



Inspectie Leefomgeving en Transport
Ministerie van Infrastructuur en Waterstaat

Heavy fuel oil for sea-going vessels

On-road fuels for West Africa

Blended in the Netherlands

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Table of contents

| | |
|----------------|--|
| | Editing, design and production—5 |
| | General summary—10 |
| Annex A | Heavy fuel oil for sea-going vessels—15 |
| | Summary—15 |
| 1 | Introduction—17 |
| 2 | A picture of the chain—19 |
| 3 | Framework for inspection—21 |
| 3.1 | Waste legislation—21 |
| 3.2 | Regulations regarding substances—21 |
| 3.2.1 | REACH—21 |
| 3.2.2 | Other regulations regarding substances—22 |
| 3.3 | Corporate Social Responsibility—22 |
| 3.4 | Competences—22 |
| 4 | Compliance with waste regulations and regulations regarding substances— |
| 23 | |
| 4.1 | Oil companies—23 |
| 4.2 | Traders and tank terminals—23 |
| 4.3 | Suppliers of blend components—24 |
| 4.4 | Waste processors/distillation companies—24 |
| 5 | Risks—26 |
| 6 | Analysis of the results—27 |
| 7 | ILT follow-up approach—29 |
| Annex B | On-road fuels for West Africa—30 |
| | Summary—30 |
| 1 | Introduction—31 |
| 2 | A picture of the chain—32 |
| 2.1 | The blend process—32 |
| 2.2 | Actors in the chain—33 |
| 3 | Framework for inspections—35 |
| 3.1 | Waste legislation—35 |
| 3.2 | Regulations regarding substances—35 |
| 3.2.1 | REACH—35 |
| 3.2.2 | PIC Regulation—36 |
| 3.2.3 | Other regulations regarding substances—36 |
| 3.3 | Corporate Social Responsibility—36 |
| 3.4 | Competences—36 |

| | |
|-----------|--|
| 4 | Compliance with waste regulations and regulations regarding substances— |
| 37 | |
| 5 | Important blend stocks in West African on-road fuels—39 |
| 5.1 | Straight-run refinery products—39 |
| 5.2 | Low-quality cracked products from refineries—39 |
| 5.3 | Petrochemical by-products—40 |
| 5.4 | Products that come from other distillation companies—40 |
| 6 | Risks—41 |
| 6.1 | High sulphur diesel and gasoline—41 |
| 6.2 | High PAH concentrations in diesel—41 |
| 6.3 | Carcinogenic blend stocks in gasoline—42 |
| 6.4 | Octane-increasing additives in gasoline based on manganese—42 |
| 6.5 | Mercaptan removal on-board of vessels—43 |
| 7 | ILT follow-up approach—44 |
| 7.1 | Inspecting compliance with REACH Regulation—44 |
| 7.2 | Other actions—45 |

General summary

Introduction to both investigations

Rotterdam is an important bunkering port for heavy fuel oil for sea-going vessels: it is the largest bunkering port of Europe and it holds the third place globally. Already since the 1990s various parties have been worried about the quality of heavy fuel oil. The question whether hazardous waste is blended herein has regularly played a role within this context.

In September 2016, Public Eye, a Swiss NGO, published the report 'Dirty Diesel'. The question whether waste was being blended too also played a role as a result of this report. In this case in on-road fuels for the West African market.

The Human Environment and Transport Inspectorate (ILT) carried out an investigation into both topics that focuses on the origin and quality of chemical (residual) flows that are used when blending, on the one hand, heavy fuel oil for sea-going vessels and, on the other hand, gasoline or diesel for the African market. The House of Representatives was promised that it would be informed about these investigations.¹

The ILT has been inspecting substances that are used for blending heavy fuel oil for sea-going vessels for some years now: what is commonly referred to as blend stocks. In addition, administrative inspections are carried out by refineries, fuel traders, oil terminals and waste processors. An inspection is carried out to determine which substances are blended to produce heavy fuel oil for sea-going vessels, where they come from and how they relate to the regulations that apply to this issue. The integral report in which the results of these inspections are described with regard to content is included in annex A, 'Heavy fuel oil for sea-going vessels'.

As an addition to this, the ILT carried out an investigation into the nature and origin of blend stocks that are used to produce motor oil for the West African market as from the beginning of 2017. For this end, information was requested from terminals about blend stocks that have been used in gasoline and diesel shipments regarding which it can be proven based on analysis that they have been brought to the West African market. The integral report in which the results of this study are described with regard to content is included in annex B 'On-road fuels for the West African market'.

The reason and approach for these two combined investigations of the ILT and therefore the nature of the reports are different. However, the question whether hazardous waste streams are blended with fuel plays a role in both investigations. The chain actors, market mechanism and legal framework also match significantly. This is why, in this summary, the theme in the inspection strategy, chain and results of both reports are summarised together in outline.

¹ Answer to the House of Representatives questions of Helvert regarding the news report 'Brandstofzwendel scheepvaart erger dan de eiercrisis' (Shipping fuel scam worse than the egg crisis), 6 December 2017 (Appendix to Proceedings II 2017/18, no. 620).
House of Representatives letter regarding the response to the documentary 'Beerput Nederland' (Cesspool Netherlands), 14 March 2018 (House of Representatives document 34 775 XII, no. 73).

The dirty diesel issue is also examined from a different perspective, namely, corporate social responsibility (CSR), in an investigation into the Dutch oil and gas sector of the National Contact Point (NCP) for OECD (Organisation for Economic Co-operation and Development) affairs. This investigation is still being completed; the previous government gave instructions for it to be carried out.

Brief summary of the results

Substances and residues of production processes are mainly processed in heavy fuel oil and West African on-road fuels for economic reasons. Refineries and chemical companies do *not* view the by-products of their processes as waste. If products are not deemed waste, the regulations regarding substances (REACH; Registration, Evaluation, Authorisation and Restriction of Chemicals) applies. Inspections from 2015-2017 shows that compliance with REACH rules by these fuel products is insufficient; most of the investigated companies do not comply with REACH regulations. This can lead to blends that represent an unknown risk to people and the environment when stored, transshipped or burnt in engines. Although these regulations have been in force since 2007, the parties in the fuel market do not sufficiently realise that all raw materials for fuels must comply with this.

The safety data sheets (SDS) are of an insufficient quality. The description of which registered substances make up the blends is described insufficiently clearly. Regularly, the information about the origin, name of the substance, REACH registration, SDS and chemical analyses leads to an inconsistent picture. In addition, in practice, selective use of accompanying documents is involved that are insufficiently specific for the relevant substance or blend.

This does not provide sufficient insight to the actors in the further logistics and use chain, competent authorities and emergency services into the real composition and risk characteristics of the blend stocks and blends and which possible protection measures are required.

The research into the fuels for the African market has shown that West African gasoline and diesel are blended as keenly as possible to the fuel standards of the West African countries of destination. Maximum use is made of the more ample fuel standards of these countries. In addition, low-quality untreated streams from refineries and the petrochemical industry are used that are not suitable for use in a fuel for the European market in view of the health and environmental risks. Fuels have been found that contain 300 times more sulphur than is permitted in accordance with European standards. To ensure the quality of the fuels meets the 'specifications', manganese and benzene are used on a large scale, which is a carcinogenic substance. Substances of concern that also demand attention are, for example, refinery streams with high concentrations of polycyclic aromatic hydrocarbons (PAHs) and 'alien' substances from process chemistry that normally are not present during gasoline production at a refinery such as the carcinogenic substances 1,3 butadiene and isoprene.

ILT approach

The primary focus of the ILT when inspecting the heavy fuel oil chain was, in the first instance, whether illegal blending of waste substances was involved. The refineries and (petro)chemical companies see everything that is created during the production process as a product (non-waste) even when the production process has the goal of producing another substance. To assess whether this is correct or that

possibly a waste substance is, nevertheless, involved, a substance must be investigated in its totality up to the first producer. Since streams that are used as a blend stock often come from abroad, have an unclear name and are frequently blended in the interim in the supply chain, this original origin is often difficult to ascertain. This means that the question whether waste is blended in fuels is often difficult to answer based on only regular administrative inspections on the basis of waste regulations.

The inspections of the ILT did not observe that substances that have been qualified as waste by a disposer have been blended illegally in fuels. However, intentional illegal blending of waste will be kept outside business records. ILT (administrative and physical) inspections based on administrative law cannot identify this. To identify illegal actions, investigative instruments of the Public Prosecution Service are more suitable. Both the National Police and the investigative service of the ILT are therefore carrying out criminal actions in this area.

Since the sector considers all blend components as products and this differs per case in accordance with the ILT, the ILT has gradually expanded its inspection activities to combined Waste-REACH inspections. The basic principle with regard to these combined inspections is that substances that are used as a blend component, must comply with the product regulations as a chemical substance and, in particular, with the REACH Regulation.

The REACH Regulation regulates that the producer must register a chemical with the European Chemicals Agency (ECHA). In this registration, the producer must indicate for which use the substance is being put on the market (identified use). In addition, it must be substantiated through a risk analysis that this use is sound in relation to health and the environment. Subsequently, the substance must be provided with a safety data sheet (SDS) during every step of the logistics and use chain in which the identified use, hazard aspects and required protective equipment are described.

