IMAROS 2

Workpackage 2 – Trends and samples

Version 1.0

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1. Introduction

Ship accidents may result in oil spills, causing time consuming and costly response operations at sea, in harbours, in freshwater and on the shoreline. International regulations in recent years have targeted emissions to air from shipping, to improve air quality. In particular, improved IMO- and EU-regulations to limit sulphur emissions to air seems to have a considerable impact on the marine fuel market. Within the Sulphur Emission Control Areas (SECAs) ships must use fuels with a maximum sulphur content of 0.10%. This already applies to the Baltic- and North Sea, and from 2025 also the Mediterranean Sea isdesignated as a SECA. Furthermore, according to IMO MARPOL Annex VI the global limit of sulphur content in marine fuel oils decreased from 3.5% to 0.5% from 2020. Alternatively, approved abatement methods (i.e. scrubbers) must be applied. These regulations have resulted in a range of new fuel oil products allowing ship owners to comply with the regulations without costly modifications on existing ships. The fuels are referred to as Low Sulphur Fuel Oils, LSFOs, further categorized into Ultra Low Sulphur Fuel Oils (ULSFO, S<0.1%) and Very Low Sulphur Fuel Oils (VLSFO, S<0.5%).

The IMAROS project (2020-2022), funded by the EU, has significantly improved our understanding of potential impacts and challenges for responders resulting from LSFO spills. In addition, experiences from recent studies and incidents underlines that fuel oil composition is changing, and that this may result in new challenges for responders. Some of the findings from the laboratory and test-basin studies in IMAROS are also reflected in observations in the field following recent incidents, e.g., a VLSFO spill of Gibraltar (2021) and a VLSFO spill outside Gothenburg in 2022.

The objective of WP2 in IMAROS2 is to collect data to improve our understanding of the environmental risk from accidental spills of LSFO in Europe. The results from the IMAROS project underlined that the fuel market has been subject to substantial changes in the past two years. However, the picture is diverse, due to market trends and regulations. Updated information from ports, authorities and industry will be collected and form the basis for the selection of representative samples, based on updated information on fuels frequently encountered in European waters. Origin of the samples may or may not be from Europe. Collection and logistics of samples from across Europe are main tasks (see table 1) of WP2 and provides the basis for WP3, WP4 and WP5.

Table 1: Tasks in workpackage 2

Task No	Task Name	Description of the task and expected result	Participants	
			Name	Role (COO, BEN, AE, AP, OTHER)
T2.1	Data collection, trends and representativeness	Statistics and interviews with producers and suppliers and port authorities will form the basis for the selection of representative samples. The approach and methodology will be decided by the CPT based on the discussion in workshop 1.	**RWS**, All partners	BEN, COO
T2.2	Collect small samples	Collect and distribute samples for WP3	**RWS**, All partners	BEN, COO
T2.3	Collect large samples	Collect and distribute samples for WP3, WP4 and WP5	**RWS**, All partners	BEN, COO

2. Trends in Fuels

The results from the IMAROS project underlined that the fuel market has been subject to substantial changes in the past five years. However, the picture is diverse, due to market trends and regulations. The objective of WP2 was to collect data to improve our understanding of the environmental risk from accidental spills of LSFO in Europe.

The information from this chapter forms the basis for the selection of representative samples for WP3, WP4 and WP5.

To gain a comprehensive understanding of the current marine fuel market, we sourced analytical data from Veritas Petroleum Services (VPS) PortStats. With their permission, we utilized their bunker fuel analysis database to examine global fuel usage trends and the specifications of fuels delivered worldwide.

The dataset provided by VPS PortStats covers the period from 2018 to 2024 and includes results from a wide range of global ports. Given VPS's estimated market coverage of approximately 40%, the dataset offers a reliable basis for analyzing the distribution and quality characteristics of various fuel types.

Dataset Overview:

- Timeframe: 2018–2024
- Fuel Types: BIO, MGO, HSFO, VLSFO, ULSFO
- Number of Samples: 781.656
    - BIO, 1.854
    - MGO, 324.014
    - HSFO, 195.635
    - VLSFO, 239.871
    - ULSFO, 20.282
- Geographic Coverage: Global

Parameters included in the VPS portstat data:

Region	Ca (mg/kg)	S (%)
Country Name	Fe (mg/kg)	CCAI
Main Port	K (mg/kg)	TSP (%)
Port Name	Mg (mg/kg)	TSA (%)
Bunker Date	Na (mg/kg)	TSE (%)
Product Type	Ni (mg/kg)	FAME Content
ISO Grade	P (mg/kg)	Net Energy (MJ/kg)
ISO Version	Si (mg/kg)	ASPH
Sampling Point	V (mg/kg)	Bacteria
BDN Density (kg/m3)	Zn (mg/kg)	Yeast
BDN Quantity (MT)	AlSi (mg/kg)	Fungi
BDN Volume (m3)	Cat Fine Category	BlendTSP
BDN Volume Temp (°C)	FP (°C)	Seperability Nr.
BDN Viscosity (cSt)	H2O (%)	GC_MS_HS
BDN Sulphur (%)	MCR (%)	Off-Spec Flag
Vol. Unit	AN	Off-Spec Param
Viscosity at 50°C (cSt)	PP (°C)	Off-Spec Limit
Viscosity at 40°C (cSt)	WAT (°C)	Off-Spec Result
Density (kg/m3)	CFPP	Off-Spec Ver
Ash (%)	CP	
Al (mg/kg)	WDT (°C)	

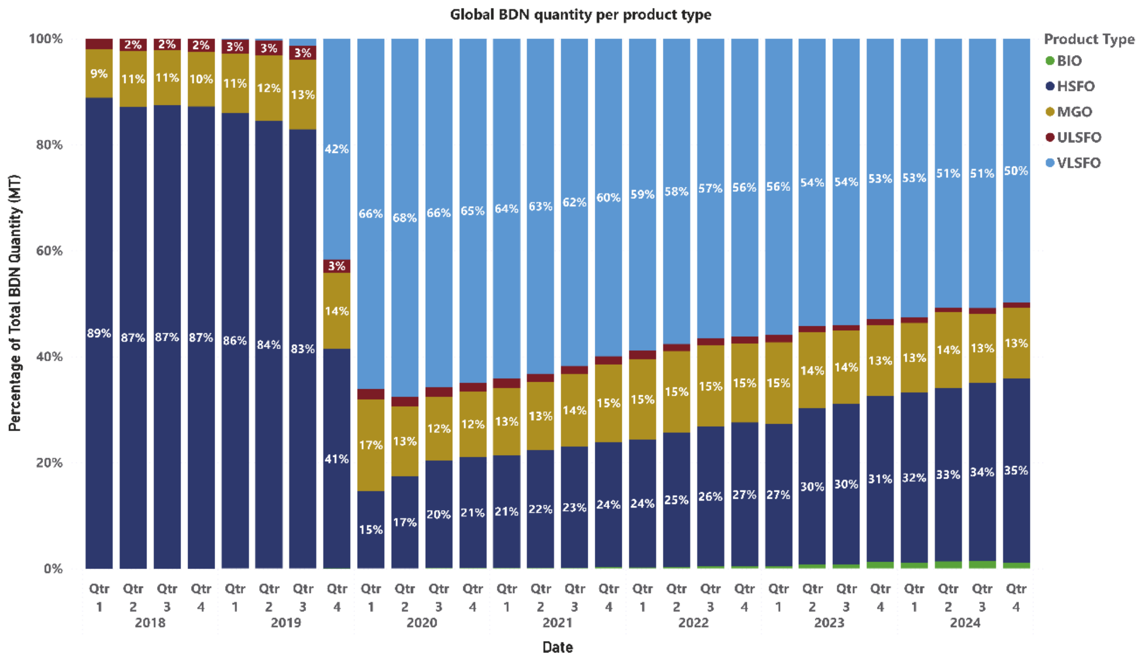
We conducted extensive data cleansing and categorized the results based on key quality indicators such as density, viscosity, and pour point. One key remark is that the standard test for the pour point in HSFO stops at 24°C

