Developing the Evidence Base around Gaseous and Volatile HNS Hazards and Incident Response.

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Introduction

Maritime accidents involving gaseous or volatile Hazardous and Noxious Substances (HNS) can be challenging due to their potential to form toxic or combustible clouds requiring prompt actions to protect human health and the environment.

To better understand the challenges a review of the existing evidence of such incidents, their impacts and response strategies was undertaken by UK Health Security Agency (UKHAS) as part of a 2 year European project called MANIFESTS (**MAN**aging risks and **I**mpacts **F**rom **E**vaporating and gaseous **S**ubstances To population **S**afety)[i].

Methods

A range of national and international maritime accident databases were reviewed in parallel to a systematic review of published scientific literature.

The review applied a defined search question and keywords and covered a 20 year period from 2000, in order to provide sufficient data to assess trends and to be aligned with relevant legislative controls and accident reporting procedures.

In addition, UK stakeholder agencies were invited to take part in an on-line survey to provide their views and experiences regards response and decision-making mechanisms for maritime and port incidents involving airborne releases.

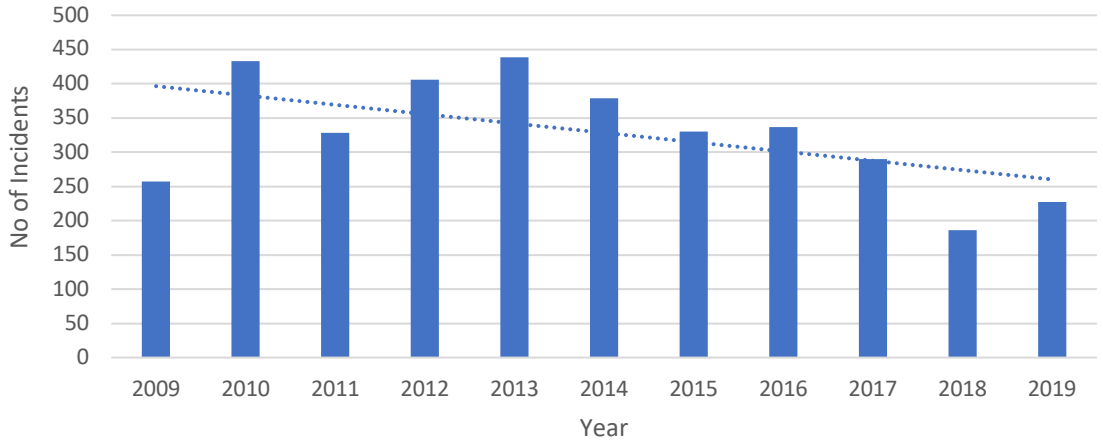
Results / Discussion

Statistics for 2020 suggest there were around 62,000 vessels in the world trading fleet and by deadweight tonnage, the fleet has doubled in size since 2005[ii].

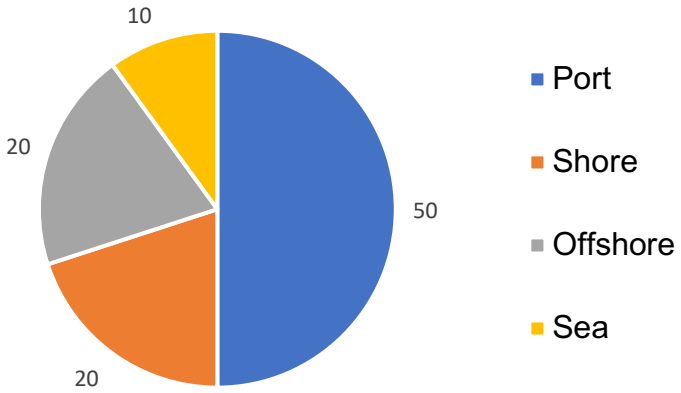
Global databases such as that of the International Maritime Organisation[iii] indicated around 200 to 400 very serious and serious incidents annually with some suggestion of a decline in numbers over time.

Incidents involving gas and volatile HNS airborne emissions represented less than 1% to 3% of this total, with many occurring in ports or near the shore[iv].

