The environmental management of oil tanker routes in UK waters

Jeanette Owen

Introduction

The impacts of oil spills are as deleterious today as they were 30 years ago. The major difference is that environmental awareness among the general public is far greater, and that dramatic media coverage magnifies environmental, social and economic consequences. Such was the case during the recent Braer [1] and Sea Empress [2] incidents, where press coverage was at least partially responsible for elevating public emotion to such a high level. For these reasons, decision makers are under great pressure to reduce the risk of tanker accidents, and improve overall navigation safety.

Concerns over tanker traffic began in the 1960s and 1970s when the "Orrey Canyon [3] and the Amoco Cadiz [4] tankers grounded off the UK and French coasts respectively. The incidents caused widespread pollution and prompted the international community to introduce a number of traffic management and tanker safety measures. Since then, those involved with maritime traffic safety have increasingly come under scrutiny for failing to reduce hazards which threaten coastal environments. Environmental management of shipping is seen as the way forward, and discussions aimed at safer shipping operations are well under way.

Marine safety poses problems of multiple dimensions. The need to manage it effectively becomes apparent once it is realised that at any one time there may be a large number of vessels, of variable size and power, of multi-national origin, under a variety of flags, in transit in different directions. In many cases, little or no communication takes place between vessels, and where attempts are made, communicators often find themselves without a common language. Physical factors that add to the complexity of the problem include lack of navigational space within port...
approaches, and adverse environmental conditions at sea. In the light of this, some might argue that the approach to environmental management of shipping in the UK is piecemeal and reactive, rather than comprehensive and proactive.

One way of approaching the problem is to undertake a risk assessment of shipping that also takes account of environmental sensitivity. To date, risk assessment work has been comprehensively completed by DNV Technica [5], Massachusetts Institute of Technology [6], and various independent risk consultants. Research into sensitivity has begun more recently, with work being undertaken by Wiens et al. [7], Davies and Wilson [8], and the Port Erin Marine Laboratory [9]. Research on maritime traffic management has been undertaken by numerous authors, including Corbet [10] and the Marine Safety Agency [11]. Although all these works are comprehensive, little has been done to combine them.

The purpose of this paper is accordingly to combine the risk assessment and sensitivity analysis and to discuss the issues and solutions surrounding the environmental management of oil tanker traffic in UK waters. The first part of the paper will review the geography of UK tanker routes and will present the results of a risk assessment that considers sensitivity as well as vulnerability. The status of national and international management measures in place to deal with tanker safety is then reviewed, followed by a discussion of major issues brought up during shipping conferences of the last twelve months.

### The geography of tanker routes

The geographical distribution of ships, and in particular tankers, around the UK is complex. Knowledge about shipping routes is limited due to the fact that vessels do not follow clearly defined routes and reporting systems are poor. Comparatively little has been done to monitor major routes and it is debatable whether the Maritime and Coastguard Agency is fully aware of how many ships are in transit around the UK at any one time. In order to appreciate the scale of the problem, it is necessary look briefly at the background of the shipping industry in a UK context.

The UK is a major importer and exporter of crude oil and petroleum products. During 1996, the Department of the Environment, Transport and Regions (DETR) reported that 157,511 merchant vessels arrived at ports in the UK. More than 500 million tonnes of cargo were transported, of which approximately 50% was crude oil or oil-based products. In terms of tonnage, major ports in the UK are London (9.6%), Grimsby and Immingham (8.5%), Forth (8.3%), Tees and Hartlepool (8.1%) and Milford Haven (6.6%) [12]. Other major ports include Southampton, Liverpool, Felixstowe, Medway, Dover, Belfast, Port Talbot, Orkney, Hull, Manchester and Clyde.

A review of the distribution of foreign and domestic oil traffic reveals that ports with the greatest amount of traffic are not necessarily the same as those with a high throughput of oil and petroleum products. In the UK, major handlers of oil traffic are Forth (15.5%), Sullom Voe (14.3%), Milford Haven (13.5%) and Tees and Hartlepool (9.4%). This can be broken down further into categories of crude oil and petroleum products. Sullom Voe, Forth, Tees and Hartlepool, and Milford Haven, handle the most crude oil in the UK, whereas Milford Haven, Grimsby and Immingham, London and Forth handle the majority of the petroleum products.
Tanker trade is attracted to two types of destination — those where oil cargo is loaded, and those where cargo is unloaded. The North and East coasts of England and Scotland are where pipelines come ashore from the North Sea and major terminals may be found at Flotta, Cruden Bay, Hound Point and Seal Sands as well as Sullom Voe on Shetland [13]. Tankers arriving at the pipeline terminals load high-quality North Sea oil before navigating to national and international destinations for further refining. In the absence of pipeline landings, other UK oil tanker ports have developed to supply refineries or petrochemical works. Such sites make use of North Sea oil, as well as crude oil from the Gulf and Indian Ocean, the Baltic regions and the rest of Europe. Exports are generally in the form of petroleum products, and are shipped out mainly to North America, the Far East, and the Baltic regions [14].

