# Identification of the highest priority HNS and the prediction of their fate, behaviour and effects


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## Introduction

Shipping is the most important mode of transport in terms of volume transported, with UK ports handling 582 million tonnes of freight traffic in 2007 (Department For Transport, 2007). Hazardous and Noxious Substances (HNS) are substances other than oil which, if introduced into the marine environment, have the potential to affect human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

The UK has a highly developed Oil Spill Contingency Plan - but to enable the UK Maritime and Coastguard Agency to provide a strong and consistent lead in the response to HNS incidents at sea, there was a need to develop the approach to HNS to a similar level. Both prioritisation of HNS and strengths of different models in handling HNS behaviour were considered but only prioritisation is discussed here.

## Background to HNS issues

Whereas most oils float on the sea surface and are immiscible with water, HNS chemicals exhibit a wide range of both behaviour and human health risk and toxicity to marine organisms. In order to be well prepared for possible future incidents involving the release of HNS chemicals, such behaviours need to be predictable in advance, (Figure 1). It is important to note that, a chemicals initial behaviour will affect the primary groups of animals or humans exposed to and affected by it but indirect effects, e.g. accumulation of contaminants in fish, may affect other groups.

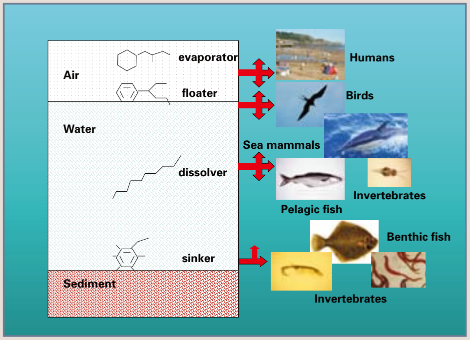


*Figure 1: The threat to humans and to different marine resources from HNS with properties that influence their fate in the marine environment*

## Prioritising HNS to aid emergency response

In emergency response there are three levels at which it is valuable to consider prioritisation of HNS, and these are:

(i) in terms of frequency with which HNS with particular properties may be encountered in an emergency.

(ii) with respect to the order in which HNS are dealt with during an incident

(iii) with respect to directing the appropriate approach to take during post-incident monitoring and impact assessment – under development (see www.cefas.co.uk/premiam)

In the first case the identification of the most frequently transported HNS may indicate those most likely to be spilt during an incident. This information can help pre-planning for response and allows government agencies involved in chemical emergencies to consider whether the regulation of HNS transport needs to be modified to reduce the risk from particular types of incident. In addition the models used to predict the fate and effects of HNS during a spill can be evaluated in terms of their ability to handle the range of factors present in the most likely incidents. Figure 2 shows the number of HNS in different behaviour categories from the GESAMP list which provides a useful indication of substances that are transported in bulk. Based on data for the actual quantities of HNS transported between EU ports and through the English Channel 2002 -2004 those that evaporate and also dissolve in or float on seawater may each represent up to 20% of the total bulk of transported chemicals and therefore are likely to be encountered in an emergency incident (HASREP, 2005).

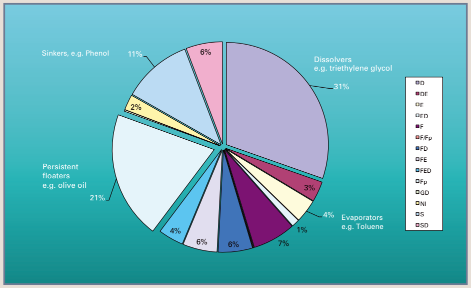


*Figure 2: Percentage of GESAMP EHS chemicals by number in each of 14 behaviour groups based on those defined by the Bonn Agreement counter pollution manual D-dissolver; DE-dissolver,evaporator; E-evaporator;ED-evaporator, dissolver; F-floater; F/Fp-floating and floating persistent; FD-floating dissolver; FE-floating evaporator; FED-floating evaporator dissolver; Fp-floating persistent; GD-gas dissover; NI-no indication; S-sinker; SD-sinker dissolver*

## Management of HNS during an incident

Chemical identification is a key step in emergency management for hazardous chemical incidents. Eyewitness accounts of explosions, fire, spilled chemical behaviour or symptoms of those exposed to chemical effects may inform chemical identification. Thereafter details of cargo manifests, safety data sheets and labels are essential to prioritise action for managing HNS containment/treatment and removal. As an incident evolves, the HNS threat to humans and the environment may dictate different response priorities (Figure 3).