The following sections detail our findings and key trends identified in the dataset.

2.1 Bunkerdeliveries Global

To analyze the distribution of bunker fuel types globally, we examined delivery trends across different fuel categories from 2018 to 2024. Figure 1 illustrates the quarterly distribution of delivered bunker fuels Globally, from 2018 to 2024, expressed as a percentage of total volume (in metric tons).

Figure 1: Global bunker fuel deliveries by product type (2018–2024)



A clear shift occurred at the end of 2019, with a marked decrease in the use of HSFO and a significant rise in VLSFO. This transition aligns with the implementation of the International Maritime Organization (IMO) global sulphur cap, which came into effect on January 1, 2020.

At the start of 2020, the global distribution of delivered fuels was approximately:

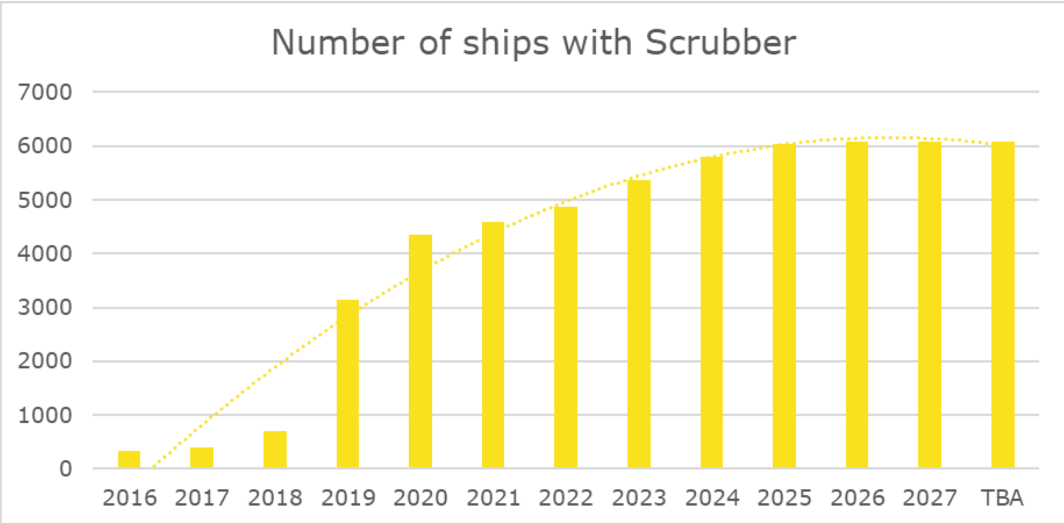
- **15%** Marine Gas Oil (MGO)
- **15%** HSFO
- **68%** VLSFO
- **2%** ULSFO

By the end of 2024, the composition had shifted to:

- **13%** MGO
- **34%** HSFO
- **50%** VLSFO
- **1%** ULSFO
- **2%** Biofuels

MGO deliveries have remained relatively stable throughout the observed period. However, an increase in HSFO consumption and a corresponding decrease in VLSFO use can be noted from 2020 onwards. One likely explanation is the growing adoption of exhaust gas cleaning systems (commonly known as scrubbers) aboard vessels. This trend is supported by data from Det Norske Veritas (DNV) shown in Figure 2, which indicates that by 2024, approximately 25% of the global fleet is equipped with either open-loop or closed-loop scrubber systems.

Figure 2: Share of global fleet equipped with scrubbers (DNV, 2024)

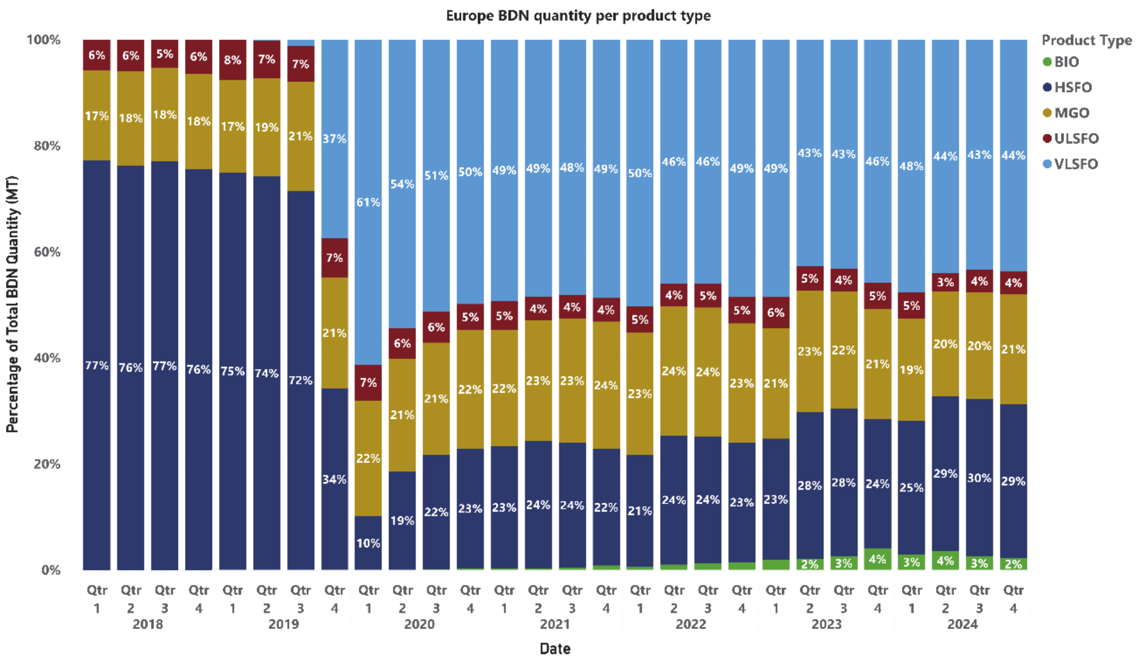


In addition, biofuel deliveries have started to gain traction, particularly from 2023 onward, marking the early stages of alternative fuel integration in the marine sector.