Annual Maritime Accidents (Very Serious and Serious) based upon IMO statistics[iii]



Location of Airborne Release Incidents (based upon NOAA statistics)



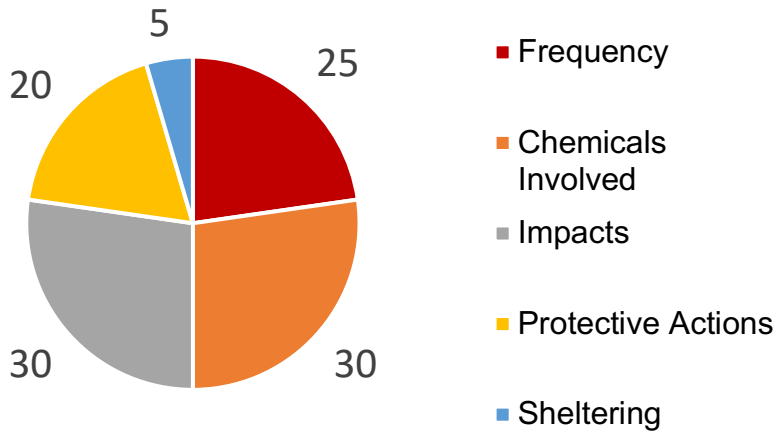
Several HNS were identified to be frequently involved in reported incidents including Ammonia, Chlorine, Hydrogen Sulphide and volatile hydrocarbons[v], while dense gas clouds represented the most common type of release reported[vi].

A review of 289 abstracts and 40 full papers suggested scientific studies of such incidents were limited, although a number of papers did present detailed reviews of events and their impacts. For example, a significant chlorine release from cylinders in the port of Mumbai in 2007 led to 120 people, including local residents, affected and seventy people suffering critical injuries[vii]. In another example, in 2004 the *Coral Arcropora* released 600 kg of Vinyl Chloride at its Berth on the Manchester Ship Canal with 33 workers and members of the public forced to shelter[viii].

Evidence was limited with regard to protection of wider communities. Where reported, the most common action undertaken was evacuation. Only 5% of papers cited

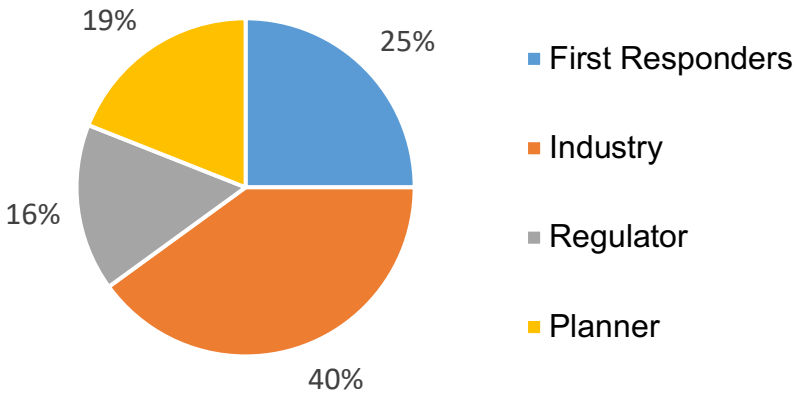
sheltering as an option. None of the papers discussed decision-making processes used for selection of protective actions.

Topics covered by papers reviewed in the study



The stakeholder survey provided 44 responses from a cross section of emergency planning and response agencies. Key findings suggested that all agencies had plans and procedures, but few were specific to maritime incidents involving airborne releases of HNS. Experience of actual maritime gas / volatile HNS incidents was limited and not all agencies felt well informed regards airborne releases. Most agencies relied on third parties for modelling and monitoring data requiring time to mobilise and receive information.

Stakeholder Survey: Organisation Type



Conclusions

Our review has identified that while shipping of chemicals and ship sizes are increasing, incidents generally appear to be reducing in frequency, and incidents involving gaseous and volatile releases are rare (less than 1% to 3% of all). However,

such incidents do occur and can impact communities, particularly when located near to coasts or in ports or harbours.

Our analysis has identified a number of hazardous gases and volatile HNS that are commonly associated with incidents, with dense gas clouds most commonly associated with releases.

There was little evidence of studies around the protection of communities during incidents and where protective actions had been reported there was little detail around decision-making or the consideration of shelter in place as an option despite evidence from land-based incidents of its potential usefulness[ix].

We believe this is a first review focussing on protective actions for gaseous and volatile HNS incidents and that the findings will help to develop and inform future guidance and training.

Recommendations

Based upon the findings it is recommended that guidance aligned with land-based approaches could be helpful to address potential gaps in contingency planning and incident management for HNS incidents involving airborne releases.

We further recommend that training and exercising for planners and responders forms a pivotal role in the use of any developed guidance.

We also propose that future marine and port incident investigation processes enhance the existing evidence-base through collection of data on chemicals involved in airborne releases, any actions taken to protect wider communities and the basis for the selection of those actions.

Acknowledgement

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References

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