Blend streams that are not REACH registered for the intended use as fuel in vessels and/or vehicles and streams regarding which the REACH registration is not correct when compared to the actual composition may not be put on the market as such. If compliance with the REACH regulations for these blend streams is not possible, they are regarded as waste.

The ILT is building up its inspection strategy based on the REACH Regulation in three steps:

1. Ensuring that producers meet the administrative REACH obligations, namely, doing a REACH registration and drawing up appropriate safety data sheets for the products;
2. Improving the quality of the REACH registration: this concerns here, for example, the exposure scenario with which it is substantiated that the relevant substance is suitable for the identified use as a fuel component from the perspective of environmental and health risks;
3. Ensuring that fuel traders use the substances correctly in accordance with the identified use from the REACH registration.

This combined inspection strategy on the basis of both the waste regulations and REACH, with which ILT is in the lead in Europe, has proven to be a good starting point for the inspection of both heavy fuel oil and West African on-road fuels. In doing so, the ILT is focusing its inspection on a more risk-oriented verification whether blend components are used responsibly in a fuel instead of a verification whether a blend component concerns waste on the basis of its origin.

Important chain actors

Both for heavy fuel oil for sea-going vessels and on-road fuels, the following actors play a specific role in relation to the nature and quality of blend stocks and fuel substances produced from this:

- Refineries, (petro)chemical companies and other distillation companies as the producers of the blend stocks; these companies are, as the producers, responsible for a correct REACH registration of the blend stocks.
- Fuel traders giving the order for the blending of the fuels; they determine the quality of the final fuel blend and are responsible for ensuring that only blend stocks are used that may be used during fuel production in accordance with the identified use.
- Oil terminals where the blends of the fuels takes place at the instructions of the fuel traders; they are responsible for ensuring that an SDS is drawn up for the blend for the buyer that specifies which substances produce this blend.

The producers and fuel traders are the determining actors for the quality of the used blend stocks. The oil terminals have a facilitating role for the ultimate physical blending of the relevant fuels.

Sector improvement approach and intensifying supervision and inspection

In part because of the inspection activities of the ILT, the Vereniging van Onafhankelijke Tankopslagbedrijven (VOTOB; Association of Independent Tank Storage Companies) has recognised the need of improving compliance with REACH and the Administrative Decision on Hazardous Substances and Preparations (Administratiebesluit milieugevaarlijke stoffen en preparaten) by their members. The VOTOB sector association supports its members actively to improve this. For this, it started a project in consultation with the ILT to improve the acceptance policy of terminals and to draw up a 'guidance' for compliance with the REACH obligations.

The ILT wants to achieve a comparable improvement procedure for REACH compliance by members at the Vereniging van de Nederlandse Chemische Industrie (VNCI; Association of the Dutch Chemical Industry) and the Vereniging Nederlandse Petrochemische Industrie (VNPI; Association of the Dutch Petrochemical Industry). Herewith, the ILT provides the specifics for the first two steps in the previously described step-by-step inspection strategy.

In addition to the aforementioned procedures for the general improvement of compliance with REACH, the ILT is intensifying the targeted REACH and waste inspection at producers and fuel traders in relation to the aforementioned problem substances. Within the scope and legal possibilities of the REACH Regulation, it will be assessed whether producers register these substances correctly and sufficiently as a blend component and whether use by fuel traders is taking place in accordance with the identified use described in the registration. Within this context, sampling and analyses will be carried out to verify the documents about substance streams. Herewith, the ILT fills in steps 2 and 3 of the inspection strategy.

This approach will be closely aligned by the ILT with the ECHA: the European Chemicals Agency. In addition, the ILT will continue to share its knowledge and experience with the enforcement partners within the EU in order to maintain a level playing field for Dutch companies. The practise in the chain described in the reports is, after all, not specifically for the involved Dutch companies, but is an internationally common practise within the sector.

In addition, the ILT will monitor and supervise:

- The reduction of the mercaptan content of gasoline on-board of vessels during sea voyages; it is prohibited based on the SOLAS (International Convention for the Safety of Life at Sea) Regulation to allow a chemical process to take place during sea voyages.
- Compliance with the Prior Informed Consent (PIC) Regulation based on which gasoline with a higher benzene content than 1% may not be exported to countries outside the EU without reporting.

Annex A Heavy fuel oil for sea-going vessels

Summary

The origin of the substances with which heavy fuel oil for sea-going vessels is produced is difficult to discover. This also applies to the way in which these substances have been made and certainly if the substances come from abroad. Inspecting bunker fuel that has been produced in accordance with the standards is complex and time-consuming because of this.

Substances and residues of production processes are mainly processed in heavy fuel oil for economic reasons. Within this context, the regulations regarding substances are often not sufficiently complied with. This can lead to blends that represent an unknown risk to people and the environment when stored, transshipped or burnt in marine engines.

Rotterdam is the third largest bunkering location for heavy fuel oil for sea-going vessels in the world with an annual turnover of 6 billion euros. The bunker fuel market consists of large oil companies (that both produce and trade in oil), independent traders in oil products, transshipment companies, suppliers of blend components, waste processors, brokers, carriers and shipowners. The first two – the traders – play a central role in blending and delivering the heavy fuel oil to vessels.

The enforcement in relation to the bunker fuel chain by the Human Environment and Transport Inspectorate (ILT) initially run on the basis of the waste regulations. It is prohibited to deploy waste substances during the production of fuels. However, since it is often unclear whether waste is involved from a legal perspective, inspections based on the regulations regarding substances (in particular, the European REACH substance regulation) has been added to this.

The combined approach must ensure that the produced bunker fuel meets the waste regulations and regulations regarding substances and entails the slightest possible risk to people and the environment during the entire use chain (including during storage, transshipment and burning on-board of a sea-going vessel).

Inspections from 2015-2017 show that compliance with REACH rules in the bunker fuel sector is insufficient. The obligatory information, in particular, about the delivered and blended substances is often incorrect. Substances can, for example, be added to heavy fuel oil that creates a product regarding which the safety risk (when storing, transshipping or burning) is unknown.

In one case, it was observed that a cutter stock was imported and processed into bunker fuel with a concentration of PCBs that was too high in accordance with the paperwork of the sender. In another case, oil was purchased with an organochlorine content that was too high.

At two of the seven inspected traders, products that were considered waste by ILT were used to produce bunker fuel, which is illegal. A number of cases were transferred to the Inlichtingen- en Opsporingsdienst (ILT/IOD; Intelligence and Investigative Service) for possible prosecution. An investigation into similar activities is currently running at three other companies.

During the investigation, it did not emerge that streams that were earmarked as waste by the companies themselves have been used during the production of bunker fuel (refineries and petrochemical companies, for that matter, nearly always regard the streams that arise at their plants as products and not waste). For tracing the intentional blending of hazardous waste in bunker fuel, criminal investigations are a better instrument than the here applied administrative inspections because of the farther-reaching competences and instruments available when investigating crimes. Both the National Police and the investigative service of the ILT are therefore carrying out criminal actions in this area.

Although the REACH regulations have been in force since 2007, the parties that operate in the bunker fuel market are not yet sufficiently aware that all raw materials for bunker fuel must comply with the REACH Regulation. In view of the international nature of this topic, this problem is not an issue solely in the Netherlands. This is why the Netherlands is putting this topic on the EU agenda with the objective of ensuring that the inspection in EU members states of the bunker fuel sector must also start to take place based on the waste and REACH regulations.

1 Introduction

Large quantities of fuels are delivered to shipping from the Netherlands. Rotterdam is in third place worldwide as one of the largest bunkering locations for sea-going vessels with more than ten million metric tonnes per year and is the largest in Europe. Annually, the tanks of about twenty thousand vessels are completely filled on average. Three quarters of this stream goes to container shipping. The value of the supplied fuels amounts to more than six billion euros. By far the largest part of the maritime bunker fuel (94%) consists of heavy fuel oil. Five percent concerns filling up with diesel and then another one percent remains for lubricants. The three large refineries in Rotterdam of BP, Gunvor (previously KPE) and Shell produce more than seven of the ten million metric tonnes on an annual basis while the other heavy fuel oil mainly comes from Russia.²

Various parties have already been worried since the beginning of the 1990s about possible co-blending of hazardous waste in bunker fuel. A report from 1997 of the 'Olievlek' (Oil Spill) inspection action of the former Inspectie Milieuhygiëne (Environmental Hygiene Inspectorate) and DCMR Milieudienst Rijnmond³ (joint environmental protection agency of the province of Zuid Holland and 15 municipalities) came to the conclusion that the bunker fuel market is non-transparent to a high degree with many changing players. At the instructions of the former VROM Inspectorate, a report was drawn up in 2011 to show factual information about the composition of heavy fuel oil, the size of the streams, the 'players' on the market and the incidents and risks of blending with high-risks elements⁴.