2.2 Bunkerdeliveries Europe

This section focuses on fuel delivery trends within the European market. Figure 3 illustrates the quarterly distribution of delivered bunker fuels in Europe, from 2018 to 2024, expressed as a percentage of total volume (in metric tons).

Figure 3: Bunker fuel deliveries in Europe by product type (2018–2024)



Between 2020 and 2024, marine fuel usage patterns showed notable shifts. MGO maintained a steady presence, with a slight decrease from 22% to 21%. HSFO saw a strong upward trend, rising from 10% to 29%, reflecting increased scrubber usage. In contrast, VLSFO declined significantly, dropping from 61% to 44%. ULSFO also decreased, falling from 7% to 4%. Meanwhile, biofuels, which entered the market after 2021, reached a 2% share by 2024, marking a growing interest in alternative, lower-emission fuels.

When comparing Europe to the global market, the fuel mix appears relatively stable following the introduction of the IMO 2020 sulphur cap. VLSFO remains the dominant fuel, but its share is declining. HSFO resurgence is visible here too, likely for the same reason: growing scrubber adoption.

One likely reason for this stability is Europe's early adoption of stricter emission regulations. Emission Control Areas (ECAs) had already been established in key regions such as the Baltic Sea (since 2005) and the North Sea (since 2008) prompting earlier market adjustments and a smoother transition to compliant fuels.

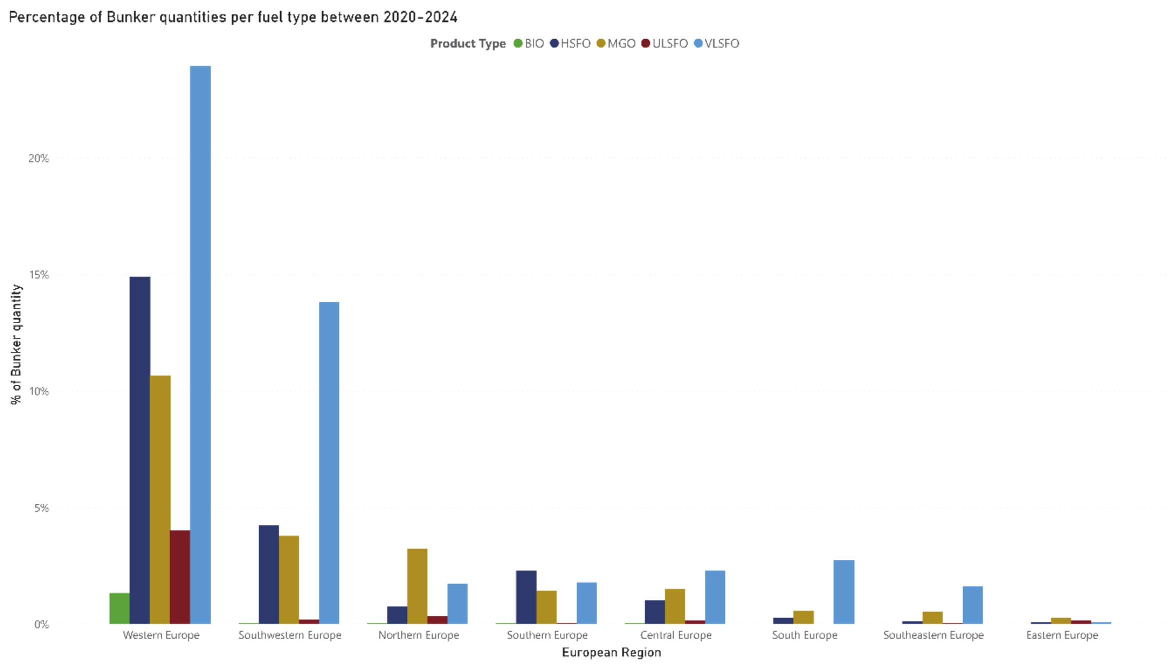
Biofuels have been present in the European market since as early as 2021, likely due to targeted policy measures and regional initiatives supporting low-emission alternatives.

If we now further subdivide Europe based on The World Factbook (as shown in Figure 4, sourced from Wikipedia), we observe the following:

Figure 4: Subregions of Europe based on the world factbook

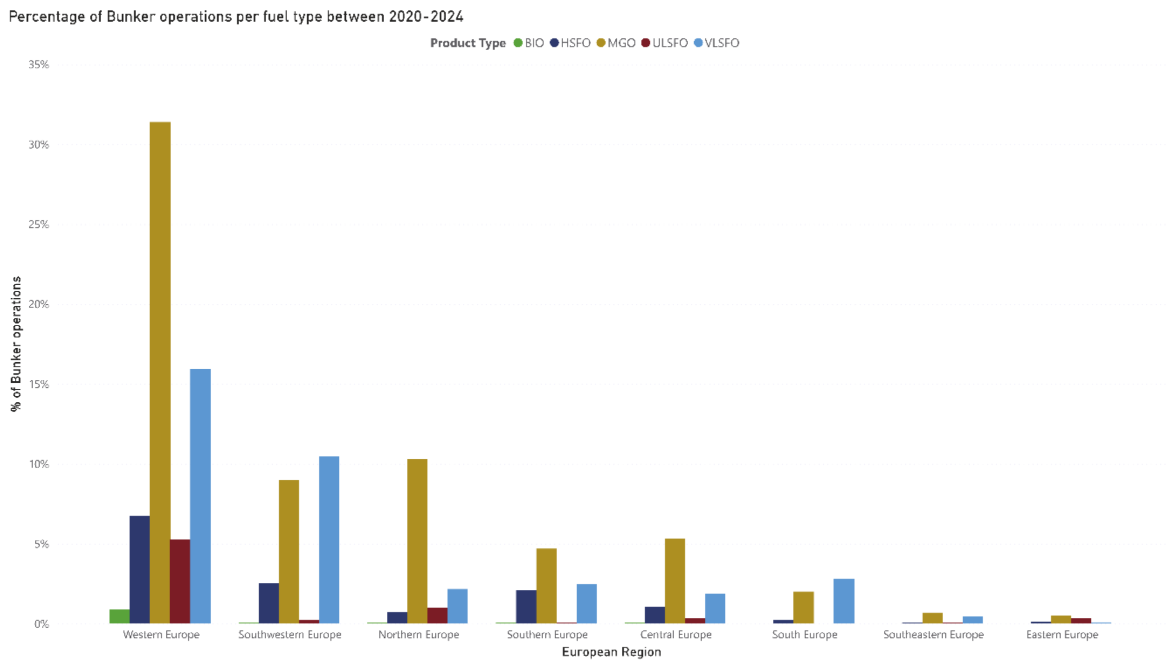
The majority of the fuel originates from Western Europe as shown in figure 5. This region also contains the largest ports in Europe where bunkering activities take place, namely Rotterdam and Antwerp.

