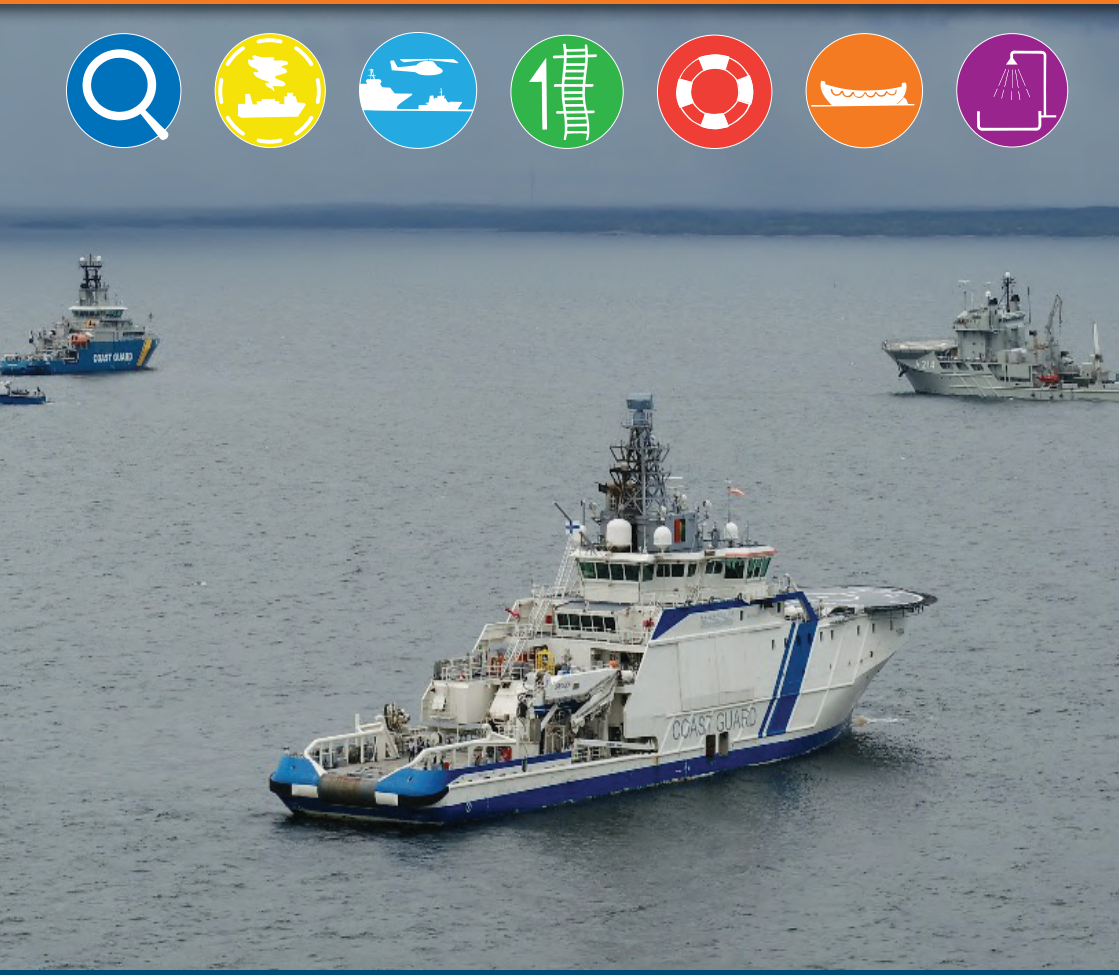
HANDBOOK
FOR

MARITIME SAR IN HNS INCIDENTS



OPERATIONAL PLAN STANDARD OPERATIONAL PROCEDURES CHECKLISTS

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Operational Plan and Standard Operational Procedures for Maritime SAR in HNS Incidents

DISCLAIMER The content of this HNS handbook has been produced in ChemSAR project in cooperation with nine different partners from five different Baltic Sea Region countries. The information given in this handbook is based on the work of the project partners and it has been prepared with due care to the best of knowledge. It should be anyhow acknowledged that the information provided is not in anyhow comprehensive. ChemSAR project or its project partners cannot be held legally responsible for the information provided in this handbook or on the decisions that are based on the information provided in these pages. This information does not replace or interfere with any international, national, regional or local decision procedures unless particularly decided so. Also national and organisational occupational safety regulations have to be followed in search and rescue operations.

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Cover photo: Balex Delta

Introduction

The starting point for the planning of all rescue operations for maritime hazardous and noxious substances (HNS) incidents should be saving human lives and getting persons under threat away from the hazardous area and to safety. Actions aimed at preventing or limiting environmental damage are carried out during rescue operations if they can reduce the immediate threat to human life and health or prevent further damage without delaying the objective of getting all people to safety. There should also be sufficient resources, i.e. capabilities and capacities to carry out such response measures. The units and organisations that carry out these maritime response measures on-scene following maritime search and rescue (SAR) operations are often the same as those that carry out the initial rescue operation.

Incidents involving HNS are often broad in their impacts and often pose a challenge for rescue operations. Depending on the type of incident and properties of the substance, compound or compounds in question, the possible consequences for human health are often significant and immediate, in contrast to the impact of an oil spill. Incidents involve large uncertainty factors and time constraints, as well as the properties of the substances transported, and so the final results can be impossible to predict. The vessel carrying dangerous cargo may be transporting a number of different substances, so an incident may lead to a risk of a dangerous reaction, fire or explosion when these substances are mixed together. That may also lead to the production of toxic vapours/fumes.

