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Are SDS/MSDS relevant in case of chemical spill at sea?

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ABSTRACT

Responses to Hazardous and Noxious Substances (HNS) incidents differ from oil spills as it is often difficult or impossible to contain, recover or neutralise a chemical spilt at sea. A specific scenario could be developed prior to the incident to generate data on the safety zones (atmosphere and fishing) in order to protect human life and health (responders, crew, and general population).

In a chemical spill at sea, the first action is to obtain relevant information on the substance(s) in order to develop a first assessment of the hazards and risks, despite all uncertainties associated with first line response. The first documents often used by authorities and response experts are the Safety Data Sheet (SDS) or the Material Safety Data Sheet (MSDS) of the substance. SDS/MSDS provide detailed information in a standardised form on the chemical properties of the substance (or a family of substances). On the one hand, this information may be too specific for those not familiar with chemistry while on the other hand no specific information regarding marine incidents is provided. In particular, they lack on information on the behaviour of the chemical when spilt to the marine environment (SEBC[1] classification) and information on the GESAMP[2] classification.

Depending on the type of substance, HNS response operations may be limited to the monitoring and securing the disabled ship in order to recover the remaining chemical on board. Nevertheless, it is the responsibility of affected state(s) to be prepared to respond to all types of HNS incidents. The access to response related information focusing on the maritime transport of HNS is fundamental to provide relevant information to the responders.

This paper describes the various elements required to fulfil these tasks.

[1] SEBC: Standard European Behaviour Classification
[2] GESAMP: Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection

INTRODUCTION

The maritime transport of HNS encompasses risks for the ship, its crew and the environment. The prescription of construction standards and rules for ships carrying HNS mitigates those risks. Nonetheless incidents involving HNS occur and EU Member States' emergency response authorities must be prepared to respond (in some way) to any and every type of HNS.

A fundamental need in an HNS incident is the identification of substance(s) involved. HNS definition covers a great number of substances with different properties, hazards and behaviours. This basic requirement for HNS response is not always easy to fulfil upon an incident. Particularly for packaged goods, a ship might carry dozens of different substances with different properties which may react with each other, react with water or polymerise. Although the segregation according to the type of substance is foreseen in the maritime transport regulations, in an incident the situation might rapidly evolve to unforeseen events.

Consequently, specific information regarding inherent properties of the substance(s) is (are) needed for hazard and risk evaluation of the incident to the public, the responders as well as the potential response operations. The nature of the substance(s) involved will define the response operations to be mobilised.

The producers of the HNS are the most knowledgeable in respect to the chemical and physical properties of HNS. Chemical legislation requires that manufacturers and importers of a substance to communicate how their substances can be used safely for humans and environment. The main instrument for this communication is through the Safety Data Sheets (SDSs). In some countries it is named MSDS (Material Safety Data Sheets). These are product related standardised documents composed of 16 sections which provide information on a very wide range of aspects of occupational health and safety, transport safety and environmental protection.

In a HNS incident the information needs for the response operations vary depending on the stage of the emergency response. At a first stage the focus is on concise and basic information on the substance(s) involved or potentially involved in the incident. SDS/MSDSs with specific maritime related information can fulfil these requirements. At a second phase more precise information related to the ship integrity is needed in order carry out an assessment of the incident. Finally at third phase information related with the salvage, pumping of cargo and fuels is needed in order to evaluate possible impacts.

WHY SDS/MSDS ARE NOT ENOUGH?

Although SDS/MSDSs are readily available sources of information that can be used in HNS incident pollution response, they lack specific information related to maritime pollution response. The maritime transport of HNS gathers some exceptional conditions when compared to land based transport. The HNS maritime transport comprises long distance transport sometimes in adverse weather conditions, which may constrain and delay the emergency response operations. In addition, it often involves the transport of large quantities of HNS, sometimes including incompatible substances which might lead to an escalation of the incident. In order to handle these particulars, specific regulations have

been developed for the maritime transport of HNS which are not included in the SDS/MSDSs.

Though SDS/MSDSs should include the provision of basic classification information on the transport/shipment of substances, the information provided is not self-explanatory. The IMO Maritime transportation codes (IMDG[3] code, IBC[4] code and IMSBC[5] code) define how the HNS must be carried on-board: the ship type; tank type, ventilation needs, fire protection, loading requirements… which are required by law and fundamental for minimising the risks of maritime transport of HNS. They provide specific information on segregation and stowage of packaged and bulk HNS on board a vessel. This information should be included and explained in order to provide to the responders the maximum available information on the existing safeguards on board due to maritime transport regulations. In addition, information related to maritime pollution response on board of ships should be included. Information related with emergency response measures to be taken on deck and in confined spaces, how to access (containers), the integrity of vessel structure and remote (offshore) location are relevant and should be made available in order to help the emergency responders' decision.

Specific criteria, thresholds and procedures have been developed for classifying HNS that may enter in the marine environment through operational discharge, accidental spillage or loss of overboard containers from ships. This evaluation includes the effects to the aquatic environment, to the human health and the potential interference with other uses of the sea by means of an easily understandable GESAMP[2] hazard profile for the substance(s) involved. Despite its relevance, the GESAMP hazard profile is not included in the SDS/MSDSs.

Additionally a joint European system for classification of chemicals once spilt into water (SEBC[1]) has been developed. It is based on the physical behaviours in water and it is very relevant for emergency responders because it helps and simplifies the HNS response operations by combining the HNS into physical behaviour categories (e.g. dissolvers, evaporators, floaters, sinkers and combinations) facilitating the decision making on the type of response operations to be mobilised. However this type of information is also not part of the standardised information included in SDS/MSDSs. Despite its usefulness, the aggregation and consequent simplification into physical behaviour categories entails important limitations that must be considered by the emergency responders as it does not take into consideration the hazards and the risks associated with the spilt HNS.

