



PERSGA

الهيئة الإقليمية للمحافظة على بيئة البحر الأحمر وخليج عدن
Regional Organization for the Conservation of
Environment of the Red Sea and Gulf of Aden

HNS SPILL RESPONSE GUIDELINES

May 2024



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(1) Introduction

These guidance notes offer a summary of the spill response options to incidents involving Hazardous and Noxious Substances (HNS). HNS spill response involves many of the response techniques associated with oil spill response and, building on these, is often the best way to start understanding HNS response.

The Marine HNS Response Manual, developed under a multi-regional agreement between the Bonn Agreement, HERLCOM, REMPEC and other key institutions provides a detailed summary of this subject. The Marine HNS Response Manual should be used in conjunction with these guidelines.

Further reading is encouraged to gain a more in-depth knowledge of the subject. There are many useful documents that can be studied. A selection of useful reference works is referenced in Appendix 1 and can be found at:

- International Maritime Organisation (www.imo.org)
- ITOPF Technical Information Papers (www.itopf.org/knowledge-resources/documents-guides/technical-information-papers/)
- CEDRE Clean-up Activities (www.cedre.fr/en/Resources/Practical-datasheets/Cleanup-activities)

PERSGA maintain a large electronic library of useful reference material.

Personnel with designated responsibilities for HNS spill preparedness and response should undergo specific training, both theoretical and practical, in their roles.

(2) HNS Definition

There are two different key definitions of Hazardous and Noxious Substances (HNS). These are the 2000 OPRC-HNS Protocol and the 2010 HNS Convention.

The OPRC-HNS Protocol, building on the OPRC Convention, defines HNS

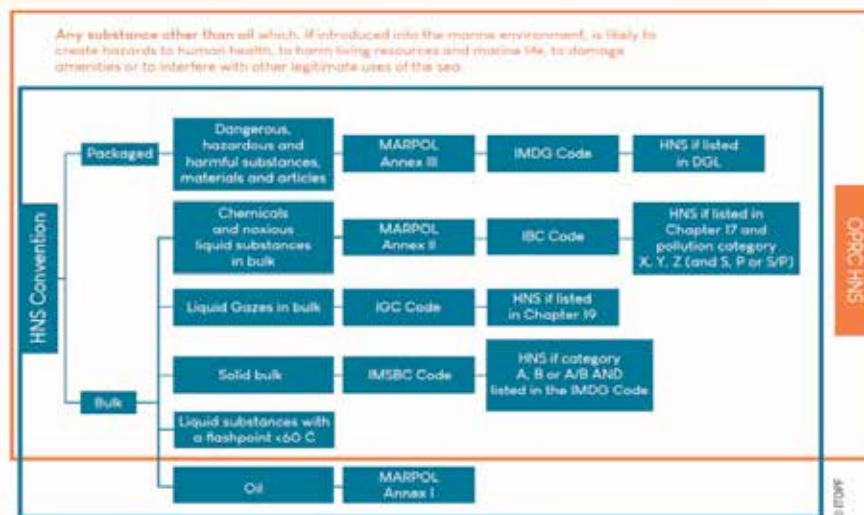
as “any substance other than oil which, if introduced into the marine environment, is likely to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea”.

The definition by the HNS Convention, one of the financial and compensation conventions, also includes oil and provides a detailed list of HNS categories as defined by various International Maritime Organization (IMO) conventions and codes. A summary of the IMO conventions, protocols and codes relevant for the transport of HNS at sea is shown in Figure 1.



(Figure1) : IMO conventions, protocols and codes relevant for the transport of HNS at sea

The definitions of HNS according to both the OPRC-HNS Protocol and the HNS Convention are shown in Figure 2.



(Figure2) : Definition of HNS according to OPRC-HNS Protocol and HNS Convention

(3) HNS Hazard and Behaviour Classifications

Maritime transport is often described as “the backbone of globalized trade and the manufacturing supply chain”, since more than 80% of the global merchandise trade by volume is carried by sea. Some of the goods transported are defined as Hazardous and Noxious Substances (HNS).

HNS might be released into the sea as the consequence of illegal discharges or maritime accidents such as groundings or collisions; and whilst major incidents involving an HNS spill are rare, they can be very complex and potentially have severe impacts on human health, the environment, and socio-economic resources.