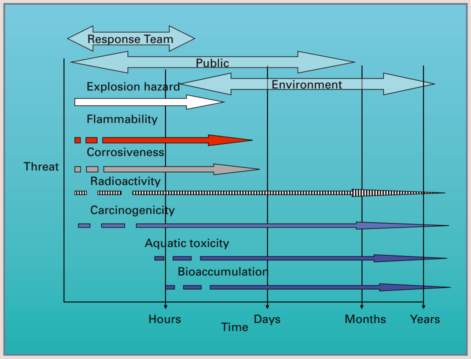


*Figure 3: Time course of different chemical threats during an HNS emergency incident and those receptors under threat*


**References**

CEDRE Chemical Incident Response Guides http://www.cedre.fr:80/fr/publication/guides/chimique.html

Department for Transport Maritime Statistics.

http://www.dft.gov.uk/pgr/statistics/datatablespublications/maritime/

GESAMP (2002) The Revised GESAMP Hazard Evaluation Procedure for Chemical Substances carried by Ships. GESAMP Reports and Studies No. 64, Publication Number 463/02, 137pp.

HASREP, Response to harmful Substances spilt at sea. Project co funded by the European commission under the community framework for co-operation in the field of accidental or deliberate marine pollution. 2005. Prepared by The Alliance of Maritime Regional Influences in Europe (amrie), Centre de documentation, de recherche et d'expérimentations sur les pollutions accidentelles des eaux, (Cedre) and TNO Built Environment and Geosciences,The Netherlands.

MIDSIS-TROCS is a decision support system based on TROCS 2001 database, which was developed by the IMO/UNEP - (REMPEC) in collaboration with Malta University Services (MUS) for the use of REMPEC's Operational Focal Points. It is available free of charge from REMPEC at the following link http://www.rempec.org/databases.asp.

PREMIAM – Pollution Response in Emergencies – Marine Impact Assessment and Monitoring, www.cefas.co.uk/premiam, for further information contact premiam@cefas.co.uk or mark.kirby@cefas.co.uk


## Prioritisation during an incident

Those HNS that can cause explosions, fires or noxious gas clouds represent a threat to a wider sea area as well as to the emergency or salvage teams and therefore require most immediate prioritisation for action. Figure 4 illustrates how removal or remediation of HNS might be prioritised during an incident. Factors such as sea state, wind direction and proximity to different human or environmental sensitivities will also have an important influence on HNS prioritisation.

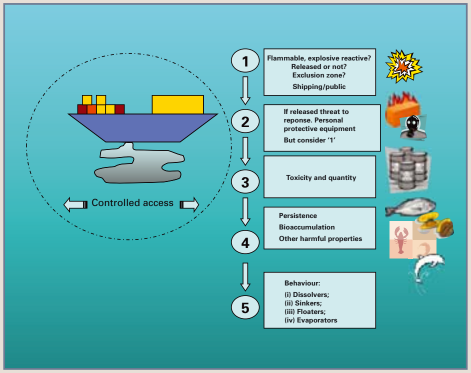


*Figure 4: Prioritisation of HNS for removal or remediation during a maritime incident*

## Sources of information

A range of data sources on HNS properties including free standing databases and others with internet access are available. Health and Safety data sites are also valuable sources of emergency response information (e.g. The Institute for Occupational Safety and Health guides to hazardous substances) and include information on personal protective equipment resistance to particular chemicals and data on chemical reactivity. Several European projects have also made valuable assessments of risk from HNS transport and some also consider issues around specific types of HNS spill that provide useful insight into the different behaviour categories of HNS (e.g. Cedre chemical incident response guides). Decision Support Trees are also provided in some instances to aid in the decision making process (e.g. The Mediterranean Integrated Decision Support Information System, MIDSIS-TROCS).

## Concluding points

Shipping incidents that involve the transport of HNS present uncertainties because of different behaviour categories of these substances and the potential for interaction with air, water or other HNS. As this is the case it is important that response options are simplified as far as possible. By considering the main behaviour categories of HNS as identified in the Bonn Agreement counter pollution manual, a first level of prioritisation for management of chemical cargoes can be achieved.

The GESAMP 'hazard profile' approach appears to be one of the most appropriate sources of HNS data, providing a simplified summary of the chemical in question that can be used by field operatives and primary advisors in the first instance. It also has the added advantage of being focussed on the marine environment and on regularly shipped chemical cargoes.


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