Figure 1 shows that there is a wide distribution of merchant vessels above 40,000 tonnes around the UK [12] and that the majority of shipping traffic is concentrated around the South and East coasts [11]. It has been estimated that approximately 46.99 vessels over 40,000 DWT traverse the English Channel each day³, making the English Channel one of the most densely populated stretches of water in the world. The distribution of large merchant vessels is also high throughout the rest of the UK, although levels are not as elevated as in the English Channel. Eastern waters generally have a greater number of routes than the West, and approximately 7.22 large vessels navigate the waters each day [15]. Most traffic along the west coast is concentrated along the route between Milford Haven and the North Sea⁴, where a daily frequency of 12.12 large merchant vessels has been reported. The waters around the Shetland Islands are also heavily used, with 6.69 large vessels being reported each day. Even though there is a high frequency of merchant vessels > 40,000 DWT, the majority are concentrated on two or three major routes.

The ports of Sullom Voe, Milford Haven and Immingham were recently included in a risk assessment of shipping in environmentally sensitive areas [16]. The ports and their surrounding areas were chosen because they had heavily designated coastlines and high throughput of crude oil or petroleum-based products. Sullom Voe was also chosen as an example of an export port with extensive traffic management measures in place, while Milford Haven and Immingham were selected as examples of ports with associated petrochemical and refinery industries. The area around the Minches was also used in the study, and although the region does not have a major oil port, it is used by approximately 5.88 large merchant vessels per day as a route between Scotland and the South-west and has a particularly sensitive coastline.

**Analysis of accidents**

Unfortunately, tanker accidents and oil spills are an inevitable element of seaborne oil transportation. Prior to statistical analysis, one would expect the number of accidents to increase proportionally with the number of tankers in a given area [5]. However, research has shown that outside influences, for example, the presence of vessels other than tankers, particularly complex current and bathymetric patterns and widespread occurrence of extreme weather conditions can make navigation more dangerous and the probability of an accident higher [17]. The following section demonstrates the results of a recent risk analysis [16].

³The data is from the results of a research project [5] undertaken by DNV Technica and published in, Safer Ships Cleaner Seas [15].

⁴For the purposes of this paper, large merchant vessels may be defined as those in excess of 40,000 DWT.
Figure 1. Traffic levels in the UK.
Table 1. Distribution of incidents

<table>
<thead>
<tr>
<th>Value label</th>
<th>(%)</th>
<th>(Cum %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W Wales</td>
<td>71.29842</td>
<td>71.29842</td>
</tr>
<tr>
<td>Shetland Isles</td>
<td>2.63804</td>
<td>73.936462</td>
</tr>
<tr>
<td>NE England</td>
<td>21.07265</td>
<td>95.009112</td>
</tr>
<tr>
<td>NW Scotland</td>
<td>4.77699</td>
<td>99.786102</td>
</tr>
</tbody>
</table>

Note: some accuracy has been lost due to reduced decimal places.

Table 1 and Figure 2 illustrate the percentages of accidents within each study area. The majority of accidents and near misses occurred in West Wales, followed by those along the North East coast of England, North West Scotland and Shetland.

A review of tanker accident distributions is meaningless without a reference to tanker numbers within the same area. One way of doing this is to assess the ‘accident to tanker ratio’. Table 2 demonstrates the tanker to accident ratio for each study area. It also uses statistics to complete an ‘oil spill to tanker ratio’.

Based on the statistical probabilities, it was found that West Wales had the highest incident ratio, with one incident occurring every 312 tankers (1:312 or 0.0032051). Although West Wales had the highest number of reported incidents, it also had the lowest oil spill ratio, with a spill occurring only once every 109 tankers (1:109 or 0.0091743). Shetland, on the other hand, had the best safety record, with one incident occurring every 1261 tankers (1:1261 or 0.000793). Contrary to what might be expected, there were more spills per tanker there than anywhere else, with one oil spill occurring every 14 tankers (1:14 or 0.0714285).

Sensitivity of the coastal environment

As well as identifying where risks from oil tankers were greatest, the research assessed the environmental sensitivity of the coasts that would be likely to be affected. Although all coastal areas are susceptible to damage from oil pollution, some are more sensitive than others. In this context, the UK coast can be split into general sectors — the urban South-east, the industrialised North-east and North-west, and the rural Scottish, Welsh and South-west coasts. Areas between are semi-rural or semi-developed.