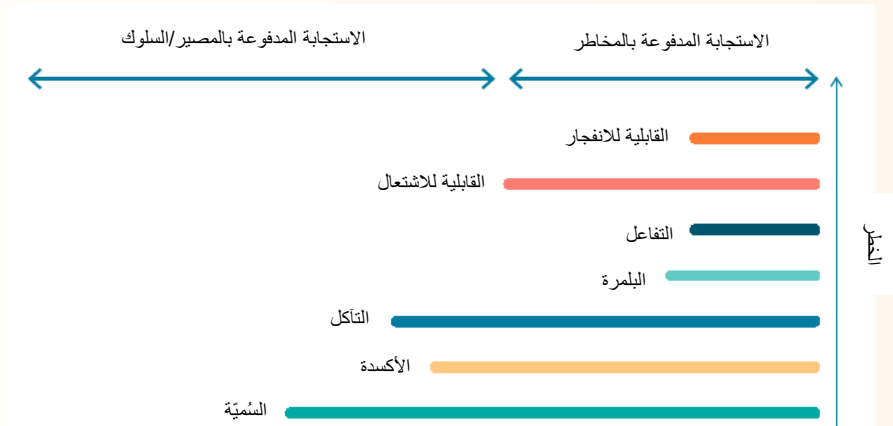
The particular challenges associated with responding to HNS incidents are linked to the diverse characteristics of the various substances considered as HNS, which include substances presenting various hazards (physical hazards such as fire and explosion, health hazards such as toxicity, and environmental hazards) and behaviours (gases/evaporators, floaters, dissolvers, sinkers). In order to better understand

the challenges posed by HNS it is best to start with an understanding of their hazards and behaviors.

During a marine incident involving HNS, it is crucial to obtain information about the spilled substance's chemical and physical properties, associated hazards and likely behaviour when spilled at sea. This information is key in the development of a response strategy.

(3-1) HNS by Hazard Groupings

Decisions on the first actions to be taken are often driven by the potential hazards associated with HNS, such as explosion, flammability, oxidation, corrosivity, reactivity, toxicity and ecotoxicity. However, depending on the timespan of the hazards, the longer-term response strategy will tend to be driven by the chemical's behaviour (as described by the Standard European Behaviour Classification (SEBC)). This is shown in Figure 3 below.

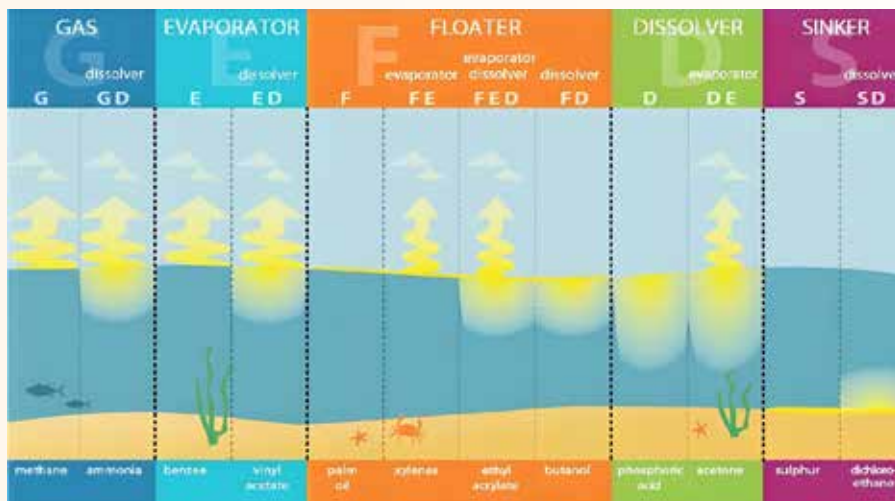


(Figure3) : Response Actions Change Over Time

The Standard European Behaviour Classification (SEBC) determines the theoretical behaviour of a substance according to its physical and chemical properties and classifies it into one of the five main categories gases (G), evaporators (E), floaters (F), dissolvers (D), sinkers (S).

However, substances might show not only one but several behavioural phases throughout a spill – depending on the characteristics of the

product(s) and its/their exposure to environmental processes; this explains why seven further sub-categories were developed (Figure 4).



(Figure4) : SEBC Classification

(3-2) HNS by Behaviour Groupings

A substance's chemical and physical properties not only determine its behaviour but also its hazard(s). In general terms, a hazard is defined as something that can cause harm to people and the environment whereas a risk is the probability to be harmed if exposed to the hazard.

Flammability, explosivity and toxicity are some of the hazards that are crucial to assess in order to understand the potential effects and risks of an HNS spill on human health, the environment, and other resources.

