MARINE INFORMATION NOTE

Maritime and Coastguard Agency

MIN 326 (M)

Research Project 522 - Very Heavy Fuel Oil: UK Spill Risk Assessment

Notice to all UK maritime contingency planning and response organisations, local authorities, UK oil industry, UK government departments with a maritime remit.

This Min Expires May 2009

PLEASE NOTE:-
Where this document provides guidance on the law it should not be regarded as definitive. The way the law applies to any particular case can vary according to circumstances - for example, from vessel to vessel and you should consider seeking independent legal advice if you are unsure of your own legal position.

Summary

The UK Maritime and Coastguard Agency has conducted an assessment of the risk to UK Waters from a spill of Very Heavy Fuel Oil (VHFO), which is defined here as fuel oil with a viscosity greater than 380cSt at 50°C. A data gathering exercise has been conducted to determine the annual tonnages of VHFO passing along routes through UK Waters, both as cargoes and bunkers, and to determine how these have changed over recent years. In 2003, it is estimated that approximately 30 million tonnes of VHFO passed through the Dover Strait, with a significant proportion originating in Russia and Former Soviet Union countries. VHFO cargoes transported within UK waters as a whole increased from approximately 26 million tonnes in 1998 to approximately 50 million tonnes in 2003. Using preliminary data, VHFO bunker movements through UK waters are estimated to be 30 million tonnes in 2005, an increase from 23 million tonnes in 1998. Risk maps of the impact of a VHFO spill to UK Waters and coastlines has been conducted using oil spill trajectory probability modelling and environmental sensitivity data.

The MCA wishes to acknowledge financial support from the Energy Institute for this research project.

1. Introduction/ Background

1.1 The spills of Heavy Fuel Oils (HFOs) and VHFO's from the Tanio (1980), Evoikos (1997), Erika (1999) and Prestige (2002) have demonstrated that these oils are very persistent and that counter-pollution response is difficult, time-consuming and very expensive.

1.2 Increases in fuel oil shipping traffic from Russia have raised concerns about the UK capacity to respond to spills of VHFO. Counter pollution resources in the UK focus on large spills of crude oil and, in particular, on the use of dispersants, which can be very effective at reducing the sea surface volume of light and medium oil spills in UK waters. However, dispersants are not effective on viscous oils like VHFO's and the MCA only has limited stocks of heavy oil recovery equipment, such as booms and skimmers.

1.3 The UK Maritime and Coastguard Agency commissioned a risk assessment for VHFO spills and response in UK waters.

2. Key Project Objectives

- To identify the quantities and routeings of Very Heavy Fuel Oils (VHFO's), both as cargoes and as bunkers, that are transported within and through the UK pollution control zone (UKPCZ);

- To assess the locations of environmental and economic resources vulnerable to pollution from VHFO's;

- To evaluate the existing capacity to respond to VHFO spills in UK waters and make recommendations for additional measures.

VHFO is not an industry-standard classification. The term has been applied to distinguish the 'heavier', higher viscosity grades of residual fuel oils from 'lighter', less viscous grades. In this study, VHFO's are defined as those fuel oils with a viscosity at 50ºC of 380 cSt or higher.

3. Methodology

The project was carried out entirely as a desktop study covering the following areas:

- The processes through which VHFO is produced and its characteristics, particularly when spilled at sea.
- The study into the quantities of VHFO cargo and bunkers passing through the UKPCZ and the volumes passing along individual routes. It includes a review of VHFO transferred around the UK, imported to and exported from the UK and international passing traffic. Further work looked into VHFO originating in Russia.
- The methodology and results of oil spill trajectory and weathering modeling was conducted for 5 locations around the UK, using a spill of 16,000 m3 over 2 days. The purpose of the modeling was to assess the probability of VHFO affecting shorelines following incidents around the UK and to determine the volumes of emulsified VHFO that may come ashore.
- An assessment of the sensitivity of UK shoreline and marine habitats to VHFO pollution and shows location maps for different habitats. A review of economically sensitive locations was carried out.
- A review of counter-pollution equipment and its effectiveness in responding to spills of VHFO's.
- The results, including maps, of data gathering performed to assess the capacity of the UK to respond to a VHFO spill of 16,000 m3 was collated for clear presentation in the final report.
- Recommendations arising from the study were teased out and collated in discussions with MCA.