LIMITATIONS OF HNS RESPONSE OPERATIONS

Usually the HNS maritime transport in bulk entails more risks than HNS transported in packaged form. In case of a spill involving HNS transported in bulk, the substance will be in direct contact with the environment. For HNS transported in packaged form, the container can prevent or delay the spread of the HNS over the environment. Additionally the bulk

[3] International Maritime Dangerous Goods Code
[4] International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
[5] International Maritime Solid Bulk Cargoes Code

transportation normally involves larger quantities than in packaged form. Though the quantity spilt is not the only factor for assessing the impact of HNS spills. A small spill involving a highly toxic substance can have similar or worse impacts than a large spill, depending on the substances' properties.

In HNS incidents the time factor is crucial. The window of opportunity can be very small and it is dependent on the type of substances. In addition, the distance can hamper and delay the timely arrival of emergency responder teams. However, depending on the type of substance (e.g. evaporators) the time factor can benefit the response operations by reducing the hazards and risks through the natural evaporation of the HNS in specific cases.

In a HNS incident the first level of response should rely on the rescue of the ship's crew if still on board, their safety and the responder's safety. This first analysis should also provide a first assessment on the ship's integrity, the amount of chemical released to the environment and the remaining chemical inside the ship. The next step of response should focus on the containment and the recovery of the HNS in order to minimise the spill impacts to the marine environment and the public safety.

For HNS transported in bulk, the response/neutralisation actions on the spilt chemical might be very limited or impossible beyond the monitoring and the establishment of safety zones. For substances that dissolve and evaporate, little can be done in respect of recovery as the substance will quickly spread into the water column or into the atmosphere. For floaters and eventually for sinkers there are more response options possible, however those will depend on the persistency of the substance and the mobilisation time for the response operations. In reality most of the times not all the cargo is released to the environment, therefore the transfer of the remaining chemical substances to a different tank or lightering to a different ship are potential response operations to prevent the worsening of the situation.

For HNS in packaged form the focus should be on the recovery and closure of the damaged containers avoiding the release of HNS to the environment. If still on board and leaking then it should be sealed or enclosed in a larger container. If lost overboard then the recovery is more difficult depending on its position and the feasibility of its recovery.

In addition to how the substances behave once spilt in water, a number of other scenarios may happen depending on the properties and resulting reactivity of the substances. If a chemical substance is released it may spread and react with other substances on board. The potentially resulting reaction products and their hazardousness must be evaluated and considered in the first assessment of the situation. This scenario is more probable for packaged goods where typically the number of different HNS on board is higher. A chemical substance may also react with water and air once it is released from its container or tank. In this case the HNS responders will have limited control or to stop the reaction. Another possible scenario is the polymerisation or self-reaction of substances on board. In many cases it is impossible to stop such chemical reactions. In addition this self-reaction may be exothermic, which might contribute to worsen the situation putting other substances on board at risk.

In addition to all the limitations and risks mentioned above, there are other factors that may jeopardise the HNS response operations. Quite frequently HNS are not properly

declared as danger goods in the cargo manifests, or declared under trademarks or other improper names. Particularly for packaged danger goods transported inside container boxes, the cargo manifest is the only way to identify the HNS and its inherent risks. In case of mis-declarations the safety of the response operations may be at risk.

PROPOSED WAY FORWARD

As discussed above, one of the priority requirements when dealing with an HNS pollution incident are the identification of the hazards and an assessment of the risks posed by a stricken vessel and its cargo. The primary factors that determine the safety, environmental and socioeconomic impacts of the released HNS material(s) relate to the chemical and physical properties of the material spilt and its physical fate in the environment.

HNS response operations are limited and strongly dependent on the substance type. Nevertheless national emergency response authorities must be prepared to respond to these types of incidents. The public and responder safety, the environment and the socioeconomic assets that a state or coastal community depends upon are too valuable and must be preserved.

Due to the broad meaning of HNS, the definition of contingency plans to respond to each and all substances is impracticable. Therefore the grouping and aggregation of HNS into categories simplifies the emergency response operations. However, as mentioned before, this approach entails limitations that must properly be considered by the responders. The development of specific scenarios prior to the incident to generate data on the safety zones (atmosphere and no-fishing areas) in order to protect human life and health (responders, crew, and general population) could help dealing with this limitation. This approach would allow the command centre teams to predict possible impacts and therefore to optimise the distribution of response means in order to reduce and minimise the effects of the incident.

These scenarios require information coming from various sources: the manufacturer of the chemical substances, research centres and expert networks, in order to take into account, as close as possible, the specificities of a real HNS incident. In addition to this, the scenario parameters could be defined based on risk assessment. This scenario approach could lead to a better preparedness of EU Member States to a HNS incident.

CONCLUSION

The level of information needs during a chemical spill depend on the response phase. For the initial response dedicated maritime transport information regarding the HNS physical and chemical properties is fundamental. SDS/MSDSs are available resources that, if complemented with specific maritime information, can fulfil the first level of information requirements. Information on the existing safeguards on-board, specific emergency measures on-board of vessels, the physical behaviour of chemicals once spilt into water and GESAMP hazard profile are examples of maritime specific information. These extended

“SDS/MSDS” should be readily available for response planners and responders in a chemical spill. In all cases the information provided must be relevant, easy to access and readily understandable by first responders. The more it reflects the maritime transport reality, the better it will serve the HNS responders.