There are two main guidance documents governing and harmonising all communication on substances' hazards:

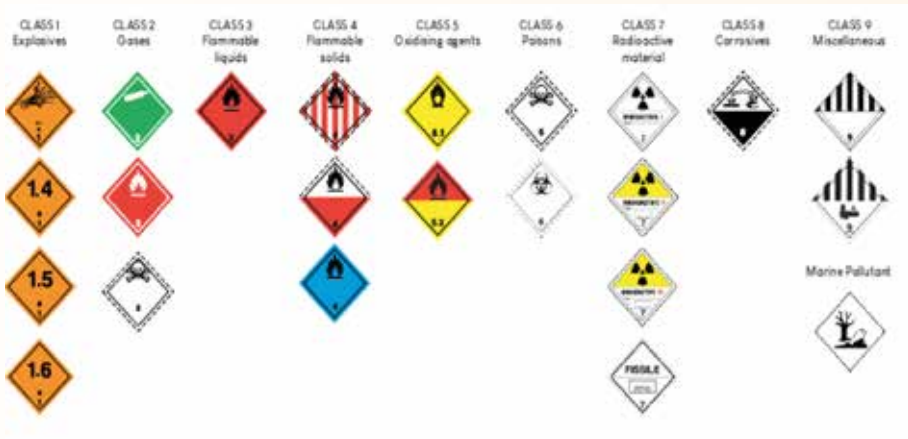
1. The "UN Orange Book" or "UN Recommendations on the Transport of Dangerous Goods – Model Regulations" (UNECE, 2015), which forms the basis for most transport regulations such as the IMDG Code and IATA.

2. The “UN Purple Book” or “Globally Harmonized System of Classification and Labelling of Chemicals (GHS)” (UNECE, 2019), which defines physical, health and environmental hazards of chemicals, harmonises classification criteria and standardises the content and format of chemical labels and Safety Data Sheets (SDS).

The IMDG Code (International Maritime Dangerous Goods Code) sets out the provisions for the safe transport of dangerous, hazardous and harmful substances, materials and articles in packaged form by sea (IMO, 2020a). The carriage of HNS in bulk is covered in different legislation (Figure 1).

The IMDG Code is based on the UN Recommendations on the Transport of Dangerous Goods, also known as the UN Model Regulations, which provides a framework of rules for the safe carriage of dangerous goods by all modes of transport (air, road, rail and sea).

All goods listed in the IMDG Code are allocated one of nine “classes” (excluding sub-divisions), according to the main danger they present.



(Figure5) : IMDG Code Classification Pictograms

The IMDG Code comprises two volumes and a supplement, which are

published bi-annually:

- Volume 1 addresses general provisions/definitions/training, classification, packing and tank provisions, consignment procedures, testing requirements for receptacles and transport operations requirements.
- Volume 2 covers the Dangerous Goods List (DGL), special provisions and exceptions where substances are listed by their assigned UN number and proper shipping name.
- The supplement contains Emergency Response Procedures for Ships Carrying Dangerous Goods (EmS Guide) and the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG), which is the supplement to the International Medical Guide for Ships published by the World Health Organization (WHO). The information contained in the EmS Guide and MFAG is primarily for shipboard use but may be of use to shore-based personnel when responding to an incident involving a container within a terminal.