Figure 5: Fuel deliveries in subregions of Europe



When we examine the number of fuel bunkering operations (figure 6), it becomes clear that MGO is by far the most frequently bunkered fuel type across all regions of Europe, as illustrated below.

Figure 6: number of bunker operations in Europe



Although the total quantity of MGO bunkered is lower compared to other fuel types, the number of bunkering operations involving MGO is significantly higher with exception of Southwestern Europe where VLSFO remains the largest bunkered fuel.

Summarized

Between 2020 and 2024, the global marine fuel market underwent significant shifts. VLSFO declined from 68% to 50%, while HSFO rebounded from 15% to 34%, largely due to increased adoption of scrubbers. MGO remained relatively stable, slipping slightly from 15% to 13%. ULSFO decreased from 2% to 1%, and biofuels, introduced in 2023, reached 2% by 2024.

In Europe, trends mirrored the global picture, though with some distinctions. VLSFO use dropped from 61% to 44%, and HSFO rose from 10% to 29%. MGO held steady (22% to 21%), while ULSFO declined from 7% to 4%. Biofuels entered the mix after 2021, reaching a 2% share by 2024. Europe's early adoption of sulphur regulations meant the IMO 2020 rules had a smaller impact, but the region is now leading in biofuel adoption.

The introduction of IMO 2020 marked a turning point, boosting VLSFO and curbing HSFO. Yet by 2024, the market partially reverted as scrubbers enabled a resurgence of HSFO. MGO continued to serve as a dependable, regulation-compliant fuel. Meanwhile, biofuels are emerging as a promising alternative, with Europe at the forefront.

Key Takeaways:

- IMO 2020 initially boosted VLSFO and reduced HSFO use.
- Scrubbers helped HSFO recover strongly by 2024.
- MGO remained a stable, compliant choice.
- Europe, already ahead on sulphur rules, is now leading in biofuel uptake.
- Biofuels, while still small in share, show strong growth potential.

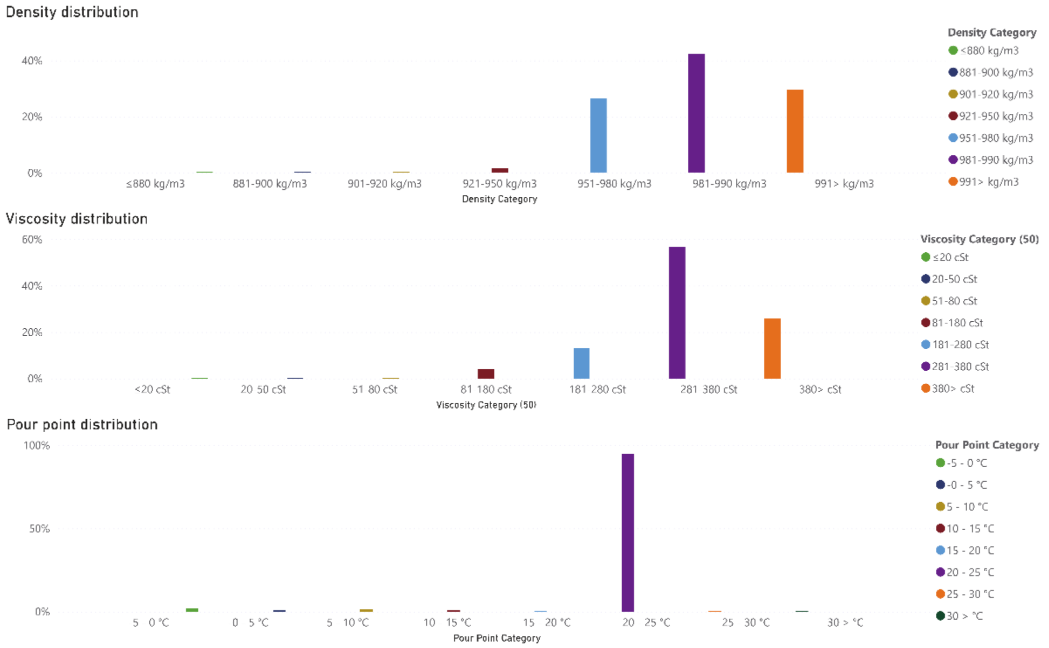
2.3 Fuel properties

In this section, we take a closer look at the specifications of various types of fuel oil, excluding MGO for the time period 2020-2024. The three key parameters considered are: density, viscosity (at 50°C), and the pour point. These properties are particularly important as they strongly influence the behavior of the oil when discharged into water.

HSFO

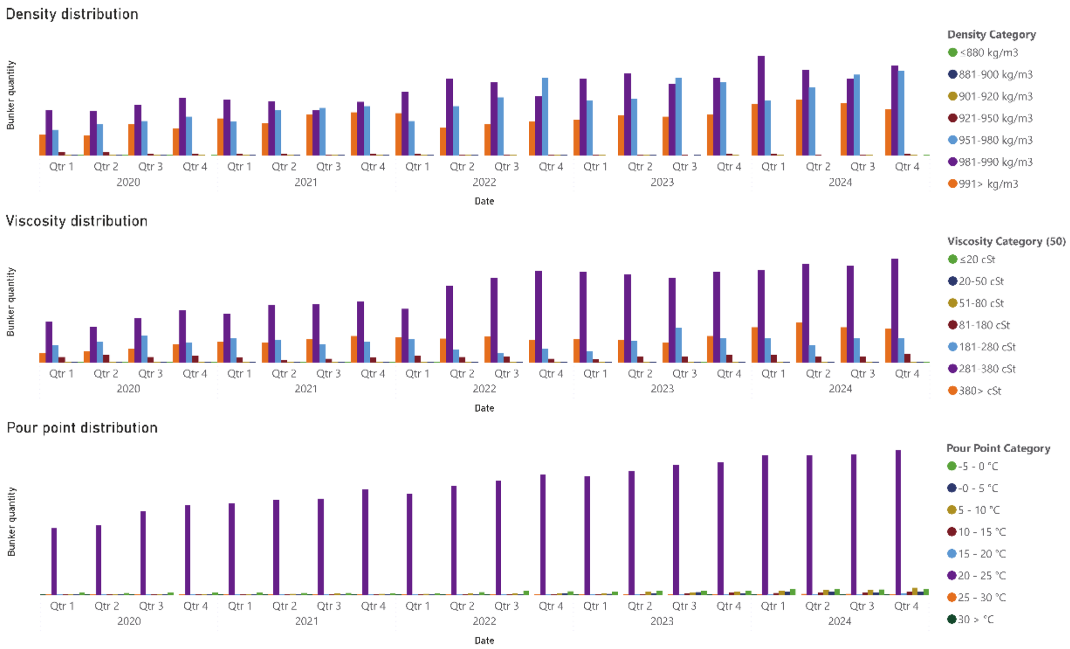
The density of HSFO as shown in figure 7 is, as expected, relatively high. In most cases, it exceeds 951 kg/m^3, with a viscosity of 280 cSt or higher. The pour point generally falls between 20 and 25°C, this is due to the specific test conditions. The PP is only tested until 24°C.