4. Summary of Results

VHFO Traffic in the UK Pollution Control Zone

4.1 It was not possible to gain information directly from industry on the volume of VHFO cargoes and bunkers passing along routes through the UK Pollution Control Zones (UKPCZ). Therefore, information on cargoes was determined using national, European and international statistical sources, and bunker volumes derived using indirect estimation techniques. 2002 and 2003 were used as base years for statistical data, and these were generally the latest years for which complete data was available at the time of the study.

Cargoes

4.2 The UK produced 11.5 million tonnes of Residual Fuel Oils (RFO) in 2003, of which 6.4 million tonnes were exported, 0.9 million tonnes supplied to international shipping as bunkers and 3.5 million tonnes were used in the UK industry and other sectors. 0.4 million tonnes was imported. Differences between figures arise from changes in stocks and statistical errors. It is estimated that 1.5 million tonnes were transferred domestically along coastal routes.

4.2.1 Within the EU, 6 countries produced over 10 million tonnes of RFO in 2003. In descending order these were Italy, Netherlands, Germany, Spain, France and the UK. The Netherlands and Belgium also act as trading hubs for RFO, importing and exporting large quantities of RFO. The Netherlands imported 15.5 million tonnes of RFO in 2003, exported 12 million tonnes (and supplied 13 million tonnes of RFO for international marine bunkers). Figures for recent years and newly available data for 2005 indicate that imports of RFO to the Netherlands are increasing and have doubled since 1998.

Bunkers

4.3 Determining accurate information about the quantities of bunkers passing through the UKPCZ was not possible. A number of statistics were found but none gave information that could be easily used to determine VHFO bunker volumes or routeings. 27 million tonnes of RFO bunkers were sold through NW European ports in 2002, of which 19 million tonnes are estimated to have been VHFO bunkers. This quantity can be expected to have passed through the UKPCZ but does not include Baltic Russian sales, domestic traffic or non-bunkering traffic which would have contributed to UKPCZ route volumes.

4.3.1 A rudimentary estimation has been made based upon a ‘rule of thumb’ those vessels greater than 20,000 deadweight (DWT) tonnes will tend to use IFO380 (or IFO500 or IFO700). The MCA provided vessel movement data for the Dover Strait, which included vessel types and DWT. Vessels greater than 20,000 tonnes DWT were separated and information regarding bunker capacities for different vessel classes used to determine the total bunker capacity of these vessels, which was 60 million tonnes. It was assumed that these vessels would, on average, be half full and therefore that 30 million tonnes of VHFO bunkers would pass through the Dover Strait. However, this does not account for traffic not passing through this route or the fact that vessels may not always completely fill their tanks when bunkering.

Trends in VHFO transport

4.4 The transport of VHFO cargoes through the UKPCZ almost doubled from approximately 26 million tonnes in 1998 to approximately 50 million tonnes in 2003. This has arisen from increases in imports and exports to EU countries and particularly the Netherlands. More significantly, and contributing to imports and exports from the Netherlands, is a rise in RFO exports through the Baltic Sea from Russia, which increased from 12.5 million tonnes in 1998 to 27.5 million tonnes in 2003.

4.4.1 It has not been possible to determine accurate figures for the increases transport of bunkers through the UKPCZ, which are believed to have been more gradual. It is estimated that these have increased from approximately 23 million tonnes in 1998 to 30 million tonnes in 2004.

VHFO Spill Trajectory Assessment

4.5 Spill trajectory and weathering modelling was conducted for 5 locations around the UK to assess the volumes of VHFO that might come ashore in the event of a spill and the vulnerability of different shorelines to a VHFO spill. A spill of 16,000m^3 was modelled, based upon an extreme outflow data reported in the literature. Locations for the spill scenarios considered incident location probability assessments conducted in earlier UK pollution risk assessments, as well locations that covered a number of areas around the UK. The chosen locations were the Dover Strait, English Channel, St. George's Channel, the Minches and the central North Sea.

4.5.1 The modelling has determined that the coastlines most vulnerable to VHFO pollution within the UK are the southern English coast and, with a lower probability of spill incident occurrence, the western UK coast. The coasts of northern France, Belgium and the Netherlands are particularly vulnerable, although are not directly considered in this study. Under prevailing conditions, the eastern UK coast is less vulnerable, although the oil spill scenario considered here was offshore and in a near-shore incident or easterly winds, this coast would be vulnerable.

