study in rabbits. Primary dermal irritation study in rabbits. Primary eye irritation study in rabbits. Dermal sensitization study in guinea pigs. API 84-01 light paraffinic distillate (CAS 64741-50-0). Study conducted by Hazleton Laboratories America Inc. API Health Environ. Sci. Dep. Rep. 33-30595. WashingtonDC: American Petroleum Institute

API (1986c) Mutagenicity of API 83-15, heavy naphthenic distillate (CAS 64742-52-5), in a mouse lymphoma mutation assay. Study conducted by Litton Bionetics Inc. API Med. Res. Publ. 33-32800. WashingtonDC: American Petroleum Institute

API (1986d) Mutagenicity of API 84-01, light paraffinic distillate (CAS 64741-50-0), in a mouse lymphoma mutation assay. Study conducted by Litton Bionetics Inc. API Med. Res. Publ. 33-32801. WashingtonDC: American Petroleum Institute

API (1987) 28-day dermal toxicity study of API 83-15, hydrotreated heavy naphthenic distillate (CAS 64742-52-5), in the rabbit. Study conducted by Tegeris Laboratories Inc. API Health Environ. Sci. Dep. Rep. 35-32430. WashingtonDC: American Petroleum Institute

ARCO (1987a) Evaluation of chromosome aberrations in Chinese hamster ovary (CHO) cells. Study conducted by Microbiological Associates Inc. ARCO Study No. ATX-85-0059. Los AngelesCA: ARCO

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Croucher, E.A. and Girling, A.E. (1988) Oils: acute toxicity of four oils to *Daphnia magna* and *Gammarus pulex*. Report No. SBGR.88.075. Sittingbourne: Shell Research Ltd

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EBSI (1995) Fish, acute toxicity test. MRD-94-981 basestock solvent neutral 600. Report prepared for Exxon Company International. EBSI Study No. 198140. East MillstoneNJ: Exxon Biomedical Sciences Inc.

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Kane, M.L. et al (1984) Toxicological characteristics of refinery streams used to manufacture lubricating oils. *Am J Ind Med 5, 3, 183-200*

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Mobil (1983) Thirteen-week toxicity study by dermal application of metalworking fluid components to rats. Mobil Environ. and Health Sci. Lab. Study No. 1451-81. PrincetonNJ: Mobil Oil Corporation

Mobil (1987) 100 SUS solvent refined base oil developmental toxicity screen in rats. Mobil Environ. and Health Sci. Lab. Study No. 51841. PrincetonNJ: Mobil Oil Corporation

Mobil (1989) Developmental toxicity study in rats exposed dermally to 318 isthmus furfural extract. Mobil Environ. and Health Sci. Lab. Study No. 62884. PrincetonNJ: Mobil Oil Corporation

Mobil (1990) Thirteen-week administration of 318 isthmus furfural extract to rats. Mobil Environ. and Health Sci. Lab. Study No. 61737. PrincetonNJ: Mobil Oil Corporation

Petro-Canada (2008) 72-hour growth inhibition toxicity test report. *Pseudokirchneriella subcapitata*. Study performed by AquaTox Testing & Consulting Inc. Study No. 213706. MississaugaON: Petro-Canada Research & Development

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Przygoda, R.T. et al (1999) Assessment of the utility of the micronucleus test for petroleum-derived materials. *Mutation Research 438, 145-153*

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WIL Research Laboratories (1995) An oral reproduction/developmental toxicity screening study of OLOA 219 in finished oils in rats. Study conducted for Chevron Research and Technology Company. Study No. WIL-187007. AshlandOH: WIL Research Laboratories Inc.

PARAFFIN AND HYDROCARBON WAXES

Definition / Domain: The domain of this category is established by the process by which the category members are produced, the predominant hydrocarbon classes present, the melting point range and the carbon number range as follows:

- Derived from vacuum distilled fractions and separated as a solid by chilling.
- Refinery processes
  - atmospheric distillation
  - vacuum distillation
  - hydrotreatment / hydrodesulfurization
  - solvent extraction
  - chilling

Note: *some category members are subject to further processing such as de-oiling or treatment with acid, clay, active carbon or hydrogenation but without changing their hydrocarbon composition significantly.*

- Hydrocarbon types: the major components of all paraffin and hydrocarbon waxes are branched and straight chain paraffin's and naphthenes (cycloparaffins), which normally account for at least 85% by volume of a wax process stream. Aromatic hydrocarbons, mainly alkylbenzenes and alkylnaphthalenes will not normally exceed 15% by volume of paraffin and hydrocarbon wax streams. The boiling point range of paraffin and hydrocarbon waxes is such that components of specific toxicological concern such as benzene (boiling point 80°C) and n-hexane (boiling point 69°C) are typically not present. The boiling points of the hazardous, 3 to 7 fused-ring polycyclic aromatic hydrocarbons (PAHs) are in the boiling range of the paraffin and hydrocarbon waxes, but they are removed by solvent extraction before chilling and wax separation.
- Typical melting point range: predominantly 43°C to 95°C
- Typical boiling point range: predominantly 300°C to 800°C
- Typical carbon number range: predominantly C_{12} to C_{85}

Part 1 – Classification Endpoint[31] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – paraffin and hydrocarbon waxes are solids.

Flammable Aerosol: Not relevant – paraffin and hydrocarbon waxes are solids.

Flammable Liquid: Not relevant – paraffin and hydrocarbon waxes are solids.

Flammable Solid: Paraffin and hydrocarbon waxes do not meet the requirement for classification as a flammable solid as the flash point is typically >160°C.

Oxidising Gas: Not relevant – paraffin and hydrocarbon waxes are solids.

Oxidising Liquid: Not relevant – paraffin and hydrocarbon waxes are solids.

Oxidising Solid: Not considered oxidising based on structural considerations.

[31] Hazard endpoints presented are derived from the EU CLP Regulation ((EC) No 1272/2008) and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Pyrophoric Liquid: Not relevant – paraffin and hydrocarbon waxes are solids.

Pyrophoric Solid: Paraffin and hydrocarbon waxes do not spontaneously ignite in contact with air.

Self-reactive Substance: Paraffin and hydrocarbon waxes are not self reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Paraffin and hydrocarbon waxes do not react exothermically.

Gas under Pressure: Not relevant – paraffin and hydrocarbon waxes are solids.

Organic Peroxide: Paraffin and hydrocarbon waxes do not meet the definition of a peroxide.

Corrosive to Metal: Paraffin and hydrocarbon waxes donot meet the requirement for corrosion to metal.

Substance which in contact with water emits flammable gas: Paraffin and hydrocarbon waxes do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of substances representative of paraffin and hydrocarbon waxes have been tested in acute oral and dermal studies. Results indicate the following:

Rat oral	LD_{50}>5000 mg/kg bodyweight (SafePharm Laboratories, 2007a; IBR, 1976).
Rat dermal	LD_{50}>2000 mg/kg bodyweight (BIBRA, 1993b)

Skin Corrosion / Irritation: Paraffin and hydrocarbon waxes were tested in rabbit skin irritation studies under semi-occlusive conditions for 4 hours. Slight erythema was observed and was fully reversible by 24 hours (NOTOX, 2003). There was no evidence of skin corrosion.

Serious Eye Damage / Irritation: Eye irritation potential of a paraffin and hydrocarbon wax was evaluated. Results indicate that the eye irritation that occurred had cleared within 24 hours. Based on the Draize scores, the material is not considered to be an eye irritant (SafePharm Laboratories, 2007b).

Respiratory or Skin Sensitization: No studies were located for respiratory sensitization. For skin sensitization paraffin and hydrocarbon waxes was evaluated in a guideline study and determined to be non-sensitising (Phycher Bio Développement, 2007).

Germ Cell Mutagenicity: Paraffin and hydrocarbon waxes tested negative in *in vitro* assays (TNO, 2005a; TNO, 2005b; TNO, 2005c). *In vivo* assays for samples representative of paraffin and hydrocarbon waxes did not exhibit mutagenicity (McKee RH et al, 1990). Based on the available data, paraffin and hydrocarbon waxes are not considered to be germ cell mutagens.

Carcinogenicity: The carcinogenic potential of paraffin and hydrocarbon waxes was assessed in oral and dermal studies. The waxes were not considered to be carcinogenic (Shubik P et al, 1962).

Reproductive Toxicity: Paraffin and hydrocarbon waxes were assessed for fertility and developmental effects via read across to sufficiently refined Other Lubricant Base Oils. No reproductive toxicity was observed (WIL Research Laboratories, 1995; Mobil, 1987).

Specific Target Organ Toxicity

Single Exposure: Acute exposure studies do not indicate any specific organ toxicity following single exposure to paraffin and hydrocarbon waxes (SafePharm Laboratories, 2007a; IBR, 1976; BIBRA, 1993b).

Repeated Exposure: The repeat dose toxicity of paraffin and hydrocarbon waxes was assessed for both oral and dermal routes of exposure either as the substance or as read across from Other Lubricant Base Oils. The study data indicate that no target organ toxicity was observed (BIBRA, 1993a; Worrell NR, 1992; Shubik P et al, 1962; Mobil, 1983; API, 1987; EBSI, 1991).

Aspiration: Paraffin and hydrocarbon waxes span a range of viscosities with values reported in the range 3 to 30 mm^2/s at 100°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: All acute aquatic toxicity studies with fish, invertebrates and algae on samples of paraffin and hydrocarbon waxes (reading across from Other Lubricant Base Oils) show acute toxicity values greater than 100 mg/l. These tests were carried out on water accommodated fractions. (EBSI1995, Petro-Canada 2008, Croucher, E.A. and Girling, A.E.1988). Supporting acute toxicity QSAR predictions for fish, invertebrates and algae show toxicity above 1000 mg/l (Redman, 2010).

Chronic (long-term) Aquatic Hazard: Chronic aquatic toxicity studies on samples of paraffin and hydrocarbon waxes (reading across from Other Lubricant Base Oils) show chronic toxicity values greater than 1 mg/l for invertebrates. These tests were carried out on water accommodated fractions (Girling, A.E., 1995). A supporting QSAR prediction for chronic fish toxicity is greater than 1000 mg/l (Redman, 2010).

Environmental fate (biodegradation / bioaccumulation): Paraffin and hydrocarbon waxes are hydrocarbon UVCBs. Based on compositional information available and measured or predicted data, key constituents are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of paraffin and hydrocarbon waxes show predicted values for log K_{ow} ranging from 2 to greater than 6 and are therefore considered potentially bioaccumulative (HydroQual, 2010).

Part 2 – Summary of Classification Recommendations – Paraffin and Hydrocarbon Waxes
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:
No classification required

Health:
No classification required

Environment:
No classification required

Risk Phrases:
Not applicable

Part 3 – Summary of Classification and Labelling Recommendations – Paraffin and Hydrocarbon Waxes
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:
No classification required

Health:
No classification required

Environment:
No classification required

3.2 Labelling

Pictograms:
Not applicable

Signal Words:
Not applicable

Hazard Statements:
Not applicable

Precautionary Statements:
Not applicable

Supplemental Hazard Information:
Not applicable

Additional Considerations for Labelling:
Not applicable

REFERENCES: PARAFFIN AND HYDROCARBON WAXES

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BIBRA (1993a) A 90-day feeding study in the rat with two mineral waxes identified as paraffin wax 64 (OFH-064) and micro/paraffin wax mixture. Study conducted for European Wax Federation. BIBRA Report No. 1205/2/93. Surrey UK: BIBRA Toxicology International

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Shubik, P. et al (1962) Studies on the toxicity of petroleum waxes. *Toxicol Applied Pharmacol 4, Suppl. 1, 1-62*

TNO (2005a) Bacterial reverse mutation test with extract of Sasolwax 5203. Report No. V 6205/12. Study conducted for European Wax Federation. Zeist The Netherlands: TNO

TNO (2005b) Chromosomal aberration test with Sasolwax 5203 in cultured Chinese hamster ovary (CHO) cells. Report No. V 6202/11. Study conducted for European Wax Federation. Zeist The Netherlands: TNO

TNO (2005c) Gene mutation test at the TK-locus of L5178Y cells with Sasolwax 5203. Report No. V 6203/08. Study conducted for European Wax Federation. Zeist The Netherlands: TNO

WIL Research Laboratories(1995) An oral reproduction/developmental toxicity screening study of OLOA 219 in finished oils in rats. Study conducted for Chevron Research and Technology Company.Study No. WIL-187007. AshlandOH: WIL Research Laboratories Inc.

Worrell, N.R. (1992) A 90-day feeding study in the rat with six different mineral oils (N15(H), N70(H), N70(A), P15(H), N10(A) and P100(H)), three different mineral waxes (a low melting point wax, a high melting point wax and a high sulphur wax) and coconut oil. BIBRA Report No. 1010/3/92. Study conducted for CONCAWE. Surrey UK: BIBRA Toxicology International

FOOTS OILS

Definition / Domain: The domain of this category is established by the refining processes by which the category members are produced, the predominant hydrocarbon classes present and the carbon number range as follows:

- Derived from crude petroleum which is refined by atmospheric and vacuum distillation
- Refinery processes
  - acid treatment (sulphuric or silicic acid)
  - clay treatment
  - de-oiling of slack waxes
  - activated carbon
- Hydrocarbon types: aromatics, paraffins, naphthenics
- Typical carbon number range: predominantly C_{20} to C_{50}

Part 1 – Classification Endpoint[32] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – Foots oils are liquids.

Flammable Aerosol: Not relevant – Foots oils are not in aerosol form.

Flammable Liquid: Foots oils typically have flash points >98°C (read-across to Other Lubricant Base Oils).

Flammable Solid: Not relevant – Foots oils are liquids.

Oxidising Gas: Not relevant – Foots oils are liquids.

Oxidising Liquid: Foots oils are not considered oxidising based on structural considerations.

Oxidising Solid: Not relevant – Foots oils are liquids.

Pyrophoric Liquid: Foots oils do not spontaneously ignite in contact with air.

Pyrophoric Solid: Not relevant – Foots oils are liquids.

Self-reactive Substance: Foots oils are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Foots oils do not react exothermically.

Gas under Pressure: Not relevant – Foots oils are liquids.

Organic Peroxide: Foots oils do not meet the definition of a peroxide.

Corrosive to Metal: Foots oils are liquids and do not meet the criteria for corrosion of metal.

[32] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Substance which in contact with water emits flammable gas: Foots oils do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples representative of foots oils have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50}> 5000 mg/kg bodyweight (API, 1982; API, 1986b)
Rat inhalation	LC_{50}> 5.53 mg/l (EBSI, 1988)
Rabbit dermal	LD_{50} > 2000 mg/kg bodyweight (API, 1982; API, 1986b)

Skin Corrosion / Irritation: Samples representative of foots oils have been tested in rabbit skin irritation studies. The majority of the data were derived using a 24 hour occluded exposure protocol. The read across study performed on“insufficiently refined” Other Lubricant Base Oils showed moderate irritation. The study was performed for 24 hours rather than 4 hours and consequently the result from a shorter exposure time is not likely to cause irritation. In read across studies on “sufficiently refined” Other Lubricant Base Oils no irritation was observed. There was no evidence of skin corrosion (API, 1982; API, 1986b).

Serious Eye Damage / Irritation: The effects of samples representative of foots oils on the eye have been investigated in rabbits using a number of samples. All of the samples tested were non-irritating to the eyes (API, 1982; API, 1986b).

Respiratory or Skin Sensitization: Tests in guinea pig with samples representative of foots oils showed no evidence of skin sensitization (API, 1982; API, 1986b). There are no reports available to indicate a potential to cause respiratory sensitization.

Germ Cell Mutagenicity: Data were read acrossfrom Other Lubricant Base Oils. The mutagenic potential has been extensively studied in a range of *in vivo* and *in vitro* assays. The majority of the studies showed no evidence of mutagenic activity (Blackburn et al, 1984; Blackburn et al, 1986; API, 1986d; API, 1986c; ARCO, 1987a; ARCO, 1987b, Przygoda RT et al, 1999; McKee, RH, et al, 1990). Based on the available data, foots oils are not considered to be germ cell mutagens.

Carcinogenicity: The carcinogenic potential of samples representative of foots oils has been investigated in animals following dermal exposure. Based on these findings, foots oils similar to “insufficiently refined” Other Lubricant Base Oils are carcinogenic while those that are similar to “sufficiently refined” Other Lubricant Base Oils are not carcinogenic (Doak, S.M.A., et al, 1983; Chasey& McKee, 1993).

Reproductive Toxicity: There are no reproductive toxicity data available for foots oil. Data were derived from Other Lubricant Base Oils. Results of developmental and reproductive toxicity studies on “sufficiently refined” Other Lubricant Base Oils did not show any evidence of developmental or reproductive toxicity in rats (WIL Research Laboratories, 1995; Mobil, 1987). There are no developmental toxicity data for "insufficiently refined" Other Lubricant Base Oils, but their hazards are assumed to be similar to those of distillate aromatic extracts. In a read-across developmental study from distillate aromatic extracts, heavy paraffinic distillate furfural extract produced maternal, reproductive, and foetal toxicity in rats (Schreiner C, et al, 1997; Mobil, 1989). For the carcinogenic foots oils, there are no data on fertility but based on evidence from repeated dose toxicity studies, no effects on reproductive organs are expected.

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies with samples representative of foots oils show no evidence of systemic toxicity (API, 1982; API, 1986b; API, 1987b; EBSI, 1988).

Repeated Exposure: The repeat dose toxicity of samples representative of foots oils has been investigated by dermal and inhalation routes for periods between 4 weeks and up to 2 years by read across to Other Lubricant Base Oils.
"Insufficiently refined" Other Lubricant Base Oils: Read-across subchronic studies performed on distillate aromatic extracts (DAEs) resulted in specific target organ toxicity in the following tissues: adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus (Mobil, 1990; Chasey & McKee, 1993; API, 1986a).
"Sufficiently refined" Other Lubricant Base Oils: Repeat dose inhalation and dermal studies showed no systemic effects (Dalbey, et al., 1991, API, 1987a; Mobil, 1983, EBSI, 1991).

Aspiration: Samples representative of foots oils span a range of viscosities with values reported as >2 mm^2/s at 40°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: All acute aquatic toxicity studies with fish, invertebrates and algae on samples representative of foots oils (reading across from other lubricant base oils) show acute toxicity values greater than 100 mg/l. These tests were carried out on water accommodated fractions (EBSI 1995; Petro Canada 2008; Shell 1988). Supporting acute toxicity QSAR predictions for fish, invertebrates and algae show toxicity above 1000 mg/l (Redman, 2010).

Chronic (long-term) Aquatic Hazard: Chronic aquatic toxicity studies on a sample of foots oils show chronic toxicity values greater than 1 mg/l for invertebrates. These tests were carried out on water accommodated fractions. (EMBSI, 2012m).

Environmental fate (biodegradation / bioaccumulation): Foots Oils are hydrocarbon UVCBs. Based on compositional information available and measured or predicted data, key constituents are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of foots oils show predicted values for log K_{ow} ranging from 2 to greater than 6 and are therefore considered potentially bioaccumulative (HydroQual 2010).

Part 2 – Summary of Classification Recommendations – Foots Oils Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

No classification required

Health:

Carcinogenic Category 2 (EC DSD Note L)
Harmful (OIN7)

Environment:

No classification required

Risk Phrases:

R45: May cause cancer
R48/21: Harmful: danger of serious damage to health by prolonged exposure in contact with skin
R63: Possible risk of harm to the unborn child
R65[33]: Harmful: may cause lung damage if swallowed

[33] If the viscosity is >7 mm^2/s @ 40°C, the substance does not need to be classified and labelled R65 and S62 does not apply. The classification as Harmful shall still apply if classied for other endpoints..

Part 3 – Summary of Classification and Labelling Recommendations – Foots Oils
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:

No classification required

Health:

H372 Specific Target Organ Toxicity (repeatedexposure) Category 1 (OIN 8)
H350 Carcinogenicity Category 1B (EC CLP Note L; OIN L(CLP))
H361d Reproductive Toxicity Category 2 (OIN 8)
H304 Asp. Tox. 1 (unless the kinematic viscosity is above 20.5 mm^2/s @40°C)

Environment:

No classification required

3.2 Labelling

Pictograms: GHS08

Signal Words: Danger

Hazard Statements:

H304: May be fatal if swallowed and enters airways
H350: May cause cancer
H361d: Suspected of damaging fertility or the unborn child
H372: Causes damage to organs, adrenals, bone marrow, liver, lymph nodes, kidney, stomach and thymus through prolonged or repeated exposure

Precautionary Statements: Six suggested statements for use on labels are shown in **bold text**

P201: Obtain special instructions before use
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P281: Use personal protective equipment as required
P301+P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
P331: Do NOT induce vomiting
P501: Dispose of contents/container to...in accordance with local/regional /national/international regulations (to be specified)

P202: Do not handle until all safety precautions have been read and understood
P264: Wash... thoroughly after handling
P270: Do not eat, drink or smoke when using this product
P314: Get medical advice/attention if you feel unwell
P308+313: If exposed or concerned: Get medical advice/attention
P405: Store locked up

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:

- Restricted to professional users when classified as a carcinogen Category 1B.
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

REFERENCES: FOOTS OILS

API (1982) Acute toxicity tests of API 78-9 paraffinic oil, nominal viscosity 70 SUS/100°F (CAS 64742-56-9). Study conducted by Elars Bioresearch Laboratories Inc. API Med. Res. Publ. 29-33104. WashingtonDC: American Petroleum Institute

API (1986a) 28-day dermal toxicity study in the rabbit of API 83-12. Hydrotreated light naphthenic distillate (CAS 64742-53-6). Study conducted by Tegeris Laboratories Inc. API Med. Res. Publ. 33-30499. WashingtonDC: American Petroleum Institute

API (1986b) Acute oral toxicity study in rats. Acute dermal toxicity study in rabbits. Primary dermal irritation study in rabbits. Primary eye irritation study in rabbits. Dermal sensitization study in guinea pigs. API 83-12 hydrotreated light naphthenic distillate (CAS 64742-53-6). Study conducted by Hazleton Laboratories America Inc. API Med. Res. Publ. 33-30592. WashingtonDC: American Petroleum Institute

API (1986c) Mutagenicity of API 83-12, hydrotreated light naphthenic distillate (CAS 64742-53-6), in a mouse lymphoma mutation assay. Study conducted by Litton Bionetics Inc. API Med. Res. Publ. 33-32802. WashingtonDC: American Petroleum Institute

API (1986d) Mutagenicity of API 83-15, heavy naphthenic distillate (CAS 64742-52-5), in a mouse lymphoma mutation assay. Study conducted by Litton Bionetics Inc. API Med. Res. Publ. 33-32800. WashingtonDC: American Petroleum Institute

API (1987a) 28-day dermal toxicity study of API 83-15, hydrotreated heavy naphthenic distillate (CAS 64742-52-5), in the rabbit. Study conducted by Tegeris Laboratories Inc. API Health Environ. Sci. Dep. Rep. 35-32430. WashingtonDC: American Petroleum Institute

API (1987b) Acute inhalation toxicity evaluation of a petroleum derived hydrocarbon in rats. API 83-12 hydrotreated light naphthenic distillate. Study conducted by Hazleton Laboratories America Inc. API Health Environ. Sci. Dep. Rep. 34-32775. WashingtonDC: American Petroleum Institute

ARCO (1987a) Evaluation of chromosome aberrations in Chinese hamster ovary (CHO) cells. Study conducted by Microbiological Associates Inc. ARCO Study No. ATX-85-0059. Los AngelesCA: ARCO

ARCO (1987b) Evaluation of chromosome aberrations in Chinese hamster ovary (CHO) cells. Study conducted by Microbiological Associates Inc. ARCO Study No. ATX-85-0054. Los AngelesCA: ARCO

Blackburn, G.R. et al (1984) Estimation of the dermal carcinogenic activity of petroleum fractions using a modified Ames assay. *Cell Biology and Toxicology 1, 1, 67-80*

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Dalbey, W. et al (1991) Four-week inhalation exposures of rats to aerosols of three lubricant base oils. *J Appl Toxicol 11, 4, 297-302*

Doak, S.M.A. et al (1983) The carcinogenic potential of twelve refined mineral oils following long-term topical application. *Br J Cancer 48, 429-436*

EBSI (1988) Four hour acute inhalation toxicity study in rats. MRD-87-102. EBSI Study No. 210215. East MillstoneNJ: Exxon Biomedical Sciences Inc.