Based on this report, the Human Environment and Transport Inspectorate (ILT) carried out inspections at a number of companies in the chain where it was determined whether waste materials have been processed in the bunker fuel. This showed that the inspection of the bunker fuel chain can only be given shape to a limited degree on the basis of waste regulations. The origin and production process of the blend stocks is often difficult to determine and certainly when they originate from abroad. This is why the ILT is not only carrying out this inspection since 2015 from the perspective of the waste regulations, but has combined it with inspections based on the REACH⁵ regulations for chemicals.

The results of the inspections carried out by ILT during the 2015-2017 period are described in the present report. Traders and storage companies (tank terminals) were mainly inspected since they play a key role in the production of bunker fuel. Approximately half of the most important companies were inspected. With regard to the other companies (especially the large oil companies, suppliers of blend components and waste companies/distillation companies), approximately a third of the most important companies were inspected. In addition, substance streams were inspected with a possible increased risk for people and the environment or a possible low level of compliance.

² **Shell window**, 02-2014

³ **Toezichtsactie 'olievlek'**: een beoordeling van de bunkeroliemarkt vanuit het perspectief van de handhaving (The 'olievlek' monitoring action: an assessment of the bunker oil market from the perspective of enforcement). W. Veldman, A. Ligthart (Inspectie Milieuhygiëne); C. Smit, DCMR, waste enforcement, 1997

⁴ **Blends in beeld**; een analyse van de bunkerolieketen (Focus on blends: an analysis of the bunker fuel chain). CE Delft, May 2011, www.ce.nl

⁵ **REACH**: EU regulation for the Registration, Evaluation and Authorisation of Chemicals (no. 1907/2006)

Via these inspections, a good picture about the working method and compliance with the waste regulations and regulations regarding substances in the bunker fuel sector could be obtained.

2 A picture of the chain

In the previously referred to report⁶ about the bunker fuel market, it was indicated that bunker fuel as it is bunkered in Rotterdam by sea-going vessels consists of:

- 75-90%: oil residue from 'simple' refineries
- 10–25%: residue from complex refineries (coming from what is commonly referred to as 'cat-crackers', i.e. fluid catalytic cracking)
- 1-5%: 'light' components (cutter stocks, that come from oil refineries or residual streams of other industrial processes such as ethylene crackers or the production of synthetic resin).

In order to make the residual refinery streams (1st and 2nd bullets) suitable as fuel for sea-going vessels, the residue is blended with 'light' components (3rd bullet). By blending various streams, the right viscosity, density, sulphur content or flashpoint is achieved.

The oil residue that forms the basis of bunker fuel naturally contains harmful elements such as PAHs. By adding blend components with hazardous properties, the harmfulness of the fuel for people, the environment and marine engines can be increased.

The bunker fuel market in the Netherlands mainly consists of the following players:

- 6 large oil companies (Shell, BP, Lukoil, Exxon Mobil, Total S.A. and Petrobras)
- More than 10 independent traders in oil products (traders such as Vitol, Glencore and Gunvor)
- More than 10 tank storage and transshipping companies (tank terminals such as Vopak, Argos, and Nustar)
- Suppliers of blend components (cutter stocks) such as SJB, North Sea Group and Litasco
- Approximately 7 waste processors (such as Odfjell, Main, Martens and ATM)
- More than 20 suppliers of bunker fuel to shipowners (suppliers such as Argos, Ceebunkers and Verbeke)
- Approximately 10 brokers
- More than 10 shippers (using inland navigation vessels)
- Shipowners.

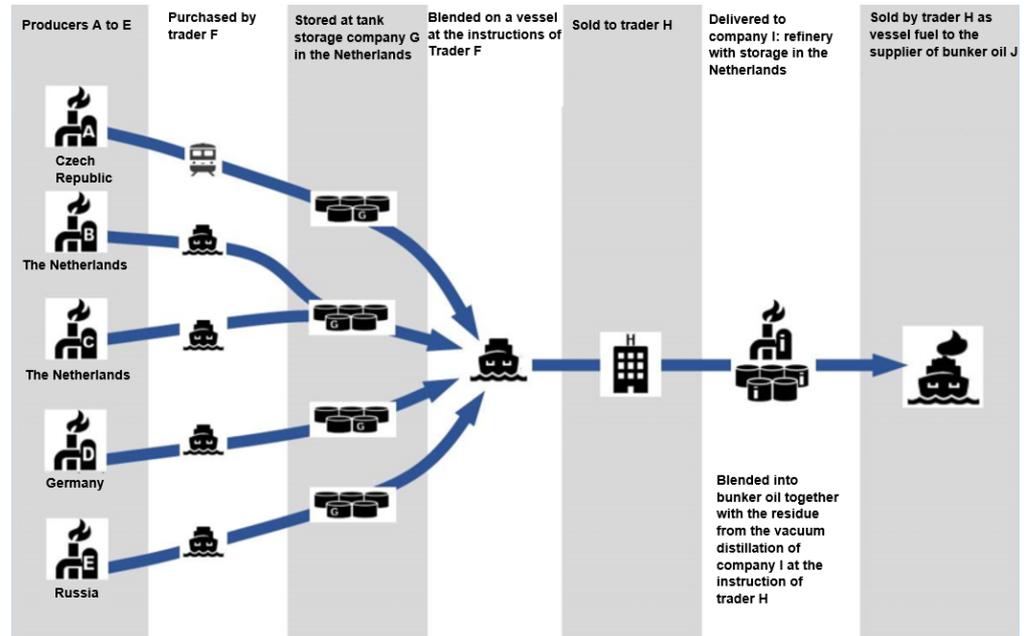
Oil traders or traders play a key role in the bunker fuel market. They are oil companies or independent oil traders. These traders buy the residual oil and the required raw materials on the international market. They give instructions to store and blend (at tank storage and transshipment companies and at vessels) and to possibly further process the products. They sell the bunker fuel to suppliers who, subsequently, sell it on to shipowners for use as vessel fuel.

The bunker fuel market in the Netherlands may only have a limited number of (large) players, but the origin of the substance streams is very diverse and the substances often change owner before they end up as bunker fuel.

The figure below gives an example of the substance streams that are involved in the production of bunker fuel in one of the cases that was investigated by ILT. To determine whether there is compliance with REACH and waste regulations during the production of bunker fuel in such a case, the entire chain starting from the delivery of raw materials, by-products and/or waste and including the blending of these substances must be checked up to the country of origin. This makes effective inspection to determine compliance with the rules in this sector complex and time consuming.

⁶ **Blends in beeld**; een analyse van de bunkerolieketen (Focus on blends: an analysis of the bunker oil chain). CE Delft, May 2011, www.ce.nl

Example of substance streams involved in the production of heavy fuel oil for sea-going vessels (bunker fuel)



3 Framework for inspection

3.1 Waste legislation

It is prohibited based on the Waste Framework Directive to use waste as a raw material for fuel.

Whether a substance is a product or waste is determined by the value for the holder: do they want to or must they get rid of it. If a material is not consciously produced, but is released as residue, it can be put on the market as what is commonly referred to as a by-product. The conditions are that this residue based on the composition:

- Can be used usefully directly without further processing without additional risks for the environment and health;
- Meets the product regulations that apply for the use; in case of chemicals such as blend components for fuel, this is the REACH Regulation (amongst others).

When importing and exporting waste, the European Waste Shipment Regulation (EWSR) must be met.

3.2 Regulations regarding substances

3.2.1 REACH

Based on the REACH Regulation, a chemical substance that is put on the European market must be registered by the producer and/or importer with the ECHA (European Chemicals Agency).

This registration includes:

- Description of the production process and chemical composition of the substance;
- A description of the identified use for which the substance has been put on the market;
- A description of the risks of the substance for people and the environment and the protection measures against these risks;
- Exposure scenario in which it is substantiated that the identified use does not have negative effects on health and the environment.

If a recycling company in the EU produces a substance based on a waste material/stream that is the same as a substance that was already registered previously (by whatever company in the EU whatsoever), this substance of the recycling company will be exempted from the REACH registration obligation (Article 2.7.d, REACH).

A hazardous substance must be provided with an appropriate safety data sheet at every logistics and use step in the chain in which the nature, composition, hazard aspects and use options are summarised in a correct and understandable way for the user.

If hazardous substances are blended, a new safety information sheet that is specified for this blend must be drawn up that shows which substances make up the blend and what the risk is of this mixture.

On the basis of the Administrative Decision on Hazardous Substances and Preparations (Administratiebesluit milieugevaarlijke stoffen en preparaten),

companies must have insight on a substance level into which substances and blends they produce, import or deliver and in which quantities.

3.2.2 *Other regulations regarding substances*

Other regulations regarding substances also apply to fuels such as:

- Fuel sulphur content: EU Directive 1999/32;
- Inorganic acids: Marpol 18.3;
- Polychlorinated biphenyls (PCBs) EU Directive 96/59/EC;
- Organic halogens (PCBs and total organic bound chlorine, bromine and iodine): Decision regarding the organic halogen content of fuels, Environmental Management Act.

3.3 Corporate Social Responsibility

The former Minister for Foreign Trade and Development Cooperation has instructed the Dutch OECD National Contact Point to carry out research into compliance with the OECD guideline for Corporate Social Responsibility (CSR) by the Dutch oil and gas sector.