As far as conservation of the marine and coastal environment is concerned, the majority of measures are located away from developed areas, where man has had more limited influence on the natural environment. Estuaries, sheltered embayments and stretches of open coast with restricted access are frequently designated in order to protect natural habitats and landscape from human interference, as well as to provide opportunities for scientific study. Nearer developed areas, designations are generally assigned to provide opportunities for the general public to enjoy the semi-natural environment, as well as for educational purposes.

As part of the risk assessment it was necessary to use environmental designations combined with Gundlach and Hayes [18] sensitivity indexing, to identify which areas would be most susceptible to damage from oil pollution. It is not possible at present to assess the sensitivity of the whole UK coastal environment, but it is possible to appraise physical characteristics from existing maps and charts, and to assess ecological, social and cultural characteristics by referring to existing site designations that have similar characteristics [16].

For the purposes of this paper, areas of high sensitivity are identified according to the criteria listed in Table 2. The list is by no means definitive. It is intended as a basis from which other criteria may be developed. For ease of application, the list has been divided into four categories—physical, ecological, social and cultural. Of all the criteria, the physical and ecological characteristics are most important. Physical attributes determine the direction in which any oil spilled will travel, as well as the rate of natural breakdown, and ecological attributes determine the severity of

5The report shows how UK designations can be used to represent Particularly Sensitive Sea Area criteria.
Figure 2. Chart to show areas of accidents and near misses.
Table 2. Summary of tanker traffic, incident and oil spill statistics

<table>
<thead>
<tr>
<th>Area</th>
<th>No. tankers</th>
<th>No. incidents</th>
<th>Incident ratio</th>
<th>No. oil spills</th>
<th>Oil spill ratio</th>
<th>Oil spill cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Wales</td>
<td>2813</td>
<td>9</td>
<td>1:312</td>
<td>25.833</td>
<td>1:109</td>
<td>Two or more factors</td>
</tr>
<tr>
<td>North West Scotland</td>
<td>691</td>
<td>0.603</td>
<td>1:1146</td>
<td>22.9167</td>
<td>1:30</td>
<td>Strandings and groundings</td>
</tr>
<tr>
<td>Shetland</td>
<td>420</td>
<td>0.333</td>
<td>1:1261</td>
<td>30.1667</td>
<td>1:14</td>
<td>Machinery failure</td>
</tr>
<tr>
<td>North East England</td>
<td>2116</td>
<td>2.66</td>
<td>1:795</td>
<td>22.667</td>
<td>1:95</td>
<td>Fire and explosion</td>
</tr>
</tbody>
</table>

Note: All statistics cited are based on expected frequencies based over the period of one year. Figures were calculated via analysis of data collected between 1992 and 1997 in each study area.

consequences for the natural environment. The social and cultural needs are wholly dependent upon the physical and ecological characteristics.

The identification of designated areas is useful in that it can provide an appreciation of certain characteristics, but it should be noted that the site selection process is subjective and that criteria used to select such sites does not always match the criteria used to identify a sensitive area. For this reason, PSSA criteria have also been applied to determine whether an area has other characteristics which make it environmentally sensitive, such as those listed in Table 3. Although it is difficult to quantify environmental sensitivity, the exercise has revealed a number of features of interest, such as identifying sheltered estuaries, rias and voes as being particularly sensitive areas, even though such areas also provide the deep sheltered waters required by oil tankers for berthing.

Each area has unique characteristics and is considered important for a number of reasons. The West Wales coast is particularly sensitive because it is highly indented with protected bays and inlets, many of which have restricted access for cleanup. The Milford Haven ria, within which the port is based, is also host to one of the most diverse ecosystems in the UK. Saltmarsh is present in the area, which is particularly difficult to remove oil from, as well as a number of rare species. The wide diversity of the ria ecosystem is further enhanced by the biogeographic boundary which lies just off St. David’s Head. The meeting of the warmer Atlantic and cooler Arctic waters also means that many of the species may be close to the limits of their tolerance, as defined by water temperature and salinity. As may be seen in Table 4, West Wales is also host to one of the two Marine Nature Reserves that are to be found in the UK, thereby firmly establishing the area in scientific terms. The region is also highly significant for its geology [19], as is demonstrated by the plethora of Geological Conservation Review Sites and geological Sites of Special Scientific Interest. Commercial activity in the area is dominated by the declining oil industry and growing recreation and tourism sectors. Commercial fishing still takes place in the region, although to a lesser extent than in past years. The latter three industry types are dependent upon the pristine quality of the marine and coastal environment, therefore it is essential that no further oil pollution takes place.