EBSI (1991) Dermal carcinogenesis assay in C_3H/HeNCrlBR mice. Report prepared for Exxon Company USA. EBSI Study No. 201111. East MillstoneNJ: Exxon Biomedical Sciences Inc.

EBSI (1995) Fish, acute toxicity test. MRD-94-981 basestock solvent neutral 600. Report prepared for Exxon Company International. EBSI Study No. 198140. East MillstoneNJ: Exxon Biomedical Sciences Inc.

EMBSI (2012m). Daphnia sp, reproduction test. MRD-08-383 foots oil #1. Study performed for CONCAWE. EMBSI study No. 0834746. Annandale NJ. ExxonMobil Biomedical Sciences Inc.

Girling, A.E. (1995) Lubricant base oil LVIN 38: chronic toxicity of water-accommodated fractions to *Daphnia magna*. Report No. SBGR.94.099. Sittingbourne: Shell Research Ltd

HydroQual (2010) PETRORISK Model. Prepared for CONCAWE. MahwahNJ: HydroQual Inc.

McKee, R.H. et al (1990) An evaluation of the genotoxic potential of mineral hydrocarbons. *Environ Molecular Mutagen 15, Suppl. 17, 41*

Mobil (1983) Thirteen-week toxicity study by dermal application of metalworking fluid components to rats. Mobil Environ. and Health Sci. Lab. Study No. 1451-81. PrincetonNJ: Mobil Oil Corporation

Mobil (1987) 100 SUS solvent refined base oil developmental toxicity screen in rats. Mobil Environ. and Health Sci. Lab. Study No. 51841. PrincetonNJ: Mobil Oil Corporation

Mobil (1989) Developmental toxicity study in rats exposed dermally to 318 isthmus furfural extract. Mobil Environ. and Health Sci. Lab. Study No. 62884. PrincetonNJ: Mobil Oil Corporation

Mobil (1990) Thirteen-week administration of 318 isthmus furfural extract to rats. Mobil Environ. and Health Sci. Lab. Study No. 61737. PrincetonNJ: Mobil Oil Corporation

Petro-Canada (2008) 72-hour growth inhibition toxicity test report. *Pseudokirchneriella subcapitata*. Study performed by AquaTox Testing & Consulting Inc. Study No. 213706. MississaugaON: Petro-Canada Research & Development

Przygoda, R.T. et al (1999) Assessment of the utility of the micronucleus test for petroleum-derived materials. *Mutation Research 438, 145-153*

Schreiner, C. et al (1997) Toxicity evaluation of petroleum blending streams: reproductive and developmental effects of hydrodesulfurized kerosine. *J Toxicol Environ Health 52, 211-229*

WIL Research Laboratories (1995) An oral reproduction/developmental toxicity screening study of OLOA 219 in finished oils in rats. Study conducted for Chevron Research and Technology Company. Study No. WIL-187007. AshlandOH: WIL Research Laboratories Inc.

PETROLATUMS

Definition / Domain: The domain of this category is established by the process by which the category members are produced, the predominant hydrocarbon classes present, the melting point range and the carbon number range as follows:

- Derived from vacuum distilled fractions and separated as a solid by chilling.
- Refinery processes
  - atmospheric distillation
  - vacuum distillation
  - hydrotreatment / hydrodesulfurization
  - solvent extraction
  - chilling

  Note: *some category members are subject to further intermediate processing such as de-oiling or treatment with acid, clay, active carbon or hydrogenation but without changing their hydrocarbon composition significantly.*
- Hydrocarbon types: the major components of all paraffin and hydrocarbon waxes are branched and straight chain paraffins and naphthenes (cycloparaffins), which normally account for at least 85% by volume of a wax process stream. Aromatic hydrocarbons, mainly alkylbenzenes and alkylnaphthalenes will not normally exceed 15% by volume of paraffin and hydrocarbon wax streams. The boiling point range of paraffin and hydrocarbon waxes is such that components of specific toxicological concern such as benzene (boiling point 80°C) and n-hexane (boiling point 69°C) are typically not present. The boiling points of the hazardous, 3 to 7 fused-ring polycyclic aromatic hydrocarbons (PAHs) are in the boiling range of the paraffin and hydrocarbon waxes, but they are removed by solvent extraction before chilling and wax separation.
- Typical melting point range: predominantly 43°C to 95°C
- Typical boiling point range: predominantly 300°C to 800°C
- Typical carbon number range: predominantly C_{12} to C_{85}

Part 1 – Classification Endpoint[34] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – petrolatums are solids.

Flammable Aerosol: Not relevant – petrolatums are solids.

Flammable Liquid: Not relevant – petrolatums are solids.

Flammable Solid: Typical flash points > 160°C.

Oxidising Gas: Not relevant – petrolatums are solids.

Oxidising Liquid: Not relevant – petrolatums are solids.

Oxidising Solid: Not considered oxidising based on structural considerations.

[34] Hazard endpoints presented are derived from the EU CLP Regulation ((EC) No 1272/2008) and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Pyrophoric Liquid: Not relevant – petrolatums are solids.

Pyrophoric Solid: Petrolatums do not spontaneously ignite in contact with air.

Self-reactive Substance: Petrolatums are not self reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Petrolatums do not react exothermically.

Gas under Pressure: Not relevant – petrolatums are solids.

Organic Peroxide: Petrolatums do not meet the definition of a peroxide.

Corrosive to Metal: Petrolatums do not meet the criteria the requirement for corrosion of metal.

Substance which in contact with water emits flammable gas: Petrolatums do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of substances representative of petrolatum have been tested in acute oral and dermal studies. Results indicate the following:

Rat oral LD_{50}	>5000 mg/kg bodyweight (API, 1982; API, 1986b)
Rabbit dermal LD_{50}	>2000 mg/kg bodyweight (BIBRA, 1993b; API, 1986b)

Skin Corrosion / Irritation: Samples of substances representative of petrolatum were evaluated in rabbit skin irritation studies. Results indicate that the material is not considered irritating to skin.There was no evidence of skin corrosion (API, 1986b; NOTOX, 2003).

Serious Eye Damage / Irritation: Samples of substances representative of petrolatum were evaluated in rabbit eye irritation studies. Results indicate that the material is not considered irritating to eye (API, 1986b; Safepharm Laboratories, 2007).

Respiratory or Skin Sensitization: No studies were located for respiratory sensitization. Samples of substances representative of petrolatum were evaluated for skin sensitization in the guinea pig and were shown to be non-sensitizing (API, 1986b; Kuhn, JO, 1995).

Germ Cell Mutagenicity: The mutagenicity for petrolatum was assessed using samples of substances representative of petrolatum. *In vitro* assays gave mixed results depending on the degree of refining. *In vivo* assays were negative in the mouse micronucleus assay (Blackburn, GR et al, 1984; Blackburn GR et al, 1986; TNO, 2005a; API, 1986c; TNO, 2005b; ARCO, 1987; TNO, 2005c; Mobil, 1987b; McKee RH, 1990). Based on the available data, petrolatums are not considered to be a germ cell mutagen.

Carcinogenicity: The carcinogenic potential of petrolatums is determined by the feedstock from which the petrolatum is derived. Based on the available data, petrolatum from insufficiently refined feedstock is carcinogenic, while material from sufficiently refined feedstocks are not carcinogenic (Kane ML, 1984; Lijinsky W et al, 1966; Oser BL et al, 1965).

Reproductive Toxicity: The reproductive toxicity potential of petrolatums is determined by the feedstock from which the petrolatum is derived. For petrolatum from sufficiently refined feed-stock, read across studies indicated no reproductive toxicity (WIL Research Laboratories, 1995; Mobil, 1987a).

For petrolatum derived from insufficiently refined feedstock a read across study indicates developmental effects are likely (Mobil, 1989).

Specific Target Organ Toxicity

Single Exposure: Acute exposure studies do not indicate any specific organ toxicity following single exposure to petrolatum (API, 1982; API, 1986b; BIBRA, 1993b).

Repeated Exposure: The repeat dose toxicity of insufficiently refined petrolatum was assessed by read across to similar substances. Results indicate that oral and dermal exposure could result in target organ toxicity (adrenals, bone marrow, blood, liver, lymph nodes, kidney, stomach and thymus) (Mobil, 1990; Mobil, 1989; API, 1986a; Chasey KL & McKee RH, 1993). For sufficiently refined petrolatum, dermal and oral repeat dose read across studies indicate no biologically significant target organ toxicity (Worrell, NR, 1992; BIBRA, 1993a; Oser BL et al, 1965; Mobil, 1983; API, 1987; EBSI, 1991).

Aspiration: Petrolatum spans a range of viscosities with values reported as 3 to 30 mm^2/s at 100°C.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: All acute aquatic toxicity studies with fish, invertebrates and algae for petrolatum (reading across from Other Lubricant Base Oils) show acute toxicity values greater than 100 mg/l. These tests were carried out on water accommodated fractions (EBSI, 1995; Petro-Canada, 2008; Croucher, EA and Girling, AE, 1988). Supporting acute toxicity QSAR predictions for fish, invertebrates and algae show toxicity above 1000 mg/l (Redman, 2010).

Chronic (long-term) Aquatic Hazard: Chronic aquatic toxicity studies on samples of petrolatum (reading across from Other Lubricant Base Oils) show a lowest chronic toxicity value of 3 mg/l for invertebrates. These tests were carried out on water accommodated fractions (Girling, AE, 1995). A supporting QSAR prediction for chronic fish toxicity is greater than 1000 mg/l (Redman, 2010).

Environmental fate (biodegradation / bioaccumulation): Petrolatums are hydrocarbon UVCBs. Based on compositional information available and measured or predicted data, key constituents are not expected to meet the criteria for ready degradability but are inherently biodegradable. Constituents of petrolatum show predicted values for log K_{ow} ranging from 2 to greater than 6 and are considered potentially bioaccumulative. (HydroQual, 2010).

Part 2 – Summary of Classification Recommendations – Petrolatums Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical:

No classification required

Health:

Carcinogenic Category 2 (EC DSD Note N)
Reproductive Hazard Category 3 (OIN 7)
Harmful (OIN 7)

Environment:

No classification required

Risk Phrases:

R45: May cause cancer
R63: Possible risk of harm to the unborn child
R48/21: Harmful: danger of serious damage to health by prolonged exposure in contact with skin

Part 3 – Summary of Classification and Labelling Recommendations - Petrolatums
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:
No classification required

Health:
H350 Carcinogen Category1B (EC CLP Note N)
H372 Specific Target Organ Toxicity (Repeated Exposure) Category 1 (OIN 8)
H361d Reproductive Toxicity Category 2 (OIN 8)

Environment:
No classification required

3.2 Labelling

Pictograms: GHS08

Signal Words: Danger

Hazard Statements:
H350: May cause cancer
H372: Causes damage toadrenals, bone marrow, blood, liver, lymph nodes, kidney, stomach and thymus; through prolonged or repeated exposure
H361d: Suspected of damaging the unborn child

Precautionary Statements: Suggested statements for use on labels are shown in **bold text**
P201: Obtain special instructions before use
P260: Do not breathe dust/fume/gas/mist/vapours/spray
P281: Use personal protective equipment as required
P308 + P313: IF exposed or concerned: Get medical advice/attention
P501: Dispose of contents/container to….in accordance with local/regional /national/international regulations (to be specified)

P202: Do not handle until all safety precautions have been read and understood
P264: Wash ... thoroughly after handling
P270: Do not eat, drink or smoke when using this product
P314: Get medical advice/attention if you feel unwell
P405: Store locked up

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:
- Restricted to professional users when classifed as a Category 1B carcinogen.
- If the worst case classification does not apply, it will be necessary to identify the pictograms, signal words, H-statements, and P-statements that apply.

REFERENCES: PETROLATUMS

API (1982) Acute toxicity tests of API 78-9 paraffinic oil, nominal viscosity 70 SUS/100°F (CAS 64742-56-9). Study conducted by Elars Bioresearch Laboratories Inc. API Med. Res. Publ. 29-33104. WashingtonDC: American Petroleum Institute

API (1986a) 28-day dermal toxicity study in the rabbit of API 84-01. Light paraffinic distillate (CAS 64741-50-0). Study conducted by Tegeris Laboratories Inc. API Med. Res. Publ. 33-31642. WashingtonDC: American Petroleum Institute

API (1986b) Acute oral toxicity study in rats. Acute dermal toxicity study in rabbits. Primary dermal irritation study in rabbits. Primary eye irritation study in rabbits. Dermal sensitization study in guinea pigs. API 84-01 light paraffinic distillate (CAS 64741-50-0). Study conducted by Hazleton Laboratories America Inc. API Med. Res. Publ. 33-30595. WashingtonDC: American Petroleum Institute

API (1986c) Mutagenicity of API 84-01, light paraffinic distillate (CAS 64741-50-0), in a mouse lymphoma mutation assay. Study conducted by Litton Bionetics Inc. API Med. Res. Publ. 33-32801. WashingtonDC: American Petroleum Institute

API (1987) 28-day dermal toxicity study of API 83-15, hydrotreated heavy naphthenic distillate (CAS 64742-52-5), in the rabbit. Study conducted by Tegeris Laboratories Inc. API Health Environ. Sci. Dep. Rep. 35-32430. WashingtonDC: American Petroleum Institute

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BIBRA (1993a) A 90-day feeding study in the rat with two mineral waxes identified as paraffin wax 64 (OFH-064) and micro/paraffin wax mixture. Study conducted for European Wax Federation. BIBRA Report No. 1205/2/93. Surrey UK: BIBRA Toxicology International

BIBRA (1993b) An acute dermal toxicity limit test in the rat with SX30. Study conducted for Shell International Petroleum Mij. B.V. BIBRA Report No. 1091/2. Surrey UK: BIBRA Toxicology International

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Kuhn, J.O. (1995) Dermal sensitization study in guinea pigs. 4531 pet blend white USP. Study conducted for Penzoil Products Company. Study No. 1588-94. Sugar LandTX: STILLMEADOW Inc.

Lijinsky, W. et al (1966) Skin tumorigenesis by an extract of amber petrolatum. *Toxicol Applied Pharmacol 8, 1, 113-117*

McKee, R.H. et al (1990) An evaluation of the genotoxic potential of mineral hydrocarbons. *Environ Molecular Mutagen 15, Suppl. 17, 41*

Mobil (1983) Thirteen-week toxicity study by dermal application of metalworking fluid components to rats. Mobil Environ. and Health Sci. Lab. Study No. 1451-81. PrincetonNJ: Mobil Oil Corporation

Mobil (1987a) 100 SUS solvent refined base oil developmental toxicity screen in rats. Mobil Environ. and Health Sci. Lab. Study No. 51841. PrincetonNJ: Mobil Oil Corporation

Mobil (1987b) Micronucleus assay of bone marrow red blood cells from rats treated for thirteen weeks with 318 isthmus furfural extract. Mobil Environ. and Health Sci. Lab. Study No. 61738. PrincetonNJ: Mobil Oil Corporation

Mobil (1989) Developmental toxicity study in rats exposed dermally to 318 isthmus furfural extract. Mobil Environ. and Health Sci. Lab. Study No. 62884. PrincetonNJ: Mobil Oil Corporation

Mobil (1990) Thirteen-week administration of 318 isthmus furfural extract to rats. Mobil Environ. and Health Sci. Lab. Study No. 61737. PrincetonNJ: Mobil Oil Corporation

NOTOX (2003) Primary skin irritation/corrosion study with SX-50 (Sarawax 50) in the rabbit (4-hour semi-occlusive application). Report No. 393648. The Netherlands: NOTOX

Oser, B.L. et al (1965) Toxicologic studies of petrolatum in mice and rats. *Toxicol Applied Pharmacol 7, 382-401*

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Redman, A. and Yadav, B. (2010) Aquatic toxicity predictions using the PETROTOX model for petroleum substance categories. Report prepared for CONCAWE. MahwahNJ: HydroQual Inc.

SafePharm Laboratories (2007) Paraffin waxes (Fischer-Tropsch), full range, C15-50 - branched and linear. Acute eye irritation in the rabbit. Report No. 2041/0055. Study conducted for Shell International Gas Ltd. Derbyshire UK: SafePharm Laboratories Ltd

TNO (2005a) Bacterial reverse mutation test with extract of Sasolwax 5203. Report No. V 6205/12. Study conducted for European Wax Federation. Zeist The Netherlands: TNO

TNO (2005b) Chromosomal aberration test with Sasolwax 5203 in cultured Chinese hamster ovary (CHO) cells. Report No. V 6202/11. Study conducted for European Wax Federation. Zeist The Netherlands: TNO

TNO (2005c) Gene mutation test at the TK-locus of L5178Y cells with Sasolwax 5203. Report No. V 6203/08. Study conducted for European Wax Federation. Zeist The Netherlands: TNO

WIL Research Laboratories (1995) An oral reproduction/developmental toxicity screening study of OLOA 219 in finished oils in rats. Study conducted for Chevron Research and Technology Company. Study No. WIL-187007. AshlandOH: WIL Research Laboratories Inc.

Worrell, N.R. (1992) A 90-day feeding study in the rat with six different mineral oils (N15(H), N70(H), N70(A), P15(H), N10(A) and P100(H)), three different mineral waxes (a low melting point wax, a high melting point wax and a high sulphur wax) and coconut oil. BIBRA Report No. 1010/3/92. Study conducted for CONCAWE. Surrey UK: BIBRA Toxicology International

BITUMEN

Definition / Domain: The domain of this category is established by the petroleum refining processes, or combination of, by which the category members are produced, the predominant hydrocarbon classes present, the boiling point range and the carbon number range as follows:

- Derived from crude petroleum.
- Refinery processes
  - atmospheric distillation
  - vacuum distillation
  - solvent deasphalting
  - thermal cracking
- Hydrocarbon types: predominantly asphaltenes (MW 2,000 to 5,000) and maltenes (MW 500 to 2,000) with small amounts of lower weight materials, including polycyclic aromatic hydrocarbons (PAHs)
- Typical boiling point range greater than 320°C to more than 500°C
- Typical carbon number range: predominantly greater than C_{25} but with the bulk of the material having carbon numbers greater than C_{50} and up to C_{80}.

Part 1 – Classification Endpoint[35] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – bitumens are solids.

Flammable Aerosol: Not relevant – bitumens are not in aerosol form.

Flammable Liquid: Bitumens are high molecular weight hydrocarbon solids.

Flammable Solid: .Bitumen flash points are greater than 180°C.

Oxidising Gas: Not relevant – bitumens are solids.

Oxidising Liquid: Not relevant – bitumens are solid**.** They are not considered oxidising based on structural considerations.

Oxidising Solid: Bitumens are solids. They are not considered oxidising based on structural considerations.

Pyrophoric Liquid: Not relevant – bitumens are solid**.** They do not spontaneously ignite in contact with air.

Pyrophoric Solid: Bitumens do not spontaneously ignite in contact with air.

Self-reactive Substance: Bitumens are not self-reactive. They do not undergo exothermic decomposition when heated.

Self-heating Substance: Bitumens do not react exothermically.

[35] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Gas under Pressure: Not relevant – bitumens are solids.

Organic Peroxide: Bitumens do not meet the definition of a peroxide.

Corrosive to Metal: Bitumens do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Bitumens do not react with water.

1.2 Health Hazards

Acute Toxicity: Samples of bitumens have been tested in acute oral and dermal studies. Results show the following:

Rat oral	LD_{50} > 5000 mg / kg bodyweight (API 1982a, API 1982b)
Rabbit dermal	LD_{50} > 2000 mg / kg bodyweight (API 1982a, API 1982b)

Fumes from oxidized bitumen (aerosol and vapour) have been tested in an acute inhalation study and the 4hr LC_{50} (rat) was > 94.4 mg/m^3 (Fraunhofer 2001).

Skin Corrosion / Irritation: Samples of bitumens have been tested in rabbit skin irritation studies. The data were derived using a 24 hour occluded exposure protocol. Only minimal, transient irritation was seen (API 1982a; API 1982b).

Serious Eye Damage / Irritation: The effects of bitumens on the eye have been investigated in rabbits. None of the samples tested showed more than minimal redness and swelling, which resolved quickly (API 1982a; API 1982b).

Respiratory or Skin Sensitization: Tests in guinea pigs with samples of bitumen showed no evidence of skin sensitization. There are no reports available to indicate that bitumens have the potential to cause respiratory sensitization (API 1984a; API 1984b).

Germ Cell Mutagenicity: The mutagenic potential of bitumens and fume condensates has been extensively studied in a range of *in vivo* and *in vitro* assays. Overall, there is no convincing evidence that exposure to bitumen or fumes from bitumen causes mutagenic effects (Kriech 2007; De Meo, et al, 1996; Qian, H.W., et al, 1996; Bottin, M.C.,et al, 2006; Micillino, J.C. et al,2002; Fraunhofer, 2009). Based on the available data, bitumens are not considered to be germ cell mutagens.

Carcinogenicity: The carcinogenic potential of bitumen and bitumen fume has been investigated in animals following dermal and inhalation exposure. In addition epidemiological studies have been undertaken in exposed human populations. The data available do notindicate that exposure to bitumen or fumes from bitumen present a carcinogenic hazard (Clark 2011; Goyak 2011; Fraunhofer 2006; Hueper, WC& Payne, WW; 1960; Wallcave, L et al,1971; Boffetta P et al, 2009, Boffetta P et al, 2001).

Reproductive Toxicity: There are no studies available on reproductive or developmental toxicity. Testing proposals have been included in the registration dossiers submitted to ECHA.

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity (API 1982a; API 1982b; Fraunhofer 2001).

Repeated Exposure: The repeat dose toxicity of bitumen has been investigated by dermal and inhalation routes. Apart from mild irritation of the upper respiratory tract there

is no evidence that exposure to bitumen or bitumen fume causes systemic toxicity. (Fraunhofer 2006; API 1983a; API 1983b).

Aspiration: Not relevant as bitumens are solid.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: There are no data available on the acute aquatic toxicity of bitumen. Bitumen is not expected to exert chronic toxicity based on water solubility limitations. QSAR assessment, based on their hydrocarbon composition, indicates that they would be expected to give LL50 values > 1000 mg/l for fish, daphnia and algae (Redman, et al 2010).

Chronic (long-term) Aquatic Hazard: There are no chronic toxicity data available for bitumens. QSAR assessment of chronic toxicity, based on hydrocarbon composition, indicates that they would be expected to give chronic NOEL values in fish and daphnia of > 1000 mg/l. (Redman, et al, 2010)

Environmental fate (biodegradation / bioaccumulation): Bitumens are hydrocarbon UVCBs. Based on compositional information available and measured or predicted data on key constituents, bitumens are not expected to meet the criteria for ready degradability. Constituents of bitumen show predicted values for log $K_{ow} \geq 4$ and are considered potentially bioaccumulative. (HydroQual, 2010).

Part 2 – Summary of Classification Recommendations – Bitumen Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical: No classification required

Health: No classification required

Environment: No classification required.

Part 3 – Summary of Classification and Labelling Recommendations - Bitumen
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical: No classification required

Health: No classification required

Environment: No classification required

3.2 Labelling

Pictograms:
Not applicable

Signal Words:
Not applicable

Hazard Statements:
Not applicable

Precautionary Statements:
Not applicable

Supplemental Hazard Information:
Not applicable

Additional Considerations for Labelling:
Not applicable

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OXIDIZED ASPHALT

Definition / Domain: Oxidized asphalt is derived from crude petroleum. It is a complex black solid, obtained by blowing air through heated petroleum residues, or the raffinate from a deasphalting process with or without a catalyst. The process is principally one of oxidative condensation which increases the molecular weight.

- Derived from crude petroleum
- Refinery processes
  - atmospheric distillation
  - vacuum distillation
  - solvent deasphalting
  - thermal cracking
  - oxidation
- Hydrocarbon types: Predominantly asphaltenes (MW 2,000 to 5,000) and maltenes (MW 500 to 2,000) with small amounts of lower weight materials, including polycyclic aromatic hydrocarbons (PAHs)
- Typical boiling point range: Greater than 308°C
- Typical carbon number range: Predominantly greater than C_{25} but with the bulk of the material having carbon numbers greater than C_{50} and up to C_{80}.

Part 1 – Classification Endpoint[36] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – oxidized asphalts are solids.

Flammable Aerosol: Not relevant – oxidized asphalts are not in aerosol form.

Flammable Liquid: Oxidized asphalts are high molecular weight hydrocarbon solids.

