

Additives in liquid hydrocarbon fuels and blending streams imported into the EU under REACH

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Fuels & Petroleum Streams

Hydrocarbon Fuels and Petroleum Streams are UVCB¹ substances of variable composition, typically comprised of at least 99% hydrocarbons, within their respective EINECS or CAS descriptions. They, however, generally contain impurities, such as water and product carry over from pumping, storage and transport operations. Additives may be used to maintain product stability. These additives are the primary subject of this note. It is proposed that they are to be considered as integral to the Petroleum Substance itself.

Some imported fuels and streams also contain additives that are non-hydrocarbon components (at % levels) such as ether oxygenates, alcohols or FAMEs. When these components are added to a hydrocarbon fuel stream, the material produced by such intentional blending is a preparation (or 'mixture' under GHS) and they are not integral to the substance.

Fuels, as sold to retail and commercial customers, may also contain further small quantities of non-hydrocarbon "performance" additives. Again these are not integral to the substance.

Definition of Substance

REACH Article 3(1): 'Substance: means a chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition.'

Stabilising additives must be identified in the primary Substance Identification ref: Annex VI 2.3.4:

'Nature and order of magnitude (ppm, %) of any additives (e.g. stabilising agents or inhibitors). The guidance specifies that the chemical identity of the stabilising additive (EC number, CAS number, IUPAC name etc) and the typical concentrations and concentration ranges should be specified for all stabilising additives.'

Impurities are not normally considered relevant for UVCB substances², although it would be reasonable for impurities unrelated to the main constituents present at or over 1% to be specified³, as for simple substances. Where an impurity would change the outcome of the PBT assessment and/or is relevant for the classification of the substance, then it should always be specified, regardless of concentration⁴. The number and total concentration of non-specified impurities shall be specified to make the substance's total concentration complete up to 100%.

¹ Substances of Unknown or Variable Composition, complex reaction products or Biological materials

² P.30 Section 4.3.1.1 Guidance for Substance Identification and Naming in REACH

³ Supported by UK REACH Help Desk

⁴ P.45 of the Guidance of PBT Assessment suggests that substances with PBT or vPvB properties need to be considered for the PBT assessment down to a threshold level of 0.1% (w/w).

Chemical additives added to Fuels and Petroleum Streams

Fuels and petroleum streams may contain a number of chemical additives that can be added at various stages in the supply chain – from manufacture to end use - to preserve the integrity of the product and prevent damage to storage tanks, pipe-work and pumps, to aid their transport and to enhance product performance, as well as meeting regulatory requirements. They can be broadly categorised as follows:

1. **Stabilisers**, to maintain product integrity – typically added at concentrations of a few ppm to a few hundred ppm
2. **Impurities**, including additives used during the manufacturing process and transportation – typically at concentrations of a few ppm to a few hundred ppm
3. **Additives / components** used to enhance the performance of the fuel or to meet regulatory requirements – typically at concentrations of a few hundred ppm to 10 or more percent.

These added substances ensure that fuels meet the required specifications, some of which vary seasonally. The chemical types of added substances and their concentration vary from shipment to shipment, and their presence or absence is not generally indicated on the shipping documents. Depending on the refinery configuration and crude oils used to make the fuel, a range of added substances may be required. These added substances may be seen as 'stabilising additives', 'impurities' or 'separate substances in a preparation' under REACH.

Types of Additive used in Fuels and Fuel Streams by Category

1. Stabilisers – to maintain product integrity

- **Antioxidants** – hindered phenols and phenylene diamines
- **Cold-Flow improvers** – polymeric – preventing wax settling at low temperature
- **Antistatic additives** – almost exclusively Stadis®450– preventing development of static discharges leading to an explosion during product transfer
- **Lubricity additives** – fatty acids and esters to replace natural components lost during refining processes to remove sulphur compounds - to prevent damage to fuel pumps
- **Metal-corrosion inhibitors** – preventing corrosion of copper and iron and their dissolution in the fuel where they accelerate oxidation and gum formation
- **Hydrogen sulphide scavengers** – to remove H₂S that can appear unexpectedly in some fuels as a result of chemical or biological action
- **Biocides** – preventing microbial degradation - covered by the Biocides directive and exempt from registration under REACH (Art 15(2)).

2. Impurities - including additives used during the manufacturing process and transportation are at concentrations that are too low (below 0.1%) to need to be included in the substance identity

- Pipeline drag reducing agents – polymeric
- Demulsifiers – to aid oil-water separation within the supply chain

3. Additives / components used to enhance the performance of the fuel or to meet regulatory requirements – are not part of the substance, unless as impurities picked up during product transfer, storage and shipment

- Cetane Improvers in diesel – usually 2-Ethyl Hexyl Nitrate (EINECS: 248-363-6) may be used up to 2000 ppm, but typically below 1000 ppm
- Metal-containing octane enhancers

- Up to 560 ppm Lead as TEL (EINECS: 201-075-4) and 1,2-dibromoethane (Ethylene Dibromide) (EINECS: 203-444-5) for Aviation gasoline; and
- Up to 16ppm Manganese as MMT (EINECS: 235-166-5) for motor gasoline
- Dyes / markers added at a few parts per million to identify the product grade (e.g. Aviation Gasoline, Avgas) or the relevant duty and taxes applicable to the product. Although these might not exceed 1 T/yr per Legal Entity
- Ether oxygenates, alcohols or FAMES added at percent levels to increase performance of the fuel and / or to comply with regulations on biofuels.

Proposals & Rationale

In IUCLID, a link to a reference substance for stabilizing additives is required (as they are known constituents)⁵ in order to define the stabilizing additive's chemical identity. For each stabilizing additive, the concentration (both typical and range) shall be given. It will not, however, generally be possible to do this for stabilizing additives in imported Petroleum substances because of supply chain complexity – for example products from different sources can be commingled in storage or during transport.

As deviations from the REACH Technical Guidance can be acceptable if they are properly justified in the Remarks section of Substance Identification, it is proposed that information on stabilizing (Category 1) additives is included in the Remarks section of the Substance Identification in Section 1 of IUCLID⁵.

Category 2 additives that are considered impurities will not need to be included in the substance identity, as they do not meet the concentration threshold for reporting as impurities⁶.

Importers of fuels will need to pre-register and ultimately register the substances in those additives or their components, if they are importing any of the Category 3 additives/components in fuels where the amount of additive exceeds one tonne a year,.

Note: additives, including performance additives such as detergents to keep fuel injectors clean or antifoaming agents to prevent diesel entraining air during filling, added after the fuel or petroleum stream is imported into Europe, need to be registered by the additive supplier or their primary EU manufacturer, importer, or via an Only Representative.

⁵ P.92 and p.88 of Guidance to Substance Identification.

⁶ See page 1 final paragraph on “Definition of Substance”.