The Minches region has a wide range of characteristics that make it particularly sensitive to oil pollution, including vast expanses of ‘machair’\(^6\), a highly indented coastline with restricted coastal access, and low flushing rates within the many lochs. As the region is relatively

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\(^6\)machair is a complex of arcuate beaches of shell sand.
Table 3. Criteria used to identify sensitive areas

<table>
<thead>
<tr>
<th>Physical</th>
<th>Ecological</th>
<th>Social</th>
<th>Scientific</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shingle shore</td>
<td>Diverse ecosystem, habitat, community or species</td>
<td>Particularly important for utilisation of marine resources</td>
<td>High scientific interest</td>
</tr>
<tr>
<td>Saltmarsh</td>
<td>High natural productivity</td>
<td>Special significance for recreation and tourism</td>
<td>Suitable baseline conditions for research</td>
</tr>
<tr>
<td>Convergence zone</td>
<td>High degree of naturalness</td>
<td>Supports traditional subsistence activities</td>
<td>Effectively demonstrates particular natural phenomena</td>
</tr>
<tr>
<td>Oceanic front or gyre</td>
<td>Unique or rare ecosystem</td>
<td>Very strong maritime culture</td>
<td>Historical or archaeological significance</td>
</tr>
<tr>
<td>Long residence time caused by low flushing rate</td>
<td>High dependency on biologically structures systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highly indented coastline with protected bays and inlets</td>
<td>Highly representative of ecological processes, community or habitat type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restricted access for cleanup</td>
<td>A biologically functional unit</td>
<td>Biotic communities are close to limits of their tolerance (as defined by water temperature, salinity and turbidity)</td>
<td></td>
</tr>
</tbody>
</table>

undeveloped, there is a very high degree of naturalness, and many of the habitats are unique. Fishing is still a major employer — although sea fishing is giving way to fish farming and shell fisheries. Coastal recreation and tourism are also growing in the region, much of the tourism being based around the cultural heritage of coastal settlements. Traditional activities such as crofting still take place on the Islands, and the cultural heritage of the region remains very much alive. Scientifically, North-west Scotland has the widest range and greatest extent of designated areas. It is particularly important for its Special Areas of Conservation, Sites of Special Scientific Interest and especially for the only coastal example of a World Heritage Site in the UK [20].

Many of Shetland’s physical characteristics are similar to those found in North-west Scotland. The coastline is highly indented and there are numerous protected voes. As the Islands have a low population and are relatively undeveloped, many coastal areas have restricted access. With the exception of the area around the oil terminal and the settlement of Lerwick, there is generally a high degree of naturalness. Many rare species, especially birdlife, occupy the Islands and make them highly productive. Many tourists visit Shetland to view the wildlife and to take advantage of the unspoilt environment. Although levels have never been significant in comparison to the rest of the UK, numbers are rising. Commercial sea fishing, the oil industry and crofting are the other major employers on the Islands, although the fish-farming industry is also growing at a rapid rate. The sense of community is particularly strong on the Islands, and traditional festivals [7] based around the Islands’ cultural heritage are still celebrated. Scientific interests are particularly well represented on the

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[7] One of the main traditions celebrated in Shetland is *Up Helly Aa*. Britain’s biggest fire festival and torch procession takes place in Lerwick on the last Tuesday every January. Over 900 colourfully dressed guisers follow the Jarl’s squad of Vikings and their longship through the darkened streets of the town to the burning site. Here the official ceremony ends in a spectacular blaze as 800 flaming torches are thrown into a galley.
<table>
<thead>
<tr>
<th>Designation</th>
<th>Statutory</th>
<th>Marine</th>
<th>Nature/landscape conservation</th>
<th>Scientific</th>
<th>Historical/cultural</th>
<th>Recreation</th>
<th>W Wales</th>
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<th>Shetland</th>
<th>NE Coast</th>
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<td>2 sites</td>
</tr>
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<td>Wildlife Trust Site (WT)</td>
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<td>490</td>
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<tr>
<td>Woodland Trust Site</td>
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<td>*</td>
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<td></td>
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<tr>
<td>World Heritage Site (WHS)</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>853</td>
</tr>
</tbody>
</table>

Islands, as is demonstrated by the 16 000 Ha. designated as Sites of Special Scientific Interest [21].

The North-east Coast of England has the greatest population and is the most industrialised of all the sites but despite this, is important in terms of designated areas of outstanding natural beauty and for measures that protect birds, especially rare species [22]. The physical environment is characterised by two large estuaries — the Humber and the Tees, separated by an expanse of high cliffs. Both estuaries have long residence times, and are host to areas of saltmarsh and mudflats which are very difficult to clean. Although traditional subsistence activities rarely take place along the North East coast, there is a growing tourism industry based around
the region’s maritime heritage. Water-based recreation is also developing throughout the area, and is slowly taking over the sites where fishing villages were once located.

**Status of management measures**

*The international background*

The objective of marine traffic management is to preserve the natural environment, all human and non-human life and to optimise the transport of goods and passengers by reducing the risks of collisions and strandings [23]. The approach to management of shipping in the UK, and indeed elsewhere in the world is generally complex. Management is undertaken by port and harbour authorities, DETR (Department of the Environment, Transport and Regions) and IMO (International Maritime Organisation), although policy and legislation is based upon advice from port users and stakeholders.