Figure 7: Distribution of density, viscosity and pour point for HSFO



Over the five-year period from 2020 to 2024, HSFO properties showed very limited variability (figure 8). Density values consistently remained in the higher ranges, confirming the product's residual nature. Viscosity data across all quarters continued to cluster in the 281–380 cSt range, with some seasonal or regional shifts into even thicker categories.

Figure 8: Time-series HSFO characteristics, density, viscosity and pour point



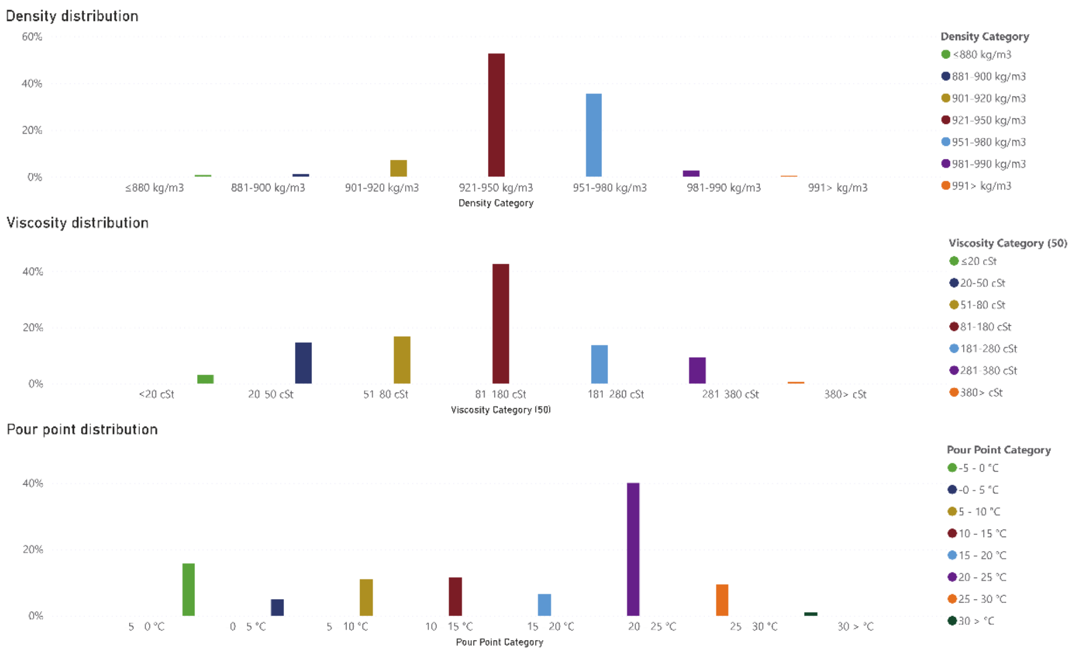
The analysis of HSFO over the 2020–2024 period reveals a fuel type with persistently high density, extreme viscosity, and pour points mostly below 25 °C. HFSO would most likely have a density greater than 951 kg/m3 and a viscosity of 280cSt or higher. The pourpoint for these oils are all below 25 °C.

VLSFO

This section shows the VLSFO Properties within Europe 2020-2024 across the data collected.

The distribution of VLSFO properties - density, viscosity (at 50°C), and pour point are shown below in figure 9.

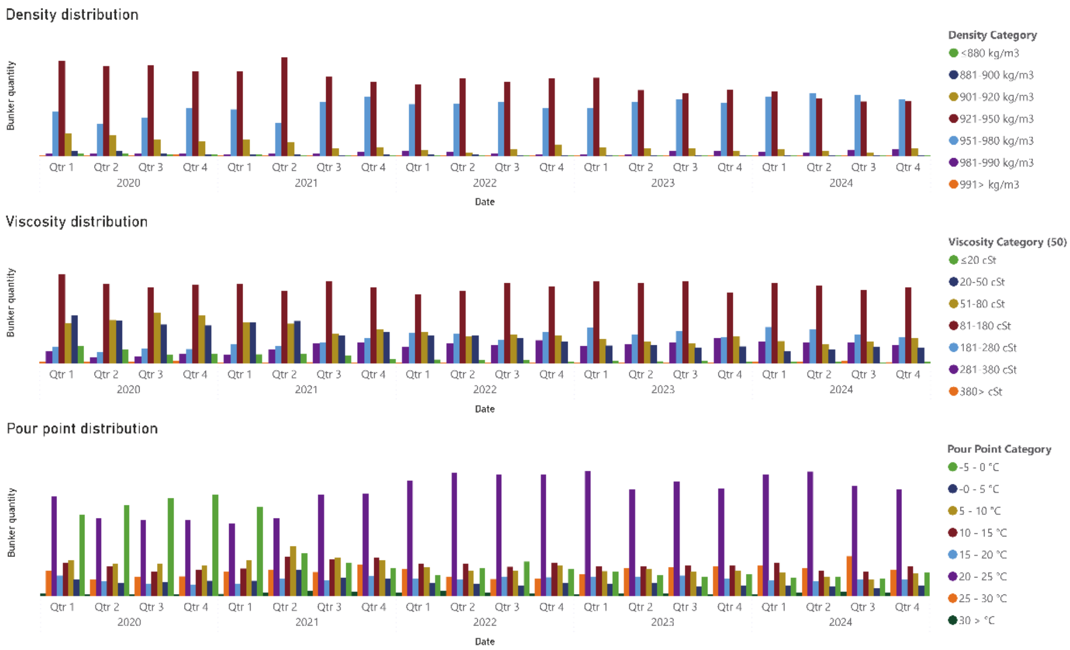
Figure 9: Distribution of density, viscosity and pour point for VLSFO



Most of the VLSFO data fall within the 921–950 kg/m^3 density range, indicating a relatively stable and moderately heavy fuel profile. The viscosity is predominantly in the 81–180 cSt range, which suggests manageable flow characteristics under typical operating conditions. However, the pour point frequently peaks at 20–25 °C, highlighting potential challenges for cold flow and handling in lower-temperature environments.

We can see how these properties evolve over time, with the time-series analysis of VLSFO characteristics over 20 quarters (2020-2024) shown in figure 10.

Figure 10: Time-series VLSFO characteristics, density, viscosity and pour point



Throughout the period, both density and viscosity remained stable, with values of 921–950 kg/m^3 and 81–180 cSt consistently dominating. However, the pour point exhibited a noticeable shift toward higher values, particularly around 20–25 °C, which raises concerns about fuel handling and flow performance during colder seasons.