Ecological and economic sensitivity review

4.6 The sensitivity review assessed the impact of VHFO on typical UK coastline and marine habitats and economic activities. The sites most sensitive to VHFO pollution are the same as those generally vulnerable to oil contamination. However, VHFO spills present some specific threats to habitats compared with spills of lighter oils:

- They are more persistent at sea and can travel greater distances, presenting a risk of pollution to sites several hundred miles form the incident location.
- They may sink through the water column, presenting an increased risk to seabed communities.
- Whilst they tend to be less toxic than lighter oils, their viscosity increases the risk of smothering of habitats.
- They can adhere strongly to rocks or concrete and be difficult to wash off.

4.6.1 The most sensitive habitats to VHFO pollution are saltwater marshes, seagrass beds, sheltered mud flats, sheltered rocky shorelines and seabird sites, several of which are designated conservation sites. Sites of economic activity such as ports, harbours, marinas, fisheries and aquaculture, resorts, beaches, power stations, offshore wind farms and ferries would also be sensitive to VHFO contamination.

VHFO Response Techniques

4.7 The response to VHFO spills requires consideration of its characteristics when spilled in seawater:

- Its density is either similar to or greater than seawater causing it to have neutral buoyancy, sometimes remaining just below the surface or to sink.

- It emulsifies to very viscous or near solid phases

- It can fragment in to a number of smaller slicks floating either on the surface or sub-surface, and these are difficult to detect.

- It is highly persistent and does not readily disperse naturally or chemically.

4.8 As a result, not all counter-pollution equipment is suitable. A review of equipment was conducted to determine which was most effective in responding to VHFO spills. This included a review of the response to Erika and Prestige. The assessment considered only specialised counter- pollution equipment and not readily available response equipment such as construction plant.

5. Conclusions

5.1 The response to the early stages of the *Erika* and *Prestige* (before the slick had significantly broken up) involved several vessels with a number of skimmers and pumps. The initial response to both was largely in heavy offshore conditions and response efficiency was limited as a consequence. The spill volumes from the Erika and Prestige (both single hulled) were also larger than the ‘extreme outflow’ from a double-hulled vessel considered in this study, which was 16,000 m3 for the largest oil products’ tankers typically passing through UK waters. On this basis, and having reviewed the equipment stocks outlined in Section 8 with experienced oil spill responders, it is believed that the VHFO-suitable counter-pollution equipment stocked within the UK is currently sufficient to respond to such a spill. In addition, support from Bonn Agreement partners would be expected in the event of a significant VHFO spill and a large range of supplementary equipment is available through these. Even when allowing for shortfalls and limits on availability from commercial contractors, there appears to be sufficient capacity to respond to a VHFO spill. However, there are a number of considerations:

Supporting equipment arrangements. Whilst sufficient equipment exists in the NW European area, the MCA’s own stocks would only be sufficient for initial response in the event of a significant spill. It would require stocks from commercial contractors and partner countries in the longer term and should ensure that arrangements are in place to enable this.

Vessel availability. The speed with which equipment deployment vessels can attend a VHFO spill is important. With lighter oil spills dispersant spraying is a valid initial response, providing a method that can quickly reduce the volume of the spill, and rapid vessel response is often not as critical. Dispersant spraying is not an option with VHFO spills. Furthermore, VHFO recovery is made much more difficult once it has increased in viscosity and density through weathering, and has broken into several smaller (semi-buoyant) spill fragments. Vessels would ideally attend a VHFO spill as soon as possible: discussions with oil spill responders suggest that attendance within 48 hours of the initial spill would be a practical timescale assuming vessels and equipment are prepared. There are several suitable vessels potentially available in the NW European area. However, it is likely that the time for these to be released from their existing duties and arrive on scene at a spill would exceed 48 hours for some locations around the UK, particularly on the western side. Consideration should therefore be given to the UK’s spill response vessel arrangements.

Future equipment stocks. A further consideration is that, as the frequency of large oil spills reduces, organisations are tending to reduce their stocks of counter-pollution equipment. Therefore, regular monitoring of equipment stocks is required and new arrangements may need to be considered.