Port and harbour authorities have powers to implement traffic management schemes within their jurisdiction — which is usually within the approaches to the ports concerned. Beyond port jurisdiction, the DETR takes control. Major stakeholders such as the Royal Institute of Navigation and the UK Petroleum Industry Association advise the DETR on the need for action. Although the DETR recognises the need for many of the traffic management measures, it is not possible to directly implement them as they may interfere with other countries’ rights to innocent passage. For this reason, the DETR submits proposals to IMO, which considers whether measures should be accepted on an international basis.

Once IMO has agreed that there is a need for measures and has decided upon the tools it will use to implement the strategy, it is left to the competent national authority in the state concerned (in this case, the DETRs Maritime and Coastguard Agency) to enforce it.

Under international law, a number of measures are available to improve maritime safety and reduce accidents. These are based upon:

- the International Convention for the Safety of Life at Sea 1974 and its Protocol of 1978, as amended (SOLAS);
- the Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREG);
- the General Provisions on Ship’s Routeing (IMO Res. A. 572(14), as amended).

Under these provisions, it is possible to implement a wide range of measures designed to reduce the risk of an accident, which include routing, creation of areas to be avoided, vessel reporting with information and monitoring systems, vessel traffic service systems and compulsory pilotage.

A number instruments have been introduced over the last few years that make use of the above conventions. These include Special Areas of Conservation, Special Protection Areas, Particularly Sensitive Sea Areas[^8], Marine Environmental High Risk Areas and Marine Environmentally Sensitive Areas. As the list of protected areas grows longer and criteria for identification becomes more complex, national conservation bodies have been moving away the concept of site-based protection and are instead

[^8]: IMO (1996) Follow-up Action to UNCED. Protection of Particularly Sensitive Sea Areas. Implementation of Paragraph 17.31(a)(iv) of Agenda 21. MEPC 38/7/1. A Particularly Sensitive Sea Area is defined as an area which needs special protection through action by IMO because of its significance for recognised ecological or socio-economic or scientific reasons and which may be vulnerable to damage by maritime activities.
campaigning for the adoption of a safety culture and widespread environmental responsibility.

**UK waters**

The status of marine management in UK waters can be considered first of all by looking at navigation charts. However, there are also many local measures introduced by port and harbour authorities, which can only be identified with reference to port handbooks. Figure 3 illustrates internationally recognised measures which are in place to guide traffic through UK hazardous and sensitive areas.

With reference to Figure 3, it may be seen that a number of internationally recognised measures are in place around the UK to protect shipping and the environment from risk. These include Areas to be Avoided, Precautionary Areas, Deep Water Routes, Internal Traffic Zones, Recommended Tracks and Traffic Separation Schemes. The majority of measures are to be found around the English Channel, around the Shetland and Orkney Islands, around the Minches, off West Wales and off the Scilly Isles. It should be noted that Immingham, which has the greatest number of vessel arrivals of the study areas, has no internationally recognised management measures, and instead relies upon port authority guidance.

The Shetland Islands are completely surrounded by a combination of Areas to be Avoided and Precautionary Areas [24]. There are also Recommended Routes to the north and south of the Fair Isle to separate opposing traffic flows, and a Voluntary Ship Reporting Scheme for laden vessels entering or leaving the Fair Isle Channel. Internationally recognised measures are backed up by a number of local measures, which include radar coverage, multi-media communications, pre-arrival checklists, standby pilots and permanent on-site weather forecasters.

The Minches are used as the tanker route between the North Sea and west coast ports such as Milford Haven and Tranmere. Existing traffic management measures include a Deep Water Route, a Recommended Route, a Voluntary Reporting Scheme and a Formal Reporting Scheme [25]. The Minches do not have complete radar coverage, but are fully covered by radio. After a study by the MSA (Marine Safety Agency) [26] of traffic around the Minches, IMO recommended that tankers >10000 GRT should (weather permitting) use the Deep Water Route between the Outer Hebrides to the East, and the Flannan Isles and St Kilda to the west. This route was adopted in 1987, although there was concern that the Deep Water Route passed within four miles of the shore at certain points and that prevailing winds were onshore and frequently of considerable strength. The Deep Water Route has since been extended as far north as the Butt of Lewis and south to Barra Head. The IMO has also agreed to re-align the southern leg of the route 3.5 Nm further west.

South of the Minches, further management schemes are in place. The narrow North Channel, which lies between Ireland and Scotland is managed via a Traffic Separation Scheme. Similarly to the Minches, northbound traffic is advised to keep to the east, while southbound is advised to keep to the west.

