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European commitment to the prevention of marine pollution from shipwrecks

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Late 19th and 20th century shipwrecks pose a potential oil pollution threat to European coastlines. This risk must be quantified and a pollution management framework implemented. Prioritised Action Plans will provide a practical mechanism for management.

Introduction

Until relatively recently, the pollution threat posed by the thousands of wrecks which litter the seas around Europe and UK was very low. The development of engine-powered, iron and steel vessels in the 19th century, their ever-increasing size and thus cargo capacity, and the widespread introduction of oil-fired engines in the last 100 years has dramatically raised the pollution potential of these modern wrecks.

The extent of the problem within European waters yet to be quantified, but as an example of a subset of wrecks with the potential to contain fuel and other pollutants, there are in the region of 2127 World War I and II British Royal Navy losses in European and UK seas and adjacent international waters alone*.

This suggests a need for a European Union effort to quantify the problem, consider how best to address it, and then introduce a practical mechanism to do so.

Tiered preparedness

The potential for spillage or pollution arising out of any wreck will be governed by a combination of factors, including the circumstances of it's loss, its age, condition and current structural integrity, its propulsion system and thus the potential for oil or lubricants aboard, and also the cargo it was carrying and whether this is potentially polluting or hazardous.

Based on this combination of factors, the pollution potential of the majority of late-19th and 20th century wrecks is likely to be low, and only a minority will present a substantial pollution or spillage risk that requires proactive management.

Until an EU database of potentially polluting wrecks has been developed, however, upon which the assessment described below can be undertaken, these numbers remain unknown and a relatively small number of potentially polluting wrecks remains an assumption.

Figure 1: EU response vessel locations
(Source: http://www.emsa.europa.eu/operations/network-of-stand-by-oil-spill-response-vessels.html)

Mapping oil dispersion

Since wrecks lie on the seabed (Figure 2), the behaviour of oil escaping through the water column must be simulated in three dimensions.

Oil Spill Response Limited uses a number of oil spill modelling tools model to simulate the path of an oil spill in three dimensions (Figure 3). The model inputs include spill volume, release time, oil properties, metocean information, coastlines and bathymetry.

The use of oil spill modelling to simulate the release of oil from surface and subsea sources is common across the oil and gas industry. Modelling provides a good indication of where an oil spill can end up although 100% accuracy is not guaranteed.

The potential volume of oil pollution arising from wrecks will vary dramatically. Oil spill modelling will allow the temporal impact of an oil leak to be investigated against the surrounding environment.

Figure 2: Multibeam sonar image of MV *Californie*, sunk in 2006 © ADUS Deepocean Ltd

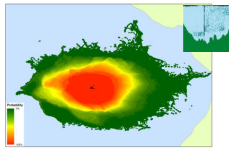

Figure 3: Example of oil spill modelling showing the spill envelope around a shipwreck and the cross-section of a release

Tiered dispersion

The IPIECA tiered response concept is globally accepted and implemented across the oil and gas. The UK and other European countries who are signatories to the OPRC'90 Convention have established robust Tier 1, 2 and 3 response capabilities.

Although potential oil spill volumes from individual ship wrecks may not be considered significant, the long term and on-going release of oil could lead to an incident of significant impact to European shorelines. Assessment of the individual states capability to effectively manage and respond to oil spill incidents not necessarily confined within the tiered approach is necessary.

Determining the management priority

The proximity to the potential polluting wreck of receptors sensitive to the effects of oil is a key factor in determining the management priorities. The presence of highly sensitive receptors within the oil dispersion envelope will increase the potential impacts of a leak.

The management priorities can be rated by combining receptor sensitivity and spillage potential in an assessment matrix (Table 1).

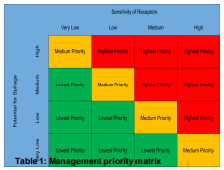

Table 1: Management priority matrix

Management actions

The management priorities indicated by the dispersion-receptor overlap assessment matrix above can be translated into a number of management actions. (Table 2).

Management Priority	Recommended Actions
Lowest	Action Plan and Assessment Timetable
Medium	Action Plan and Assessment Timetable
	Full Desk Based Assessment
Highest	Action Plan and Assessment Timetable
	Full Desk Based Assessment
	Field Work Assessment

Table 2: Management priorities and recommended actions

Action plan and assessment timetable

Every vessel within the database will have an Action Plan and Assessment Timetable.

For Lowest Priority vessels this will comprise a five year reappraisal. For Medium and Highest Priority wrecks, a bespoke Action Plan will identify risks, data gaps and further work required, triggers for fieldwork monitoring and a monitoring plan, and containment and salvage options.

These Action Plans will be live documents and will be critically reviewed every five years to ensure they remain current and take account of new information or knowledge.

Full desk based assessment

A full DBA will be undertaken for vessels that have been assigned Medium or Highest Priority, and will comprise:

Vessel History	Purpose of the vessel (e.g. military or civilian) and its role at the time of sinking. In the case of military vessels this will include an assessment of the likely presence on the wreck of unexploded ordnance (UXO).
Vessel GA Plans	Vessel-specific General Arrangement (GA) plans, or alternative design plans from similar vessels, will be sourced where available.
Pollutant Inventory	A hazard and risk assessment of all potentially polluting chemicals carried, including an estimation of volume
Pollution Modelling	Detailed pollution models will be run for all chemicals deemed to be a threat to the environment. The dispersion models will define the site-specific Wreck Impact Envelope.
EIA	An Environmental Impact Assessment (EIA) will be carried out using the Wreck Impact Envelope as a boundary for impacts on the human and biological environment.

Field Work Assessment

Field work assessment is triggered for the Highest Priority wrecks. This will comprise:

High Resolution Remote Sensing	A multibeam bathymetric survey to gather data on site condition and structural integrity
	High resolution meteorology
	Data comparison to GA plans
Pollution Modelling	Seabed sampling
	Water Quality sampling, in-situ fluorometry
Data Feedback	Combination of Results and comparison with DBA within the GIS management system

Conclusions

The potential for oil pollution incidents from shipwrecks within UK and European waters remains an unknown risk. Before any preventative action can take place, quantification is needed through a centralised EU database. From this, oil spill modelling and desk-based assessments of the receiving coastal sensitivities will determine the management priority of the vessels. Action Plans and Assessment Timetables for Low to High priority vessels will identify where areas for further work are required through full desk based assessment to fieldwork.

EU members signatory to the OPRC Convention have tiered oil spill response and preparedness frameworks in place. The threat of oil pollution from shipwrecks is not immediate but poses an incremental risk. A Member States capacity to effectively respond may not be related to the national tiered resources. By adopting a pan-European approach, cross-boundary pollution incidents will be managed cohesively and effectively between countries.

* UK UNESCO 2001 Convention Review Group, 2013, The UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001: An Impact Review for the United Kingdom, Published Report, December 2013