Flammable Solid: Oxidized asphaltflash points are greater than 180°C.

Oxidising Gas: Not relevant – oxidized asphalts are solids.

Oxidising Liquid: Not relevant – oxidized asphalts are solid**.** They are not considered oxidising based on structural considerations.

Oxidising Solid: Oxidized asphalts are solids. They are not considered oxidising based on structural considerations.

Pyrophoric Liquid: Not relevant – oxidized asphalts are solid**.** They do not spontaneously ignite in contact with air.

Pyrophoric Solid: Oxidized asphalts do not spontaneously ignite in contact with air.

Self-reactive Substance: Oxidized asphalts are not self-reactive. They do not undergo exothermic decomposition when heated.

[36] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Self-heating Substance: Oxidized asphalts do not react exothermically.

Gas under Pressure: Not relevant – oxidized asphalts are solids.

Organic Peroxide: Oxidized asphalts do not meet the definition of a peroxide.

Corrosive to Metal: Oxidized asphalts do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Oxidized asphalts do not react with water

1.2 Health Hazards

Acute Toxicity: Samples of bitumens have been tested in acute oral and dermal studies. Results show the following:

Rat oral	LD_{50}> 5000 mg / kg bodyweight (API 1982a, API 1982b)
Rabbit dermal	LD_{50} > 2000 mg / kg bodyweight (API 1982a, API 1982b)

Fumes from oxidized asphalt (aerosol and vapour) have been tested in an acute inhalation study and the 4hour LC_{50} (rat) was > 94.4 mg/m^3 (Fraunhofer 2001)

Skin Corrosion / Irritation: Samples of bitumens have been tested in rabbit skin irritation studies. The data were derived using a 24 hour occluded exposure protocol. Only minimal, transient irritation was seen (API 1982a, API 1982b).

Serious Eye Damage / Irritation: The effects of bitumens on the eye have been investigated in rabbits. None of the samples tested showed more than minimal redness and swelling, which resolved quickly (API 1982a, API 1982b)

Respiratory or Skin Sensitization: Tests in guinea pigs with samples of bitumens showed no evidence of skin sensitization. There are no reports available to indicate that oxidized asphalts have the potential to cause respiratory sensitization (API 1984a, API 1984b).

Germ Cell Mutagenicity: The mutagenic potential of bitumens and fume condensates has been extensively studied in a range of *in vivo* and *in vitro* assays. Overall, there is no evidence that exposure to bitumen, or fumes from bitumen, causes mutagenic effects (Kriech 2007; De Meo, et al, 1996; Qian, HW 1996; Bottin, MC, et al, 2006; Micillino, JC et al,2002; Fraunhofer, 2009). Based on the available data, oxidized asphalt is not considered to be a germ cell mutagen.

Carcinogenicity: The carcinogenic potential of oxidized asphalt and oxidized asphalt fume has been investigated in animals following dermal and inhalation exposure. In addition epidemiological studies have been undertaken in exposed human populations. Based on the available information, oxidized asphalt is not considered to be a carcinogenic hazard and does not meet the criteria for classification as carcinogen (Clark 2011; Freeman 2011; Fraunhofer 2006; Niemeir et al,1988; Sivak et al, 1989; Sivak et al, 1997;Boffetta P et al, 2009; Boffetta P et al, 2001).

Reproductive Toxicity: The potential effects on reproductive and developmental toxicity have been investigated in an OECD 422 screening study on fumes from oxidized asphalt. The data available do not indicate a concern for reproductive toxicity following exposure to oxidized asphalt fume (Fraunhofer 2009).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity. (API 1982a; API 1982b; Fraunhofer 2001)

Repeated Exposure: The repeat dose toxicity of oxidized asphalt has been investigated by dermal and inhalation routes. Apart from mild irritation of the upper respiratory tract there is no evidence to suggest that exposure causes systemic toxicity (Fraunhofer 2006; API 1983a; API 1983b).

Aspiration: Not relevant as oxidized asphalts are solid.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: There are no data available on the acute aquatic toxicity of oxidized asphalt. QSAR assessment, based hydrocarbon composition, indicates that they would be expected to give LL50 values > 1000 mg/l for fish, daphnia and algae (Redman, et al, 2010).

Chronic (long-term) Aquatic Hazard: There are no chronic toxicity data available for oxidized asphalt. Oxidized asphalt is not expected to exert chronic toxicity based on water solubility limitations. QSAR assessment of chronic toxicity, based on hydrocarbon composition, indicates that they would be expected to give chronic NOEL values in fish and daphnia of > 1000 mg/l. (Redman, et al, 2010)

Environmental fate (biodegradation / bioaccumulation): Oxidized asphalts are hydrocarbon UVCBs. Based on compositional information available and measured or predicted data on key constituents, oxidized asphalts are not expected to meet the criteria for ready degradability. Constituents of bitumen show predicted values for log $K_{ow} \geq 4$ and are considered potentially bioaccumulative. (HydroQual, 2010).

Part 2 – Summary of Classification Recommendations – Oxidized Asphalt Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical: No classification required

Health: No classification required

Environment: No classification required.

Part 3 – Summary of Classification and Labelling Recommendations – Oxidized Asphalt EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical: No classification required

Health: No classification required

Environment: No classification required

3.2 Labelling

Pictograms:
Not applicable

Signal Words:
Not applicable

Hazard Statements:
Not applicable

Precautionary Statements:
Not applicable

Supplemental Hazard Information:
Not applicable

Additional Considerations for Labelling:
Not applicable

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PETROLEUM COKE

Definition / Domain: Petroleum coke is a black solid produced through the thermal decomposition of heavy petroleum process streams and residues. The petroleum feedstocks undergo cracking and carbonisation to produce a product with a high carbon to hydrogen ratio, which may be granular, sponge or needle-like in appearance. Petroleum cokes can be described as either green or calcined coke.

Part 1 – Classification Endpoint[37] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations.

Flammable Gas: Not relevant – petroleum cokes are solid.

Flammable Aerosol: Not relevant – petroleum cokes are solid

Flammable Liquid: Not relevant – petroleum cokes are solid

Flammable Solid: Petroleum cokes do not meet the criteria for flammability

Oxidising Gas: Not relevant – petroleum cokes are solid.

Oxidising Liquid: Not relevant – petroleum cokes are solid.

Oxidising Solid: Petroleum cokes are solid. They are not considered oxidising based on structural considerations.

Pyrophoric Liquid: Not relevant – petroleum cokes are solid.

Pyrophoric Solid: Petroleum cokes are not pyrophoric.

Self-reactive Substance: Petroleum cokes arenot self-reactive.

Self-heating Substance: Petroleum cokes do not react exothermically.

Gas under Pressure: Not relevant – petroleum cokes are solid.

Organic Peroxide: Petroleum cokes do not meet the definition of a peroxide.

Corrosive to Metal: Petroleum cokes do not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Petroleum cokes do not react with water.

1.2 Health Hazards

Acute Toxicity: Petroleum cokes have not been tested for acute oral, dermal or inhalation toxicity. The data from repeated dose studies in rats, mice and monkeys indicate that their acute toxicity is low (ARCO, 1999; API, 1982b).

[37] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

Skin Corrosion / Irritation: Petroleum cokes have not been tested in skin corrosion/irritation studies. However, their physico-chemical properties and observations made during dermal carcinogenicity studies in mice indicate that the dermal irritation potential of petroleum cokes is low (API, 1982b).

Serious Eye Damage / Irritation: Petroleum cokeshave not been tested in eye irritation studies. However, their physico-chemical properties and observations made during repeated exposure studies in rats and carcinogenicity studies in both rats and monkeys, indicate that the eye irritation potential of petroleum cokes is low (API, 1985).

Respiratory or Skin Sensitization: Petroleum cokeshave not been tested in animal sensitization studies. However, the physico-chemical properties of petroleum cokes and observations made during repeated exposure studies in rats and carcinogenicity studies in both rats and monkeys, did not indicate that any evidence of allergic reactions (ARCO, 1999; API, 1982b). There are no reports in the literature to indicate allergic reactions to humans. It is concluded that the respiratory and dermal sensitization potential of petroleum coke is low

Germ Cell Mutagenicity: The mutagenic potential of petroleum cokes has been studied in both of *in vivo*and *in vitro* assays. Based on the available data, petroleum cokes are not considered to be germ cell mutagens (API, 1981a; API, 1981b).

Carcinogenicity: The carcinogenic potential of petroleum cokes has been investigated in animals following both dermal and inhalation exposures. In addition epidemiological studies have been undertaken in exposed human populations. Based on the available data, petroleum cokes are not considered carcinogenic (API, 1982a; API, 1985)

Reproductive Toxicity: The potential for petroleum coke to induce reproductive toxicity has been examined in animal studies. Results from these studies indicate that exposure to petroleum coke is unlikely to present a reproductive hazard (API, 2004).

Specific Target Organ Toxicity (STOT)

Single Exposure: There are no acute exposure studies available for petroleum cokes.

Repeated Exposure: The repeat dose toxicity of petroleum coke has been investigated by dermal and inhalation routes. Apart from mild irritation of the upper respiratory tract the data do not indicate that exposure to petroleum coke causes systemic toxicity (API, 1982a; API, 1985).

Aspiration: Not relevant as petroleum coke is asolid.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Samples of petroleum coke have been tested for acute aquatic toxicity studies. Results show the following:

LC50 Fathead minnow	> 1,000 mg/l (API, 2007b)
EC50 Daphnia	> 1,000 mg/l (API, 2007a).
IC50 Algae	> 1,000 mg/l (API, 2006).

Chronic (long-term) Aquatic Hazard: There are no chronic toxicity data available for petroleum cokes. The available short-term data and physico-chemical properties of petroleum cokes indicate that this substance is unlikely to pose a long-term hazard to the environment.

Environmental fate (biodegradation / bioaccumulation): Petroleum coke is an amorphous solid composed mainly of elemental carbon. Petroleum cokes are not expected to meet the criteria for ready degradability. The trace hydrocarbon components of petroleum cokes have values for log K_{ow} greater than 6. However, based on their physico-chemical properties (i.e. negligible solubility), the components of this category would not be expected to pose a long-term hazard to the environment.

Part 2 – Summary of Classification Recommendations – Petroleum Coke Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical: No classification required

Health: No classification required

Environment: No classification required

Part 3 – Summary of Classification and Labelling Recommendations – Petroleum Coke
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical: No classification required

Health: No classification required

Environment: No classification required

3.2 Labelling

Pictograms:
Not applicable

Signal Words:
Not applicable

Hazard Statements:
Not applicable

Precautionary Statements:
Not applicable

Supplemental Hazard Information:
Not applicable

Additional Considerations for Labelling:
Not applicable

REFERENCES: PETROLEUM COKE

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ARCO (1999) Calcined coke (F-284) and green coke (F-285): fibrogenic screening study in the rat. Huntingdon Life Sciences Study No. 97-6119. Los AngelesCA: ARCO

SULFUR

Definition / Domain: Most sulfur is produced in de-sulfurisation processes of oil refinery streams, natural gas, gas from coke manufacture, synthesis gas or biogas, where the sulfur is extracted in the form of hydrogen sulfide which is subsequently converted to elemental sulfur. These processes provide sulfur in the form of a mono-constituent substance, i.e. with a concentration of 80% weight/weight or more. Some of these processes, such as the Claus process, yield sulfur with purity in excess of 99%.

Part 1 – Classification Endpoint[38] Rationale / Data Summary

1.1 Physical Hazards

Explosive: Not considered explosive, based on structural and oxygen balance considerations

Flammable Gas: Not relevant **–** sulfur is a solid.

Flammable Aerosol: Not relevant **–** sulfur is not in aerosol form.

Flammable Liquid: Not relevant – sulfur is a solid.

Flammable Solid: Not relevant **–** as sulfur is inorganic.

Oxidising Gas: Not relevant – sulfur is a solid.

Oxidising Liquid: Not relevant – sulfur is a solid.

Oxidising Solid: Not relevant **–** sulfur is an inorganic substance which does not contain oxygen or halogen atoms.

Pyrophoric Liquid: Not relevant – sulfur is a solid.

Pyrophoric Solid: Sulfur does not spontaneously ignite in contact with air.

Self-reactive Substance: Sulfur is not self-reactive. It does not undergo exothermic decomposition when heated.

Self-heating Substance: Sulfur does not react exothermically.

Gas under Pressure: Not relevant - sulfur is a solid.

Organic Peroxide: Sulfur does not meet the definition of a peroxide.

Corrosive to Metal: Sulfur is solid and does not meet the criteria for corrosion of metal.

Substance which in contact with water emits flammable gas: Sulfur does not react with water.

[38] Hazard endpoints presented are derived from the EU CLP Regulation and may not be directly linkable to hazard endpoints in the EC Dangerous Substances Directive

1.2 Health Hazards

Acute Toxicity: Samples of sulfur have been tested in acute oral, dermal and inhalation studies. Results indicate the following:

Rat oral	LD_{50}>2000 mg/kg bw (Terlouw, G.D.C. et al, 1994a)
Rat inhalation	LC_{50} >5430 mg/m³ air (Terlouw, G.D.C. et al, 1994b)
Rabbit dermal	LD_{50}>2000 mg/kg bw (TNO, 1994a)

Skin Corrosion / Irritation: Sulfur was examined for acute dermal irritating/corrosive properties in the rabbit. The test material was irritating to the skin. Based on the available data, this substance is not expected to be corrosive (TNO, 1994b).

Serious Eye Damage / Irritation: The effects of sulfur on the eye have been investigated in the rabbit. None of the samples tested showed more than minimal effects, which resolved within 72 hours (TNO, 1994c; Ravi GS, 2005).

Respiratory or Skin Sensitization: Tests in guinea pigs showed no evidence of skin sensitization. These results together with extensive human experience indicate that sulfur is not a dermal sensitizer (Sulaiman SM, 2005; Venugopala Rao, K, 2005; Arcelin, G, 1994a; Arcelin, G, 1994b). There is no evidence to Indicate that sulfur is likely to be a respiratory sensitizer.

Germ Cell Mutagenicity: The mutagenic potential of sulfur has been extensively studied in a range of *in vivo* and *in vitro* assays. These studies showed no evidence of mutagenic activity (Shivaram, S, 2005c; Indrani, BK, 2005; Rao G, 2005). Based on the available data sulfur is not a germ cell mutagen.

Carcinogenicity: Sulfur is not expected to be carcinogenic based on no evidence of mutagenicity and a lack of structural alerts formutagenicity/carcinogenicity. Furthermore, since sulfur did not cause hyperplasia or pre-neoplastic lesions in the repeat dose toxicity study, it is unlikely that it will present a carcinogenic hazard to man (Malleshappa HN, 2006b; Ramesh E, 2005; Malleshappa HN, 2006a).

Reproductive Toxicity: Based on weight of evidence approach, taking into account both dietary and occupational exposure in humans, its lack of mutagenic activity and its ubiquitous natural occurrence, sulfur is unlikely to present a reproductive hazard to man (EPA 1991).

Specific Target Organ Toxicity (STOT)

Single Exposure: Acute exposure studies show no evidence of systemic toxicity (Terlouw, G.D.C. et al, 1994a; TNO, 1994a; Terlouw, G.D.C. et al, 1994b)

Repeated Exposure: A repeat dose toxicity of sulfur has been in rats following dermal and oral exposure for periods between 28 days and 21 weeks. No systemic toxicity was observed; the only effect observed was local skin effects (Malleshappa HN, 2006b; Ramesh E, 2005b; Malleshappa HN, 2006a).

Aspiration: Not relevant as sulfur is a solid.

1.3 Environmental Hazards

Acute (short-term) Aquatic Hazard: Acute toxicity studies in fish, Daphnia and algae show LC50/EC50 values at >5 µg/l (maximum water solubility) (Pawlowski, S and Wydra, V 2005 a,b; Moll, M and Wydra, V, 2005).

Chronic (long-term) Aquatic Hazard: Sulfur is highly insoluble in water (water solubility <5 µg/l) and is unlikely to present a chronic aquatic hazard.

Environmental fate (biodegradation / bioaccumulation): Biodegradation and bioaccumulation tests are not applicable for sulfur as this substance is inorganic.

Part 2 – Summary of Classification Labelling Recommendations – Sulfur
Dangerous Substances Directive – 67/548/EC, up to 31st ATP

2.1 Hazard Classification

Physical: No classification required

Health: Irritant

Environment: No classification required

Risk Phrases:
R38: Irritating to skin

Part 3 – Summary of Classification and Labelling Recommendations – Sulfur
EU Regulation (EC No. 1272/2008) on Classification, Labelling and Packaging of Substances and Mixtures, up to 3rd ATP

3.1 Hazard Classification

Physical:
No classification required

Health:
H315 Skin Corrosion/Irritation Category 2

Environment:
No classification required

3.2 Labelling

Pictograms: GHS07

Signal Words: Warning

Hazard Statements:
H315: Causes skin irritation

Precautionary Statements: Suggested statementsfor use on labels are shown in **bold text**
P280: Wear protective gloves/protective clothing/eye protection/face protection
P302 + P352: IF ON SKIN: Wash with plenty of soap and water
P332 + P313: If skin irritation occurs: Get medical advice/attention
P264 Wash … thoroughly after handling.
P362 Take off contaminated clothing and wash before reuse.

Supplemental Hazard Information: Consult CLP legislation as appropriate

Additional Considerations for Labelling:
- Not applicable

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APPENDIX 1

Summary of differences between 2010 and 2012 CLP Classification for Petroleum Substances
(Key differences highlighted in green)

	2010 CLP Classification Recommendations	2012 CLP Classifcation Recommendations
Category name		
Crude oil	**H224 (OIN 4)** H304 H350 **H319** H336 H373 **H411**	**H224 (OIN 4)** H304 H350 **H319** H336 H373 **H411**
Petroleum gases[1, 2]	H220 **H280** H340 (EC CLP Note K) H350 (EC CLP Note K) (EC CLP Notes H, U)	H220 **H280** H340 (EC CLP Note K) H350 (EC CLP Note K) (EC CLP Note U)
Other petroleum gases[2]	H220 **H280** H340 (EC CLP Note K) **H360D**[3] H350 (EC CLP Note K) **H332** **H373** (EC CLP Notes H, U)	H220 **H280** H340 (EC CLP Note K) **H360D**[3] H350 (EC CLP Note K) **H332** **H373** (EC CLP Note U)
Low boiling point naphthas/gasoline[4]	H224 (OIN 4) H304 H340 (EC CLP Note P, OIN P (CLP) H350 (EC CLP Note P, OIN P (CLP)) H315 H336 H361fd (OIN 5, OIN 6) H411 (EC CLP Note H)	H224 (OIN 4) H304 H340 (EC CLP Note P, OIN P (CLP)) H350 (EC CLP Note P, OIN P (CLP)) H315 H336 H361fd (OIN 5, OIN 6) H411
Kerosines	H226 (OIN 12) H304 H315 **H336** H411 (EC CLP Note H)	H226 (OIN 12) H304 H315 **H336** H411

[1] Note K do not apply to the substances with CAS RN 74-98-6, 75-28-5 and 106-97-8. Note C applies only to the substances with CAS RN 75-28-5 and 106-97-8. Note S applies only to the substances with CAS RN 68476-85-7, 68476-86-8 and 92045-80-2. Only for CLP, Note U applies to all substances.

[2] See CONCAWE substance/category inventory, as members of these categories have been updated versus the historic CONCAWE petroleum gases categories.

[3] H360D, H332, H373 are applied only when CO and H_2S exceed specified thresholds

[4] Notes H and P do not apply to the substances with CAS RN 64741-72-6 and 68783-11-9. Note P does not apply to the substances with CAS RN 92045-37-9 and 68919-39-1. Note J applies only to the substance with CAS RN 68919-39-1.

MK1 Diesel Fuel	H304 H315 **H336** H411	H304 H315 **H336** H411
Straight run gas oils	**H226 (OIN 12)** H304 H332 **H373** H411	**H226 (OIN 12)** H304 H332 **H373** H411
Cracked gas oils	**H226 (OIN 12)** H304 H350 H315 H332 H373 H400 (M Factor =1) H410 (M Factor =1)	**H226 (OIN 12)** H304 H350 H315 H332 H373 H400 (M Factor =1) H410 (M Factor =1)
Vacuum gas oils Hydrocracked gas oils Distillate fuels oils	**H226 (OIN 12)** H304 H315 H332 H351 **H373** H411	**H226 (OIN 12)** H304 H315 H332 H351 **H373** H411
Other gas oils	**H226 (OIN 12)** H304 H350 (EC CLP Note N) H315 H332 H373 (OIN 14) H411 (EC CLP Note H)	**H226 (OIN 12)** H304 H350 (EC CLP Note N) H315 H332 H373 (OIN 14) H411
Heavy Fuel Oil Components	H350 **H304** H332 H361d H373 H400 (M Factor =1) H410 (M Factor =1) (EC CLP Note H)	H350 **H304** H332 H361d H373 H400 (M Factor =1) H410 (M Factor =1)
Unrefined/acid treated oils	H304 H350 **H372** H361d H412 (EC CLP Note H)	H304 H350 **H372** H361d H411
Highly refined base oils	H304	H304

Other Lubricant Base Oils[5]	H304 H350 (EC CLP Note L, OIN L(CLP)) **H372 (OIN 8)** H361d (OIN 8) (EC CLP Note H)	H304 H350 (EC CLP Note L, OIN L (CLP)) **H372 (OIN 8)** H361d (OIN 8)
Foots oils	H304 H350 (EC CLP Note L) **H372 (OIN 8)** H361d (OIN 8) (EC CLP Note H)	H304 H350 (EC CLP Note L) **H372 (OIN 8)** H361d (OIN 8)
Residual aromatic extracts	H351 (OIN 10)	H351 (OIN 10)
Untreated Distillate aromatic extracts	**H304** H350 **H372** H361d H412 (EC CLP Note H)	**H304** H350 **H372** H361d H411
Treated DAE	**H304** H350 (Note L) **H372 (OIN 8)** H361d (OIN 8) (EC CLP Note H)	**H304** H350 (Note L) **H372 (OIN 8)** H361d (OIN 8)
Paraffin and hydrocarbon waxes	Not classified	Not classified
Slack waxes	H350 (EC CLP Note N) **H372 (OIN 8)** H361d (OIN 8) (EC CLP Note H)	H350 (EC CLP Note N) **H372 (OIN 8)** H361d (OIN 8)
Petrolatums	H350 (EC CLP Note N) **H372 (OIN 8)** H361d (OIN 8) (EC CLP Note H)	H350 (EC CLP Note N) **H372 (OIN 8)** H361d (OIN 8)
Bitumen	Not classified	Not classified
Oxidized Asphalt[6]	Not classified	Not classified
Petroleum coke	Not classified	Not classified
Sulfur	H315	H315

[5] Notes H and L do not apply to the substances with CAS RN 72623-83-7, 92045-44-8 and 92045-45-9.
[6] Oxidized asphalt previously included in the Bitumen category

APPENDIX 2

LISTINGS OF PETROLEUM SUBSTANCES

2A. Groups of Petroleum Substances (EINECS Number Order)

2B. Petroleum Substances (EINECS Number Order) with Short Names

APPENDIX 2A

Groups of Petroleum Substances (EC No. order)

CRUDE OILS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
232-298-5	8002-05-9	Petroleum

PETROLEUM GASES		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
200-827-9	74-98-6	Propane
200-857-2	75-28-5	Isobutane
203-448-7	106-97-8	Butane