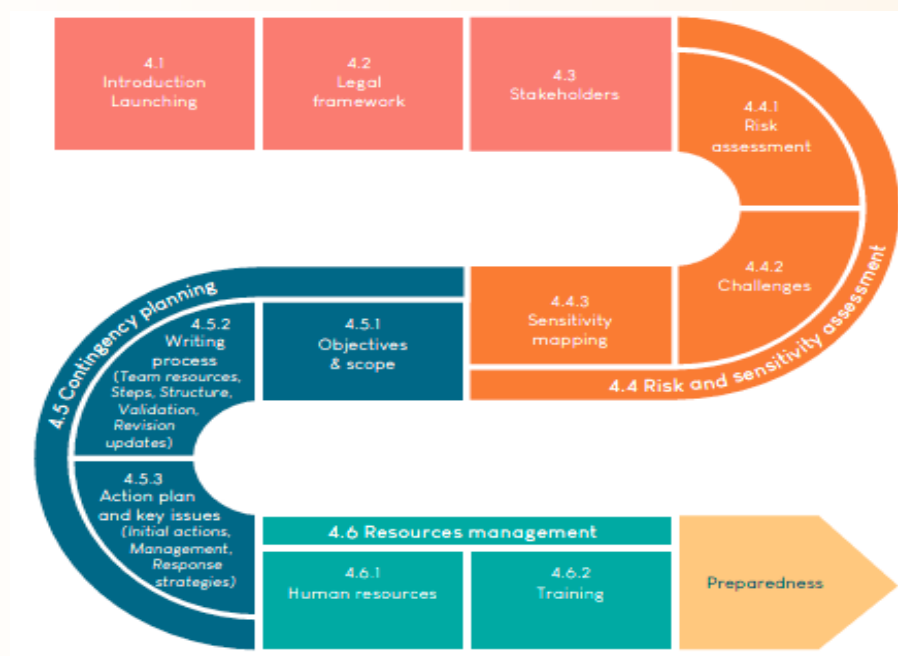
(4) HNS Preparedness

(4-1) : Contingency Planning

The large variety of behaviours, properties and fates of chemicals, means that the response to HNS spills are likely to require expertise not only from civil and governmental agencies but also private entities and industries. Certain components of preparedness are more critical for HNS spills, in particular health and safety aspects. Therefore, aspects relating to Personal protective equipment (PPE), decontamination and monitoring must be thoroughly prepared.

Once the scope and objectives have been clearly defined, the overall preparedness process will follow different steps which are illustrated in the diagram in Figure 6 below. This is no different

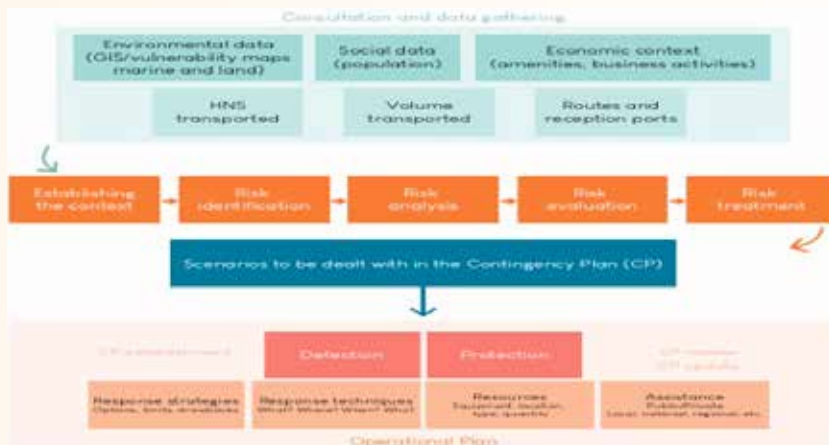
to oil spill response preparedness but has added focus on the challenges posed by HNS.



(Figure6) : Figure 6. Main Steps in HNS Preparedness

Understanding and assessing the risk posed by transported chemicals is an essential starting point for developing the contingency plan. Conducting a risk assessment is a multi-sectorial effort. By modelling and analysing volumes of chemicals transported locally or regionally, a representation of risk can be derived.

This must be coupled with the likelihood of a spill occurring as well as determining the probable consequences for the health and safety of workers and the population, whilst identifying environmental and economic resources that could potentially be affected. The incorporation of local marine/land sensitivity data as well as weather conditions into the assessment can further improve the risk assessment process. All this data drives the determination of likely spill scenarios (Figure 7).



(Figure7) : Figure 7. Development of a Contingency Plan

The challenges of an HNS incident are specifically linked to the location of an incident (at sea or in port) and can be very diverse. Therefore, it is essential to tailor risk assessments to the reality of the risks for each location or each situation. An example of typical challenges is shown in Figure 8.

Remember that, in addition to the HNS dimension, the incident will also have an oil spill threat from the vessel's fuel and machinery.

		Port	At sea
Evaluation	Detection	Can be stationary and computerised Otherwise led by a dedicated specialised team	Specialised team to be sent on board with dedicated equipment (logistics to plan) Aerial detection should be considered
	Resources	Specialised team Assisted by and headquartered in the harbour area	On board for immediate actions (specialised crew member) External specialised team sent on board Support and decision-making at external headquarters on shore
	Information access	Information on extent of contamination relatively easy to obtain	Potentially difficult to assess
	Affected area	Heterogeneous	Homogenous
Hazards	Modelling	Usually difficult due to the lack of reliable data and micrometeorological phenomena near shore	More complex in areas close to the coast and in sheltered areas Bathymetric and current data to be integrated into the model
	Navigation	Floating & sinking containers	Floating or sunken containers
	Amenities	Nearby and very exposed	Remote and not very exposed (except in the case of onshore winds)
	Other legitimate uses	Navigation, etc.	Commercial, touristic, fishing activities Water intakes/outfalls to be careful of
Evacuation if required	Crew	Relatively straightforward	Asset depending, potentially challenging
	General public	Might become necessary in case of toxic gas cloud for example	Unlikely to occur
Response	Personnel, vessel and equipment availability	Potentially in close proximity	Not readily available
	Strategies and techniques	May be possible and recommended to contain and manage spill	Potentially difficult to contain and manage Monitoring to be planned