The heatmap analysis in figure 11 offers insights into how different VLSFO property combinations interact. Among fuels in the 921–950 kg/m^3 density group, the majority exhibit viscosities of 81–180 cSt and pour points between 20 and 25 °C, reflecting a fairly uniform profile. In contrast, denser fuels within the 951–980 kg/m^3 range show a marked increase in viscosity, most commonly falling between 281 and 380 cSt, while maintaining the same high pour point. Notably, across both density categories, fuels with low pour points are relatively rare.

Figure 11: Heatmap analysis largest 2 density categories

VLSFO

Density category 921-950 kg/m3 (no. reports 20662)

Viscosity Category (50)	-5 - 0 °C	-0 - 5 °C	5 - 10 °C	10 - 15 °C	15 - 20 °C	20 - 25 °C	25 - 30 °C	30 > °C
≤20 cSt	1%	0%	0%	0%	0%	0%	0%	0%
20-50 cSt	2%	0%	2%	1%	0%	1%	1%	0%
51-80 cSt	2%	1%	2%	2%	1%	3%	2%	0%
81-180 cSt	3%	2%	4%	6%	4%	14%	8%	1%
181-280 cSt	1%	1%	1%	2%	2%	9%	4%	1%
281-380 cSt	0%	1%	1%	2%	2%	7%	3%	0%
380> cSt	0%	0%	0%	0%	0%	0%	0%	0%

VLSFO

Density category 951-980 kg/m3 (no. reports 26951)

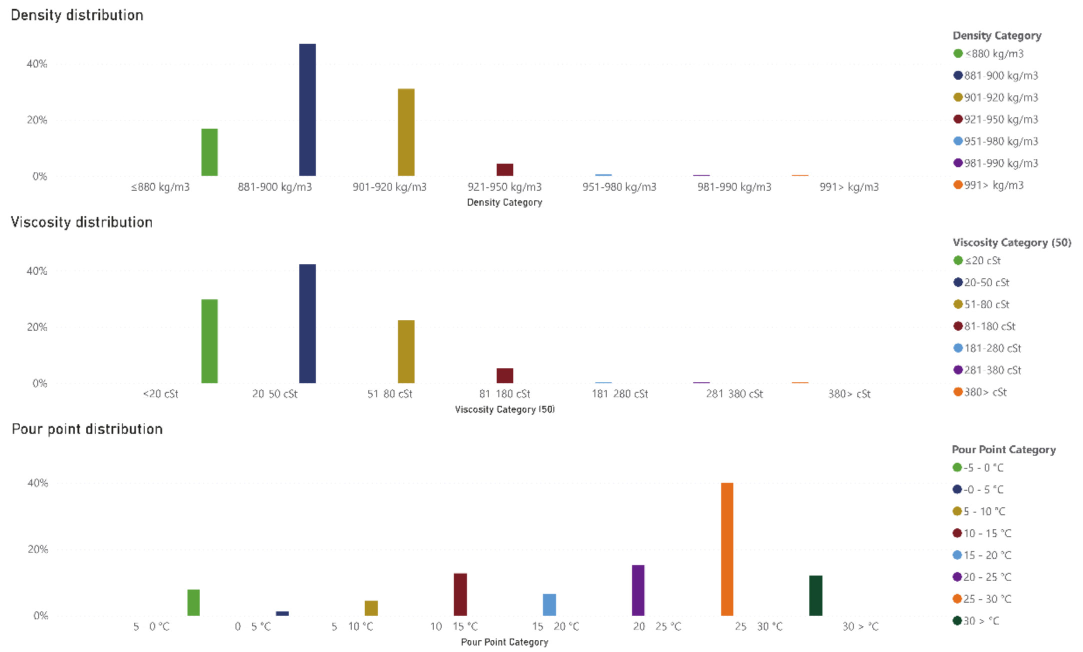
Viscosity Category (50)	-5 - 0 °C	-0 - 5 °C	5 - 10 °C	10 - 15 °C	15 - 20 °C	20 - 25 °C	25 - 30 °C	30 > °C
	0%			0%		0%		
≤20 cSt	0%	0%	0%	0%	0%	0%	0%	0%
20-50 cSt	1%	0%	1%	1%	1%	1%	0%	0%
51-80 cSt	3%	1%	3%	2%	1%	1%	1%	0%
81-180 cSt	4%	3%	5%	4%	1%	10%	1%	0%
181-280 cSt	1%	1%	3%	2%	1%	11%	1%	0%
281-380 cSt	2%	3%	4%	3%	1%	16%	1%	0%
380> cSt	0%	0%	0%	0%	0%	1%	0%	0%

The analysis of VLSFO characteristics from 2020 to 2024 highlights a fuel that, while compliant and operationally stable, presents increasing concerns in the context of spill response. Its density and viscosity profiles remain largely within predictable ranges, offering reliability in behavior and handling. However, the observable trend toward higher pour points in recent years has implications for spill preparedness, especially in colder marine environments.

ULSFO

This chart presents the general distribution of Ultra Low Sulphur Fuel Oil (ULSFO) based on density, viscosity (at 50°C), and pour point categories.

Figure 12: Distribution of density, viscosity and pour point for ULSFO



Most ULSFO samples fall within the 881–900 and 901–920 kg/m^3 density categories, reflecting their relatively light and distillate-like nature. The viscosity of these fuels is primarily concentrated in the ≤20 cSt and 20–50 cSt ranges, making them more fluid compared to VLSFO and HSFO. While the pour point distribution peaks around 25–30 °C, it also exhibits a broader spread, with a noticeable portion of samples falling into lower categories indicating some variability in cold flow behavior across ULSFO formulations.

Figure 13: Time-series ULSFO characteristics, density, viscosity and pour point

The time-series in figure 13 illustrates the evolution of ULSFO density, viscosity, and pour point characteristics over a five-year period. Throughout this timeframe, the density remained remarkably stable, with the 881–900 kg/m^3 range consistently representing the majority of samples. Viscosity values largely clustered within the ≤20 and 20–50 cSt ranges, reinforcing the fuel's fluid and easily manageable nature. Although the pour point was persistently dominated by values between 25 and 30 °C, a considerable portion of samples also exhibited lower pour points ranging from 0 to 15 °C highlighting the variability in cold flow performance across different ULSFO blends.

The heatmap in figure 14 provides a detailed view of how ULSFO density, viscosity, and pour point characteristics interact. Among fuels with a density of 881–900 kg/m^3, the majority fall within the 20–50 cSt viscosity range and have pour points between 25 and 30 °C, accounting for approximately 37% of the samples. In the slightly denser 901–920 kg/m^3 group, about 32% of fuels also exhibit viscosities of 20–50 cSt but are characterized by lower pour points around 10–15 °C, making them more suitable for cold environments. For fuels with densities below 880 kg/m^3, the data shows a wider distribution of pour points, with many falling into colder categories including below 0 °C suggesting a higher potential for effective use in low-temperature operations.