UK VHFO Response Equipment Review

5.2 An assessment of the UK's current capability to respond to spills of VHFO was conducted using data from the MCA stockpile inventory and through discussions, questionnaires and information gathering from other organisations. These organisations included partners from Bonn Agreement and other European neighbouring countries, which provide for mutual assistance in the event of a major spill.

5.3 The gathered information was reviewed to determine the stocks of equipment most effective against VHFO's:

- Inshore, offshore and shore-sealing booms
- Toothed disk, drum, weir, belt and grab skimmers.
- Cargo transfer and other pumps.
- Heated tanks and other storage

5.4 In addition, an inventory of available oil pollution response vessels in the NW European region was compiled, based on information published by the European Maritime Safety Agency (EMSA).

5.5 This review determined that the current stocks of equipment were sufficient for a response to a spill of 16,000m^3 in relatively calm conditions, particularly when resources from Bonn Agreement partner countries were included. However, it was highlighted that spill incidents vary widely in their characteristics and therefore it is difficult to prescribe response resources that allow for every eventuality. There were a number of recommendations for ensuring that the UK's preparedness for a VHFO spill were optimised:

6. Recommendations

6.1 The MCA maintains a large stock of dispersants – these are a key counter-pollution resource outlined in the UK National Contingency Plan. However, they are ineffective against spills of VHFO. It is clear from the findings of this study that the quantities of VHFO passing through the UKPCZ, and hence the potential for a spill of VHFO, is increasing. It is recommended that the MCA review the National Contingency Plan, their advice and training to local authorities and other parties, to ensure that these have an appropriate balance between spills of light and heavy oils.

6.2 It is recommended that the MCA considers review of the availability of suitable vessels for the event of a VHFO spill. There are several vessels with capability to respond to VHFO spills available through EMSA and the Bonn Agreement partners, or that could be relatively quickly equipped through delivery of MCA equipment. They would need to be available on scene very quickly to efficiently respond to a VHFO spill.

6.3 ETVs are currently placed at the four "corners" of the UK, with central areas on the eastern and western side covered by tugs and other vessels (e.g. through Liverpool or Aberdeen). However, as speed of vessel response is more critical in a VHFO spill, the MCA should review these locations.

6.4 The MCA should recognise that, as there has been a reduction in the number of spills over recent years, many commercial spill contractors are understood to have reduced their equipment holding and no longer retain equipment unnecessarily. Therefore regular review of the commercial spill contractor arrangements is recommended.

6.5 It is recommended that the MCA investigates 3D oil spill trajectory and fate models to allow for prediction of the pathway of sunken oil, as well as the specific characteristics of VHFO.

6.6 The study has shown that VHFO trade, in particular from Russia, has increased significantly in recent years. These changes have happened relatively quickly and it is recommended that regular reviews of the changing conditions are conducted to ensure that the capacity of UK counter-pollution resources can continue to be assessed.

6.7 It is recommended that the MCA maintains awareness of developments in the detection of sunken high density spills, such as laser and sonar techniques, to allow them to assess whether such equipment would benefit to UK's response capabilities.

6.8 At sea recovery operations are able to continue more efficiently if recovered oil storage vessels are on site as long as possible. It is recommended that:

a. A review of the capacity and transfer capabilities of ports and other reception/disposal facilities in the UK be conducted and a database compiled.

b. The use of barges during (inshore) spill cleanup is considered. These would not necessarily require offloading as quickly and several could be used in rotation.

c. The ability to airlift temporary storage tanks on to and off of vessels is considered.

7. Implementation

The MCA will evaluate the recommendations made by the contractor in the light of other activities currently underway with MCA, the EC and EMSA. Further work is already underway in many areas including research into submerged and sunken oils, and the UK framework for disposing of large quantities of oily waste. The report will inform future review of the UK NCP, MCA response strategy, equipment stockholdings planning for the UK public and private sector.

More Information

Counter Pollution Branch
Maritime and Coastguard Agency
Bay 1-09
Spring Place
105 Commercial Road
Southampton
SO15 1EG

Tel : +44 (0) 23 8032 9411
Fax : +44 (0) 23 8032 9485
e-mail: kevin.colcomb@mcga.gov.uk

General Inquiries: infoline@mcga.gov.uk

MCA Website Address: www.mcga.gov.uk

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