OTHER PETROLEUM GASES		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
268-629-5	68131-75-9	Gases (petroleum), C3-4
269-617-2	68307-98-2	Tail gas (petroleum), catalytic cracked distillate and catalytic cracked naphtha fractionation absorber
269-618-8	68307-99-3	Tail gas (petroleum), catalytic polymn. naphtha fractionation stabilizer
269-619-3	68308-00-9	Tail gas (petroleum), catalytic reformed naphtha fractionation stabilizer, hydrogen sulfide-free
269-620-9	68308-01-0	Tail gas (petroleum), cracked distillate hydrotreater stripper
269-623-5	68308-03-2	Tail gas (petroleum), gas oil catalytic cracking absorber
269-624-0	68308-04-3	Tail gas (petroleum), gas recovery plant
269-625-6	68308-05-4	Tail gas (petroleum), gas recovery plant deethanizer
269-626-1	68308-06-5	Tail gas (petroleum), hydrodesulfurized distillate and hydrodesulfurized naphtha fractionator, acid-free
269-627-7	68308-07-6	Tail gas (petroleum), hydrodesulfurized vacuum gas oil stripper, hydrogen sulfide-free
269-628-2	68308-08-7	Tail gas (petroleum), isomerized naphtha fractionation stabilizer
269-629-8	68308-09-8	Tail gas (petroleum), light straight-run naphtha stabilizer, hydrogen sulfide-free
269-630-3	68308-10-1	Tail gas (petroleum), straight-run distillate hydrodesulfurizer, hydrogen sulfide-free
269-631-9	68308-11-2	Tail gas (petroleum), propane-propylene alkylation feed prep deethanizer
269-632-4	68308-12-3	Tail gas (petroleum), vacuum gas oil hydrodesulfurizer, hydrogen sulfide-free
269-640-8	68308-27-0	Fuel gases, refinery
270-071-2	68409-99-4	Gases (petroleum), catalytic cracked overheads
270-651-5	68475-57-0	Alkanes, C1-2

OTHER PETROLEUM GASES		
270-652-0	68475-58-1	Alkanes, C2-3
270-653-6	68475-59-2	Alkanes, C3-4
270-654-1	68475-60-5	Alkanes, C4-5
270-667-2	68476-26-6	Fuel gases
270-670-9	68476-29-9	Fuel gases, crude oil distillates
270-681-9	68476-40-4	Hydrocarbons, C3-4
270-682-4	68476-42-6	Hydrocarbons, C4-5
270-689-2	68476-49-3	Hydrocarbons, C2-4, C3-rich
270-704-2	68476-85-7	Petroleum gases, liquefied
270-705-8	68476-86-8	Petroleum gases, liquefied, sweetened
270-724-1	68477-33-8	Gases (petroleum), C3-4, isobutane-rich
270-726-2	68477-35-0	Distillates (petroleum), C3-6, piperylene-rich
270-746-1	68477-65-6	Gases (petroleum), amine system feed
270-747-7	68477-66-7	Gases (petroleum), benzene unit hydrodesulfurizer off
270-748-2	68477-67-8	Gases (petroleum), benzene unit recycle, hydrogen-rich
270-749-8	68477-68-9	Gases (petroleum), blend oil, hydrogen-nitrogen-rich
270-750-3	68477-69-0	Gases (petroleum), butane splitter overheads
270-751-9	68477-70-3	Gases (petroleum), C2-3
270-752-4	68477-71-4	Gases (petroleum), catalytic-cracked gas oil depropanizer bottoms, C4-rich acid-free
270-754-5	68477-72-5	Gases (petroleum), catalytic-cracked naphtha debutanizer bottoms, C3-5-rich
270-755-0	68477-73-6	Gases (petroleum), catalytic cracked naphtha depropanizer overhead, C3-rich acid-free
270-756-6	68477-74-7	Gases (petroleum), catalytic cracker
270-757-1	68477-75-8	Gases (petroleum), catalytic cracker, C1-5-rich
270-758-7	68477-76-9	Gases (petroleum), catalytic polymd. naphtha stabilizer overhead, C2-4-rich
270-759-2	68477-77-0	Gases (petroleum), catalytic reformed naphtha stripper overheads
270-760-8	68477-79-2	Gases (petroleum), catalytic reformer, C1-4-rich
270-761-3	68477-80-5	Gases (petroleum), C6-8 catalytic reformer recycle
270-762-9	68477-81-6	Gases (petroleum), C6-8 catalytic reformer
270-763-4	68477-82-7	Gases (petroleum), C6-8 catalytic reformer recycle, hydrogen-rich
270-765-5	68477-83-8	Gases (petroleum), C3-5 olefinic-paraffinic alkylation feed
270-766-0	68477-84-9	Gases (petroleum), C2-return stream
270-767-6	68477-85-0	Gases (petroleum), C4-rich
270-768-1	68477-86-1	Gases (petroleum), deethanizer overheads
270-769-7	68477-87-2	Gases (petroleum), deisobutanizer tower overheads
270-772-3	68477-90-7	Gases (petroleum), depropanizer dry, propene-rich
270-773-9	68477-91-8	Gases (petroleum), depropanizer overheads
270-774-4	68477-92-9	Gases (petroleum), dry sour, gas-concn.-unit-off
270-776-5	68477-93-0	Gases (petroleum), gas concn. reabsorber distn.
270-777-0	68477-94-1	Gases (petroleum), gas recovery plant depropanizer overheads
270-778-6	68477-95-2	Gases (petroleum), Girbatol unit feed
270-779-1	68477-96-3	Gases (petroleum), hydrogen absorber off
270-780-7	68477-97-4	Gases (petroleum), hydrogen-rich

OTHER PETROLEUM GASES		
270-781-2	68477-98-5	Gases (petroleum), hydrotreater blend oil recycle, hydrogen-nitrogen-rich
270-782-8	68477-99-6	Gases (petroleum), isomerized naphtha fractionator, C4-rich, hydrogen sulfide-free
270-783-3	68478-00-2	Gases (petroleum), recycle, hydrogen-rich
270-784-9	68478-01-3	Gases (petroleum), reformer make-up, hydrogen-rich
270-785-4	68478-02-4	Gases (petroleum), reforming hydrotreater
270-787-5	68478-03-5	Gases (petroleum), reforming hydrotreater, hydrogen-methane-rich
270-788-0	68478-04-6	Gases (petroleum), reforming hydrotreater make-up, hydrogen-rich
270-789-6	68478-05-7	Gases (petroleum), thermal cracking distn.
270-802-5	68478-21-7	Tail gas (petroleum), catalytic cracked clarified oil and thermal cracked vacuum residue fractionation reflux drum
270-803-0	68478-22-8	Tail gas (petroleum), catalytic cracked naphtha stabilization absorber
270-804-6	68478-24-0	Tail gas (petroleum), catalytic cracker, catalytic reformer and hydrodesulfurizer combined fractionater
270-805-1	68478-25-1	Tail gas (petroleum), catalytic cracker refractionation absorber
270-806-7	68478-26-2	Tail gas (petroleum), catalytic reformed naphtha fractionation stabilizer
270-807-2	68478-27-3	Tail gas (petroleum), catalytic reformed naphtha separator
270-808-8	68478-28-4	Tail gas (petroleum), catalytic reformed naphtha stabilizer
270-809-3	68478-29-5	Tail gas (petroleum), cracked distillate hydrotreater separator
270-810-9	68478-30-8	Tail gas (petroleum), hydrodesulfurized straight-run naphtha separator
270-813-5	68478-32-0	Tail gas (petroleum), saturate gas plant mixed stream, C4-rich
270-814-0	68478-33-1	Tail gas (petroleum), saturate gas recovery plant, C1-2-rich
270-815-6	68478-34-2	Tail gas (petroleum), vacuum residues thermal cracker
270-990-9	68512-91-4	Hydrocarbons, C3-4-rich, petroleum distillate
270-999-8	68513-14-4	Gases (petroleum), catalytic reformed straight-run naphtha stabilizer overheads
271-000-8	68513-15-5	Gases (petroleum), full-range straight-run naphtha dehexanizer off
271-001-3	68513-16-6	Gases (petroleum), hydrocracking depropanizer off, hydrocarbon-rich
271-002-9	68513-17-7	Gases (petroleum), light straight-run naphtha stabilizer off
271-003-4	68513-18-8	Gases (petroleum), reformer effluent high-pressure flash drum off
271-005-5	68513-19-9	Gases (petroleum), reformer effluent low-pressure flash drum off
271-010-2	68513-66-6	Residues (petroleum), alkylation splitter, C4-rich
271-032-2	68514-31-8	Hydrocarbons, C1-4
271-038-5	68514-36-3	Hydrocarbons, C1-4, sweetened
271-258-1	68527-15-1	Gases (petroleum), oil refinery gas distn. off
271-259-7	68527-16-2	Hydrocarbons, C1-3
271-261-8	68527-19-5	Hydrocarbons, C1-4, debutanizer fraction
271-623-5	68602-82-4	Gases (petroleum), benzene unit hydrotreater depentanizer overheads
271-624-0	68602-83-5	Gases (petroleum), C1-5, wet

OTHER PETROLEUM GASES		
271-625-6	68602-84-6	Gases (petroleum), secondary absorber off, fluidized catalytic cracker overheads fractionator
271-734-9	68606-25-7	Hydrocarbons, C2-4
271-735-4	68606-26-8	Hydrocarbons, C3
271-737-5	68606-27-9	Gases (petroleum), alkylation feed
271-742-2	68606-34-8	Gases (petroleum), depropanizer bottoms fractionation off
271-750-6	68607-11-4	Petroleum products, refinery gases
272-182-1	68783-06-2	Gases (petroleum), hydrocracking low-pressure separator
272-183-7	68783-07-3	Gases (petroleum), refinery blend
272-203-4	68783-64-2	Gases (petroleum), catalytic cracking
272-205-5	68783-65-3	Gases (petroleum), C2-4, sweetened
272-338-9	68814-67-5	Gases (petroleum), refinery
272-343-6	68814-90-4	Gases (petroleum), platformer products separator off
272-775-5	68911-58-0	Gases (petroleum), hydrotreated sour kerosine depentanizer stabilizer off
272-776-0	68911-59-1	Gases (petroleum), hydrotreated sour kerosine flash drum
272-871-7	68918-99-0	Gases (petroleum), crude oil fractionation off
272-872-2	68919-00-6	Gases (petroleum), dehexanizer off
272-873-8	68919-01-7	Gases (petroleum), distillate unifiner desulfurization stripper off
272-874-3	68919-02-8	Gases (petroleum), fluidized catalytic cracker fractionation off
272-875-9	68919-03-9	Gases (petroleum), fluidized catalytic cracker scrubbing secondary absorber off
272-876-4	68919-04-0	Gases (petroleum), heavy distillate hydrotreater desulfurization stripper off
272-878-5	68919-05-1	Gases (petroleum), light straight run gasoline fractionation stabilizer off
272-879-0	68919-06-2	Gases (petroleum), naphtha unifiner desulfurization stripper off
272-880-6	68919-07-3	Gases (petroleum), platformer stabilizer off, light ends fractionation
272-881-1	68919-08-4	Gases (petroleum), preflash tower off, crude distn.
272-882-7	68919-09-5	Gases (petroleum), straight-run naphtha catalytic reforming off
272-883-2	68919-10-8	Gases (petroleum), straight-run stabilizer off
272-884-8	68919-11-9	Gases (petroleum), tar stripper off
272-885-3	68919-12-0	Gases (petroleum), unifiner stripper off
272-893-7	68919-20-0	Gases (petroleum), fluidized catalytic cracker splitter overheads
273-169-3	68952-76-1	Gases (petroleum), catalytic cracked naphtha debutanizer
273-170-9	68952-77-2	Tail gas (petroleum), catalytic cracked distillate and naphtha stabilizer
273-173-5	68952-79-4	Tail gas (petroleum), catalytic hydrodesulfurized naphtha separator
273-174-0	68952-80-7	Tail gas (petroleum), straight-run naphtha hydrodesulfurizer
273-175-6	68952-81-8	Tail gas (petroleum), thermal-cracked distillate, gas oil and naphtha absorber
273-176-1	68952-82-9	Tail gas (petroleum), thermal cracked hydrocarbon fractionation stabilizer, petroleum coking
273-265-5	68955-28-2	Gases (petroleum), light steam-cracked, butadiene conc.

OTHER PETROLEUM GASES		
273-269-7	68955-33-9	Gases (petroleum), sponge absorber off, fluidized catalytic cracker and gas oil desulfurizer overhead fractionation
273-270-2	68955-34-0	Gases (petroleum), straight-run naphtha catalytic reformer stabilizer overhead
273-563-5	68989-88-8	Gases (petroleum), crude distn. and catalytic cracking
289-339-5	87741-01-3	Hydrocarbons, C4
292-456-4	90622-55-2	Alkanes, C1-4, C3-rich
295-397-2	92045-15-3	Gases (petroleum), gas oil diethanolamine scrubber off
295-398-8	92045-16-4	Gases (petroleum), gas oil hydrodesulfurization effluent
295-399-3	92045-17-5	Gases (petroleum), gas oil hydrodesulfurization purge
295-400-7	92045-18-6	Gases (petroleum), hydrogenator effluent flash drum off
295-401-2	92045-19-7	Gases (petroleum), naphtha steam cracking high-pressure residual
295-402-8	92045-20-0	Gases (petroleum), residue visbreaking off
295-404-9	92045-22-2	Gases (petroleum), steam-cracker C3-rich
295-405-4	92045-23-3	Hydrocarbons, C4, steam-cracker distillate
295-463-0	92045-80-2	Petroleum gases, liquefied, sweetened, C4 fraction
306-004-1	95465-89-7	Hydrocarbons, C4, 1,3-butadiene- and isobutene-free
307-769-4	97722-19-5	Raffinates (petroleum), steam-cracked C4 fraction cuprous ammonium acetate extn., C3-5 and C3-5 unsatd., butadiene-free

LOW BOILING POINT NAPHTHAS (GASOLINES)		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
232-349-1	8006-61-9	Gasoline, natural
232-443-2	8030-30-6	Naphtha
232-453-7	8032-32-4	Ligroine
265-041-0	64741-41-9	Naphtha (petroleum), heavy straight-run
265-042-6	64741-42-0	Naphtha (petroleum), full-range straight-run
265-046-8	64741-46-4	Naphtha (petroleum), light straight-run
265-047-3	64741-47-5	Natural gas condensates (petroleum)
265-048-9	64741-48-6	Natural gas (petroleum), raw liq. mix
265-055-7	64741-54-4	Naphtha (petroleum), heavy catalytic cracked
265-056-2	64741-55-5	Naphtha (petroleum), light catalytic cracked
265-065-1	64741-63-5	Naphtha (petroleum), light catalytic reformed
265-066-7	64741-64-6	Naphtha (petroleum), full-range alkylate
265-067-2	64741-65-7	Naphtha (petroleum), heavy alkylate
265-068-8	64741-66-8	Naphtha (petroleum), light alkylate
265-070-9	64741-68-0	Naphtha (petroleum), heavy catalytic reformed
265-071-4	64741-69-1	Naphtha (petroleum), light hydrocracked
265-073-5	64741-70-4	Naphtha (petroleum), isomerization
613-683-0	64741-72-6	Naphtha (petroleum), polymn.
265-075-6	64741-74-8	Naphtha (petroleum), light thermal cracked
265-079-8	64741-78-2	Naphtha (petroleum), heavy hydrocracked
265-085-0	64741-83-9	Naphtha (petroleum), heavy thermal cracked
265-086-6	64741-84-0	Naphtha (petroleum), solvent-refined light
265-089-2	64741-87-3	Naphtha (petroleum), sweetened

LOW BOILING POINT NAPHTHAS (GASOLINES)		
265-095-5	64741-92-0	Naphtha (petroleum), solvent-refined heavy
265-115-2	64742-15-0	Naphtha (petroleum), acid-treated
265-122-0	64742-22-9	Naphtha (petroleum), chemically neutralized heavy
265-123-6	64742-23-0	Naphtha (petroleum), chemically neutralized light
265-150-3	64742-48-9	Naphtha (petroleum), hydrotreated heavy
265-151-9	64742-49-0	Naphtha (petroleum), hydrotreated light
265-170-2	64742-66-1	Naphtha (petroleum), catalytic dewaxed
265-178-6	64742-73-0	Naphtha (petroleum), hydrodesulfurized light
265-185-4	64742-82-1	Naphtha (petroleum), hydrodesulfurized heavy
265-192-2	64742-89-8	Solvent naphtha (petroleum), light aliph.
265-199-0	64742-95-6	Solvent naphtha (petroleum), light arom.
267-563-4	67891-79-6	Distillates (petroleum), heavy arom.
267-565-5	67891-80-9	Distillates (petroleum), light arom.
268-618-5	68131-49-7	Aromatic hydrocarbons, C6-10, acid-treated, neutralized
270-077-5	68410-05-9	Distillates (petroleum), straight-run Light
270-088-5	68410-71-9	Raffinates (petroleum), catalytic reformer ethylene glycol-water countercurrent exts.
270-092-7	68410-96-8	Distillates (petroleum), hydrotreated middle, intermediate boiling
270-093-2	68410-97-9	Distillates (petroleum), light distillate hydrotreating process, low-boiling
270-094-8	68410-98-0	Distillates (petroleum), hydrotreated heavy naphtha, deisohexanizer overheads
270-344-6	68425-29-6	Distillates (petroleum), naphtha-raffinate pyrolyzate-derived, gasoline-blending
270-349-3	68425-35-4	Raffinates (petroleum), reformer, Lurgi unit-sepd.
270-658-3	68475-70-7	Aromatic hydrocarbons, C6-8, naphtha-raffinate pyrolyzate-derived
270-660-4	68475-79-6	Distillates (petroleum), catalytic reformed depentanizer
270-686-6	68476-46-0	Hydrocarbons, C3-11, catalytic cracker distillates
270-687-1	68476-47-1	Hydrocarbons, C2-6, C6-8 catalytic reformer
270-690-8	68476-50-6	Hydrocarbons, C≥5, C5-6-rich
270-695-5	68476-55-1	Hydrocarbons, C5-rich
270-725-7	68477-34-9	Distillates (petroleum), C3-5, 2-methyl-2-butene-rich
270-741-4	68477-61-2	Extracts (petroleum), cold-acid, C4-6
270-771-8	68477-89-4	Distillates (petroleum), depentanizer overheads
270-791-7	68478-12-6	Residues (petroleum), butane splitter bottoms
270-794-3	68478-15-9	Residues (petroleum), C6-8 catalytic reformer
270-795-9	68478-16-0	Residual oils (petroleum), deisobutanizer tower
270-988-8	68512-78-7	Solvent naphtha (petroleum), light arom., hydrotreated
270-991-4	68513-02-0	Naphtha (petroleum), full-range coker
270-993-5	68513-03-1	Naphtha (petroleum), light catalytic reformed, arom.-free
271-008-1	68513-63-3	Distillates (petroleum), catalytic reformed straight-run naphtha overheads
271-025-4	68514-15-8	Gasoline, vapor-recovery
271-058-4	68514-79-4	Petroleum products, hydrofiner-powerformer reformates
271-262-3	68527-21-9	Naphtha (petroleum), clay-treated full-range straight-run
271-263-9	68527-22-0	Naphtha (petroleum), clay-treated light straight-run

LOW BOILING POINT NAPHTHAS (GASOLINES)		
271-267-0	68527-27-5	Naphtha (petroleum), full-range alkylate, butane-contg.
271-631-9	68603-00-9	Distillates (petroleum), thermal cracked naphtha and gas oil
271-632-4	68603-01-0	Distillates (petroleum), thermal cracked naphtha and gas oil, C5-dimer-contg.
271-634-5	68603-03-2	Distillates (petroleum), thermal cracked naphtha and gas oil, extractive
271-635-0	68603-08-7	Naphtha (petroleum), arom
271-726-5	68606-10-0	Gasoline, pyrolysis, debutanizer bottoms
271-727-0	68606-11-1	Gasoline, straight-run, topping-plant
272-185-8	68783-09-5	Naphtha (petroleum), catalytic cracked light distd.
614-725-0	68783-11-9	Naphtha (petroleum), light polymn.
272-186-3	68783-12-0	Naphtha (petroleum), unsweetened
272-206-0	68783-66-4	Naphtha (petroleum), light, sweetened
272-895-8	68919-37-9	Naphtha (petroleum), full-range reformed
272-896-3	68919-39-1	Natural gas condensates
272-931-2	68921-08-4	Distillates (petroleum), light straight-run gasoline fractionation stabilizer overheads
272-932-8	68921-09-5	Distillates (petroleum), naphtha unifiner stripper
273-266-0	68955-29-3	Distillates (petroleum), light thermal cracked, debutanized arom.
273-271-8	68955-35-1	Naphtha (petroleum), catalytic reformed
285-509-8	85116-58-1	Distillates (petroleum), catalytic reformed hydrotreated light, C8-12 arom. fraction
285-510-3	85116-59-2	Naphtha (petroleum), catalytic reformed light, arom.-free fraction
285-511-9	85116-60-5	Naphtha (petroleum), hydrodesulfurized thermal cracked light
285-512-4	85116-61-6	Naphtha (petroleum), hydrotreated light, cycloalkane-contg.
289-220-8	86290-81-5	Gasoline
292-695-4	90989-39-2	Aromatic hydrocarbons, C8-10
292-698-0	90989-42-7	Aromatic hydrocarbons, C7-8, dealkylation products, distn. residues
295-279-0	91995-18-5	Aromatic hydrocarbons, C8, catalytic reforming-derived
295-298-4	91995-38-9	Hydrocarbons, C4-6, depentanizer lights, arom. hydrotreater
295-331-2	91995-68-5	Extracts (petroleum), catalytic reformed light naphtha solvent
295-418-5	92045-37-9	Kerosine (petroleum), straight-run wide-cut
295-430-0	92045-49-3	Naphtha (petroleum), C4-12 butane-alkylate, isooctane-rich
295-431-6	92045-50-6	Naphtha (petroleum), heavy catalytic cracked, sweetened
295-433-7	92045-52-8	Naphtha (petroleum), hydrodesulfurized full-range
295-434-2	92045-53-9	Naphtha (petroleum), hydrodesulfurized light, dearomatized
295-436-3	92045-55-1	Hydrocarbons, hydrotreated light naphtha distillates, solvent-refined
295-440-5	92045-58-4	Naphtha (petroleum), isomerization, C6-fraction
295-441-0	92045-59-5	Naphtha (petroleum), light catalytic cracked sweetened
295-442-6	92045-60-8	Naphtha (petroleum), light, C5-rich, sweetened
295-444-7	92045-62-0	Hydrocarbons, C8-11, naphtha-cracking, toluene cut
295-445-2	92045-63-1	Hydrocarbons, C4-11, naphtha-cracking, arom.-free
295-446-8	92045-64-2	Hydrocarbons, C6-7, naphtha-cracking, solvent-refined
295-447-3	92045-65-3	Naphtha (petroleum), light thermal cracked, sweetened
295-529-9	92062-15-2	Solvent naphtha (petroleum), hydrotreated light naphthenic

LOW BOILING POINT NAPHTHAS (GASOLINES)		
295-794-0	92128-94-4	Hydrocarbons, C8-12, catalytic-cracking, chem. neutralized
296-903-4	93165-19-6	Distillates (petroleum), C6-rich
297-401-8	93571-75-6	Aromatic hydrocarbons, C7-12, C8-rich
297-458-9	93572-29-3	Gasoline, C5-11, high-octane stabilized reformed
297-465-7	93572-35-1	Hydrocarbons, C7-12, C>9-arom.-rich, reforming heavy fraction
297-466-2	93572-36-2	Hydrocarbons, C5-11, nonaroms.-rich, reforming light fraction
297-852-0	93763-33-8	Hydrocarbons, C6-11, hydrotreated, dearomatized
297-853-6	93763-34-9	Hydrocarbons, C9-12, hydrotreated, dearomatized
302-639-3	94114-03-1	Gasoline, pyrolysis, hydrogenated
308-261-5	97926-43-7	Extracts (petroleum), heavy naphtha solvent, clay-treated
309-862-5	101316-56-7	Distillates (petroleum), C7-9, C8-rich, hydrodesulfurized dearomatized
309-870-9	101316-66-9	Hydrocarbons, C6-8, hydrogenated sorption-dearomatized, toluene raffination
309-871-4	101316-67-0	Hydrocarbons, C6-rich, hydrotreated light naphtha distillates, solvent-refined
309-879-8	101316-76-1	Naphtha (petroleum), hydrodesulfurized full-range coker
309-945-6	101631-20-3	Naphtha (petroleum), heavy straight run, arom
309-974-4	101794-97-2	Hydrocarbons, C8-12, catalytic cracker distillates
309-976-5	101795-01-1	Naphtha (petroleum), sweetened light
309-987-5	101896-28-0	Hydrocarbons, C8-12, catalytic cracking, chem. neutralized, sweetened