(Figure8) : Typical HNS Challenges

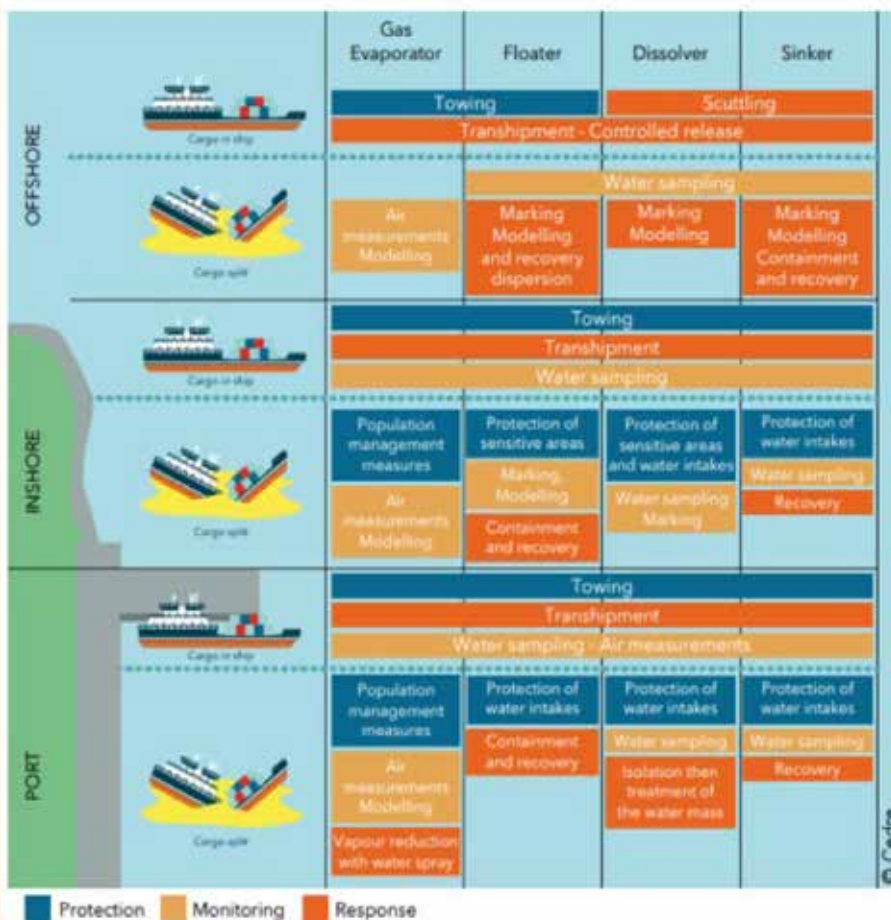
(4-2) : HNS Response Strategies

Preparing an effective operational response requires understanding the various incident scenarios that could be encountered. To make these scenarios as realistic as possible, they should be based on past incidents and a recent analysis of the context, and the risks associated with activities involving HNS.

The response strategies are essentially dictated by three criteria:

- the accident area (offshore, inshore, port area)
- the location of the product (in the vessel or the HNS release point)
- the behaviour of the product spilt

Figure 9 shows a range of potential accident, locations and behaviours.



(Figure9) : Typical HNS Scenarios

The selection of suitable response techniques can be heavily influenced and restricted by various factors: extreme weather conditions, hazards

of HNS spilled, remote locations, and proximity to highly sensitive areas. Strategies should be focused on clear, attainable goals by taking into account a number of inputs:

- health, safety and security issues for responders and the public
- regulatory requirements and restrictions regarding the use of specific strategies (dispersion or in situ burning for instance)
- equipment availability and mobilisation timeframe
- sensitive sites within the potentially impacted area

All response techniques have advantages and disadvantages. A response strategy therefore generally consists of a combination of techniques. An appropriate strategy for a minor scenario may comprise one or two techniques. Scenarios that are more complex may require various combinations of techniques at different tier levels, possibly in different locations or for varying seasonality. Whatever the case, the strategy should be established in consultation with the stakeholders, with consideration given to the greatest net environmental benefit.