The sea area around West Wales is managed via an Area to be Avoided which is in place between the Small and Grassholme Island for vessels carrying hazardous cargoes or for those >5000GRT [27]. To the west of the Small a Traffic Separation Scheme runs through St George’s Channel.
Figure 3. TMS in the UK.
and in addition, laden tankers are advised to avoid the area between the traffic separation scheme and the Area to be Avoided. In 1993, IMO accepted that laden tankers >10000GRT should be advised not to use the channel between Skomer and Grassholme, unless moving between the anchorage at St Bride’s Bay and Milford Haven port.

Decision-making issues

Over the last year, a number of concerns about the state of marine traffic management in the UK have been raised. The following section discusses the role and concerns about the major decision-makers, which include owners, operators, port authorities, the UK Government and the IMO.

Owners and operators

Tanker owners have been criticised for their reluctance to hire tugs in sufficient numbers and with adequate power and of putting excessive commercial pressure on crew to catch tides and minimise time spent in port. For example, the Sea Empress incident in 1996 may have been less serious if appropriate tugs had been able to get to the site sooner. As yet, there have been no moves to encourage owners to hire more tugs, and it is not an action that is foreseen in the near future. With regards to commercial pressures, it is accepted that although they cannot be removed, they can be managed, and in turn, somewhat reduced in scale. IMO are publicising the application of a safety culture to remove some of the pressures, are implementing the amendments made by the 1995 Standards of Training, Certification and Watchkeeping (STCW) [28] and are adding the International Safety Management Code (ISM) [29] to SOLAS. It is hoped that such actions will improve management standards of owners and operators throughout the industry.

Owners and operators have also been criticised for their lack of recruitment and poor training. In more recent years, the number of experienced tanker seafarers has fallen to critical levels. Second engineers with tanker and hazardous cargo endorsements are hard to find, not to mention the shortage of pumpmen, steam engineers and mates with Very Large Crude Carrier (VLCC) experience. Many tanker owners and operators are relying on outdated training, or poaching crew from other owners who have spent considerable time and money in developing seafarers’ skills [30]. Graduates from maritime schools are at their lowest ever levels, and even if measures to improve recruitment were taken immediately, there would be still be a shortfall in experienced officers [31]. The only way to deal with the situation is by improving standards in less developed countries and by offering ‘fast-track’ training courses.

Port authorities

Under the Transport and Works Act 1992 [10], port authorities have a duty to ‘have regard’ to the environment. Port authorities are under great pressure to ensure that there are high levels of safety, while also ensuring that turnaround time is minimised. Issues of concern revolve around the structure of the management approach and the improvement of pilotage services.

Ports groups are fairly well represented in the UK and compared with other parts of the industry, have good levels of co-operation. The Ports Safety Organisation is one of the co-ordinating groups, which keeps members informed of new developments and advises on best practice.
Rotterdam’s ‘Clean Sea Initiative’ is one example of ‘best practice’, where ‘clean’ customers are rewarded with reduced port charges, thereby encouraging owners and operators to improve standards and operations. Advantages of using policy to change attitudes of users include a more cost-effective management regime, where incidents are prevented far sooner than they would otherwise have been, and where there is scope for continual review and updating. However, the success of such a scheme is dependent upon a number of factors, such as the general availability of waste reception facilities, extra charges for use of waste reception facilities, and time taken to discharge into waste reception facilities [32]. It is also accepted that such measures cannot be put in place overnight, and port users must be fully aware of what is expected of them. If such a scheme is to be effective, port users should be included as part of the consultative process and be given adequate time to conform.

Unlike seafarers, pilots are not subject to a unified, international training and certification process, and it is felt by some that there is inadequate training and experience for pilots of large tankers. Although further simulator training might increase the confidence of a pilot, it is debatable about how far one can justify the expense. It is well known that pilots acquire the majority of their skills while at sea, therefore it is argued that they might benefit more from being trained initially on simulators and then monitored and tutored for longer periods while at sea.

Concerns have also been expressed over pilots’ control over vessels. Although a pilot may know the surrounding waters better than the master, this is not to say that he is fully aware of the capabilities of the vessel. There have been calls for more information about the intended ship’s passage flows to be passed between the pilot and the master in advance of the transit. Intertanko recently developed a draft Pilotage Passage Plan that provides a protocol for such communications. It was submitted as a proposal to the 67th Session of IMO’s Maritime Safety Committee in December 1996, where it was welcomed. It is currently being developed further but will soon be resubmitted. It is now intended that a Pilotage Passage Plan format is prepared which is non-mandatory and which reflects a two-way flow of information.

UK Department of the Environment, Transport and the Regions

The main criticisms of the UK Government are that over the last few years, they have taken a back seat with regards to maritime management. Lord Donaldson’s Report, which came out after the Braer incident made a number of recommendations aimed at improving shipping safety. Although a number of the recommendations have been accepted, there is still the opinion that feasibility studies and implementation are sadly lacking.