On the basis of this OECD guideline for CSR, multinationally operating companies are urged to prevent that their products and activities should lead to damage to health and the environment both during production and within the logistics and use chain that follows from this.

3.4 Competences

The ILT enforces the REACH Regulation, Administrative Decision on Hazardous Substances and Preparations (Administratiebesluit milieugevaarlijke stoffen en preparaten), regulations specified in other regulations regarding substances (paragraph 3.2.2) and the EWSR (paragraph 3.1).

The decision about complying with the OECD guidelines for corporate social responsibility must be taken by the NCP/OECD. CSR is referred to within this context in view of the fact that both REACH and CSR appeal to the chain responsibility of producers. Responsibility for risks for health and the environment by their products in the further logistics and use chain.

4 Compliance with waste regulations and regulations regarding substances

Waste and REACH inspections were carried out during the 2015-2017 period at different companies that play a key role with regard to the origin and composition of the substances that are used to produce bunker fuel. The results are shown below.

4.1 Oil companies

When refining oil, a residue is produced that forms the basis for bunker fuel. The REACH registration file and safety data sheet for oil residue of the inspected refineries do describe the effects of the oil residue itself on people and the environment, but no account is taken of the combustion emissions by the vessels when they use bunker fuel. This is, however, mandatory in accordance with the REACH Regulation (Annex I, sections 5.2.3 and 5.2.4). At the other refinery (and at other companies), no account is yet being taken of the effects of combustion emissions (mistakenly). The ILT has written to these companies to tackle this omission.

Other shortcomings were also observed in the inspected safety data sheet at the other refinery (such as the mistaken classification of the substance as non-hazardous). The ILT took an administrative approach in relation to this.

4.2 Traders and tank terminals

Traders lease storage capacity at tank terminals. They buy batches of substances and blends on the international market and have them shipped to the tank terminals. There, these batches are pumped over into the tanks at the instructions of the trader. When the trader has 'built up' a heavy fuel oil in this way from different batches, it is sold on the market.

The inspection have shown that the traders only pay attention to a limited number of properties of the purchased substances and substances to be traded (especially, viscosity, density, sulphur content and flashpoint). Also the tank terminals generally sample incoming and outgoing streams (at the instructions of the traders) on just a few parameters.

The inspected traders and tank terminals were not aware (or not fully aware) of their obligations based on REACH and the Administrative Decision on Hazardous Substances and Preparations (Administratiebesluit milieugevaarlijke stoffen en preparaten). The mutual responsibilities for the delivery of the required data for the substances/blends also turned out to often not be arranged appropriately.

The (mistaken) assumption dominated at the inspected tank terminals that they did not fall under the REACH Regulation because they only carry out activities at the instructions of traders.

In most cases, different substances are blended in the land tanks at the tank terminals, which results in a blend. Blending also takes place in the tanks of vessels that are there to load. The tank terminal must draw up a safety data sheet for this blend in which it is specified which hazardous substances make up the blend and what the risk properties of the blend are. It was observed that both the traders and tank terminals usually issued a safety data sheet of a substance (instead of a blend) and therefore the safety data sheet basically did not cover the load. This meant that

it was unclear for the receiver (and the enforcers) what the composition and origin was of the blend. If the actual composition of a blend deviates from the described composition, it is unclear which risk users run with regard to harmful effects. Moreover, the quality of the safety data sheets that were given to the buyers did not comply with the REACH requirements with regard to a number of other aspects.

It was also observed that substances are used as a component for bunker fuel while this is not the contemplated use of the substance in accordance with the safety data sheet.

In addition, the Administrative Decision on Hazardous Substances and Preparations (Administratiebesluit milieugevaarlijke stoffen en preparaten) was not being complied with in which it is prescribed that the substances and blends that are produced on an annual basis, imported in the Netherlands or made available to another party must be known with regard to 95% of the composition. Often, safety data sheets are supplied in which very broad concentration ranges are specified and therefore the concentration of the relevant substances in the blend itself is unclear even through approximation. This means that the company that uses such a blend cannot correctly determine what the risk properties are.

The ILT acted administratively against the aforementioned breaches.

In one case, it was observed that a cutter stock was imported and processed to produce bunker fuel with a concentration of PCBs that was too high in accordance with the paperwork of the sender⁷. In another case, oil was purchased with an organochlorine content that was too high⁸.

At two traders, products that were considered waste by ILT were used to produce bunker fuel, which is illegal. A few cases were transferred to the Intelligence and Investigative Service of the ILT for prosecution.

The ILT has the suspicion at three other companies at least that products that are used as a raw material for bunker fuel has not reached the end waste stage (and therefore are still waste). In 2018, further research into this will be conducted.

4.3 Suppliers of blend components

It was also observed at a supplier of blend components that no account had yet been taken of the effects of combustion emissions in the registration file and safety data sheet.

At the other supplier, more general shortcomings in the safety data sheet were observed (such as no identified use of the substance being specified, a risk classification of the substance that deviates from that of the registration file and insufficient specification of the safety gloves). The ILT acted both administratively and under criminal law with regard to this.

4.4 Waste processors/distillation companies

It was observed at a distillation company that only sketchy analyses had been carried out with regard to the streams that are processed and the streams that are created after processing. Analyses that are carried out on the incoming and outgoing streams show exceedances of the contract specifications, the values from

⁷ higher than the 0.5 ppm of PCBs of the Decree regarding organic halogen content of fuels

⁸ higher than the 50 ppm in organic halogen of the Decree regarding organic halogen content of fuels

the data safety sheet and/or the *operating limits* of the system in nearly all investigated cases. This means that substances are put on the market where the REACH registration and the safety data sheet do not match the composition of the substance. Therefore, substances can be bought and used with very hazardous properties while the buyer is unaware of this. This leads to insufficient protection measures being taken and therefore danger for employees and/or the environment. The ILT is acting administratively with regard to this case.

At another processing company, collected waste turned out to be converted into a product through simple operations that was exported for fuel, however, the ILT regards the product as still being waste (there is no valid REACH registration and the EOX (extractable organic halide) content does not comply with the fuel standards). By exporting a waste without an EWSR licence, the EWSR was breached. The ILT also acted administratively in this case. After this intervention by the ILT, this stream was again transferred as a waste to a waste processor outside the Netherlands under the EWSR notification. Cases were also transferred to the Intelligence and Investigative Service of the ILT for prosecution at waste processors/distillation companies.

5 Risks

The chemical composition and other issues of the substance must be described in the REACH registration file of a substance as well as the risks of the substance for people and the environment and the protection measures against these risks. In the safety data sheet of a hazardous substance or blend, the most important data from the registration file is passed on to the buyer who then will know whether he or she can deal with the substance or blend safely.

Why is it important for the protection of people and the environment to become aware of the composition of the bunker fuel via the safety data sheet? The residual oil that forms the basis of the bunker fuel is already hazardous for people and the environment in accordance with the safety data sheet and if likewise hazardous substances are added to it to, for example, improve viscosity, the blend will still continue to be hazardous, right? This is further discussed below.

Residual oil is amongst other things carcinogenic and toxic for fertility, but is not really highly inflammable or acutely toxic. In practice, more than 5% of blends are added to residual oil to make the oil more fluid and/or inflammable. This would mean that the blend could also become easily inflammable or acutely toxic with increased risks for fire safety and the health of employees on-board and during the storage and transshipment of the blend elsewhere.

The components that are blended with residual oil, moreover, may contain organohalogen compounds that cause extra emissions upon combustion of acid-forming hydrogen halogenides (hydrochloric acid, hydrobromide and hydrogen fluoride) and substances that are persistent, bio-accumulating and toxic such as chlorinated and brominated dioxins.

It is for these reasons important to know which substances are present in the blend and the quantities thereof.

6 Analysis of the results

REACH registrations specify the risk classification of a substance. This information is passed on to the buyer in the safety data sheet. However, in the heavy fuel oil sector, various substances are blended together and, subsequently, very broad ranges are used in the safety data sheet for the added substances (sometimes 0-100%). Safety data sheets are also often used of a substance while, in fact, it concerns a blend that is composed of various substances that may possibly have different properties than the ones specified on the safety data sheet. This means that it is unclear what the actual composition and risk of the blend is.

Substances are also used in relation to the production of fuels for vessels regarding which it is not shown through the documents (REACH registration and/or safety data sheet) that these substances are intended for this.

The mutual responsibility for compliance with the REACH regulations is not clear to all involved parties either. The traders believed that the tank terminals (as the actual blender of the vessel fuel) were responsible and vice versa during the initial inspections.

The repeated inspections that have now been carried out at the previously visited traders and tank terminals have, in general, shown an improved transparency and an improvement of compliance with the REACH regulations has been observed. Good agreements have been made between traders and tank terminal about responsibilities in a few cases. The quality of the safety data sheets at the visited companies have also often been improved. Whether such an improvement has also occurred at the companies that have not yet been visited will have to transpire from the inspections that will take place in 2018 and thereafter.

It was observed at two traders that substances have been used illegally to produce bunker fuel because this concerns here waste in accordance with the ILT. At three other companies, an investigation will take place in 2018 to determine whether this phenomenon also occurs there.