KEROSINES		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
232-366-4	8008-20-6	Kerosine (petroleum)
265-074-0	64741-73-7	Distillates (petroleum), alkylate
265-099-7	64741-98-6	Extracts (petroleum), heavy naphtha solvent
265-132-5	64742-31-0	Distillates (petroleum), chemically neutralized light
265-149-8	64742-47-8	Distillates (petroleum), hydrotreated light
265-184-9	64742-81-0	Kerosine (petroleum), hydrodesulfurized
265-191-7	64742-88-7	Solvent naphtha (petroleum), medium aliph.
265-198-5	64742-94-5	Solvent naphtha (petroleum), heavy arom.
265-200-4	64742-96-7	Solvent naphtha (petroleum), heavy aliph.
269-778-9	68333-23-3	Naphtha (petroleum), heavy coker
285-507-7	85116-55-8	Kerosine (petroleum), hydrodesulfurized thermal cracked
285-508-2	85116-57-0	Naphtha (petroleum), catalytic reformed hydrodesulfurized heavy, arom. fraction
294-799-5	91770-15-9	Kerosine (petroleum), sweetened
295-416-4	92045-36-8	Kerosine (petroleum), solvent-refined sweetened
297-854-1	93763-35-0	Hydrocarbons, C9-16, hydrotreated, dearomatized
307-033-2	97488-94-3	Kerosine (petroleum), solvent-refined hydrodesulfurized
309-864-6	101316-58-9	Distillates (petroleum), hydrodesulfurized full-range middle coker
309-866-7	101316-61-4	Distillates (petroleum), thermal-cracked, alkylarom. hydrocarbon-rich

KEROSINES		
309-881-9	101316-80-7	Solvent naphtha (petroleum), hydrocracked heavy arom.
309-882-4	101316-81-8	Solvent naphtha (petroleum), hydrodesulfurized heavy arom.
309-884-5	101316-82-9	Solvent naphtha (petroleum), hydrodesulfurized medium
309-938-8	101631-13-4	Distillates (petroleum), catalytic cracked heavy tar light
309-944-0	101631-19-0	Kerosine (petroleum), hydrotreated

MK1 DIESEL FUEL		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
None	none	MK1 diesel fuel

STRAIGHT RUN GAS OILS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-043-1	64741-43-1	Gas oils (petroleum), straight-run
265-044-7	64741-44-2	Distillates (petroleum), straight-run middle
272-341-5	68814-87-9	Distillates (petroleum), full-range straight-run middle
272-817-2	68915-96-8	Distillates (petroleum), heavy straight-run
272-818-8	68915-97-9	Gas oils (petroleum), straight-run, high-boiling
294-454-9	91722-55-3	Distillates (petroleum), solvent-dewaxed straight-run middle
295-528-3	92062-14-1	Solvent naphtha (petroleum), heavy
296-468-0	92704-36-4	Gas oils (petroleum), straight-run, clay-treated
309-695-8	100684-24-0	Gas oils (petroleum), straight-run, carbon-treated

CRACKED GAS OILS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-060-4	64741-59-9	Distillates (petroleum), light catalytic cracked
265-062-5	64741-60-2	Distillates (petroleum), intermediate catalytic cracked
265-084-5	64741-82-8	Distillates (petroleum), light thermal cracked
269-781-5	68333-25-5	Distillates (petroleum), hydrodesulfurized light catalytic cracked
272-930-7	68921-07-3	Distillates (petroleum), hydrotreated light catalytic cracked
285-505-6	85116-53-6	Distillates (petroleum), hydrodesulfurized thermal cracked middle
295-411-7	92045-29-9	Gas oils (petroleum), thermal-cracked, hydrodesulfurized
295-991-1	92201-60-0	Distillates (petroleum), light catalytic cracked, thermally degraded
308-278-8	97926-59-5	Gas oils (petroleum), light vacuum, thermal-cracked hydrodesulfurized
309-865-1	101316-59-0	Distillates (petroleum), hydrodesulfurized middle coker

VACUUM GAS OILS, HYDROCRACKED GAS OILS AND DISTILLATE FUELS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-049-4	64741-49-7	Condensates (petroleum), vacuum tower
265-059-9	64741-58-8	Gas oils (petroleum), light vacuum

VACUUM GAS OILS, HYDROCRACKED GAS OILS AND DISTILLATE FUELS		
265-078-2	64741-77-1	Distillates (petroleum), light hydrocracked
265-190-1	64742-87-6	Gas oils (petroleum), hydrodesulfurized light vacuum
269-822-7	68334-30-5	Fuels, diesel
270-671-4	68476-30-2	Fuel oil, no. 2
270-673-5	68476-31-3	Fuel oil, no. 4
270-676-1	68476-34-6	Fuels, diesel, no. 2
295-407-5	92045-24-4	Gas oils (petroleum), hydrotreated light vacuum
295-408-0	92045-26-6	Gas oils (petroleum), light vacuum, solvent-dewaxed
295-409-6	92045-27-7	Gas oils (petroleum), solvent-refined light vacuum
307-662-2	97675-88-2	Hydrocarbons, C16-20, solvent-dewaxed hydrocracked paraffinic distn. residue
307-750-0	97722-01-5	Gas oils, light naphthenic vacuum
307-754-2	97722-05-9	Hydrocarbons, C16-20, hydrotreated distillate, vacuum distn. lights
307-756-3	97722-07-1	Hydrocarbons, C11-17, naphthenic middle
309-693-7	100684-22-8	Gas oils (petroleum), light vacuum, carbon-treated
309-694-2	100684-23-9	Gas oils (petroleum), light vacuum, clay-treated

OTHER GAS OILS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-088-7	64741-86-2	Distillates (petroleum), sweetened middle
265-092-9	64741-90-8	Gas oils (petroleum), solvent-refined
265-093-4	64741-91-9	Distillates (petroleum), solvent-refined middle
265-112-6	64742-12-7	Gas oils (petroleum), acid-treated
265-113-1	64742-13-8	Distillates (petroleum), acid-treated middle
265-114-7	64742-14-9	Distillates (petroleum), acid-treated light
265-129-9	64742-29-6	Gas oils (petroleum), chemically neutralized
265-130-4	64742-30-9	Distillates (petroleum), chemically neutralized middle
265-139-3	64742-38-7	Distillates (petroleum), clay-treated middle
265-148-2	64742-46-7	Distillates (petroleum), hydrotreated middle
265-182-8	64742-79-6	Gas oils (petroleum), hydrodesulfurized
265-183-3	64742-80-9	Distillates (petroleum), hydrodesulfurized middle
270-719-4	68477-29-2	Distillates (petroleum), catalytic reformer fractionator residue, high-boiling
270-721-5	68477-30-5	Distillates (petroleum), catalytic reformer fractionator residue, intermediate-boiling
270-722-0	68477-31-6	Distillates (petroleum), catalytic reformer fractionator residue, low-boiling
292-454-3	90622-53-0	Alkanes, C12-26-branched and linear
292-615-8	90640-93-0	Distillates (petroleum), highly refined middle
295-294-2	91995-34-5	Distillates (petroleum), catalytic reformer, heavy arom. conc.
300-227-8	93924-33-5	Gas oils, paraffinic
307-035-3	97488-96-5	Naphtha (petroleum), solvent-refined hydrodesulfurized heavy
307-659-6	97675-85-9	Hydrocarbons, C16-20, hydrotreated middle distillate, distn. lights
307-660-1	97675-86-0	Hydrocarbons, C12-20, hydrotreated paraffinic, distn. lights

OTHER GAS OILS		
307-757-9	97722-08-2	Hydrocarbons, C11-17, solvent-extd. light naphthenic
308-128-1	97862-78-7	Gas oils, hydrotreated
309-667-5	100683-97-4	Distillates (petroleum), carbon-treated light paraffinic
309-668-0	100683-98-5	Distillates (petroleum), intermediate paraffinic, carbon-treated
309-669-6	100683-99-6	Distillates (petroleum), intermediate paraffinic, clay-treated

HEAVY FUEL OIL COMPONENTS		
EINECS No.	CAS Registry No.	SUBSTANCE
265-045-2	64741-45-3	Residues (petroleum), atm. tower
265-058-3	64741-57-7	Gas oils (petroleum), heavy vacuum
265-063-0	64741-61-3	Distillates (petroleum), heavy catalytic cracked
265-064-6	64741-62-4	Clarified oils (petroleum), catalytic cracked
265-069-3	64741-67-9	Residues (petroleum), catalytic reformer fractionator
265-076-1	64741-75-9	Residues (petroleum), hydrocracked
265-081-9	64741-80-6	Residues (petroleum), thermal cracked
265-082-4	64741-81-7	Distillates (petroleum), heavy thermal cracked
265-162-9	64742-59-2	Gas oils (petroleum), hydrotreated vacuum
265-181-2	64742-78-5	Residues (petroleum), hydrodesulfurized atmospheric tower
265-189-6	64742-86-5	Gas oils (petroleum), hydrodesulfurized heavy vacuum
269-777-3	68333-22-2	Residues (petroleum), atmospheric
269-782-0	68333-26-6	Clarified oils (petroleum), hydrodesulfurized catalytic cracked
269-783-6	68333-27-7	Distillates (petroleum), hydrodesulfurized intermediate catalytic cracked
269-784-1	68333-28-8	Distillates (petroleum), hydrodesulfurized heavy catalytic cracked
270-674-0	68476-32-4	Fuel oil, residues-straight-run gas oils, high-sulfur
270-675-6	68476-33-5	Fuel oil, residual
270-792-2	68478-13-7	Residues (petroleum), catalytic reformer fractionator residue distn.
270-796-4	68478-17-1	Residues (petroleum), heavy coker gas oil and vacuum gas oil
270-983-0	68512-61-8	Residues (petroleum), heavy coker and light vacuum
270-984-6	68512-62-9	Residues (petroleum), light vacuum
271-384-7	68553-00-4	Fuel oil, no. 6
271-763-7	68607-30-7	Residues (petroleum), topping plant, low-sulfur
272-184-2	68783-08-4	Gas oils (petroleum), heavy atmospheric
272-187-9	68783-13-1	Residues (petroleum), coker scrubber, condensed-ring-arom
273-263-4	68955-27-1	Distillates (petroleum), petroleum residues vacuum
274-683-0	70592-76-6	Distillates (petroleum), intermediate vacuum
274-684-6	70592-77-7	Distillates (petroleum), light vacuum
274-685-1	70592-78-8	Distillates (petroleum), vacuum
285-555-9	85117-03-9	Gas oils (petroleum), hydrodesulfurized coker heavy vacuum
292-658-2	90669-76-4	Residues (petroleum), vacuum, light
295-396-7	92045-14-2	Fuel oil, heavy, high-sulfur
295-511-0	92061-97-7	Residues (petroleum), catalytic cracking
295-990-6	92201-59-7	Distillates (petroleum), intermediate catalytic cracked, thermally degraded

HEAVY FUEL OIL COMPONENTS		
298-754-0	93821-66-0	Residual oils (petroleum)
309-863-0	101316-57-8	Distillates (petroleum), hydrodesulfurized full-range middle

UNREFINED/ACID TREATED OILS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-051-5	64741-50-0	Distillates (petroleum), light paraffinic
265-052-0	64741-51-1	Distillates (petroleum), heavy paraffinic
265-053-6	64741-52-2	Distillates (petroleum), light naphthenic
265-054-1	64741-53-3	Distillates (petroleum), heavy naphthenic
265-117-3	64742-18-3	Distillates (petroleum), acid-treated heavy naphthenic
265-118-9	64742-19-4	Distillates (petroleum), acid-treated light naphthenic
265-119-4	64742-20-7	Distillates (petroleum), acid-treated heavy paraffinic
265-121-5	64742-21-8	Distillates (petroleum), acid-treated light paraffinic
265-127-8	64742-27-4	Distillates (petroleum), chemically neutralized heavy paraffinic
265-128-3	64742-28-5	Distillates (petroleum), chemically neutralized light paraffinic
265-135-1	64742-34-3	Distillates (petroleum), chemically neutralized heavy naphthenic
265-136-7	64742-35-4	Distillates (petroleum), chemically neutralized light naphthenic

HIGHLY REFINED BASEOILS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
232-455-8	8042-47-5	White mineral oil (petroleum)
295-550-3	92062-35-6	White mineral oil (petroleum), light

OTHER LUBRICANT BASE OILS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-077-7	64741-76-0	Distillates (petroleum), heavy hydrocracked
265-090-8	64741-88-4	Distillates (petroleum), solvent-refined heavy paraffinic
265-091-3	64741-89-5	Distillates (petroleum), solvent-refined light paraffinic
265-096-0	64741-95-3	Residual oils (petroleum), solvent deasphalted
265-097-6	64741-96-4	Distillates (petroleum), solvent-refined heavy naphthenic
265-098-1	64741-97-5	Distillates (petroleum), solvent-refined light naphthenic
265-101-6	64742-01-4	Residual oils (petroleum), solvent-refined
265-137-2	64742-36-5	Distillates (petroleum), clay-treated heavy paraffinic
265-138-8	64742-37-6	Distillates (petroleum), clay-treated light paraffinic
265-143-5	64742-41-2	Residual oils (petroleum), clay-treated
265-146-1	64742-44-5	Distillates (petroleum), clay-treated heavy naphthenic
265-147-7	64742-45-6	Distillates (petroleum), clay-treated light naphthenic
265-155-0	64742-52-5	Distillates (petroleum), hydrotreated heavy naphthenic
265-156-6	64742-53-6	Distillates (petroleum), hydrotreated light naphthenic
265-157-1	64742-54-7	Distillates (petroleum), hydrotreated heavy paraffinic
265-158-7	64742-55-8	Distillates (petroleum), hydrotreated light paraffinic
265-159-2	64742-56-9	Distillates (petroleum), solvent-dewaxed light paraffinic

OTHER LUBRICANT BASE OILS		
265-160-8	64742-57-0	Residual oils (petroleum), hydrotreated
265-166-0	64742-62-7	Residual oils (petroleum), solvent-dewaxed
265-167-6	64742-63-8	Distillates (petroleum), solvent-dewaxed heavy naphthenic
265-168-1	64742-64-9	Distillates (petroleum), solvent-dewaxed light naphthenic
265-169-7	64742-65-0	Distillates (petroleum), solvent-dewaxed heavy paraffinic
265-172-3	64742-68-3	Naphthenic oils (petroleum), catalytic dewaxed heavy
265-173-9	64742-69-4	Naphthenic oils (petroleum), catalytic dewaxed light
265-174-4	64742-70-7	Paraffin oils (petroleum), catalytic dewaxed heavy
265-176-5	64742-71-8	Paraffin oils (petroleum), catalytic dewaxed light
265-179-1	64742-75-2	Naphthenic oils (petroleum), complex dewaxed heavy
265-180-7	64742-76-3	Naphthenic oils (petroleum), complex dewaxed light
276-735-8	72623-83-7	Lubricating oils (petroleum), C>25, hydrotreated bright stock-based
276-736-3	72623-85-9	Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high-viscosity
276-737-9	72623-86-0	Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based
276-738-4	72623-87-1	Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based
278-012-2	74869-22-0	Lubricating oils
292-613-7	90640-91-8	Distillates (petroleum), complex dewaxed heavy paraffinic
292-614-2	90640-92-9	Distillates (petroleum), complex dewaxed light paraffinic
292-616-3	90640-94-1	Distillates (petroleum), solvent dewaxed heavy paraffinic, clay-treated
292-617-9	90640-95-2	Hydrocarbons, C20-50, solvent dewaxed heavy paraffinic, hydrotreated
292-618-4	90640-96-3	Distillates (petroleum), solvent dewaxed light paraffinic, clay-treated
292-620-5	90640-97-4	Distillates (petroleum), solvent dewaxed light paraffinic, hydrotreated
292-656-1	90669-74-2	Residual oils (petroleum), hydrotreated solvent dewaxed
294-843-3	91770-57-9	Residual oils (petroleum), catalytic dewaxed
295-300-3	91995-39-0	Distillates (petroleum), dewaxed heavy paraffinic, hydrotreated
295-301-9	91995-40-3	Distillates (petroleum), dewaxed light paraffinic, hydrotreated
295-306-6	91995-45-8	Distillates (petroleum), hydrocracked solvent-refined, dewaxed
295-316-0	91995-54-9	Distillates (petroleum), solvent-refined light naphthenic, hydrotreated
295-423-2	92045-42-6	Lubricating oils (petroleum), C17-35, solvent-extd., dewaxed, hydrotreated
295-424-8	92045-43-7	Lubricating oils (petroleum), hydrocracked nonarom. solvent-deparaffined
295-425-3	92045-44-8	Lubricating oils (petroleum), hydrotreated bright stock-based
295-426-9	92045-45-9	Lubricating oils (petroleum), hydrotreated solvent-refined bright stock-based
295-499-7	92061-86-4	Residual oils (petroleum), hydrocracked acid-treated solvent-dewaxed
295-810-6	92129-09-4	Paraffin oils (petroleum), solvent-refined dewaxed heavy
297-474-6	93572-43-1	Lubricating oils (petroleum), base oils, paraffinic

OTHER LUBRICANT BASE OILS		
297-857-8	93763-38-3	Hydrocarbons, hydrocracked paraffinic distn. residues, solvent-dewaxed
300-257-1	93924-61-9	Hydrocarbons, C20-50, residual oil hydrogenation vacuum distillate
305-588-5	94733-08-1	Distillates (petroleum), solvent-refined hydrotreated heavy, hydrogenated
305-589-0	94733-09-2	Distillates (petroleum), solvent-refined hydrocracked light
305-594-8	94733-15-0	Lubricating oils (petroleum), C18-40, solvent-dewaxed hydrocracked distillate-based
305-595-3	94733-16-1	Lubricating oils (petroleum), C18-40, solvent-dewaxed hydrogenated raffinate-based
305-971-7	95371-04-3	Hydrocarbons, C13-30, arom.-rich, solvent-extd. naphthenic distillate
305-972-2	95371-05-4	Hydrocarbons, C16-32, arom. rich, solvent-extd. naphthenic distillate
305-974-3	95371-07-6	Hydrocarbons, C37-68, dewaxed deasphalted hydrotreated vacuum distn. residues
305-975-9	95371-08-7	Hydrocarbons, C37-65, hydrotreated deasphalted vacuum distn. residues
307-010-7	97488-73-8	Distillates (petroleum), hydrocracked solvent-refined light
307-011-2	97488-74-9	Distillates (petroleum), solvent-refined hydrogenated heavy
307-034-8	97488-95-4	Lubricating oils (petroleum), C18-27, hydrocracked solvent-dewaxed
307-661-7	97675-87-1	Hydrocarbons, C17-30, hydrotreated solvent-deasphalted atm. distn. residue, distn. lights
307-755-8	97722-06-0	Hydrocarbons, C17-40, hydrotreated solvent-deasphalted distn. residue, vacuum distn. lights
307-758-4	97722-09-3	Hydrocarbons, C13-27, solvent-extd. light naphthenic
307-760-5	97722-10-6	Hydrocarbons, C14-29, solvent-extd. light naphthenic
308-131-8	97862-81-2	Hydrocarbons, C27-42, dearomatized
308-132-3	97862-82-3	Hydrocarbons, C17-30, hydrotreated distillates, distn. lights
308-133-9	97862-83-4	Hydrocarbons, C27-45, naphthenic vacuum distn.
308-287-7	97926-68-6	Hydrocarbons, C27-45, dearomatized
308-289-8	97926-70-0	Hydrocarbons, C20-58, hydrotreated
308-290-3	97926-71-1	Hydrocarbons, C27-42, naphthenic
309-710-8	100684-37-5	Residual oils (petroleum), carbon-treated solvent-dewaxed
309-711-3	100684-38-6	Residual oils (petroleum), clay-treated solvent-dewaxed
309-874-0	101316-69-2	Lubricating oils (petroleum), C>25, solvent-extd., deasphalted, dewaxed, hydrogenated
309-875-6	101316-70-5	Lubricating oils (petroleum), C17-32, solvent-extd., dewaxed, hydrogenated
309-876-1	101316-71-6	Lubricating oils (petroleum), C20-35, solvent-extd., dewaxed, hydrogenated
309-877-7	101316-72-7	Lubricating oils (petroleum), C24-50, solvent-extd., dewaxed, hydrogenated

UNTREATED DISTILLATE AROMATIC EXTRACTS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-102-1	64742-03-6	Extracts (petroleum), light naphthenic distillate solvent
265-103-7	64742-04-7	Extracts (petroleum), heavy paraffinic distillate solvent
265-104-2	64742-05-8	Extracts (petroleum), light paraffinic distillate solvent
265-111-0	64742-11-6	Extracts (petroleum), heavy naphthenic distillate solvent
295-341-7	91995-78-7	Extracts (petroleum), light vacuum gas oil solvent
307-753-7	97722-04-8	Hydrocarbons, C26-55, arom.-rich

TREATED DISTILLATE AROMATIC EXTRACTS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
272-175-3	68783-00-6	Extracts (petroleum), heavy naphthenic distillate solvent, arom. conc.
272-180-0	68783-04-0	Extracts (petroleum), solvent-refined heavy paraffinic distillate solvent
272-342-0	68814-89-1	Extracts (petroleum), heavy paraffinic distillates, solvent-deasphalted
292-631-5	90641-07-9	Extracts (petroleum), heavy naphthenic distillate solvent, hydrotreated
292-632-0	90641-08-0	Extracts (petroleum), heavy paraffinic distillate solvent, hydrotreated
292-633-6	90641-09-1	Extracts (petroleum), light paraffinic distillate solvent, hydrotreated
295-335-4	91995-73-2	Extracts (petroleum), hydrotreated light paraffinic distillate solvent
295-338-0	91995-75-4	Extracts (petroleum), light naphthenic distillate solvent, hydrodesulfurized
295-339-6	91995-76-5	Extracts (petroleum), light paraffinic distillate solvent, acid-treated
295-340-1	91995-77-6	Extracts (petroleum), light paraffinic distillate solvent, hydrodesulfurized
295-342-2	91995-79-8	Extracts (petroleum), light vacuum gas oil solvent, hydrotreated
296-437-1	92704-08-0	Extracts (petroleum), heavy paraffinic distillate solvent, clay-treated
297-827-4	93763-10-1	Extracts (petroleum), heavy naphthenic distillate solvent, hydrodesulfurized
297-829-5	93763-11-2	Extracts (petroleum), solvent-dewaxed heavy paraffinic distillate solvent, hydrodesulfurized
309-672-2	100684-02-4	Extracts (petroleum), light paraffinic distillate solvent, carbon-treated
309-673-8	100684-03-5	Extracts (petroleum), light paraffinic distillate solvent, clay-treated
309-674-3	100684-04-6	Extracts (petroleum), light vacuum, gas oil solvent, carbon-treated
309-675-9	100684-05-7	Extracts (petroleum), light vacuum gas oil solvent, clay-treated

RESIDUAL AROMATIC EXTRACTS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-110-5	64742-10-5	Extracts (petroleum), residual oil solvent
295-332-8	91995-70-9	Extracts (petroleum), deasphalted vacuum residue solvent

SLACK WAXES		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-165-5	64742-61-6	Slack wax (petroleum)
292-659-8	90669-77-5	Slack wax (petroleum), acid-treated
292-660-3	90669-78-6	Slack wax (petroleum), clay-treated
295-523-6	92062-09-4	Slack wax (petroleum), hydrotreated
295-524-1	92062-10-7	Slack wax (petroleum), low-melting
295-525-7	92062-11-8	Slack wax (petroleum), low-melting, hydrotreated
308-155-9	97863-04-2	Slack wax (petroleum), low-melting, carbon-treated
308-156-4	97863-05-3	Slack wax (petroleum), low-melting, clay-treated
308-158-5	97863-06-4	Slack wax (petroleum), low-melting, silicic acid-treated
309-723-9	100684-49-9	Slack wax (petroleum), carbon-treated