Another concern is that the present provision of emergency high powered tugs at just two sites in the UK during winter months is woefully inadequate. It is concluded that emergency tugs should be stationed year-round at Sullom Voe, Stornoway, Immingham, Southampton and Pembrokeshire. Although it is accepted that the provision of high powered emergency tugs are an expensive safety measure, it is felt that the expense is justified when compared with compensation and cleanup costs. It has been suggested that the cost of the provision could be alleviated by putting the tugs to alternative use within the port area.

No management practice can ever be effective without the implementation of some sort of monitoring programme. Transponders have been hailed as a breakthrough in terms of automatic real-time monitoring and
reporting systems, with the capability of being used on short and long ranges. Although their use will shortly become compulsory, a trial run around Shetland has been unsuccessful [33]. The shore stations are set up, but vessels are not volunteering for tagging (only one major foreign tanker owner has so far converted its fleet). It cost £80,000 to set up the three shore receiving stations, and just £500 to convert each vessel. With such competitive pricing, there is no obvious reason why there are not more participants. The only way in which transponders will be effective is if their application is more enthusiastically encouraged by government and by IMO.

IMO

The main criticisms against IMO are that the decision-making process is too slow and that it is forced to work to the lowest common denominator [34]. It is also accused of not prosecuting offenders, although in many ways, IMO are in a similar position to port authorities, whereby it is charged with the responsibility of ensuring safe navigation, without having any real teeth to prosecute those who do not comply.

Nevertheless, IMO have been particularly active over the last few years and has concentrated efforts on improving safety. The Organisation has established a sound basis for future action by improved flag state implementation, extending port state control, improving management standards, and by improving seafarers’ standards. While the advantages of such measures are the intended improved navigational safety, the disadvantages are that IMO are still working toward the lowest common denominator, and that measures only extend as far as the States which are IMO compliant. Although these actions have made a good start at addressing the problem of crew performance, there is still much scope to reduce the 80% of accidents caused by human error.

Conclusions

Of the study areas considered, West-Wales significantly stands out as having the highest number of tanker accidents — even though the East coast has more traffic and a more complex route network. Oil spills are reported to be highest around the Shetland Isles, closely followed by the Minches. A review of sensitivity highlighted the fact that the Minches have the greatest number of environmental designations and the greatest coverage of protected areas. Although there are a wide range of management measures in place both around West-Wales and around Shetland, there are still high numbers of accidents and oil spills. With accidents and oil spills occurring so frequently in sensitive areas, it may be only a matter of time before another large spill seriously damages the natural environment. It is also notable that there are no internationally recognised measures around the North–East coast of England, even though it has the highest number of tankers, and the second greatest number of accidents. From the review of shipping and environmental characteristics, it may be concluded that the majority of management measures are concentrated in areas of highest risk, but do not focus on areas of high sensitivity.

In the past, environmental management of tankers has been driven by political pressure and based on the subjective judgement of decision makers. Although some measures have genuinely improved safety, there are too many areas in the UK that have been ignored. It is felt that the decision making process would be substantially improved if it was aided
by more risk assessments which consider sensitivity as well as vulnerabi-

lity. However, in an area where there is already a confusing plethora of
different types of ‘special area’\textsuperscript{12} and a great deal of other information
marked onto charts it is difficult to see how new protection measures such
as PSSAs and SPAs, which are essentially voluntary and rely upon
masters’ reactions to information, can reduce the risk of an accident or oil
spill, without making matters even more confusing.

A master may be persuaded to avoid such areas if he is made aware of
the fact that if his ship grounded, for whatever reason, there could be the
risk of exceptional environmental damage, which would probably expose
his owners and insurers to substantial claims from those who rely upon
a clean marine and coastal environment for their livelihood. Well inten-
tioned masters will react correctly to map information regarding PSSAs
and similar designations, but only in so far as commercial pressures allow
them to. Unfortunately, less diligent masters may not, and for this reason,
the voluntary measures should be backed up with comprehensive
monitoring and reporting schemes and strict sanctions. It is also suggested
that criteria are tightened so that the concept applies only to those areas
which are truly environmentally sensitive \textsuperscript{[35]}. Although it is recognised
that such actions may affect trade, this is the price that will have to be paid
for a safe and clean environment.