Figure 14: Heatmap analysis largest 3 density categories

ULSFO

Density category 881-900 kg/m3 (no. reports 6397)

Viscosity Category (50)	-5 - 0 °C	-0 - 5 °C	5 - 10 °C	10 - 15 °C	15 - 20 °C	20 - 25 °C	25 - 30 °C	30 > °C
≤20 cSt	0%	0%	1%	1%	1%	2%	1%	0%
20-50 cSt	0%	0%	1%	2%	1%	6%	37%	6%
51-80 cSt				0%	0%	2%	27%	8%
81-180 cSt							2%	1%
181-280 cSt								0%

ULSFO

Density category 901-920 kg/m3 (no. reports 5614)

Viscosity Category (50)	-5 - 0 °C	-0 - 5 °C	5 - 10 °C	10 - 15 °C	15 - 20 °C	20 - 25 °C	25 - 30 °C	30 > °C
≤20 cSt	1%	0%	0%	1%	0%	1%	2%	1%
20-50 cSt	0%	0%	9%	32%	10%	6%	6%	2%
51-80 cSt	0%	0%		0%	0%	1%	11%	8%
81-180 cSt			0%		0%	0%	4%	5%

ULSFO

Density category <880 kg/m3 (no. reports 2421)

Viscosity Category (50)	-5 - 0 °C	-0 - 5 °C	5 - 10 °C	10 - 15 °C	15 - 20 °C	20 - 25 °C	25 - 30 °C	30 > °C
		0%		0%				
≤20 cSt	7%	2%	6%	6%	5%	18%	22%	7%
20-50 cSt	0%		0%	1%	1%	3%	6%	13%
51-80 cSt	1%	1%	0%	0%	0%	0%		
81-180 cSt			0%	0%	0%	0%		0%

Summarized

Based on the above analysis of HSFO, VLSFO and ULSFO, representative samples for this project would have the following characteristics as shown in table 2. For the small samples a range of different fuel characteristics would be acceptable.

Table 2: Suggested representative large samples for Imaros 2

Sample	Fuel Type	Density (kg/m^3)	Viscosity (cSt @50°C)	Pour Point (°C)	Trend Context
1	VLSFO	921–950	81–180	15–20	Stable 2020–2022 baseline
2	VLSFO	951–980	181–280	20–25	Post-2022 upward trend
3	ULSFO	881–900	20–50	20–25	Consistent across all quarters

Sample 1 reflects the dominant and stable VLSFO profile observed consistently from 2020 to 2022. It marks the baseline before the upward pour point shift, offering a solid comparison point for assessing how newer blends behave differently.

Sample 2 would reflect the trend shift observed after 2022 increased viscosity and pour point in denser blends. It represents modern VLSFO formulations that behave more like residual fuels and pose greater handling and cold-flow issues, aligning with the evolving product quality in the market.

Sample 3 ULSFO showed remarkably consistent trends in density and viscosity across all quarters. This sample captures that stability while including a moderate pour point reflecting fuels that are operationally flexible but still exhibit some seasonal pour point sensitivity, as highlighted in your time-series plots.

3. Samples

3.1 Introduction

The IMAROS project experienced many obstacles to collect the envisaged samples. This experience has been discussed in the first workshop and taken into account for the work in WP2 trends and samples. WP2 has provided representative samples for WP3 Characterization and impacts, WP4 Mechanical recovery and WP5 shoreline response. All project partners have joined their forces in this work package under the leadership of RWS. The project consortium has an extensive network enabling a successful completion of the sampling phase.

Based on the trend analyses in this project and the first IMAROS project, the desired characteristics have been determined, mainly for the large samples. Project partners have reached out to their network for help in obtaining both small and large samples. Appendix 1 shows the network that has been contacted for this project. For this project information has been sent about the project (appendix 2), as well as a questionnaire (appendix 3) and a statement of intent (appendix 4).

3.2 Small samples

After contacts with the network a total of 18 small samples was obtained. Two of them were discarded from the collection because they were either the same as another sample or contained the wrong type of fuel. Table 2 shows the samples that were used for WP 3, 12 of them were VLSFO and 4 of them ULSFO.

Table 3: Small samples for Imaros2

IMAROS 2 reference	Fuel Type	Pour point (°C)	Viscosity @ 50°C
IM-20	VLSFO	+9	283
IM-21	ULSFO	+27	83
IM-22	VLSFO	+9	352
IM-23	ULSFO	+30	78
IM-24	VLSFO	no COA	no CAO
IM-25	VLSFO	no COA	no CAO
IM-30	VLSFO	-12	49,38
IM-31	VLSFO	-15	34,58
IM-32	ULSFO	+30	42,65
IM-33	VLSFO	-6	217
IM-34	ULSFO	+27	59,88
IM-36	VLSFO	-6	86,82
IM-37	VLSFO	27	187
IM-38	VLSFO	6	303
IM-39	VLSFO	no COA	no COA
IM-40	VLSFO	no COA	no COA

The fuel properties with regard to pour point and viscosity varies a lot over the samples. This will give a broad image of the low sulphur fuels that are used in Europe.

Figure 15 : Example of two small samples

3.3 Large samples

For WP 3, 4 and 5 three large samples were obtained. Based on the trend analyses (chapter 2) it was shown that most probable the oil in table 1 in Europe and worldwide is VLSFO.

- 3 large samples (10 m3) for weathering and equipment testing
    - 2 VLSFO with pour point between 10 and 20° C and > 23° C
    - 1 ULSFO with pour point between 15 and 25° C

After contacting the network we have been able to obtain the samples listed in table 3. The characteristics of the samples have been provided by the suppliers. We were able to obtain two VLSFO samples and one ULSFO sample. The characteristics of the fuels are within the range of most used fuels in Europe.