The NEBA (Net Environmental Benefits Analysis) process provides a useful framework to achieve science-based planning and stakeholder consensus prior to, and away from, the emotive atmosphere prevalent at the time of a spill. It weighs up the advantages and disadvantages, or trade-offs, of the available techniques so that an effective response may be formulated to achieve the maximum overall benefit for the environment.

The term NEBA (Net Environmental Benefits Analysis) has been used to describe a process for guiding the selection of the most appropriate response option(s) to minimise the net impacts of spills on people, the environment and other shared resources. Considering that the selection of the appropriate response action(s) may be in practice guided by additional considerations, the oil and gas industry sought to transition to a term that also reflects the process, its objectives and the decision-making framework. In 2016, the term Spill Impact Mitigation Assessment (SIMA) was introduced to encompass ecological, socio-economic and cultural considerations. This new term also eliminates the perceptions associated with the word 'benefit'.

Regardless of terminology, effective implementation of NEBA/SIMA processes is incumbent on the use of competent and knowledgeable experts to understand specific event conditions and local resources, and make reasonable response trade-off decisions.

(4-3) : Response Options

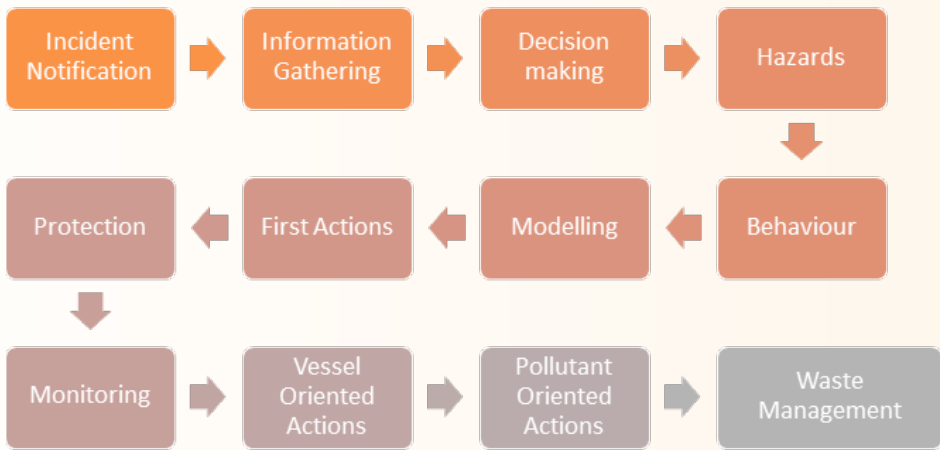
There are no universally applicable response and intervention techniques in case of incidents involving HNS at sea: each response to tackle a release at sea and mitigate the potential impacts is unique and depends on numerous variables:

- The list of HNS potentially involved in a spill is very long and their behaviour is difficult to predict
- The complexity is increased by the specificities of the incident location, environmental conditions, possible mixing of chemicals, reactivity, etc.
- The level of preparedness as well as the availability of suitable equipment and training level are key factors in the effectiveness of the response.

The Marine HNS Response Manual aims to guide involved personnel (decision-makers, responders) through the different phases of a marine HNS emergency and assist with the response.

The response phases are not necessarily sequential, they may be carried out simultaneously, always keeping in mind that the priority objective must be to save lives in danger and to preserve the health of responders.

Chronologically the following phases and actions can be identified (Figure 10).



(Figure10) : Key Steps in HNS Response

4-3-1 : Notification

Notification of an incident involving HNS can be received via:

- ship reporting system produced by the captain of the casualty or a responding or passing vessel;
- Pollution Report (POLREP) by a coastal state as part of their intergovernmental pollution notification system
- pollution observation report/detection log produced by a trained aerial observer
- pollution observation report from overflying aircraft (usually reported via Air Traffic Control)
- automated spill response notifications (satellite-based surveillance)
- unofficial written/verbal reports from members of the general public (report of visually observed pollution in port for example).