PARAFFIN AND HYDROCARBON WAXES		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
232-315-6	8002-74-2	Paraffin waxes and Hydrocarbon waxes
264-038-1	63231-60-7	Paraffin waxes and Hydrocarbon waxes, microcryst.
265-126-2	64742-26-3	Hydrocarbon waxes (petroleum), acid-treated
265-134-6	64742-33-2	Hydrocarbon waxes (petroleum), chemically neutralized
265-144-0	64742-42-3	Hydrocarbon waxes (petroleum), clay-treated microcryst.
265-145-6	64742-43-4	Paraffin waxes (petroleum), clay-treated
265-154-5	64742-51-4	Paraffin waxes (petroleum), hydrotreated
265-163-4	64742-60-5	Hydrocarbon waxes (petroleum), hydrotreated microcryst.
285-095-9	85029-72-7	Hydrocarbon waxes (petroleum), deodorized
292-640-4	90669-47-9	Paraffin waxes (petroleum), acid-treated
295-456-2	92045-74-4	Paraffin waxes (petroleum), low-melting
295-457-8	92045-75-5	Paraffin waxes (petroleum), low-melting, hydrotreated
295-458-3	92045-76-6	Paraffin waxes and Hydrocarbon waxes, microcryst., hydrotreated
307-045-8	97489-05-9	Paraffin waxes and Hydrocarbon waxes, C19-38
308-140-7	97862-89-0	Paraffin waxes (petroleum), carbon-treated
308-141-2	97862-90-3	Paraffin waxes (petroleum), low-melting, carbon-treated
308-142-8	97862-91-4	Paraffin waxes (petroleum), low-melting, clay-treated
308-143-3	97862-92-5	Paraffin waxes (petroleum), low-melting, silicic acid-treated
308-144-9	97862-93-6	Paraffin waxes (petroleum), silicic acid-treated
308-145-4	97862-94-7	Paraffin waxes and Hydrocarbon waxes, microcryst., carbon-treated
308-147-5	97862-95-8	Paraffin waxes and Hydrocarbon waxes, microcryst., clay-treated
308-148-0	97862-96-9	Paraffin waxes and Hydrocarbon waxes, microcryst., silicic acid-treated

FOOTS OILS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-171-8	64742-67-2	Foots oil (petroleum)
295-394-6	92045-12-0	Foots oil (petroleum), hydrotreated
300-225-7	93924-31-3	Foots oil (petroleum), acid-treated
300-226-2	93924-32-4	Foots oil (petroleum), clay-treated
308-126-0	97862-76-5	Foots oil (petroleum), carbon-treated
308-127-6	97862-77-6	Foots oil (petroleum), silicic acid-treated

PETROLATUMS		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
232-373-2	8009-03-8	Petrolatum
265-206-7	64743-01-7	Petrolatum (petroleum), oxidized
285-098-5	85029-74-9	Petrolatum (petroleum), alumina-treated
295-459-9	92045-77-7	Petrolatum (petroleum), hydrotreated
308-149-6	97862-97-0	Petrolatum (petroleum), carbon-treated
308-150-1	97862-98-1	Petrolatum (petroleum), silicic acid-treated
309-706-6	100684-33-1	Petrolatum (petroleum), clay-treated

BITUMEN		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
232-490-9	8052-42-4	Asphalt
265-057-8	64741-56-6	Residues (petroleum), vacuum
265-188-0	64742-85-4	Residues (petroleum), hydrodesulfurized vacuum
295-284-8	91995-23-2	Asphaltenes (petroleum)
295-518-9	92062-05-0	Residues (petroleum), thermal cracked vacuum
302-656-6	94114-22-4	Residues (petroleum), dewaxed heavy paraffinic, vacuum
309-712-9	100684-39-7	Residues (petroleum), distn. residue hydrogenation
309-713-4	100684-40-0	Residues (petroleum), vacuum distn. residue hydrogenation

ASPHALT, OXIDIZED		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-196-4	64742-93-4	Asphalt, oxidized

PETROLEUM COKE		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
265-080-3	64741-79-3	Coke (petroleum)
265-209-3	64743-04-0	Coke (petroleum), recovery
265-210-9	64743-05-1	Coke (petroleum), calcined

SULFUR		
EINECS No.	**CAS Registry No.**	**SUBSTANCE**
231-722-6	7704-34-9	Sulfur

APPENDIX 2B

Petroleum Substances (EINECS No. order) with short names

EC No.	CAS Registry No.	SUBSTANCE
200-827-9	74-98-6	Propane
200-857-2	75-28-5	Isobutane
203-448-7	106-97-8	Butane
231-722-6	7704-34-9	Sulfur
232-298-5	8002-05-9	Petroleum
232-315-6	8002-74-2	Paraffin waxes and Hydrocarbon waxes
232-349-1	8006-61-9	Gasoline, natural
232-366-4	8008-20-6	Kerosine (petroleum)
232-373-2	8009-03-8	Petrolatum
232-443-2	8030-30-6	Naphtha
232-453-7	8032-32-4	Ligroine
232-455-8	8042-47-5	White mineral oil (petroleum)
232-490-9	8052-42-4	Asphalt
264-038-1	63231-60-7	Paraffin waxes and Hydrocarbon waxes, microcryst.
265-041-0	64741-41-9	Naphtha (petroleum), heavy straight-run
265-042-6	64741-42-0	Naphtha (petroleum), full-range straight-run
265-043-1	64741-43-1	Gas oils (petroleum), straight-run
265-044-7	64741-44-2	Distillates (petroleum), straight-run middle
265-045-2	64741-45-3	Residues (petroleum), atm. tower
265-046-8	64741-46-4	Naphtha (petroleum), light straight-run
265-047-3	64741-47-5	Natural gas condensates (petroleum)
265-048-9	64741-48-6	Natural gas (petroleum), raw liq. mix
265-049-4	64741-49-7	Condensates (petroleum), vacuum tower
265-051-5	64741-50-0	Distillates (petroleum), light paraffinic
265-052-0	64741-51-1	Distillates (petroleum), heavy paraffinic
265-053-6	64741-52-2	Distillates (petroleum), light naphthenic
265-054-1	64741-53-3	Distillates (petroleum), heavy naphthenic
265-055-7	64741-54-4	Naphtha (petroleum), heavy catalytic cracked
265-056-2	64741-55-5	Naphtha (petroleum), light catalytic cracked
265-057-8	64741-56-6	Residues (petroleum), vacuum
265-058-3	64741-57-7	Gas oils (petroleum), heavy vacuum
265-059-9	64741-58-8	Gas oils (petroleum), light vacuum
265-060-4	64741-59-9	Distillates (petroleum), light catalytic cracked
265-062-5	64741-60-2	Distillates (petroleum), intermediate catalytic cracked
265-063-0	64741-61-3	Distillates (petroleum), heavy catalytic cracked
265-064-6	64741-62-4	Clarified oils (petroleum), catalytic cracked
265-065-1	64741-63-5	Naphtha (petroleum), light catalytic reformed
265-066-7	64741-64-6	Naphtha (petroleum), full-range alkylate
265-067-2	64741-65-7	Naphtha (petroleum), heavy alkylate
265-068-8	64741-66-8	Naphtha (petroleum), light alkylate
265-069-3	64741-67-9	Residues (petroleum), catalytic reformer fractionator

EC No.	CAS Registry No.	SUBSTANCE
265-070-9	64741-68-0	Naphtha (petroleum), heavy catalytic reformed
265-071-4	64741-69-1	Naphtha (petroleum), light hydrocracked
265-073-5	64741-70-4	Naphtha (petroleum), isomerization
265-074-0	64741-73-7	Distillates (petroleum), alkylate
265-075-6	64741-74-8	Naphtha (petroleum), light thermal cracked
265-076-1	64741-75-9	Residues (petroleum), hydrocracked
265-077-7	64741-76-0	Distillates (petroleum), heavy hydrocracked
265-078-2	64741-77-1	Distillates (petroleum), light hydrocracked
265-079-8	64741-78-2	Naphtha (petroleum), heavy hydrocracked
265-080-3	64741-79-3	Coke (petroleum)
265-081-9	64741-80-6	Residues (petroleum), thermal cracked
265-082-4	64741-81-7	Distillates (petroleum), heavy thermal cracked
265-084-5	64741-82-8	Distillates (petroleum), light thermal cracked
265-085-0	64741-83-9	Naphtha (petroleum), heavy thermal cracked
265-086-6	64741-84-0	Naphtha (petroleum), solvent-refined light
265-088-7	64741-86-2	Distillates (petroleum), sweetened middle
265-089-2	64741-87-3	Naphtha (petroleum), sweetened
265-090-8	64741-88-4	Distillates (petroleum), solvent-refined heavy paraffinic
265-091-3	64741-89-5	Distillates (petroleum), solvent-refined light paraffinic
265-092-9	64741-90-8	Gas oils (petroleum), solvent-refined
265-093-4	64741-91-9	Distillates (petroleum), solvent-refined middle
265-095-5	64741-92-0	Naphtha (petroleum), solvent-refined heavy
265-096-0	64741-95-3	Residual oils (petroleum), solvent deasphalted
265-097-6	64741-96-4	Distillates (petroleum), solvent-refined heavy naphthenic
265-098-1	64741-97-5	Distillates (petroleum), solvent-refined light naphthenic
265-099-7	64741-98-6	Extracts (petroleum), heavy naphtha solvent
265-101-6	64742-01-4	Residual oils (petroleum), solvent-refined
265-102-1	64742-03-6	Extracts (petroleum), light naphthenic distillate solvent
265-103-7	64742-04-7	Extracts (petroleum), heavy paraffinic distillate solvent
265-104-2	64742-05-8	Extracts (petroleum), light paraffinic distillate solvent
265-110-5	64742-10-5	Extracts (petroleum), residual oil solvent
265-111-0	64742-11-6	Extracts (petroleum), heavy naphthenic distillate solvent
265-112-6	64742-12-7	Gas oils (petroleum), acid-treated
265-113-1	64742-13-8	Distillates (petroleum), acid-treated middle
265-114-7	64742-14-9	Distillates (petroleum), acid-treated light
265-115-2	64742-15-0	Naphtha (petroleum), acid-treated
265-117-3	64742-18-3	Distillates (petroleum), acid-treated heavy naphthenic
265-118-9	64742-19-4	Distillates (petroleum), acid-treated light naphthenic
265-119-4	64742-20-7	Distillates (petroleum), acid-treated heavy paraffinic
265-121-5	64742-21-8	Distillates (petroleum), acid-treated light paraffinic
265-122-0	64742-22-9	Naphtha (petroleum), chemically neutralized heavy
265-123-6	64742-23-0	Naphtha (petroleum), chemically neutralized light
265-126-2	64742-26-3	Hydrocarbon waxes (petroleum), acid-treated
265-127-8	64742-27-4	Distillates (petroleum), chemically neutralized heavy paraffinic
265-128-3	64742-28-5	Distillates (petroleum), chemically neutralized light paraffinic
265-129-9	64742-29-6	Gas oils (petroleum), chemically neutralized

EC No.	CAS Registry No.	SUBSTANCE
265-130-4	64742-30-9	Distillates (petroleum), chemically neutralized middle
265-132-5	64742-31-0	Distillates (petroleum), chemically neutralized light
265-134-6	64742-33-2	Hydrocarbon waxes (petroleum), chemically neutralized
265-135-1	64742-34-3	Distillates (petroleum), chemically neutralized heavy naphthenic
265-136-7	64742-35-4	Distillates (petroleum), chemically neutralized light naphthenic
265-137-2	64742-36-5	Distillates (petroleum), clay-treated heavy paraffinic
265-138-8	64742-37-6	Distillates (petroleum), clay-treated light paraffinic
265-139-3	64742-38-7	Distillates (petroleum), clay-treated middle
265-143-5	64742-41-2	Residual oils (petroleum), clay-treated
265-144-0	64742-42-3	Hydrocarbon waxes (petroleum), clay-treated microcryst.
265-145-6	64742-43-4	Paraffin waxes (petroleum), clay-treated
265-146-1	64742-44-5	Distillates (petroleum), clay-treated heavy naphthenic
265-147-7	64742-45-6	Distillates (petroleum), clay-treated light naphthenic
265-148-2	64742-46-7	Distillates (petroleum), hydrotreated middle
265-149-8	64742-47-8	Distillates (petroleum), hydrotreated light
265-150-3	64742-48-9	Naphtha (petroleum), hydrotreated heavy
265-151-9	64742-49-0	Naphtha (petroleum), hydrotreated light
265-154-5	64742-51-4	Paraffin waxes (petroleum), hydrotreated
265-155-0	64742-52-5	Distillates (petroleum), hydrotreated heavy naphthenic
265-156-6	64742-53-6	Distillates (petroleum), hydrotreated light naphthenic
265-157-1	64742-54-7	Distillates (petroleum), hydrotreated heavy paraffinic
265-158-7	64742-55-8	Distillates (petroleum), hydrotreated light paraffinic
265-159-2	64742-56-9	Distillates (petroleum), solvent-dewaxed light paraffinic
265-160-8	64742-57-0	Residual oils (petroleum), hydrotreated
265-162-9	64742-59-2	Gas oils (petroleum), hydrotreated vacuum
265-163-4	64742-60-5	Hydrocarbon waxes (petroleum), hydrotreated microcryst.
265-165-5	64742-61-6	Slack wax (petroleum)
265-166-0	64742-62-7	Residual oils (petroleum), solvent-dewaxed
265-167-6	64742-63-8	Distillates (petroleum), solvent-dewaxed heavy naphthenic
265-168-1	64742-64-9	Distillates (petroleum), solvent-dewaxed light naphthenic
265-169-7	64742-65-0	Distillates (petroleum), solvent-dewaxed heavy paraffinic
265-170-2	64742-66-1	Naphtha (petroleum), catalytic dewaxed
265-171-8	64742-67-2	Foots oil (petroleum)
265-172-3	64742-68-3	Naphthenic oils (petroleum), catalytic dewaxed heavy
265-173-9	64742-69-4	Naphthenic oils (petroleum), catalytic dewaxed light
265-174-4	64742-70-7	Paraffin oils (petroleum), catalytic dewaxed heavy
265-176-5	64742-71-8	Paraffin oils (petroleum), catalytic dewaxed light
265-178-6	64742-73-0	Naphtha (petroleum), hydrodesulfurized light
265-179-1	64742-75-2	Naphthenic oils (petroleum), complex dewaxed heavy
265-180-7	64742-76-3	Naphthenic oils (petroleum), complex dewaxed light
265-181-2	64742-78-5	Residues (petroleum), hydrodesulfurized atmospheric tower
265-182-8	64742-79-6	Gas oils (petroleum), hydrodesulfurized
265-183-3	64742-80-9	Distillates (petroleum), hydrodesulfurized middle
265-184-9	64742-81-0	Kerosine (petroleum), hydrodesulfurized
265-185-4	64742-82-1	Naphtha (petroleum), hydrodesulfurized heavy
265-188-0	64742-85-4	Residues (petroleum), hydrodesulfurized vacuum

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265-189-6	64742-86-5	Gas oils (petroleum), hydrodesulfurized heavy vacuum
265-190-1	64742-87-6	Gas oils (petroleum), hydrodesulfurized light vacuum
265-191-7	64742-88-7	Solvent naphtha (petroleum), medium aliph.
265-192-2	64742-89-8	Solvent naphtha (petroleum), light aliph.
265-196-4	64742-93-4	Asphalt, oxidized
265-198-5	64742-94-5	Solvent naphtha (petroleum), heavy arom.
265-199-0	64742-95-6	Solvent naphtha (petroleum), light arom.
265-200-4	64742-96-7	Solvent naphtha (petroleum), heavy aliph.
265-206-7	64743-01-7	Petrolatum (petroleum), oxidized
265-209-3	64743-04-0	Coke (petroleum), recovery
265-210-9	64743-05-1	Coke (petroleum), calcined
267-563-4	67891-79-6	Distillates (petroleum), heavy arom.
267-565-5	67891-80-9	Distillates (petroleum), light arom.
268-618-5	68131-49-7	Aromatic hydrocarbons, C6-10, acid-treated, neutralized
268-629-5	68131-75-9	Gases (petroleum), C3-4
269-617-2	68307-98-2	Tail gas (petroleum), catalytic cracked distillate and catalytic cracked naphtha fractionation absorber
269-618-8	68307-99-3	Tail gas (petroleum), catalytic polymn. naphtha fractionation stabilizer
269-619-3	68308-00-9	Tail gas (petroleum), catalytic reformed naphtha fractionation stabilizer, hydrogen sulfide-free
269-620-9	68308-01-0	Tail gas (petroleum), cracked distillate hydrotreater stripper
269-623-5	68308-03-2	Tail gas (petroleum), gas oil catalytic cracking absorber
269-624-0	68308-04-3	Tail gas (petroleum), gas recovery plant
269-625-6	68308-05-4	Tail gas (petroleum), gas recovery plant deethanizer
269-626-1	68308-06-5	Tail gas (petroleum), hydrodesulfurized distillate and hydrodesulfurized naphtha fractionator, acid-free
269-627-7	68308-07-6	Tail gas (petroleum), hydrodesulfurized vacuum gas oil stripper, hydrogen sulfide-free
269-628-2	68308-08-7	Tail gas (petroleum), isomerized naphtha fractionation stabilizer
269-629-8	68308-09-8	Tail gas (petroleum), light straight-run naphtha stabilizer, hydrogen sulfide-free
269-630-3	68308-10-1	Tail gas (petroleum), straight-run distillate hydrodesulfurizer, hydrogen sulfide-free
269-631-9	68308-11-2	Tail gas (petroleum), propane-propylene alkylation feed prep deethanizer
269-632-4	68308-12-3	Tail gas (petroleum), vacuum gas oil hydrodesulfurizer, hydrogen sulfide-free
269-640-8	68308-27-0	Fuel gases, refinery
269-777-3	68333-22-2	Residues (petroleum), atmospheric
269-778-9	68333-23-3	Naphtha (petroleum), heavy coker
269-781-5	68333-25-5	Distillates (petroleum), hydrodesulfurized light catalytic cracked
269-782-0	68333-26-6	Clarified oils (petroleum), hydrodesulfurized catalytic cracked
269-783-6	68333-27-7	Distillates (petroleum), hydrodesulfurized intermediate catalytic cracked
269-784-1	68333-28-8	Distillates (petroleum), hydrodesulfurized heavy catalytic cracked

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269-822-7	68334-30-5	Fuels, diesel
270-071-2	68409-99-4	Gases (petroleum), catalytic cracked overheads
270-077-5	68410-05-9	Distillates (petroleum), straight-run Light
270-088-5	68410-71-9	Raffinates (petroleum), catalytic reformer ethylene glycol-water countercurrent exts.
270-092-7	68410-96-8	Distillates (petroleum), hydrotreated middle, intermediate boiling
270-093-2	68410-97-9	Distillates (petroleum), light distillate hydrotreating process, low-boiling
270-094-8	68410-98-0	Distillates (petroleum), hydrotreated heavy naphtha, deisohexanizer overheads
270-344-6	68425-29-6	Distillates (petroleum), naphtha-raffinate pyrolyzate-derived, gasoline-blending
270-349-3	68425-35-4	Raffinates (petroleum), reformer, Lurgi unit-sepd.
270-651-5	68475-57-0	Alkanes, C1-2
270-652-0	68475-58-1	Alkanes, C2-3
270-653-6	68475-59-2	Alkanes, C3-4
270-654-1	68475-60-5	Alkanes, C4-5
270-658-3	68475-70-7	Aromatic hydrocarbons, C6-8, naphtha-raffinate pyrolyzate-derived
270-660-4	68475-79-6	Distillates (petroleum), catalytic reformed depentanizer
270-667-2	68476-26-6	Fuel gases
270-670-9	68476-29-9	Fuel gases, crude oil distillates
270-671-4	68476-30-2	Fuel oil, no. 2
270-673-5	68476-31-3	Fuel oil, no. 4
270-674-0	68476-32-4	Fuel oil, residues-straight-run gas oils, high-sulfur
270-675-6	68476-33-5	Fuel oil, residual
270-676-1	68476-34-6	Fuels, diesel, no. 2
270-681-9	68476-40-4	Hydrocarbons, C3-4
270-682-4	68476-42-6	Hydrocarbons, C4-5
270-686-6	68476-46-0	Hydrocarbons, C3-11, catalytic cracker distillates
270-687-1	68476-47-1	Hydrocarbons, C2-6, C6-8 catalytic reformer
270-689-2	68476-49-3	Hydrocarbons, C2-4, C3-rich
270-690-8	68476-50-6	Hydrocarbons, C≥5, C5-6-rich
270-695-5	68476-55-1	Hydrocarbons, C5-rich
270-704-2	68476-85-7	Petroleum gases, liquefied
270-705-8	68476-86-8	Petroleum gases, liquefied, sweetened
270-719-4	68477-29-2	Distillates (petroleum), catalytic reformer fractionator residue, high-boiling
270-721-5	68477-30-5	Distillates (petroleum), catalytic reformer fractionator residue, intermediate-boiling
270-722-0	68477-31-6	Distillates (petroleum), catalytic reformer fractionator residue, low-boiling
270-724-1	68477-33-8	Gases (petroleum), C3-4, isobutane-rich
270-725-7	68477-34-9	Distillates (petroleum), C3-5, 2-methyl-2-butene-rich
270-726-2	68477-35-0	Distillates (petroleum), C3-6, piperylene-rich
270-741-4	68477-61-2	Extracts (petroleum), cold-acid, C4-6
270-746-1	68477-65-6	Gases (petroleum), amine system feed

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270-747-7	68477-66-7	Gases (petroleum), benzene unit hydrodesulfurizer off
270-748-2	68477-67-8	Gases (petroleum), benzene unit recycle, hydrogen-rich
270-749-8	68477-68-9	Gases (petroleum), blend oil, hydrogen-nitrogen-rich
270-750-3	68477-69-0	Gases (petroleum), butane splitter overheads
270-751-9	68477-70-3	Gases (petroleum), C2-3
270-752-4	68477-71-4	Gases (petroleum), catalytic-cracked gas oil depropanizer bottoms, C4-rich acid-free
270-754-5	68477-72-5	Gases (petroleum), catalytic-cracked naphtha debutanizer bottoms, C3-5-rich
270-755-0	68477-73-6	Gases (petroleum), catalytic cracked naphtha depropanizer overhead, C3-rich acid-free
270-756-6	68477-74-7	Gases (petroleum), catalytic cracker
270-757-1	68477-75-8	Gases (petroleum), catalytic cracker, C1-5-rich
270-758-7	68477-76-9	Gases (petroleum), catalytic polymd. naphtha stabilizer overhead, C2-4-rich
270-759-2	68477-77-0	Gases (petroleum), catalytic reformed naphtha stripper overheads
270-760-8	68477-79-2	Gases (petroleum), catalytic reformer, C1-4-rich
270-761-3	68477-80-5	Gases (petroleum), C6-8 catalytic reformer recycle
270-762-9	68477-81-6	Gases (petroleum), C6-8 catalytic reformer
270-763-4	68477-82-7	Gases (petroleum), C6-8 catalytic reformer recycle, hydrogen-rich
270-765-5	68477-83-8	Gases (petroleum), C3-5 olefinic-paraffinic alkylation feed
270-766-0	68477-84-9	Gases (petroleum), C2-return stream
270-767-6	68477-85-0	Gases (petroleum), C4-rich
270-768-1	68477-86-1	Gases (petroleum), deethanizer overheads
270-769-7	68477-87-2	Gases (petroleum), deisobutanizer tower overheads
270-771-8	68477-89-4	Distillates (petroleum), depentanizer overheads
270-772-3	68477-90-7	Gases (petroleum), depropanizer dry, propene-rich
270-773-9	68477-91-8	Gases (petroleum), depropanizer overheads
270-774-4	68477-92-9	Gases (petroleum), dry sour, gas-concn.-unit-off
270-776-5	68477-93-0	Gases (petroleum), gas concn. reabsorber distn.
270-777-0	68477-94-1	Gases (petroleum), gas recovery plant depropanizer overheads
270-778-6	68477-95-2	Gases (petroleum), Girbatol unit feed
270-779-1	68477-96-3	Gases (petroleum), hydrogen absorber off
270-780-7	68477-97-4	Gases (petroleum), hydrogen-rich
270-781-2	68477-98-5	Gases (petroleum), hydrotreater blend oil recycle, hydrogen-nitrogen-rich
270-782-8	68477-99-6	Gases (petroleum), isomerized naphtha fractionator, C4-rich, hydrogen sulfide-free
270-783-3	68478-00-2	Gases (petroleum), recycle, hydrogen-rich
270-784-9	68478-01-3	Gases (petroleum), reformer make-up, hydrogen-rich
270-785-4	68478-02-4	Gases (petroleum), reforming hydrotreater
270-787-5	68478-03-5	Gases (petroleum), reforming hydrotreater, hydrogen-methane-rich
270-788-0	68478-04-6	Gases (petroleum), reforming hydrotreater make-up, hydrogen-rich
270-789-6	68478-05-7	Gases (petroleum), thermal cracking distn.
270-791-7	68478-12-6	Residues (petroleum), butane splitter bottoms
270-792-2	68478-13-7	Residues (petroleum), catalytic reformer fractionator residue distn.