It was determined in one case that a substance with too many PCBs was used as the raw material for vessel fuel in accordance with the analysis of the supplier. In another case, oil was purchased with a chlorine content that was too high. A number of cases were transferred to the Intelligence and Investigative Service of the ILT for prosecution.

It has not emerged during the investigation that streams that were earmarked by companies as waste were used as a blend for bunker fuel. A criminal investigation, for that matter, is a better instrument for the investigation of the intentional blending of hazardous waste in bunker fuel than the here used administrative inspections because of the farther-reaching competences and instruments used during such investigations of crimes. Both the National Police and the investigative service of the ILT are therefore carrying out criminal actions in this area.

Most (if not all) products of an oil refinery and the petrochemical industry are put on the market as a product or by-product and not as waste. However, because the origin and composition of many streams that are used in the bunker fuel sector are not really transparent, it is unclear whether it concerns waste or (non-waste) substances. If streams are not regarded as waste but do not comply with the REACH rules and the rules for fuels either, this leads to extra risks for people, the environment and marine engines. Specific streams can, for example, contain chlorinated hydrocarbons such as PCBs that may lead to hazardous combustion products such as dioxins. When the oil is heated, volatile organic substances may

be released in high concentrations that may be harmful to health and may represent an explosion risk. Specific streams may also contain hazardous heavy metals that end up in the atmosphere when combusted.

In a number of cases, it is clear that waste is involved. Such streams must therefore be dealt with in accordance with the waste rules. In those cases when it is unclear whether it concerns waste or (non-waste) substances, the relevant company will usually choose the substance status (because of the higher sales value). In this case, however, all requirements of the regulations regarding substances and, in particular, REACH must be met. The investigation has shown that this is not the case in most of the investigated streams: it did not always emerge from the REACH registration of the relevant substance that the substance was suitable for use as fuel and the relevant safety data sheets often showed many defects.

Substances and residues of production processes are mainly processed to produce heavy fuel oil for economic reasons. Within this context, the regulations regarding substances are often not sufficiently complied with. This can lead to blends that represent an unknown risk to people and the environment when stored, transferred or burnt in vessel engines.

By no means are all parties in the bunker fuel market aware that raw materials for the bunker fuel must comply with the REACH regulations. This is not just an issue in the Netherlands, but also most definitely in the other EU member states. This is why the Netherlands puts it on the EU agenda in order to encourage that, as is the case in the Netherlands, inspecting the bunker fuel sector will take place based on both waste and REACH regulations.

7 ILT follow-up approach

In part because of the inspection activities of the ILT, the Vereniging van Onafhankelijke Tankopslagbedrijven (VOTOB; Association of Independent Tank Storage Companies) has recognised the need of improving compliance with REACH and the Administrative Decision on Hazardous Substances and Preparations (Administratiebesluit milieugevaarlijke stoffen en preparaten) by their members. The VOTOB sector association supports its members actively to improve this. For this, it started a project in consultation with the ILT to improve the acceptance policy of the substances at the terminals and draw up a 'guidance' for compliance with the REACH obligations.

The ILT will push to start a comparable improvement procedure for REACH compliance by producers at the Vereniging van de Nederlandse Chemische Industrie (VNCI; Association of the Dutch Chemical Industry) and the Vereniging Nederlandse Petrochemische Industrie (VNPI; Association of the Dutch Petrochemical Industry).

The repeated inspections that have now been carried out at the previously visited traders and tank terminals have, in general, shown an improved transparency and an improvement of compliance with the REACH regulations.

Whether such an improvement has also occurred at the companies that have not yet been visited will have to transpire from the integral waste-REACH inspections that will be carried out by the ILT in 2018 and thereafter at such companies. Within this context, sampling and analyses will be carried out to verify the documents about substance streams.

It is not just in the Netherlands that sometimes the realisation is missing amongst parties in the bunker fuel market that raw materials for the bunker fuel must comply with REACH regulations. This is also an issue in other EU member states. This is why the Netherlands puts it on the EU agenda to encourage that, as is the case in the Netherlands, inspecting the bunker fuel sector will take place based on both waste regulations and REACH regulations.

Annex B On-road fuels for West Africa

Summary

Between June 2016 and May 2017, the ILT carried out inspections on 44 tankers that have loaded on-road fuels for the West African market at Dutch oil terminals. The objective was to gain insight into the nature, composition and origin of substances (blend stocks) that are blended in these fuels.

The used blend stocks often occur as residual substances and residues at refineries, chemical companies and other distillation companies. The investigated streams mainly come from companies established in the Netherlands and the surrounding countries, Russia and the US. Fuel traders buy the blend stocks and store them in tanks at oil terminals. The actual blending takes place during the loading of the seagoing tanker that carries the fuel to West Africa.

When blending West African on-road fuels, blend stocks are used that are not suitable for producing on-road fuels without additional treatment that comply with the standards that apply in Europe and most of the rest of the world (from the perspective of, amongst others, the safety of people and the environment). These low value blend stocks can be used to produce on-road fuel for a number of West African countries where the fuel requirements are a lot less strict.

This is an international common practice. The market is focused on producing fuels against the lowest costs possible by using low value refinery streams and residues from the chemical industry.

In principle, the REACH regulations (requirements on chemicals) are meant to control the risks of fuels for people and the environment. The approach of the ILT therefore focuses on compliance with REACH.

When blend stocks are put on the market, it has emerged that REACH is not properly complied with. Often, it has not been substantiated whether and under which conditions the blend stock can be used as fuel in a vehicle. In addition, the safety data sheets often contain insufficient information about the actual composition, risks and required protection measures. This means that the terminals, competent authorities and emergency assistance workers do not have a reliable picture.

The ILT also observed in its investigation that a tanker had breached the rules by carrying out processes on its gasoline cargo to suppress corrosion and smell-causing sulphur compounds (mercaptan). Such processes during sea voyages are prohibited.

On the basis of the investigation, the ILT will be carrying out REACH and waste inspections structurally at producers and fuel traders of the problem substances that are known within this context (benzene-rich pygas; manganese additive, blend stocks with high contents of 1,3-butadiene, isoprene, PAHs and sulphur). It will also be investigated whether tankers at sea keep to the prohibition of carrying out chemical processes.

1 Introduction

Reason and objective

In the answer to the House of Representatives questions of member Smaling (SP)⁹, the former Minister for Foreign Trade and Development Cooperation indicated, including on behalf of the State Secretary of Infrastructure and the Environment, that the Human Environment and Transport Inspectorate (ILT) is working on obtaining insight into the origin and composition of blend components that are used in gasoline and diesel production for the West African market. In addition, whether waste is being blended in these fuels will also be examined. This report describes the results of this investigation in outline.

Approach

The ILT has carried out an analysis into which sea-going tankers have been loaded at a Dutch oil terminal during the June 2016 to April 2017 period and, subsequently, have shipped their load to West Africa. The ILT gained information from four Amsterdam based terminals about 44 sea-going tankers that emerged from this analysis. In addition, the ILT has focused on blend stocks that are used as input for blending 'West African Fuel' (WAF) with which the relevant sea-going tankers have been loaded. Some sea-going tankers had several cargoes on-board.

Representativeness of the analysed information

The information analysed by the ILT was related to:

- 23 gasoline cargoes for West Africa with a size of approximately 1.2 billion litres;
- 23 diesel cargoes for West Africa with a size of nearly 900 million litres.

On the basis of Statistics Netherlands (CBS) data, this is respectively approximately 20% (gasoline) and 23% (diesel) of the total quantity of gasoline and diesel that the Netherlands annually exported on average to Africa (between 2012 and 2016).

On average, the investigated seagoing tankers were loaded from 7 tanks on land and/or inland vessels. Information was requested for each sea-going tanker about the different blend components that had been unloaded from the inland barges or that had been stored in the relevant tanks on land after blending. This often concerned a multitude of different blend components because the tanks on land are continuously being topped up and partially pumped out. In this way information has been analysed of approximately 30 blends streams per sea going tanker.

Many dozens of blend stocks have been investigated in total with this approach that come from a broad range of producers. Although coming from four terminals, this provides a broadly substantiated insight into the origin, nature and composition of the blend stocks that are generally used in WAFs for 46 fuel cargoes.

⁹ House of Representatives document, TK2017Z02008

2 A picture of the chain

2.1 The blend process

West African gasoline and diesel are blended during the loading of the sea-going tanker. On the one hand, this loading takes place from different tanks on land of the terminal where loading takes place. On the other hand, this takes place from different vessels, which are often inland vessels, that supply blend stocks from other terminals or refineries and pump them straight into the sea-going tanker.

As already described above, the analysed sea-going tankers were blended from 7 tanks on land/vessels on average. Blending takes place accurately based on the 'blending recipe' specified by the customer (fuel trader) that is targeted towards the fuel standards of the country of destination. Figure 1 gives a schematic representation of an exemplary example of the blending process.