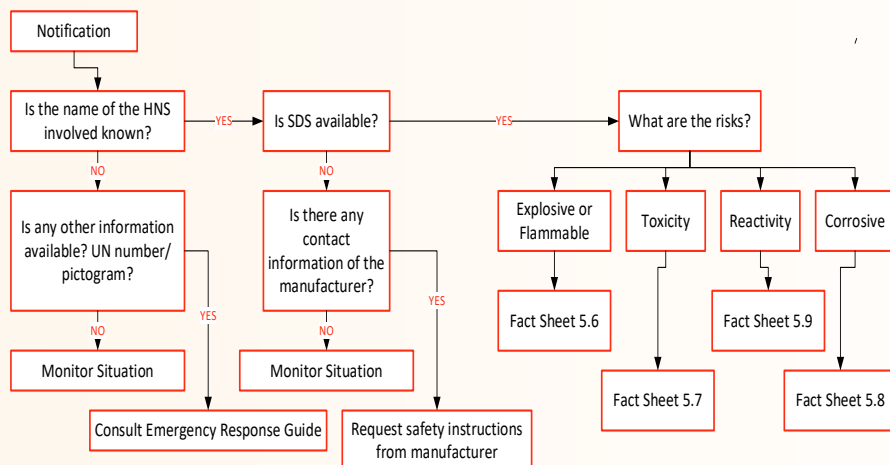
The level of detail of any initial report will be dependent on whether there is a direct link between the pollution observed and the polluter: if there is no attributable source to the pollution observed, information about the type of cargo spilled will not be immediately available but instead will need to be gathered by first responders on site through monitoring and sampling.

4-3-2 : Data Gathering

Once the initial incident notification has been received, it is crucial for decision-makers and responders to gather objective information about the case to support the first response actions.

Initially, data might be scarce and difficult to verify. However, with time and access to various information sources, the overall understanding of the situation increases. The quantity of incoming information might be challenging to verify, prioritise and filter.

Figure 11 depicts the decision-tree based on the HNS Hazard. Refer to the Fact Sheets in the Marine HNS Response Manual for further information.



(Figure11) : Decision-tree based on HNS Hazards

4-3-3 : Response Considerations

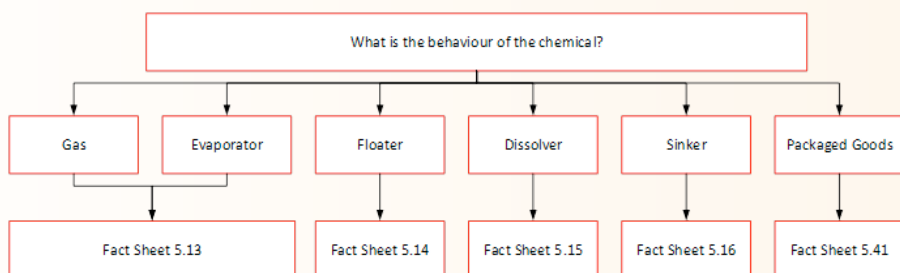
The decision-making process should not be improvised. As far as possible, the structure, organisation, resources (human and material) and procedures must have been prepared and included in the contingency plan as a reference document.

However, every incident is unique, and the incident management team will have to make important decisions in a context of potentially high pressure, especially from media or political leaders. It will be necessary to make crucial decisions quickly, sometimes with a very incomplete picture of the situation. The Incident Management Team must be capable of making reasonable decisions, tailored to the situation and the extent of the pollution (Tier 1, 2 or 3).

Risks can be generated by the HNS transported but also by the vessel's bunkers. It is important to note that the propulsion fuels currently in use may be of different natures. The risks and behaviour of these products must therefore be taken into account, as well as possible mixtures or reactions with a cargo of HNS, or interactions related to environmental conditions (e.g. contact between a gas and a nearby source of ignition).

Considering these aspects, the first actions are mostly orientated towards protecting the population, the environment or amenities.

Figure 12 depicts the decision-tree based on the behaviour of the chemical. Refer to the Fact Sheets in the Marine HNS Response Manual for further information.