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270-794-3	68478-15-9	Residues (petroleum), C6-8 catalytic reformer
270-795-9	68478-16-0	Residual oils (petroleum), deisobutanizer tower
270-796-4	68478-17-1	Residues (petroleum), heavy coker gas oil and vacuum gas oil
270-802-5	68478-21-7	Tail gas (petroleum), catalytic cracked clarified oil and thermal cracked vacuum residue fractionation reflux drum
270-803-0	68478-22-8	Tail gas (petroleum), catalytic cracked naphtha stabilization absorber
270-804-6	68478-24-0	Tail gas (petroleum), catalytic cracker, catalytic reformer and hydrodesulfurizer combined fractionater
270-805-1	68478-25-1	Tail gas (petroleum), catalytic cracker refractionation absorber
270-806-7	68478-26-2	Tail gas (petroleum), catalytic reformed naphtha fractionation stabilizer
270-807-2	68478-27-3	Tail gas (petroleum), catalytic reformed naphtha separator
270-808-8	68478-28-4	Tail gas (petroleum), catalytic reformed naphtha stabilizer
270-809-3	68478-29-5	Tail gas (petroleum), cracked distillate hydrotreater separator
270-810-9	68478-30-8	Tail gas (petroleum), hydrodesulfurized straight-run naphtha separator
270-813-5	68478-32-0	Tail gas (petroleum), saturate gas plant mixed stream, C4-rich
270-814-0	68478-33-1	Tail gas (petroleum), saturate gas recovery plant, C1-2-rich
270-815-6	68478-34-2	Tail gas (petroleum), vacuum residues thermal cracker
270-983-0	68512-61-8	Residues (petroleum), heavy coker and light vacuum
270-984-6	68512-62-9	Residues (petroleum), light vacuum
270-988-8	68512-78-7	Solvent naphtha (petroleum), light arom., hydrotreated
270-990-9	68512-91-4	Hydrocarbons, C3-4-rich, petroleum distillate
270-991-4	68513-02-0	Naphtha (petroleum), full-range coker
270-993-5	68513-03-1	Naphtha (petroleum), light catalytic reformed, arom.-free
270-999-8	68513-14-4	Gases (petroleum), catalytic reformed straight-run naphtha stabilizer overheads
271-000-8	68513-15-5	Gases (petroleum), full-range straight-run naphtha dehexanizer off
271-001-3	68513-16-6	Gases (petroleum), hydrocracking depropanizer off, hydrocarbon-rich
271-002-9	68513-17-7	Gases (petroleum), light straight-run naphtha stabilizer off
271-003-4	68513-18-8	Gases (petroleum), reformer effluent high-pressure flash drum off
271-005-5	68513-19-9	Gases (petroleum), reformer effluent low-pressure flash drum off
271-008-1	68513-63-3	Distillates (petroleum), catalytic reformed straight-run naphtha overheads
271-010-2	68513-66-6	Residues (petroleum), alkylation splitter, C4-rich
271-025-4	68514-15-8	Gasoline, vapor-recovery
271-032-2	68514-31-8	Hydrocarbons, C1-4
271-038-5	68514-36-3	Hydrocarbons, C1-4, sweetened
271-058-4	68514-79-4	Petroleum products, hydrofiner-powerformer reformates
271-258-1	68527-15-1	Gases (petroleum), oil refinery gas distn. off
271-259-7	68527-16-2	Hydrocarbons, C1-3
271-261-8	68527-19-5	Hydrocarbons, C1-4, debutanizer fraction
271-262-3	68527-21-9	Naphtha (petroleum), clay-treated full-range straight-run
271-263-9	68527-22-0	Naphtha (petroleum), clay-treated light straight-run

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271-267-0	68527-27-5	Naphtha (petroleum), full-range alkylate, butane-contg.
271-384-7	68553-00-4	Fuel oil, no. 6
271-623-5	68602-82-4	Gases (petroleum), benzene unit hydrotreater depentanizer overheads
271-624-0	68602-83-5	Gases (petroleum), C1-5, wet
271-625-6	68602-84-6	Gases (petroleum), secondary absorber off, fluidized catalytic cracker overheads fractionator
271-631-9	68603-00-9	Distillates (petroleum), thermal cracked naphtha and gas oil
271-632-4	68603-01-0	Distillates (petroleum), thermal cracked naphtha and gas oil, C5-dimer-contg.
271-634-5	68603-03-2	Distillates (petroleum), thermal cracked naphtha and gas oil, extractive
271-635-0	68603-08-7	Naphtha (petroleum), arom
271-726-5	68606-10-0	Gasoline, pyrolysis, debutanizer bottoms
271-727-0	68606-11-1	Gasoline, straight-run, topping-plant
271-734-9	68606-25-7	Hydrocarbons, C2-4
271-735-4	68606-26-8	Hydrocarbons, C3
271-737-5	68606-27-9	Gases (petroleum), alkylation feed
271-742-2	68606-34-8	Gases (petroleum), depropanizer bottoms fractionation off
271-750-6	68607-11-4	Petroleum products, refinery gases
271-763-7	68607-30-7	Residues (petroleum), topping plant, low-sulfur
272-175-3	68783-00-6	Extracts (petroleum), heavy naphthenic distillate solvent, arom. conc.
272-180-0	68783-04-0	Extracts (petroleum), solvent-refined heavy paraffinic distillate solvent
272-182-1	68783-06-2	Gases (petroleum), hydrocracking low-pressure separator
272-183-7	68783-07-3	Gases (petroleum), refinery blend
272-184-2	68783-08-4	Gas oils (petroleum), heavy atmospheric
272-185-8	68783-09-5	Naphtha (petroleum), catalytic cracked light distd.
272-186-3	68783-12-0	Naphtha (petroleum), unsweetened
272-187-9	68783-13-1	Residues (petroleum), coker scrubber, condensed-ring-arom
272-203-4	68783-64-2	Gases (petroleum), catalytic cracking
272-205-5	68783-65-3	Gases (petroleum), C2-4, sweetened
272-206-0	68783-66-4	Naphtha (petroleum), light, sweetened
272-338-9	68814-67-5	Gases (petroleum), refinery
272-341-5	68814-87-9	Distillates (petroleum), full-range straight-run middle
272-342-0	68814-89-1	Extracts (petroleum), heavy paraffinic distillates, solvent-deasphalted
272-343-6	68814-90-4	Gases (petroleum), platformer products separator off
272-775-5	68911-58-0	Gases (petroleum), hydrotreated sour kerosine depentanizer stabilizer off
272-776-0	68911-59-1	Gases (petroleum), hydrotreated sour kerosine flash drum
272-817-2	68915-96-8	Distillates (petroleum), heavy straight-run
272-818-8	68915-97-9	Gas oils (petroleum), straight-run, high-boiling
272-871-7	68918-99-0	Gases (petroleum), crude oil fractionation off
272-872-2	68919-00-6	Gases (petroleum), dehexanizer off

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272-873-8	68919-01-7	Gases (petroleum), distillate unifiner desulfurization stripper off
272-874-3	68919-02-8	Gases (petroleum), fluidized catalytic cracker fractionation off
272-875-9	68919-03-9	Gases (petroleum), fluidized catalytic cracker scrubbing secondary absorber off
272-876-4	68919-04-0	Gases (petroleum), heavy distillate hydrotreater desulfurization stripper off
272-878-5	68919-05-1	Gases (petroleum), light straight run gasoline fractionation stabilizer off
272-879-0	68919-06-2	Gases (petroleum), naphtha unifiner desulfurization stripper off
272-880-6	68919-07-3	Gases (petroleum), platformer stabilizer off, light ends fractionation
272-881-1	68919-08-4	Gases (petroleum), preflash tower off, crude distn.
272-882-7	68919-09-5	Gases (petroleum), straight-run naphtha catalytic reforming off
272-883-2	68919-10-8	Gases (petroleum), straight-run stabilizer off
272-884-8	68919-11-9	Gases (petroleum), tar stripper off
272-885-3	68919-12-0	Gases (petroleum), unifiner stripper off
272-893-7	68919-20-0	Gases (petroleum), fluidized catalytic cracker splitter overheads
272-895-8	68919-37-9	Naphtha (petroleum), full-range reformed
272-896-3	68919-39-1	Natural gas condensates
272-930-7	68921-07-3	Distillates (petroleum), hydrotreated light catalytic cracked
272-931-2	68921-08-4	Distillates (petroleum), light straight-run gasoline fractionation stabilizer overheads
272-932-8	68921-09-5	Distillates (petroleum), naphtha unifiner stripper
273-169-3	68952-76-1	Gases (petroleum), catalytic cracked naphtha debutanizer
273-170-9	68952-77-2	Tail gas (petroleum), catalytic cracked distillate and naphtha stabilizer
273-173-5	68952-79-4	Tail gas (petroleum), catalytic hydrodesulfurized naphtha separator
273-174-0	68952-80-7	Tail gas (petroleum), straight-run naphtha hydrodesulfurizer
273-175-6	68952-81-8	Tail gas (petroleum), thermal-cracked distillate, gas oil and naphtha absorber
273-176-1	68952-82-9	Tail gas (petroleum), thermal cracked hydrocarbon fractionation stabilizer, petroleum coking
273-263-4	68955-27-1	Distillates (petroleum), petroleum residues vacuum
273-265-5	68955-28-2	Gases (petroleum), light steam-cracked, butadiene conc.
273-266-0	68955-29-3	Distillates (petroleum), light thermal cracked, debutanized arom.
273-269-7	68955-33-9	Gases (petroleum), sponge absorber off, fluidized catalytic cracker and gas oil desulfurizer overhead fractionation
273-270-2	68955-34-0	Gases (petroleum), straight-run naphtha catalytic reformer stabilizer overhead
273-271-8	68955-35-1	Naphtha (petroleum), catalytic reformed
273-563-5	68989-88-8	Gases (petroleum), crude distn. and catalytic cracking
274-683-0	70592-76-6	Distillates (petroleum), intermediate vacuum
274-684-6	70592-77-7	Distillates (petroleum), light vacuum
274-685-1	70592-78-8	Distillates (petroleum), vacuum
276-735-8	72623-83-7	Lubricating oils (petroleum), C>25, hydrotreated bright stock-based
276-736-3	72623-85-9	Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high-viscosity

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276-737-9	72623-86-0	Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based
276-738-4	72623-87-1	Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based
278-012-2	74869-22-0	Lubricating oils
285-095-9	85029-72-7	Hydrocarbon waxes (petroleum), deodorized
285-098-5	85029-74-9	Petrolatum (petroleum), alumina-treated
285-505-6	85116-53-6	Distillates (petroleum), hydrodesulfurized thermal cracked middle
285-507-7	85116-55-8	Kerosine (petroleum), hydrodesulfurized thermal cracked
285-508-2	85116-57-0	Naphtha (petroleum), catalytic reformed hydrodesulfurized heavy, arom. fraction
285-509-8	85116-58-1	Distillates (petroleum), catalytic reformed hydrotreated light, C8-12 arom. fraction
285-510-3	85116-59-2	Naphtha (petroleum), catalytic reformed light, arom.-free fraction
285-511-9	85116-60-5	Naphtha (petroleum), hydrodesulfurized thermal cracked light
285-512-4	85116-61-6	Naphtha (petroleum), hydrotreated light, cycloalkane-contg.
285-555-9	85117-03-9	Gas oils (petroleum), hydrodesulfurized coker heavy vacuum
289-220-8	86290-81-5	Gasoline
289-339-5	87741-01-3	Hydrocarbons, C4
292-454-3	90622-53-0	Alkanes, C12-26-branched and linear
292-456-4	90622-55-2	Alkanes, C1-4, C3-rich
292-613-7	90640-91-8	Distillates (petroleum), complex dewaxed heavy paraffinic
292-614-2	90640-92-9	Distillates (petroleum), complex dewaxed light paraffinic
292-615-8	90640-93-0	Distillates (petroleum), highly refined middle
292-616-3	90640-94-1	Distillates (petroleum), solvent dewaxed heavy paraffinic, clay-treated
292-617-9	90640-95-2	Hydrocarbons, C20-50, solvent dewaxed heavy paraffinic, hydrotreated
292-618-4	90640-96-3	Distillates (petroleum), solvent dewaxed light paraffinic, clay-treated
292-620-5	90640-97-4	Distillates (petroleum), solvent dewaxed light paraffinic, hydrotreated
292-631-5	90641-07-9	Extracts (petroleum), heavy naphthenic distillate solvent, hydrotreated
292-632-0	90641-08-0	Extracts (petroleum), heavy paraffinic distillate solvent, hydrotreated
292-633-6	90641-09-1	Extracts (petroleum), light paraffinic distillate solvent, hydrotreated
292-640-4	90669-47-9	Paraffin waxes (petroleum), acid-treated
292-656-1	90669-74-2	Residual oils (petroleum), hydrotreated solvent dewaxed
292-658-2	90669-76-4	Residues (petroleum), vacuum, light
292-659-8	90669-77-5	Slack wax (petroleum), acid-treated
292-660-3	90669-78-6	Slack wax (petroleum), clay-treated
292-695-4	90989-39-2	Aromatic hydrocarbons, C8-10
292-698-0	90989-42-7	Aromatic hydrocarbons, C7-8, dealkylation products, distn. residues
294-454-9	91722-55-3	Distillates (petroleum), solvent-dewaxed straight-run middle
294-799-5	91770-15-9	Kerosine (petroleum), sweetened
294-843-3	91770-57-9	Residual oils (petroleum), catalytic dewaxed
295-279-0	91995-18-5	Aromatic hydrocarbons, C8, catalytic reforming-derived
295-284-8	91995-23-2	Asphaltenes (petroleum)
295-294-2	91995-34-5	Distillates (petroleum), catalytic reformer, heavy arom. conc.

EC No.	CAS Registry No.	SUBSTANCE
295-298-4	91995-38-9	Hydrocarbons, C4-6, depentanizer lights, arom. hydrotreater
295-300-3	91995-39-0	Distillates (petroleum), dewaxed heavy paraffinic, hydrotreated
295-301-9	91995-40-3	Distillates (petroleum), dewaxed light paraffinic, hydrotreated
295-306-6	91995-45-8	Distillates (petroleum), hydrocracked solvent-refined, dewaxed
295-316-0	91995-54-9	Distillates (petroleum), solvent-refined light naphthenic, hydrotreated
295-331-2	91995-68-5	Extracts (petroleum), catalytic reformed light naphtha solvent
295-332-8	91995-70-9	Extracts (petroleum), deasphalted vacuum residue solvent
295-335-4	91995-73-2	Extracts (petroleum), hydrotreated light paraffinic distillate solvent
295-338-0	91995-75-4	Extracts (petroleum), light naphthenic distillate solvent, hydrodesulfurized
295-339-6	91995-76-5	Extracts (petroleum), light paraffinic distillate solvent, acid-treated
295-340-1	91995-77-6	Extracts (petroleum), light paraffinic distillate solvent, hydrodesulfurized
295-341-7	91995-78-7	Extracts (petroleum), light vacuum gas oil solvent
295-342-2	91995-79-8	Extracts (petroleum), light vacuum gas oil solvent, hydrotreated
295-394-6	92045-12-0	Foots oil (petroleum), hydrotreated
295-396-7	92045-14-2	Fuel oil, heavy, high-sulfur
295-397-2	92045-15-3	Gases (petroleum), gas oil diethanolamine scrubber off
295-398-8	92045-16-4	Gases (petroleum), gas oil hydrodesulfurization effluent
295-399-3	92045-17-5	Gases (petroleum), gas oil hydrodesulfurization purge
295-400-7	92045-18-6	Gases (petroleum), hydrogenator effluent flash drum off
295-401-2	92045-19-7	Gases (petroleum), naphtha steam cracking high-pressure residual
295-402-8	92045-20-0	Gases (petroleum), residue visbreaking off
295-404-9	92045-22-2	Gases (petroleum), steam-cracker C3-rich
295-405-4	92045-23-3	Hydrocarbons, C4, steam-cracker distillate
295-407-5	92045-24-4	Gas oils (petroleum), hydrotreated light vacuum
295-408-0	92045-26-6	Gas oils (petroleum), light vacuum, solvent-dewaxed
295-409-6	92045-27-7	Gas oils (petroleum), solvent-refined light vacuum
295-411-7	92045-29-9	Gas oils (petroleum), thermal-cracked, hydrodesulfurized
295-416-4	92045-36-8	Kerosine (petroleum), solvent-refined sweetened
295-418-5	92045-37-9	Kerosine (petroleum), straight-run wide-cut
295-423-2	92045-42-6	Lubricating oils (petroleum), C17-35, solvent-extd., dewaxed, hydrotreated
295-424-8	92045-43-7	Lubricating oils (petroleum), hydrocracked nonarom. solvent-deparaffined
295-425-3	92045-44-8	Lubricating oils (petroleum), hydrotreated bright stock-based
295-426-9	92045-45-9	Lubricating oils (petroleum), hydrotreated solvent-refined bright stock-based
295-430-0	92045-49-3	Naphtha (petroleum), C4-12 butane-alkylate, isooctane-rich
295-431-6	92045-50-6	Naphtha (petroleum), heavy catalytic cracked, sweetened
295-433-7	92045-52-8	Naphtha (petroleum), hydrodesulfurized full-range
295-434-2	92045-53-9	Naphtha (petroleum), hydrodesulfurized light, dearomatized
295-436-3	92045-55-1	Hydrocarbons, hydrotreated light naphtha distillates, solvent-refined
295-440-5	92045-58-4	Naphtha (petroleum), isomerization, C6-fraction
295-441-0	92045-59-5	Naphtha (petroleum), light catalytic cracked sweetened

EC No.	CAS Registry No.	SUBSTANCE
295-442-6	92045-60-8	Naphtha (petroleum), light, C5-rich, sweetened
295-444-7	92045-62-0	Hydrocarbons, C8-11, naphtha-cracking, toluene cut
295-445-2	92045-63-1	Hydrocarbons, C4-11, naphtha-cracking, arom.-free
295-446-8	92045-64-2	Hydrocarbons, C6-7, naphtha-cracking, solvent-refined
295-447-3	92045-65-3	Naphtha (petroleum), light thermal cracked, sweetened
295-456-2	92045-74-4	Paraffin waxes (petroleum), low-melting
295-457-8	92045-75-5	Paraffin waxes (petroleum), low-melting, hydrotreated
295-458-3	92045-76-6	Paraffin waxes and Hydrocarbon waxes, microcryst., hydrotreated
295-459-9	92045-77-7	Petrolatum (petroleum), hydrotreated
295-463-0	92045-80-2	Petroleum gases, liquefied, sweetened, C4 fraction
295-499-7	92061-86-4	Residual oils (petroleum), hydrocracked acid-treated solvent-dewaxed
295-511-0	92061-97-7	Residues (petroleum), catalytic cracking
295-518-9	92062-05-0	Residues (petroleum), thermal cracked vacuum
295-523-6	92062-09-4	Slack wax (petroleum), hydrotreated
295-524-1	92062-10-7	Slack wax (petroleum), low-melting
295-525-7	92062-11-8	Slack wax (petroleum), low-melting, hydrotreated
295-528-3	92062-14-1	Solvent naphtha (petroleum), heavy
295-529-9	92062-15-2	Solvent naphtha (petroleum), hydrotreated light naphthenic
295-550-3	92062-35-6	White mineral oil (petroleum), light
295-794-0	92128-94-4	Hydrocarbons, C8-12, catalytic-cracking, chem. neutralized
295-810-6	92129-09-4	Paraffin oils (petroleum), solvent-refined dewaxed heavy
295-990-6	92201-59-7	Distillates (petroleum), intermediate catalytic cracked, thermally degraded
295-991-1	92201-60-0	Distillates (petroleum), light catalytic cracked, thermally degraded
296-437-1	92704-08-0	Extracts (petroleum), heavy paraffinic distillate solvent, clay-treated
296-468-0	92704-36-4	Gas oils (petroleum), straight-run, clay-treated
296-903-4	93165-19-6	Distillates (petroleum), C6-rich
297-401-8	93571-75-6	Aromatic hydrocarbons, C7-12, C8-rich
297-458-9	93572-29-3	Gasoline, C5-11, high-octane stabilized reformed
297-465-7	93572-35-1	Hydrocarbons, C7-12, C>9-arom.-rich, reforming heavy fraction
297-466-2	93572-36-2	Hydrocarbons, C5-11, nonaroms.-rich, reforming light fraction
297-474-6	93572-43-1	Lubricating oils (petroleum), base oils, paraffinic
297-827-4	93763-10-1	Extracts (petroleum), heavy naphthenic distillate solvent, hydrodesulfurized
297-829-5	93763-11-2	Extracts (petroleum), solvent-dewaxed heavy paraffinic distillate solvent, hydrodesulfurized
297-852-0	93763-33-8	Hydrocarbons, C6-11, hydrotreated, dearomatized
297-853-6	93763-34-9	Hydrocarbons, C9-12, hydrotreated, dearomatized
297-854-1	93763-35-0	Hydrocarbons, C9-16, hydrotreated, dearomatized
297-857-8	93763-38-3	Hydrocarbons, hydrocracked paraffinic distn. residues, solvent-dewaxed
298-754-0	93821-66-0	Residual oils (petroleum)
300-225-7	93924-31-3	Foots oil (petroleum), acid-treated
300-226-2	93924-32-4	Foots oil (petroleum), clay-treated
300-227-8	93924-33-5	Gas oils, paraffinic

EC No.	CAS Registry No.	SUBSTANCE
300-257-1	93924-61-9	Hydrocarbons, C20-50, residual oil hydrogenation vacuum distillate
302-639-3	94114-03-1	Gasoline, pyrolysis, hydrogenated
302-656-6	94114-22-4	Residues (petroleum), dewaxed heavy paraffinic, vacuum
305-588-5	94733-08-1	Distillates (petroleum), solvent-refined hydrotreated heavy, hydrogenated
305-589-0	94733-09-2	Distillates (petroleum), solvent-refined hydrocracked light
305-594-8	94733-15-0	Lubricating oils (petroleum), C18-40, solvent-dewaxed hydrocracked distillate-based
305-595-3	94733-16-1	Lubricating oils (petroleum), C18-40, solvent-dewaxed hydrogenated raffinate-based
305-971-7	95371-04-3	Hydrocarbons, C13-30, arom.-rich, solvent-extd. naphthenic distillate
305-972-2	95371-05-4	Hydrocarbons, C16-32, arom. rich, solvent-extd. naphthenic distillate
305-974-3	95371-07-6	Hydrocarbons, C37-68, dewaxed deasphalted hydrotreated vacuum distn. residues
305-975-9	95371-08-7	Hydrocarbons, C37-65, hydrotreated deasphalted vacuum distn. residues
306-004-1	95465-89-7	Hydrocarbons, C4, 1,3-butadiene- and isobutene-free
307-010-7	97488-73-8	Distillates (petroleum), hydrocracked solvent-refined light
307-011-2	97488-74-9	Distillates (petroleum), solvent-refined hydrogenated heavy
307-033-2	97488-94-3	Kerosine (petroleum), solvent-refined hydrodesulfurized
307-034-8	97488-95-4	Lubricating oils (petroleum), C18-27, hydrocracked solvent-dewaxed
307-035-3	97488-96-5	Naphtha (petroleum), solvent-refined hydrodesulfurized heavy
307-045-8	97489-05-9	Paraffin waxes and Hydrocarbon waxes, C19-38
307-659-6	97675-85-9	Hydrocarbons, C16-20, hydrotreated middle distillate, distn. lights
307-660-1	97675-86-0	Hydrocarbons, C12-20, hydrotreated paraffinic, distn. lights
307-661-7	97675-87-1	Hydrocarbons, C17-30, hydrotreated solvent-deasphalted atm. distn. residue, distn. lights
307-662-2	97675-88-2	Hydrocarbons, C16-20, solvent-dewaxed hydrocracked paraffinic distn. residue
307-750-0	97722-01-5	Gas oils, light naphthenic vacuum
307-753-7	97722-04-8	Hydrocarbons, C26-55, arom.-rich
307-754-2	97722-05-9	Hydrocarbons, C16-20, hydrotreated distillate, vacuum distn. lights
307-755-8	97722-06-0	Hydrocarbons, C17-40, hydrotreated solvent-deasphalted distn. residue, vacuum distn. lights
307-756-3	97722-07-1	Hydrocarbons, C11-17, naphthenic middle
307-757-9	97722-08-2	Hydrocarbons, C11-17, solvent-extd. light naphthenic
307-758-4	97722-09-3	Hydrocarbons, C13-27, solvent-extd. light naphthenic
307-760-5	97722-10-6	Hydrocarbons, C14-29, solvent-extd. light naphthenic
307-769-4	97722-19-5	Raffinates (petroleum), steam-cracked C4 fraction cuprous ammonium acetate extn., C3-5 and C3-5 unsatd., butadiene-free
308-126-0	97862-76-5	Foots oil (petroleum), carbon-treated
308-127-6	97862-77-6	Foots oil (petroleum), silicic acid-treated
308-128-1	97862-78-7	Gas oils, hydrotreated
308-131-8	97862-81-2	Hydrocarbons, C27-42, dearomatized
308-132-3	97862-82-3	Hydrocarbons, C17-30, hydrotreated distillates, distn. lights