Table 4: Large samples obtained for Workpackage 3, 4 and 5

IMAROS 2 reference	Fuel Type	Pour point (°C)	Viscosity @ 50°C (cSt)
IM-27	VLSFO	+12	322
IM-28	VLSFO	+27	124
IM-29	ULSFO	+27	39

Figure 16: Large sample obtained in Malta

Appendices

Appendix 1 List of contacts

Partner	Company
Netherlands	European tank terminal (ETT)
	Shell
	VTTI / Euro Tank Terminal B.V.
	FincoEnergies (goodfuels)
	SGS, Natural Resources Oil, Gas & Chemical Commodities
	Port of Rotterdam
	Port of Amsterdam
	EOCB
	Trefoil
	Peninsula360
	Vinotra
	The Human Environment and Transport Inspectorate (IlenT) Netherlands
	BP Marine
	Orim
	United Bunkers
	Exxon Mobile Marine
	Total Energies
	Vitolbunkers
	t Land Service
	Koseq
	Saybolt
	Boskalis
Denmark	BunkerOne
	Crossbridge Energy Fredericia (refinery)
	Kalundborg refinery
Belgium	Belgin Trading And Bunkering BVBA
	BB Energy Belgium NV
	Delta Bunkering BV (BE)
	ExxonMobil Petroleum & Chemical BVBA
	Lukoil Belgium
	Maersk A/S - Maersk Oil Trading
	Marfus BV
	Marine Oil Services BVBA
	Marine Support BV
	Minerva NWE NV

Partner	**Company**
	Northstar Bunker NV
	Oilchart International NV
	Orim Energy
	Peninsula petroleum ARA NV
	Trefoil Belgium BVBA
	United Bunkers BVBA
	Vans Sea bunkers NV
	Energia (sectororganisatie)
Sweden	Stena Oil
	Preem
	ST1
	Västkustens drivmedel och energi
	J CHRISTENSSON AB
	BunkerOne
	Scan Ocean AB
Malta	FG Ship Bunkers Ltd
	CN Bunker Fuels Ltd.
	Peninsula Petroleum (Malta) Ltd.
	Orim Energy International Ltd.
	Valletta Bunkers Ltd.
	Zeta Energy Ltd
France	Port of Le Havre
	Bunkering company SHMPP - Le Havre
	TotalEnergies
	Port of Nantes - Saint Nazaire
	Port of Marseille

Appendix 2 Information about Imaros 2

Introduction to the IMAROS 2 project and questionnaire

The aim of this document is to provide you with information about the IMAROS 2 project and an understanding of the questionnaire you receive as part of the project.

IMAROS 2 is an EU funded project. Norwegian Coastal Administration leads the project with partner agencies within Belgium, Denmark, France, Finland, Malta, Netherland and Sweden.

IMAROS 2 is a follow-up project to IMAROS in which it was found that some of these new generation fuels can behave unusually when (accidently) released into the sea, and some proved to be very difficult to combat with conventional oil recovery means (booms and skimmers; dispersants).

The following link allows you to access the results of IMAROS (https://www.kystverket.no/en/preparedness-and-emergency-response-against-acute-pollution/research-and-development/imaros_eng/) and the following video gives a good idea of the project https://www.youtube.com/watch?v=oe0ppJcwjtl.

Next phase of the low-sulphur era

The regulations to reduce sulphur oxide emissions from ships have led to a changeover in the use of fuels. A part of the global fleet now uses new generation fuels (low-sulphur fuels) for operations within Emission Control Areas (0.1% sulphur limit) and globally (0.5% sulphur limit).

The new generation fuel oils represent both distillates and residual based blends. They are to some extent manufacturer-specific products. They represent different distillation processes and potentially additives to reach the desired characteristics for use in ship's engines while complying with the sulphur emission regulations. Oil spill response testing and accidental spills have indicated significant and unforeseen variation between products in which response methods are effective. However, experience is scarce and based on a few case studies only.

The IMAROS 2 project

To be better prepared to respond to potential accidents, the environmental and pollution response authorities have taken on the IMAROS 2 project. IMAROS is an acronym for IMpacts And Response Options regarding low sulphur marine fuel oil Spills

https://civil-protection-knowledge-network.europa.eu/projects/imaros-2

IMAROS 2 will address some of the challenges caused by the use of new generation low-sulphur fuels. The aims are:

- Improve understanding of oil spill behavior of LSFOs, and consequently decision making on all levels of response operations
- Improve capacities of mechanical recovery and shoreline response

IMAROS 2 will solely focus on environmental aspects and how to respond to potential spills. If responders are prepared and ready to respond accordingly in given situations it will lead to a win-win situation for all involved parties.

The project ends in 2025 and results from the project will be available through databases and decision support tools for oil spill responders.

Your role in IMAROS 2

We hope you will contribute to IMAROS 2 by answering the questionnaire (annex 1) and give us the opportunity to get samples of relevant products. Every contribution is highly appreciated. The project consortium will purchase the oil samples and cover the costs for transportation to the test facilities at Cedre and Norwegian Coastal Administration.

Your contribution will be highly valued and will help in understanding new generation low-sulphur fuel characteristics and behaviour under different spill conditions for optimization of response options.

Companies that have contributed to the project will be credited in an annex to the report.

All data and oil samples received will be treated accordingly to our statement of intent.

Appendix 3 Questionnaire and Data Collection

Please note the short introduction to the IMAROS project and the questionnaire.

The purpose of the questionnaire is to map and identify which marine fuel oils are delivered in European waters and prepare for subsequent tests phase of IMAROS 2 (e.g. recovery equipment, shoreline cleanup).

The questionnaire consists of the general questions below.

1. What types and amounts of new generation Ultra Low (0.1%) Sulphur Fuel Oils (ULSFO) and Very Low (0.5%) Sulphur Fuel Oils (VLSFO) do you sell / trade / produce?

2. Have some of your old products been replaced by or lost market shares to new ULSFO / VLSFO products?

3. (If yes, which products have been replaced?)

4. Are you ready to share with us the oil information sheets for the ULSFO and VLSFO you have been selling / trading / producing?

5. What are your thoughts on how the market will develop?

6. Would your company be willing to provide product data sheets?

7. Would your company be willing to provide samples for testing?
    a. For initial laboratory tests of all selected products, we need 5 litres.
    b. For recovery tests, we need 10 cubic metres.
8. We will select which products to be tested and the expenses for the oil and transportation are paid by IMAROS 2 project.
9. Do you have knowledge about tests or accidents where your normal gear or procedure has failed due to new products or their new characteristics?

Your reply to the questions above could be delivered as free text.

Thank you for your contribution.

Link to project webpage: https://civil-protection-knowledge-network.europa.eu/projects/imaros-2

Appendix 4 Statement of Intent – the Imaros2 project

Purpose

The purpose of this letter of intent is to clarify the conditions of the use of data and ensure our sincere and honest intention of using the data solely with the purpose of gaining a better understanding of the environmental impacts of spills of low sulphur fuels, and how to respond to such spills.

Selection

The European refineries and bunker boat operators involved are selected by the national competent authorities within environmental protection and/or within response to oil spills in the marine environment of the partner countries.

Responsibility of the IMAROS 2 project

The data given in the questionnaire and in the project in general will only be used to achieve the objectives of the project. The remaining volumes of LSFO samples can be used after the project but only for scientific research purposes with the same intention as IMAROS 2.

Companies that have contributed to the project will be credited in an annex to the report. Specific test results of company products will be shared with the company providing samples. The results will be published in the project reports and publications.

Contribution of the provider

Delivery of data free of charge and sale of quantities to the project within the agreed deadline. Oil samples as well as transportation costs are covered by the project.

On behalf of the project consortium,

Silje Berger
Project manager

Norwegian Coastal Administration
Coordinator of the IMAROS project