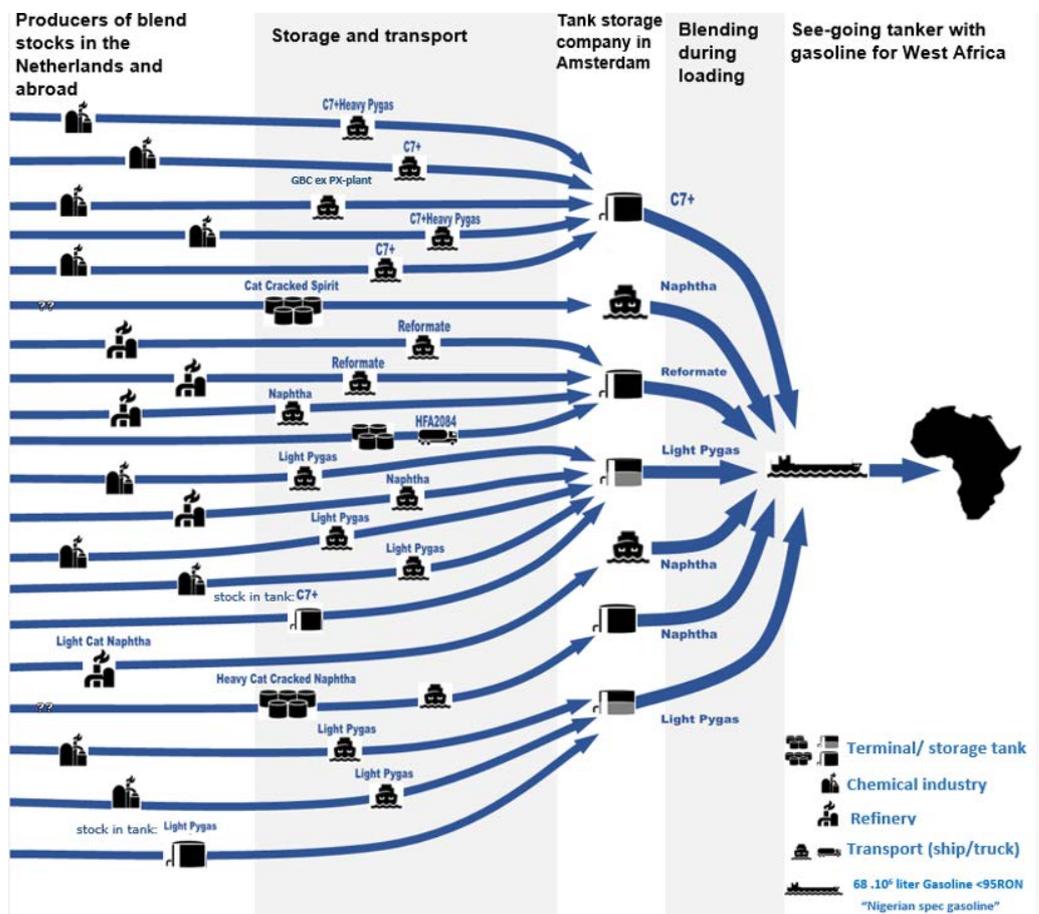


Figure 1. Schematic representation of the blend chain for on-road fuels for West Africa

2.2 Actors in the chain

The following actors play an important role in the chain for the production of West African fuels.

Producers of the blend stocks

Blend stocks are mainly produced by:

- Refineries;
- Chemical companies with a naphtha steam cracker. Raw materials are made in here from the naphtha (one of the fractions that is obtained from the distillation of oil) for, in particular, plastic production;
- Other distillation companies that distil chemical blends on order; the substance will then continue to be the property of the customer.

The investigation showed that most refineries, naphtha steam crackers and other distillation companies are from the Netherlands and the countries surrounding the Netherlands as the producer of blend stocks that are used in West African fuels. In addition, blend stocks also come from further away such as from Scandinavia, the Baltic States, Russia and the US.

The producer of a blend stock puts it on the market and is responsible for the registration of the substance within the framework of the REACH Regulation. The producer is also responsible for drawing up a safety data sheet (SDS) for the relevant substance and/or blend of substances. Based on REACH, an SDS must be supplied with each hazardous substance or blend to inform users about the risks and required protection equipment when the substance or blend is used.

The fuel traders

Fuel traders lease storage space at terminals, buy blend stocks and have the terminal store them. Subsequently, they instruct the terminal to load a seagoing tanker in accordance with an accurately determined recipe.

The fuel trader determines the quality of both the used blend stocks that the fuel trader buys on the market and the produced fuel blends.

In addition to oil traders such as Gunvor, Litasco and Vitol, the trading division of the large oil companies especially often acted as fuel traders in relation to the investigated West African gasolines and diesels; in the case of gasoline, mainly Shell Trading Rotterdam, of gasoline and diesel BP Oil International (based in the United Kingdom) and of diesel Chevron (based in the US).

The terminals

The terminal leases tank storage to the fuel trader and carries out blending and loading operations at the instructions of the fuel trader. The blend products remain at all times the property of the lessee and not the terminal.

As the actual blender, the terminal is responsible for providing the buyer with an SDS with the produced blend in accordance with REACH. The blender may, however, set down legally that the related tasks will be carried out by the customer (the fuel trader).

The terminal is also responsible for the acceptance, storage and pumping of substances within the frameworks of the integrated environmental permit. The frameworks of this integrated environmental permit are mainly related to safety and emission aspects at and directly around the terminal.

The testing agencies (laboratories)

At the instruction of the fuel trader, the testing agencies check the quality of the blend stocks and determine by means of 'Hand blends' (testing blends on a laboratory scale) the precise blending recipe and sequence to blend as strictly as possible within the required specifications.

Suppliers of additives

Often, additives are added to, in particular, West African gasoline products to ensure that the fuel is at the required technical fuel specifications; with regard to, for example, the octane number or mercaptan content or the oxidation stability. Specialised additive suppliers add the additives.

In summary

- The producers of a blend component determine the quality and the intended use of the streams that are put on the market as a blend component.
- Fuel traders determine the quality of the fuel obtained through blending by means of the choice of the used blend stocks and blending recipe.
- Terminals, laboratories and additive suppliers play a role as facilitators.

3 Framework for inspections

3.1 Waste legislation

It is prohibited based on the Waste Framework Directive to use waste as a raw material for fuel.

Whether a substance is a product or waste is determined by the value for the holder: do they want to or must they get rid of it. If a material is not consciously produced, but is released as residue, it can be put on the market as what is commonly referred to as a by-product. The conditions are that this residue based on the composition:

- Can be used usefully directly without further processing without additional risks for the environment and health;
- Meets the product regulations that apply for the use; in case of chemicals such as blend components for fuel this is the REACH Regulation (as well as others).

When importing and exporting waste, the European Waste Shipment Regulation (EWSR) must be met.

3.2 Regulations regarding substances

3.2.1 REACH

Based on the REACH Regulation, a chemical substance that is put on the European market must be registered by the producer and/or importer with the ECHA (European Chemicals Agency).

This registration includes:

- A description of the production process and chemical composition of the substance;
- A description of the identified use for which the substance has been put on the market;
- A description of the hazards of the substance for people and the environment and the protection measures against these hazards;
- An exposure scenario in which it is substantiated that the identified use does not have negative effects on health and the environment.

If a recycling company in the EU produces a substance based on a waste material/stream that is the same as a substance that was already registered previously (by whatever company in the EU whatsoever), this substance of the recycling company shall be exempted from the REACH registration obligation (Article 2.7.d, REACH).

A hazardous substance must be provided with an appropriate safety data sheet at every logistics and use link in the chain in which the nature, composition, hazard aspects and use options are summarised in a correct and understandable way for the user.

If hazardous substances are blended, a new safety information sheet that is specified for this blend must be drawn up that shows which substances make up the blend and what the hazard is of this mixture.

On the basis of the Administrative Decision on Hazardous Substances and Preparations (Administratiebesluit milieugevaarlijke stoffen en preparaten),

companies must have insight on a substance level into which substances and blends they produce, import or deliver and in which quantities.

3.2.2 PIC Regulation

The PIC Regulation (EU/649/2012) regulates the import and export of specific chemicals to non-EU countries based on the Treaty of Rotterdam. The goal is to promote joint responsibility and cooperation in international trade and thus protect health and the environment by providing developing countries with important information about this. One of the substances that is regulated in annex 1 of the PIC Regulation is benzene. It regulates that benzene with concentrations higher than 0.1% should be prevented in consumables with the exception of fuels that meet the European fuel standards (EU Directive 98/70/EU). A European gasoline may contain no more than 1% of benzene. A reporting duty to the ECHA applies with regard to the export of fuel blends with a benzene content that is higher than 1% based on the PIC Regulation. The ECHA will report this export to the intended country of destination.

3.2.3 Other regulations regarding substances

Other regulations regarding substances also apply to fuels such as:

- Fuel sulphur content: EU Directive 1999/32;
- Inorganic acids: Marpol 18.3;
- Polychlorinated biphenyls (PCBs) EU Directive 96/59/EC;
- Organic halogens (PCBs and total organic bound chlorine, bromine and iodine): Fuel Organic Halogen Content Decree, Environmental Management Act.

3.3 Corporate Social Responsibility

The former Minister for Foreign Trade and Development Cooperation has instructed the Dutch OECD National Contact Point to carry out research into compliance with the OECD guideline for Corporate Social Responsibility (CSR) by the Dutch oil and gas sector.