Apart from the general recommendations to aid the decision-making
process, a number of specific points have been raised. Owners, operators,
port authorities and the DETR have been criticised for their actions, and
in many cases, their inactions. Steps should be taken to ensure that
sufficient tugs are available to safely escort tankers into and out of port,
and ship operators should be encouraged to put more resources into crew
training instead of poaching crew from other vessels. Although port
authorities are perceived to be responsible for the majority of accidents,
this is not always the case. At present, they merely provide a service
for vessels entering or leaving their ports. If port authorities were given
further policing powers, they would be able to prosecute more rogue
vessels and ensure that lax owners and operators face up to their responsi-
bilities. Port authorities should also be encouraged to implement schemes
such as Rotterdam’s ‘Clean Sea Initiative’ and to positively attack the
problem of pollution by rewarding clean customers. Port authorities in
general would also benefit from the experienced gained from ‘best practice’
cases, as is found in Sullom Voe. However, Shetland is a special case, in
that special arrangements have been made between the port and the local
council.\textsuperscript{13}

The overall state of management is somewhat piecemeal. Thus far, the
majority of decision makers are working in isolation to solve their own
part of the problem. Although co-operation efforts are being made, many
of the same problems occur repeatedly throughout the industry. For
example, although the ports group are meeting regularly and sharing
information, very little direct action is being taken. The exception to the
rule is the merger that recently took place between HM Coastguard and
the Marine Safety Agency to form the Maritime and Coastguard Author-
ity. Throughout the industry there seems to be a general acceptance that
decision makers have only a legal obligation to comply with IMO stan-
dards, even though it is known that IMO work to the lowest common
denominator. Such a view of responsibility is not good enough to deal
with the increasing risks at sea. It is up to the decision-makers themselves
to set their standards higher, and to fulfil their moral obligation of

\textsuperscript{12}For example, MARPOL Special Areas;
Article 211(6) LOSC Special Areas; UNEP
Regional Seas Protected Areas; UNESCO
1972 Convention Concerning the Protection
of World Cultural and Natural Heritage Sites
World Heritage Sites; 1971 Wetlands of In-
ternational Importance Ramsar Sites; IMO
A720(19) Particularly Sensitive Sea Areas;
Marine Environmentally Sensitive Areas.
\textsuperscript{13}The special arrangements made between
the port authority and the council were
made under the Zetland County Council Act
1974.
ensuring that all operations are safe for the environment as well as for their own employees.

The key to the whole situation is the role played by the DETR. The DETR is the cornerstone of the bottom up and the top-down approach, both of which are required if future traffic management plans are to be made, and if existing measures are to be effectively implemented. It is essential that the DETR takes a more proactive approach, and encourages greater communication and co-operation between stakeholders and decision-makers.

Although the measures discussed will have a major impact on shipping safety and benefit the health of the oceans by reducing marine pollution, it is felt that the development of a safety culture is the only way in which risk can be reduced to an acceptable level without applying legislation to every operation that takes place. It involves a change in the attitude of stakeholders and creates an environment, where nothing is done or introduced without its safety implications being assessed and where safety becomes a way of life rather than an after-thought.¹⁴ The first real steps of converting the concept into practice are being taken by IMO. In the last few years, IMO have put a great deal of effort into investigating the application of Formal Safety Assessment (FSA) as part of the decision-making process. FSA is a new approach to the regulation of shipping safety, stemming from recommendations in Lord Carver’s report [36]. It is based on the principles of identifying hazards and evaluating risks, and has as its objective the development of a framework of safety requirements for shipping to address risks in a comprehensive and cost effective manner. The adoption of FSA for shipping represents a fundamental cultural change, from a largely reactive and piecemeal approach, to one which is integrated, proactive, and soundly based upon the evaluation of risk. Instead of waiting for accidents to occur and then implementing legislation, FSA attempts to forecast potentially hazardous situations and prevent them escalating to full-scale incidents.

It is an unfortunate fact that the processes of changing policy and attitude are slow in the maritime world, and that problems which originated in one generation are frequently experienced in the next [37]. After the Amoco Cadiz the French Government made prompt and decisive unilateral action to impose an apparently effective blanket ban within a matter of weeks. In comparison, four years after the publication of the Donaldson Report, the UK has not only not implemented the main recommendations, but is still reviewing many. It is strongly felt that if a safety culture is to be effective, there must be the means to speed up the decision-making process.

¹⁴From a speech given by Mr William A. O’Neil (the Secretary-General of IMO) to the annual meeting of the British Merchant Navy Officers’ Union in May 1995.

References


[18] E R Gundlach and M O Hayes, Vulnerability of coastal environments to oil spill impacts, Marine Technology Society Journal, Vol 12, No 4, 1978, pp 18–27. Gundlach and Hayes methodology was based upon the difficulty of cleaning up oil spills from various types of surface. They assumed that it was most difficult to clean up oil from shingle beaches and salt marshes, less difficult for hard sand beaches and easier for rocky shores.


[24] UK Admiralty Chart Nos. 3281, 3282, 2183 (Shetland Isles), Published by UK Hydrographic Office, Ministry of Defence.


[27] UK Admirally Chart Nos. 1478, 1479 (Milford Haven), Published by UK Hydrographic Office, Ministry of Defence.