EC No.	CAS Registry No.	SUBSTANCE
308-133-9	97862-83-4	Hydrocarbons, C27-45, naphthenic vacuum distn.
308-140-7	97862-89-0	Paraffin waxes (petroleum), carbon-treated
308-141-2	97862-90-3	Paraffin waxes (petroleum), low-melting, carbon-treated
308-142-8	97862-91-4	Paraffin waxes (petroleum), low-melting, clay-treated
308-143-3	97862-92-5	Paraffin waxes (petroleum), low-melting, silicic acid-treated
308-144-9	97862-93-6	Paraffin waxes (petroleum), silicic acid-treated
308-145-4	97862-94-7	Paraffin waxes and Hydrocarbon waxes, microcryst., carbon-treated
308-147-5	97862-95-8	Paraffin waxes and Hydrocarbon waxes, microcryst., clay-treated
308-148-0	97862-96-9	Paraffin waxes and Hydrocarbon waxes, microcryst., silicic acid-treated
308-149-6	97862-97-0	Petrolatum (petroleum), carbon-treated
308-150-1	97862-98-1	Petrolatum (petroleum), silicic acid-treated
308-155-9	97863-04-2	Slack wax (petroleum), low-melting, carbon-treated
308-156-4	97863-05-3	Slack wax (petroleum), low-melting, clay-treated
308-158-5	97863-06-4	Slack wax (petroleum), low-melting, silicic acid-treated
308-261-5	97926-43-7	Extracts (petroleum), heavy naphtha solvent, clay-treated
308-278-8	97926-59-5	Gas oils (petroleum), light vacuum, thermal-cracked hydrodesulfurized
308-287-7	97926-68-6	Hydrocarbons, C27-45, dearomatized
308-289-8	97926-70-0	Hydrocarbons, C20-58, hydrotreated
308-290-3	97926-71-1	Hydrocarbons, C27-42, naphthenic
309-667-5	100683-97-4	Distillates (petroleum), carbon-treated light paraffinic
309-668-0	100683-98-5	Distillates (petroleum), intermediate paraffinic, carbon-treated
309-669-6	100683-99-6	Distillates (petroleum), intermediate paraffinic, clay-treated
309-672-2	100684-02-4	Extracts (petroleum), light paraffinic distillate solvent, carbon-treated
309-673-8	100684-03-5	Extracts (petroleum), light paraffinic distillate solvent, clay-treated
309-674-3	100684-04-6	Extracts (petroleum), light vacuum, gas oil solvent, carbon-treated
309-675-9	100684-05-7	Extracts (petroleum), light vacuum gas oil solvent, clay-treated
309-693-7	100684-22-8	Gas oils (petroleum), light vacuum, carbon-treated
309-694-2	100684-23-9	Gas oils (petroleum), light vacuum, clay-treated
309-695-8	100684-24-0	Gas oils (petroleum), straight-run, carbon-treated
309-706-6	100684-33-1	Petrolatum (petroleum), clay-treated
309-710-8	100684-37-5	Residual oils (petroleum), carbon-treated solvent-dewaxed
309-711-3	100684-38-6	Residual oils (petroleum), clay-treated solvent-dewaxed
309-712-9	100684-39-7	Residues (petroleum), distn. residue hydrogenation
309-713-4	100684-40-0	Residues (petroleum), vacuum distn. residue hydrogenation
309-723-9	100684-49-9	Slack wax (petroleum), carbon-treated
309-862-5	101316-56-7	Distillates (petroleum), C7-9, C8-rich, hydrodesulfurized dearomatized
309-863-0	101316-57-8	Distillates (petroleum), hydrodesulfurized full-range middle
309-864-6	101316-58-9	Distillates (petroleum), hydrodesulfurized full-range middle coker
309-865-1	101316-59-0	Distillates (petroleum), hydrodesulfurized middle coker
309-866-7	101316-61-4	Distillates (petroleum), thermal-cracked, alkylarom. hydrocarbon-rich

EC No.	CAS Registry No.	SUBSTANCE
309-870-9	101316-66-9	Hydrocarbons, C6-8, hydrogenated sorption-dearomatized, toluene raffination
309-871-4	101316-67-0	Hydrocarbons, C6-rich, hydrotreated light naphtha distillates, solvent-refined
309-874-0	101316-69-2	Lubricating oils (petroleum), C>25, solvent-extd., deasphalted, dewaxed, hydrogenated
309-875-6	101316-70-5	Lubricating oils (petroleum), C17-32, solvent-extd., dewaxed, hydrogenated
309-876-1	101316-71-6	Lubricating oils (petroleum), C20-35, solvent-extd., dewaxed, hydrogenated
309-877-7	101316-72-7	Lubricating oils (petroleum), C24-50, solvent-extd., dewaxed, hydrogenated
309-879-8	101316-76-1	Naphtha (petroleum), hydrodesulfurized full-range coker
309-881-9	101316-80-7	Solvent naphtha (petroleum), hydrocracked heavy arom.
309-882-4	101316-81-8	Solvent naphtha (petroleum), hydrodesulfurized heavy arom.
309-884-5	101316-82-9	Solvent naphtha (petroleum), hydrodesulfurized medium
309-938-8	101631-13-4	Distillates (petroleum), catalytic cracked heavy tar light
309-944-0	101631-19-0	Kerosine (petroleum), hydrotreated
309-945-6	101631-20-3	Naphtha (petroleum), heavy straight run, arom
309-974-4	101794-97-2	Hydrocarbons, C8-12, catalytic cracker distillates
309-976-5	101795-01-1	Naphtha (petroleum), sweetened light
309-987-5	101896-28-0	Hydrocarbons, C8-12, catalytic cracking, chem. neutralized, sweetened
613-683-0	64741-72-6	Naphtha (petroleum), polymn.
614-725-0	68783-11-9	Naphtha (petroleum), light polymn.
none	none	MK1 diesel fuel

APPENDIX 3

REGULATORY AND OIL INDUSTRY NOTES

The classification and labelling recommendations in this report for the various categories of petroleum substances have been developed by CONCAWE based on available information and application of a default most severe classification. It is recognised however that for some endpoints, alternative classifications may be applicable, due to the variable properties of individual substances. The 'default' classifications apply, unless the conditions identified in the classification Notes listed below are met. These Notes are either derived from EC legislation, or have been developed by the oil industry as a practical solution for the provision of reliable and consistent hazard classifications.

OIN = Oil Industry Note
DSD = Dangerous Substances Directive (67/548/EEC)
CLP = Classification, Labelling and Packaging of Substances and Mixtures (Regulation EC 1272/2008)

Note Identifier	Note
OIN 1	Classification as EC DSD Extremely Flammable needs not apply if it can be shown that the flash point and initial boiling point of the substance meet EC DSD criteria for classification as either Highly Flammable or Flammable.
OIN 2	Classification as EC DSD Toxic to Reproduction Category 3 (development) needs not apply if it can be shown that the substance contains less than 5% toluene (CAS number 108-88-3).
OIN 3	Classification as EC DSD Toxic to Reproduction Category 3 (fertility) needs not apply if it can be shown that the substance contains less than 5% n-hexane (CAS number 110-54-3).
OIN 4	Classification as EC CLP Flammable Liquid Category 1 needs not apply if it can be shown that the flash point and initial boiling point of the substance meet EC CLP criteria for classification as either Flammable Liquid Category 2 or 3.
OIN 5	Classification as EC CLP Reproductive Toxicity Category 2 (development) needs not apply if it can be shown that the substance contains less than 3% toluene (CAS number 108-88-3).
OIN 6	Classification as EC CLP Reproductive Toxicity Category 2 (fertility) needs not apply if it can be shown that the substance contains less than 3% n-hexane (CAS number 110-54-3).
OIN 7	The EC DSD classifications as Possible risk of harm to the unborn child (R63) and Harmful: danger of serious damage to health by prolonged exposure in contact with skin (R48/21) need not apply if the substance is not classified as carcinogenic.
OIN 8	The EC CLP classifications as Suspected of damaging the unborn child (H361d) and Causes damage to organs through prolonged or repeated exposure by skin (H372) need not apply if the substance is not classified as carcinogenic.
OIN 9	The EC DSD classification as a Carcinogen needs not apply if it can be shown that the substance has a mutagenicity index (MI) less than 0.4 as measured by the test method described in ASTM E 1687-04 or if another predictive test demonstrates that the substance is not carcinogenic. This OIN applies only to residual aromatic extracts (CAS numbers 64742-10-5 and 91995-70-9).

OIN 10	The EC CLP classification as a Carcinogen needs not apply if it can be shown that the substance has a mutagenicity index (MI) less than 0.4 as measured by the test method described in ASTM E 1687-04 or if another predictive test demonstrates that the substance is not carcinogenic. This OIN applies only to residual aromatic extracts (CAS numbers 64742-10-5 and 91995-70-9).
OIN 11	Classification as EC DSD Flammable needs not apply if it can be shown that the flash point of the substance do not meet EC DSD criteria for classification.
OIN 12	Classification as EC CLP Flammable Liquid Category 3 needs not apply if it can be shown that the flash point of the substance does not meet EC CLP criteria for classification.
OIN 13	The EC DSD classifications as Harmful: danger of serious damage to health by prolonged exposure in contact with skin (R48/21) needs not apply if the substance is not classified as carcinogenic.
OIN 14	The EC CLP classifications as Causes damage to organs through prolonged or repeated exposure by skin (H373) needs not apply if the substance is not classified as carcinogenic.

OIN L (DSD)	The EC DSD classification as a Carcinogen needs not apply if it can be shown that the substance contains less than 3 % w/w DMSO extract as measured by IP 346 'Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions - Dimethyl sulphoxide extraction refractive index method', Institute of Petroleum, London. This note applies only to certain complex oil-derived substances in Annex VI.
OIN L (CLP)	The EC CLP classification as a Carcinogen needs not apply if it can be shown that the substance contains less than 3 % w/w DMSO extract as measured by IP 346 'Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions - Dimethyl sulphoxide extraction refractive index method', Institute of Petroleum, London. This note applies only to certain complex oil-derived substances in Annex VI.
OIN P (DSD)	The EC DSD classification as a Carcinogen or Mutagen needs not apply if it can be shown that the substance contains less than 0.1 % w/w benzene (CAS number 71-43-2). When the substance is classified as a carcinogen or mutagen, Note E shall also apply. When the substance is not classified as a carcinogen or mutagen, at least the S-phrases (2-)23-24-62 shall apply. This note applies only to certain complex oil-derived substances in Annex VI.
OIN P (CLP)	The EC CLP classification as a Carcinogen or Mutagen needs not apply if it can be shown that the substance contains less than 0.1% w/w benzene (CAS number 71-43-2). When the substance is not classified as a carcinogen or mutagen, at least the precautionary statements (P102-)P260-P262-P301+P310-P331 shall apply. This note applies only to certain complex oil-derived substances in Annex VI.

EC DSD Note E:	This note applies only to certain complex oil-derived substances in Annex I.
EC DSD Note K:	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 1,3-butadiene (EINECS No 203-450-8). If the substance is not classified as a carcinogen or mutagen, at least the S-phrases (2-)9-16 should apply. This note applies to certain complex oil-derived substances in Annex I.
EC CLP Note K:	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 1,3-butadiene (EINECS No 203-450-8). If the substance is not classified as a carcinogen or mutagen, at least the precautionary statements (P102-)P210-P403 (Table 3.1) or the S-phrases (2-)9-16 (Table 3.2) should apply. This note applies only to certain complex oil-derived substances in Part 3.
EC DSD Note L:	The classification as a carcinogen need not apply if it can be shown that the substance contains less than 3% w/w DMSO extract as measured by IP 346. This note applies only to certain complex oil-derived substances in Annex I.
EC CLP Note L:	The classification as a carcinogen need not apply if it can be shown that the substance contains less than 3 % DMSO extract as measured by IP 346 'Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions — Dimethyl sulphoxide extraction refractive index method', Institute of Petroleum, London. This note applies only to certain complex oil-derived substances in Part 3.
EC DSD Note N:	The classification as a carcinogen need not apply if the full refining history is known and it can be shown that the substance from which it is produced is not a carcinogen. This note applies only to certain complex oil-derived substances in Annex I.
EC CLP Note N:	The classification as a carcinogen need not apply if the full refining history is known and it can be shown that the substance from which it is produced is not a carcinogen. This note applies only to certain complex oil derived substances in Part 3.
EC DSD Note P:	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). When the substance is classified as a carcinogen or mutagen, Note E shall also apply. When the substance is not classified as a carcinogen or mutagen at least the S-phrases (2-)23-24-62 shall apply. This note applies only to certain complex oil-derived substances in Annex I.
EC CLP Note P:	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). When the substance is not classified as a carcinogen at least the precautionary statements (P102-)P260-P262-P301 + P310-P331 (Table 3.1) or the S-phrases (2-)23-24-62 (Table 3.2) shall apply. This note applies only to certain complex oil-derived substances in Part 3 of Annex VI.
EC DSD Note S:	This substance may not require a label according to Article 23 (see section 8 of Annex VI).

EC CLP Note S:	This substance may not require a label according to Article 17 (see section 1.3 of Annex I) (Table 3.1). 31.12.2008 EN Official Journal of the European Union L353/335.
EC CLP Note U:	When put on the market gases have to be classified as 'Gases under pressure', in one of the groups compressed gas, liquefied gas, refrigerated liquefied gas or dissolved gas. The group depends on the physical state in which the gas is packaged and therefore has to be assigned case by case.

APPENDIX 4

DOWNSTREAM LEGISLATION IMPACTED:

- Registration, evaluation, authorisation and restriction of chemicals (REACH): Regulation (EC) No 1907/2006 of 18 December 2006;
- Control of major-accident hazards involving dangerous substances (Seveso II): Council Directive 96/82/EC of 9 December 1996;

  Note: Further adaptation of the provisions on major accidents occurred on 4 July 2012 with publication of a replacement directive (Directive 2012/18/EU of the European Parliament and of the Council (Seveso III)) which aligns with the CLP Regulation. Member States will have to apply the provisions of Seveso III no later than 1 June 2015.

- Plant protection products: Council Directive 91/414/EEC (PPPD) of 15July1991
- Biocidal products: Directive 98/8/EC (BPD) of 16 February 1998
- Chemical agents at work: Council Directive 1998/24/EC of 7 April 1998;
- Carcinogens and mutagens at work: Directive 2004/37/EC 29 April 2004;
- Young people at work: Council Directive 1994/33/EC of 22 June 1994;
- Pregnant and breastfeeding women at work: Council Directive 1992/85/EEC of 19 October 1992;
- Health and safety signs at work: Council Directive 1992/58/EEC of 24 June 1992;
- Eco-label award scheme: Regulation (EC) No 1980/2000 of 17 July 2000;
- Aerosol dispensers: Council Directive 75/324/EEC of 20 May 1975. CLP Article 14 (2c) takes account of the Aerosols Directive Article 8 (1a);
- Ambient air quality assessment and management: Council Directive 1996/62/EC of 27 September 1996;
- Export and import of dangerous chemicals: Regulation (EC) No 689/2008 of 17 June 2008;
- Hazardous waste: Council Directive 91/689/EC of 12 December 1991, including Commission Decision 2000/532/EC of 3 May 2000;
- Batteries and accumulators: Council Directive 91/157/EEC of 18 March 1991;
- Transport of dangerous Goods
- Regulation (EC) No 1336/2008 to amend Regulation (EC) No 648/2004 of 31March 2004 on detergents. The following changes are carried out: “Mixture” replaces “preparation” and references to CLP replace those to DSD and DPD; and
- Directive 2008/112/EC to amend six Community Directives:
  - Council Directive 76/768/EEC of 27 July 1976 on the approximation of the laws of the Member States relating to cosmetic products: “Mixture” replaces “preparation” and references to CLP replace those to DSD. Insertion of general reference to Test Method Regulation (EC) No 440/2008, reference to CMR criteria under CLP and concept of “dangerous” translated into CLP hazard classifications;

- Council Directive 88/378/EEC of 3 May 1988 on the approximation of the laws of the Member States concerning the safety of toys: “Mixture” replaces “preparation”, concept of “dangerous” translated into CLP hazard classifications;
- Council Directive 1999/13/EC (VOCD) of 11 March 1999 and Directive 2004/42/EC of 21 April 2004 on the limitation of emissions of volatile organic compounds: “Mixture” replaces “preparation” (both directives), insertion of reference to CLP in VOCD Article 5(6) for substances (from 1 Dec 2010) and for mixtures (from 1 June 2015). Also, insertion of reference to CLP CMR criteria and hazard statements in VOCD Article 5(6), (8), (9) and (13) for substances (from 1 Dec 2010) and for mixtures (from 1 June 2015);
- Directive 2000/53/EC of 18 September 2000 on end-of-life vehicles: Concept of “dangerous” translated into CLP hazard classifications; and
- Directive 2002/96/EC of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment: “Mixture” replaces “preparation”, references to CLP replace those to DSD; concept of “dangerous” translated into CLP hazard classifications.

References:

Commission Services (2006). Analysis of the Potential Effects of the Proposed GHS Regulation on Its EU Downstream Legislation Analysis of the Potential Effects of the Proposed GHS Regulation on Its EU Downstream Legislation (DG Enterprise) and Addendum

http://echa.europa.eu/documents/10162/13562/clp_introductory_en.pdf

APPENDIX 5

APPLICATIONS FOR USING TEST DATA FOR THE UVCB SUBSTANCE

1. Application of Repeat Dose Toxicity Classifications (Benzene) to Low Boiling Naphthas (Gasolines)

In CLP Annex VI benzene is classified for repeat dose toxicity as R48/23/24/25 or H372 based on effects on the hematopoietic system. According to the rules laid down in CLP and DPD, classification and labelling oflow boiling naphthas (and gasoline) for repeat dose toxicity would be triggered at benzene concentrations equal to or greater than 1% m/m.

CONCAWE believes it is inappropriate to apply classification for repeat dose toxicity to low boiling naphthas (gasolines) for the following reasons:

- Repeated dermal dose studies with naphthas with exposures upto 2000 mg/kg showed no evidence of hematologic effects.
- Inhalation studies with gasoline and naphthas alsoshowed no evidence of hematologic effects.
- Naphtha blending streams tested in sub chronic inhalation studies with exposures up to 7500 ppm showed some hematological changes, mainly reduced haemoglobin and hematocrit levels and some reductions in leukocyte and lymphocyte numbers in male rats from the highest exposure groups. Since these effects were exclusively found in the male rat, and spleen weights were unaltered, the effects are believed to be secondary to the renal changes (alpha-2μ-globulin inducednephropathy).

2. Application of Repeat Dose Toxicity Classifications (Toluene) to Low Boiling Naphthas (Gasolines)

In CLP Annex VI, toluene is classified for repeat dose toxicity as R48/20 or H373 based on ototoxicity observed inanimal studies at prolonged exposure to toluene vapours. According to the rules laid down in CLP and the DPD, classification of low boiling naphthas (gasolines) for repeat dose toxicity would be triggered at toluene concentrations equal to or greater than 10% m/m. CONCAWE believes it is inappropriate to classify low boiling naphthas (gasolines) for repeat dose toxicity for the following reasons:

- Long-term inhalation studies with gasoline (PS-6) at concentrations up to 2056 ppm did not reveal any signs of neurotoxicity
- Prolonged gasoline abuse (gasoline sniffing) has led to various (reversible) neurological effects but not ototoxicity
- Toluene-induced ototoxicity cannot realistically be achieved since ototoxicity was only observed at prolonged exposure to concentrations of toluene that would cause explosive mixtures with gasoline
- Exposure to gasoline vapours, and hence the toluene therein, is sufficiently limited by classification of gasoline as Cat. 2 carcinogen (R45) to prevent any ototoxicity from gasoline; existing occupational exposure limits for hydrocarbons would further restrict potential exposure.

APPENDIX 6

HAZARD CLASSIFICATION FOR DEVELOPMENTAL TOXICITY ACCORDING TO CLP

According to CLP, Reproductive Toxicity is differentiated into 3 sub-headings:

A) adverse effects on sexual function and fertility and
B) adverse effects on development of the offspring and
C) adverse effects on or via lactation.

Developmental toxicity refers primarily to part B. A typical guideline study design that enables evaluation of this parameter is OECD TG 414. Alternatively, relevant data can be derived from the screening studies TG 421/ 422 or through other non-guideline studies, although these are not typically considered sufficiently robust to drive classification.

For parts A and/or C the multigeneration study TG 416 or TG 426 is applicable; however, these aspects are not further discussed here.

When reviewing developmental toxicity study data for the purposes of classification and labelling, key concerns are: (a) death of the developing organism, (b) structural abnormality, (c) altered growth, and (d) functional deficiency. It is also clear that a distinction is made between significant (i.e, irreversible) effects and those indicative of developmental delays. If any developmental effect is observed in the presence of maternal toxicity, there is a need to carefully evaluate both the severity of the developmental effect and the nature of the maternal effect(s) as both may ultimately influence the decision to classify.

The classification guidelines emphasize that the evaluation should start with an assessment of the developmental effects before the potential for maternal influence is considered. Accordingly, when developmental effects are reported, it is best to review the original study reports, considering both group mean and individual litter data. Although some valuable insight can be gained from individual pup data, it is important to recognise that the recognised statistical unit in reproductive toxicity studies is the litter and not the individual foetus/pup. Among the parameters that should be considered are pre- and post-implantation loss, total number of progeny and percentage live.

As stated in the CLP legislation (3.7.2.4.3) classification for reproductive toxicity is not necessarily the outcome in the case of minor developmental changes, when there is only a small reduction in foetal/pup body weight or retardation of ossification when seen in association with maternal toxicity. However classification shall be considered where there is a significant toxic effect in the offspring, e.g. irreversible effects such as structural malformations, embryo/foetal lethality and /or significant post-natal functional deficiencies. In these cases, in depth review of the study report is warranted and if appropriate a comprehensive overview on a litter by litter basis to assess the impact of maternal toxicity on foetal development. Additionally the statistical significance of any deficiencies should be considered in the evaluation of biological significance. Small changes of statistical significance but of no biological significance are not considered sufficient to classify as a developmental toxicant.

In general, when there is evidence of severe developmental toxicity such as foetal death, resorptions and/or major malformations, and there is no basis to judge these effects as not relevant to humans, then maternal toxicity needs to be considered. Normally, such effects would lead to classification unless the maternal toxicity is severe, e.g. lethality, significant weight loss or reduced weight gain, or inanition. In such cases, a justification should be prepared taking into consideration the nature of both the foetal and maternal effects. When evaluating whether maternal toxicity may be present, factors such as irritation (mild or severe), body weight gain throughout gestation, and food consumption should be examined. Classification may not be

justified if the developmental effect is judged to be of low or minimal toxicological significance, for example reductions in pup weight gain, delayed ossification, rib variations, and/or other evidence of developmental delays.

Once this initial assessment has been completed, then other factors can be considered. Ultimately, classification as a reproductive toxicant is made on the basis of 'expert judgement' taking into account the total weight of evidence. This means that all available information that bears on the determination of reproductive toxicity is considered together, such as epidemiological studies, case reports in humans and specific reproduction studies along with sub-chronic, chronic and special study results in animals that provide relevant information regarding toxicity to growth, development and reproduction. The weight given to the available evidence will be influenced by factors such as the quality of the studies, consistency of results, nature and severity of effects, the presence of maternal toxicity in experimental animal studies, level of statistical significance for inter-group differences, number of endpoints affected, relevance of route of administration to humans and freedom from bias.

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