On the basis of this OECD guideline for CSR, multinationally operating companies must prevent that their products and activities should lead to damage to health and the environment both during production and within the logistics and use chain that follows from this.

3.4 Competences

The ILT enforces compliance with the REACH Regulation, Administrative Decision on Hazardous Substances and Preparations (Administratiebesluit milieugevaarlijke stoffen en preparaten), PIC Regulation, regulations specified in other regulations regarding substances (paragraph 3.2.2) and the EWSR (paragraph 3.1).

The NCP/OECD must decide whether the OECD guidelines for corporate social responsibility are being complied with. CSR is referred to within this context in view of the fact that both REACH and CSR appeal to the chain responsibility of producers. Responsibility for risks to health and the environment by their products in further logistics and use chains.

4 Compliance with waste regulations and regulations regarding substances

General market picture

The general picture is that producers and fuel traders when putting blend stocks on the market and using them focus on the chemical applicability of them in fuels against the lowest costs possible. The market focuses on the optimisation of fuel blends based on economic factors; keenly blended within the standards of the intended country of destination. International different standards are used to the maximum (in this case, the more ample West African fuel standards). This is a common practice internationally within the industry.

Combined Waste - REACH inspections

No streams have been found that have previously been qualified as being waste and have been reported as such to a waste processor within the administrative inspections within this project. Blend stocks usually come from refineries, (petro)chemical companies, other distillation companies and terminals and are qualified as a product by the producers (and not waste). Intentional illegal blending of waste will, of course, be kept outside business records. This is very difficult to identify with the administrative inspections that the ILT carries out. To identify this, investigative instruments of the Public Prosecution Service are more suitable.

Refineries and chemical companies consider all streams that are created in the production process as a product and put them on the market as REACH registered even when they are released as a production residue during a process that had the objective of producing another substance. Whether this is correct or that waste may possibly be involved based on origin must be assessed by the competent authority based on the previously described conditions of chapter 3 in article 5 of the Waste Framework Directive. These conditions, for example, entail that the correctness of the REACH registration must be checked as well as compliance with legislation for fuels; amongst others, the BOHB (Besluit organisch halogeengehalte brandstoffen; Fuel Organic Halogen Content Decree) that prohibits an organic halogen content that is higher than 50 mg/kg.

The information requested at the terminals provides limited information on the origin and actual chemical composition of the stored blend stocks:

- The name given to the blend stocks is often unclear. The trade name often gives very little information on the origin of the substance, that is, the refinery or chemical process that produced it;
- The origin is often unknown and cannot be determined. When a blend stock originates from a different terminal where it has already been blended, the information on the origin is lost;
- If the blend stocks originate in a foreign country, the competent authority official depends on the cooperation, assessment and interpretations of foreign competent authorities.

In view of the nature of the market and the quality of the accompanying information, it is difficult if not impossible for the competent authority official to fathom the nature, origin and composition. The waste status is therefore difficult to determine from a legal perspective.

This is why the ILT performs combined Waste-REACH inspections when inspecting the fuel chain. The basic principle of these combined inspections is that substances that are used as blend components, must meet the REACH regulations as chemicals. Blend streams that are not REACH registered for the intended use as fuel in vessels and/or vehicles and streams regarding which the REACH registration is not correct when compared to the actual composition may not be put on the market as such. If compliance with the REACH regulations in relation to these blend streams is not possible, they are regarded as waste.

Insufficient insight into on the chain

The blend components assessed in the investigation were REACH registered. The quality and consistency of the REACH registration and safety data sheets was assessed during the investigation.

The following issues were observed with regard to the assessed REACH files:

- Contain an insufficiently clear description of the identified applicable use of the substance;
- Contain exposure scenarios that do not take the emissions when used as fuel (in a car) into account.

The safety data sheets (SDS) are of an insufficient quality. The chemical composition is insufficiently specific and the description is insufficiently clear with regard to the registered substances of the blends. Safety Data Sheets for refinery gasoline are often added to gasoline blends even though these gasoline blends were blended at a terminal and therefore the SDS should include a more extensive list of substances.

The provided information on the origin, name of the substance, REACH registration, safety data sheet and chemical analyses is often inconsistent. In addition, the accompanying documents are, in practice, selective and are not sufficiently specific with regard to the substance concerned.

This means that actors down the logistics chain and the use chain as well as the competent authority officials and emergency services do not have sufficient information on the actual composition, the hazard specifications of the blend stocks and blends and the protection measures required based on this information.

5 Important blend stocks in West African on-road fuels

The blend stocks that are used in the investigated WAF (West African Fuel) fuel blends can mainly be classified in the product categories listed below:

- Unprocessed 'straight-run' distillation products of refineries; products from the first separation step (distillation) of the refinery;
- Low valued and unprocessed cracked products of, in particular, refineries' catalytic crackers;
- By-products from naphtha steam crackers of (petro)chemical companies;
- Distillation products that come from other distillation companies.

5.1 Straight-run refinery products

The following straight-run products are often used as blend stock for WAF:

- Heavy gas oil (HGO) and light gas oil (LGO) as blend stock for diesel;
- Straight-run naphtha as blend stock for gasoline.

HGO and LGO need to be desulphurised before being used in European diesel. For WAF diesel, the desulphurisation step is not performed because the sulphur standard in various West African countries still provides sufficient room to apply these (very) high sulphur blend stocks.

Straight-run naphtha has a high sulphur content, sometimes a high benzene content and a low octane number. For use in a European gasoline, it must first be processed to increase the octane number and to decrease the sulphur and benzene content. This generates high-quality blend stocks (such as low aromatic reformat and isomerate).

When blending WAF gasoline, straight-run naphtha is used without further processing as blend stock. High-quality blend components such as reformat and isomerate (with a low content of benzene and other aromatics) are not often used in WAF blends.

Direct, unprocessed use of straight-run refinery products results in fuels with a high sulphur content (diesel and gasoline) and a low octane number (gasoline). The risks are further elaborated in the following section.

5.2 Low-quality cracked products from refineries

The following low-quality blend stocks are used from the fluid catalytic cracking process:

- 'Cracked gasoline products', such as FCC/LCC gasoline/spirit as blend stock for WAF gasoline;
- Light Cycle Oil (LCO) as blend stock for WAF diesel.

FCC/LCC gasoline was used for all investigated gasoline blends. These have a high sulphur content and must be processed before used in European gasoline. These blend stocks were used directly without first desulphurising in the investigated WAF gasoline blends.

In at least 11 of the 23 investigated diesel blends, LCOs were used as blend stock. LCOs are a by-product at refineries with a catalytic cracker. The objective is to produce more gasoline and LPG from vacuum distillate gas oil.

LCO often has a high sulphur and aromatic compound content including polycyclic aromatic hydrocarbons (PAHs) that increase the carcinogenetic properties of the blend. A refinery needs to process the LCO before it can be applied to a European diesel. LCO that is marketed as a blend component without processing is mainly used to dilute heavy fuel oil.

LCO is often used directly without the aforementioned processing in the investigated diesel blends. The negative effect of the LCO on the diesel quality must be offset by adding higher quality components and/or additives. The goal of using LCO in diesel is to increase the volume at a low cost and thus financially optimise the blend.

5.3 Petrochemical by-products

Nearly all 23 investigated gasoline blends included pyrolysis gasoline (Pygas) or a product made of pygas as a blend component. Pygas is a by-product of (high temperature) naphtha cracking. In this process, ethylene and propylene for plastic production are produced.

Pygas has, among others, a high benzene content because the benzene in naphtha is concentrated in this stream during cracking. For a European gasoline, pygas must first be stripped of benzene. Benzene is a carcinogenic substance that is strictly regulated in standards in European gasoline. In West-African countries benzene is less strictly or not restricted by standards¹⁰.

From an economic optimisation perspective, pygas is an interesting blend stock for a WAF gasoline. Unprocessed pygas is an inexpensive blend product and the benzene present in the blend stock increases the octane number (required for gasoline).

5.4 Products that come from other distillation companies

This investigation indicated that some gasoline and gas oil blend stocks originate from other distillation companies. These blend stocks are produced by distilling a blend of oil products that have various origins. These are separated into heavy bottom and lighter top fraction. The bottom fraction is often used to feed heavy fuel oil or diesel and the light top fraction is used as blend stock for WAF gasoline.

An additional investigation of the ILT at a distillation company showed that most of the distilled top fractions have a high benzene content (up to 44%) alongside other substances with relatively high health risks such as carcinogenic 1,3 butadiene and isoprene. The risks of these substances are described in section 6.

¹⁰ During the period of the investigation, the benzene standard values for gasoline in West-African countries varied between 1.5% to no limit value: Ghana max. 1.5%, Nigeria max. 2%, Ivory Coast max. 5%, Benin, Mali and Senegal (of 'Regular Gasoline') do not limit the content. Senegal requires that the benzene content is reported for 'Super Gasoline' grade. Ghana adjusted the fuel standards as of 1 July 2017.

6 Risks

6.1 High sulphur diesel and gasoline

A high sulphur content in on-road fuel results in high emissions of particulate matter and sulphur oxide. The EU standard limit for sulphur in diesel and gasoline is max. 10 ppm. The sulphur standard limit applicable in West African countries varies significantly; for diesel 2000-5000 ppm and for gasoline 150-3500 ppm¹¹.