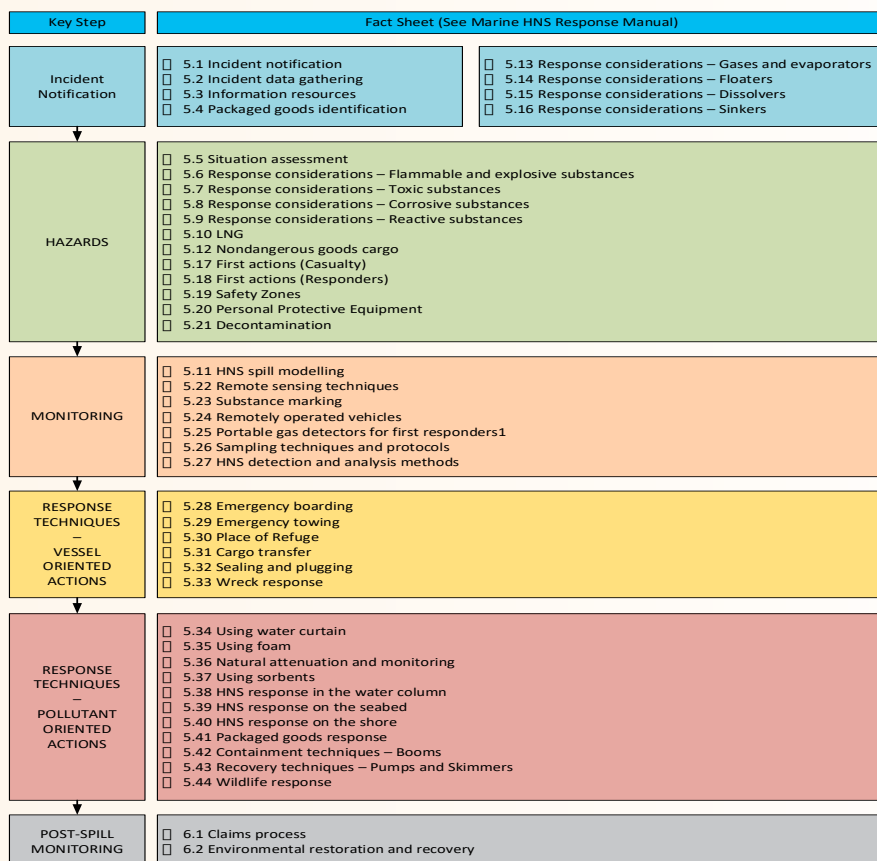


(Figure12) : Decision-tree based on the behaviour of the substance

Knowledge of both chemical hazards and behaviour represents decisive information required to drive the response with the most suitable approach. Indeed, the response tactics are mostly based on the behaviour of the chemical, while hazards must be considered with the greatest of care to continue to conduct the response in safe conditions.

4-3-4 : Fact Sheets

Fact sheets have been established to help decision-makers select possible techniques to respond to the vessel or the pollutant. These are shown in Figure 13 which describes them according to the key steps in the response.



(Figure13) : Fact Sheets according to Key Steps in the Response

The fact sheets can be found in Chapter 8 (pages 86 – 283) of the Marine HNS Response Manual. Responders are encouraged to make themselves familiar with the advice in the Manual and to consult it during response operations for guidance.

(5) Appendix 1

References and Further Reading

References:

These guidelines have been adapted to PERGA's needs from the Marine HNS Response Manual developed by the Western Mediterranean Region Marine Oil and HNS Pollution Cooperation (West MOPoCo).

The Western Mediterranean Region Marine Oil and HNS Pollution Cooperation (West MOPoCo) project supported Algeria, France, Italy, Malta, Morocco, Spain and Tunisia in collaboration with Monaco in strengthening their cooperation in the field of preparedness for and response to oil and Hazardous and Noxious Substances (HNS) marine pollution and in improving the quality and interoperability of their response capacities.

The Project was implemented through an inter-regional effort, including the participation of the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC), the Bonn Agreement for the Greater North Sea and its approaches and the Helsinki Commission (HELCOM) for the Baltic Sea. The project benefits from the technical support and expertise of expert partner institutions such as Cedre, ISPRA and ITOPE.

The present Manual has been developed by Cedre, ISPRA and ITOPE in the framework of the West MOPoCo project at the request of the Secretariat of the Bonn Agreement, HELCOM and REMPEC, to provide state of the art information on HNS pollution preparedness and response. The competent national authorities of Member States of the three regional conventions were consulted at each step of the drafting process, to ensure the Manual meets their operational needs and to enrich it with their national experience in responding to chemical spills

at sea.

This Marine HNS Response Manual is available at www.westmopoco.rempec.org.

Further Reading:

IMO:

- IMO OPRC – HNS Protocol 2000 – 2002 Edition (E556E)
-
- MO Manual on Chemical Pollution – Section 1 – Problem Assessment and Response Arrangements – 1999 Edition (Reference KA630E)
- IMO Manual on Chemical Pollution – Section 3 – Search and Recovery of Packaged Goods Lost at Sea – 2007 Edition (Reference KA633E)
- MO Manual on Chemical Pollution – Section 3 – Legal and Administrative Aspects of HNS Incidents – 2015 Edition (Reference I637E)

Copies of the above IMO publications can be obtained from IMO Publishing (sales@imo.org)

CEDRE – Operational Guides (<https://wwz.cedre.fr/en/Resources/Publications/Operational-Guides>)

ITOPF Technical Information papers (<https://www.itopf.org/knowledge-resources/documents-guides/>)



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