Blend stocks for WAF diesel often have sulphur contents of approximately 6000-7000 ppm sulphur (6 to 7 grams per kilogram). High sulphur blend stocks are also used for gasoline with a sulphur content higher than 1000 ppm. The highest sulphur content of a blendstock found was 16,460 ppm.

The very high sulphur blend stocks came from Dutch refineries approximately 50% of the time, amongst others the refineries of the large oil companies.

Based on the assessed documents, estimates have been made of the sulphur content of the diesel final blends. They have been keenly blended based on the sulphur standard of the country of destination; depending on the destination, often close to 3000 ppm of sulphur for diesel and 1000 ppm for gasoline ('Nigerian spec'). The produced diesel and gasoline blends probably comply in this way with the fuel standards of the country of destination. These sulphur concentrations are, however, very high when compared to the European sulphur standard.

6.2 High PAH concentrations in diesel

LCO streams with a PAH content higher than 65% and a total aromatic content higher than 90% were assessed during the investigation. Based on the analysis certificates of this LCO and the share of this LCO in the final blends, the PAH content in the diesel blended with this is calculated at approximately 16%. This calculated PAH concentration is twice as high as the European standard for PAHs in diesel.

Polycyclic aromatic hydrocarbons (PAHs) are a large group of substances that also occur in relation to natural combustion processes. Various PAHs have been officially classified as being (amongst others) carcinogenic.

¹¹ Sulphur standard limits for diesel: During the ILT investigation, the two largest fuel markets in West Africa, Ghana and Nigeria, had set a maximum of 3000 ppm for sulphur in diesel. Benin and Ivory Coast max. 3500 ppm sulphur, Senegal max. 5000 ppm and Guinea max. 2000 ppm. Ghana adjusted the fuel standards as of 1 July 2017: the sulphur content limit is max. 50 ppm.

Sulphur standard limits for gasoline: During the investigation, the sulphur standard limits varied significantly. Ivory Coast: max. 150 ppm, Mali: max. 500 ppm, Ghana and Nigeria: max. 1000 ppm, Benin max. 3500 ppm. Senegal max. 1500 ppm for the 'Regular Gasoline' and max 500 ppm for the 'Super Gasoline'. Ghana adjusted the fuel standards as of 1 July 2017. The sulphur content for regular and premium grade gasoline is max. 50 ppm.

6.3 Carcinogenic blend stocks in gasoline

Benzene-rich pygas

In the investigated WAF gasolines, untreated pygas streams were used with benzene contents of up to 42%, which means that they are not suitable without treatment for European gasoline.

Benzene is classified as being carcinogenic in the EU. This is why the lowest content possible of benzene is required in consumer products such as gasoline. Gasoline for the European market may contain no more than 1% benzene. This standard has not been set lower because benzene cannot be completely avoided in gasoline due to the nature of crude oil of which gasoline is made.

Cheap 'volume boosters' from process chemistry: butene and isoprene

Some investigated WAF gasoline blends had been 'butanised'. Butane is a relatively cheap product from the petrochemical industry. In European gasoline, the main objective of adding butane is to increase the vapour pressure for the production of winter gasoline. This is not necessary for African gasoline. Clean butane that comes from refineries is used for the butanisation of European winter gasoline. In the investigated WAF gasoline blends, 'olefinic butane' from the chemical process industry was also used, which contains butenes, amongst others the carcinogenic substance 1,3-butadiene.

This substance is not restricted in other fuels other than LPG since the substance is not expected when producing gasoline in a refinery. This is the reason why it is not included in the analysis of gasoline samples.

A blend stock that can be compared is 'IP Extraction Feed' that increases the vapour pressure just as butane does. IP Extraction Feed is specified on the SDS of a few gasoline blends as an ingredient of the blend. 'IP' stands for isoprene, a carcinogenic substance that forms an important part of this. IP Extraction Feed is created during the production of benzene from pygas. Isoprene is just as carcinogenic as benzene, but twice as volatile. When it is applied to gasoline, it will therefore lead to a strong increase of the carcinogenic risk when inhaling gasoline vapour.

If in addition to benzene, streams of 1,3-butadiene and isoprene are added to the gasoline, the carcinogenicity of the product will increase because of the accumulation effect.

6.4 Octane-increasing additives in gasoline based on manganese

When blending WAF gasoline products, straight run naphtha blend stocks are used with a low octane number and therefore often additives must be added to ensure that the octane number of the gasoline blend is on specification. In nearly all 23 investigated gasoline blends, 'octane boosters' were used for this that contain the manganese metal.

Manganese compounds that are created during combustion and end up in the blood through inhalation, are suspected of being harmful to health. In addition, manganese is already harmful at low concentrations for the engine and the emission control systems of vehicles. The automotive industry is arguing that we should stop using manganese additives in fuels. EU gasoline may contain no more

than 2 mg/l of manganese, which in fact means that a manganese additive may not be intentionally added.

Based on the quantity of added additive and the chemical information from the safety data sheets, the manganese concentrations in the WAF gasoline blends have been calculated. This resulted in a manganese concentration of 14-21 mg/l (19-28 mg/kg) on average. The highest calculated manganese content in a gasoline was 43-65 mg/l (58-87 mg/kg).

6.5 Mercaptan removal on-board of vessels

High sulphur containing naphtha sometimes contains high concentrations of mercaptans. Mercaptans are specific sulphur compounds that cause a smell and are corrosive. A too high mercaptan content makes the final blend non-marketable because of this.

The ILT investigation came across one case in which additives were added during the loading of a sea-going tanker to reduce the mercaptan content of the blended gasoline (commonly referred to as mercaptan scavengers).

The ILT is of the opinion that when scavengers are injected, a chemical process on-board of the sea-going tanker starts that is only completed upon unloading of the mercaptans at the destination or after washing the vessel's tanks. The ILT therefore regards the adding of mercaptan scavengers during or just before the loading of a sea-going tanker as being contrary to the SOLAS Regulation. As of 1-1-2014, it has been prohibited, based on this regulation, to carry out a chemical process on-board a vessel during the voyage in part due to the incident with the Proba Koala.

Hazardous waste is produced when using mercaptan scavengers on-board of a vessel. If the vessel has departed from a terminal after an injection of mercaptan scavengers during the loading, this waste is created during the voyage outside the supervision of the authorities.

After the relevant tanker departs, the ILT followed the vessel during a longer period and asked the port authorities of the ports that were called upon to check each time whether hazardous waste was being disposed of. Information about the waste disposal could not be determined in any of the ports. The copies of the cargo record book of the vessel checked by the various port authorities gave a picture that was suspicious. Whether they acted illegally in this case and whether a widely occurring phenomenon is involved will be further investigated.

7 ILT follow-up approach

7.1 Inspecting compliance with REACH Regulation

General improvement procedure through sector organisations

In part because of the inspection activities of the ILT, the Vereniging van Onafhankelijke Tankopslagbedrijven (VOTOB; Association of Independent Tank Storage Companies) has recognised the need of improving compliance with REACH by their members. The VOTOB sector association supports its members actively to improve this. For this, it started a project in consultation with the ILT to improve the acceptance policy of the affiliated oil terminals and a 'guidance' for compliance with the REACH obligations was drawn up.

The ILT wants to start a comparable improvement procedure for REACH compliance together with the Vereniging van de Nederlandse Chemische Industrie (VNCI; Association of the Dutch Chemical Industry) and the Vereniging Nederlandse Petrochemische Industrie (VNPI; Association of the Dutch Petrochemical Industry).

Targeted REACH and Waste inspections of risk streams

In addition to the aforementioned procedures for the general improvement of compliance with REACH, the ILT will start targeted REACH and waste inspections at producers and fuel traders in relation to the aforementioned problem substances.

- Benzene-rich pygas;
- Manganese as octane-increasing gasoline additive;
- 1,3 butadiene;
- Isoprene;
- Polycyclic aromatic hydrocarbons (PAHs);
- Very high sulphur content blend stocks.

It will be assessed whether these substances have been registered correctly as blend components for on-road fuel and whether application takes place in accordance with the identified use described in the registration within the scope and legal possibilities of the REACH Regulation.

This approach will be aligned with the ECHA and the enforcement partners in the EU member states to keep a level playing field for Dutch companies.

An item to be addressed is the question whether the scope of the REACH Regulation is limited to the application of the fuel or substance on the European market or that the chain responsibility should also cover the substance being used outside the EU in relation to a substance produced in the Netherlands.

7.2 Other actions

Inspections of mercaptan removal on-board of vessels

The ILT will investigate at the suppliers of additives whether it is possible that a new phenomenon is occurring where mercaptan scavengers are deployed to reduce the mercaptan content of the cargo on-board of vessels during sea voyages. When deployment on vessels is proven, the ILT will actively act against this within its legal possibilities as an enforcer.

PIC Regulation

The ILT will check whether the PIC Regulation is being complied with in relation to the export of gasoline to non-OECD countries so that no gasoline with a higher benzene content of 1% is exported to West African countries without being reported.

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