During HNS incidents, both incident management and executed rescue operations demand a special understanding of the substances in question and their properties. If the incident takes place at sea, the capacity of a single state to respond to the challenges of such rescue operations is limited, and the need for international assistance is often evident. In addition to the matters listed above, there is great variation between states in terms of command systems, preparedness, resources and operationally capable units for the management of sea rescue operations involving hazardous and noxious substances. For both the organisations

and individuals involved, there may be large differences in both capacities and preparation levels (regarding equipment, training and operating models).

The purpose of these ChemSAR documents (operational plan and operational procedures, referred to as standard operational procedures SOPs) is to increase the rate of saving human lives in maritime incidents where HNS can have an effect on-scene. Rescue operations in these kinds of situations can change rapidly from an emergency towing of a distressed vessel to a safe harbour to, in the worst case, evacuation of the whole vessel and isolating the dangerous area from other maritime traffic.

The objective of the ChemSAR Operational Plan (OP) and Standard Operational Procedures (SOPs) is to enhance the preparedness for international rescue operations in maritime incidents involving HNS and to clarify and harmonise the processes already in use. The operational procedures are primarily aimed at standardising the operations of rescue organisations in these kinds of incidents. Additionally, the actors involved in rescue operations already often have their own organisation- or unit-specific instructions and operating methods during the actual rescue operations on-scene. A secondary goal is to provide shipping companies and the vessels' crew supplementary information on the procedures of the rescue operation involving HNS. Behind the development of the standard operational procedures has been the idea that they would be applicable for use also in smaller scale HNS rescue operations, as well as in situations which do not initially pose a significant HNS danger.

Note! Radioactive substances have not been included in the ChemSAR framework.

The international and national legislation as well as organisation-specific merchant shipping instructions and guidelines set the obligations and required actions for a distressed vessel's crew during a HNS incident. The purpose of these ChemSAR standard operational procedures is not to increase the workload of the crew of a distressed vessel, but rather to harmonise the actions of different actors during rescue operations involving HNS.

Photo: The Finnish Border Guard

SAR in HNS Incidents

General – HNS

Hazardous and Noxious Substances (HNS) transported at sea are defined in the Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances (OPRC HNS 2000 protocol) as all substances other than oil which, when released into the water due to a leak or some other cause, are dangerous to people, the environment and general well-being. In relation to ChemSAR, this HNS definition is considered to also include on a general level other dangerous goods or hazardous materials transported by sea.

HNS can be defined as substances or compounds which have the properties of being flammable, explosive, toxic, corrosive or reactive. These can be further categorised according to the physical dangers (1), reactivity (2), and physical behaviour (3) that they cause or exhibit.

1. Physical dangers

Categorisation of HNS according to type of danger posed can be seen, for example, in the IMDG code (International Maritime Dangerous Goods Code), in which HNS are divided into nine categories according to their danger type based on the UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS). These categories are explosives, gases, flammable liquids, flammable solids, oxidisable compounds, poisons, substances and corrosive substances. (Radioactive and miscellaneous substances are not included within the GHS.)

Table 1: IMDG categories 1–9

Class 1	Explosives
Class 2	Gases
Class 3	Flammable liquids
Class 4	Flammable solids
Class 5	Oxidising agents
Class 6	Poisons
Class 7	Radioactive
Class 8	Corrosives
Class 9	Miscellaneous

This IMDG categorisation system is based on the principles that substances in the same category should have as similar danger properties as possible, that each substance should belong to only one transport category, and that substances may pose secondary dangers. Categorisation is made based on the most significant danger posed. According to the IMDG, the shipping name used in the documentation should be the so-called Proper Shipping Name (PSN). It should be noted that there are also compounds and mixtures that are categorised as dangerous but which do not have a specific UN number or name in the IMDG code. These are categorised with other compounds with similar hazards using the UN group numbers.

2. Reactivity

In terms of reactivity, HNS can be divided into groups according to whether the substance reacts with water, is reactive in itself (polymerization), is reactive with other substances or is biodegradable. A reactive substance does not normally present a threat in itself, but rather it is heat or the result of a reaction which causes danger.

3. Physical behaviour

HNS can also be divided into groups according to their behaviour in water, in air, on the water's surface, on the seabed or by any combination of these. There are four different main groups: substances which evaporate, those that float on the surface of the water, those that dissolve into the water, and those that sink to the seabed. (Table 2)

Rescue vessels arrive on scene sometime after the incident has happened thus they probably have to deal with HNS which are in gaseous form. For this reason, in the ChemSAR project, focus is put on volatile substances and gases (as well as substances that appear in aerosol form). These volatile substances are liquids which evaporate at ambient temperature, forming gas clouds. Gases are chemicals which cannot condense into liquids at ambient temperature and pressure. For this reason, many gases are transported in a pressurised and/or cooled state. If such a substance is released, it evaporates and is mixed into and diluted by the gases in the air, forming a gas cloud. (Table 3)

Table 2. Examples of chemicals in the 12 Property Groups.
Source: HELCOM Manual on Co-operation in Response to Marine Pollution Volume 2

Fate	Group	Properties	Examples of Behaviour Groups
Evaporate immediately (Gases)	G	Evaporate immediately	Propane, butane, vinyl chloride
	GD	Evaporate immediately, dissolve	Ammonia
Evaporate rapidly	E	Evaporate rapidly, float	Benzene, hexane, cyclohexane
	ED	Evaporate rapidly, dissolve	Methyl-t-butyl ether, vinyl acetate
Float	FE	Evaporate, float	Heptane, turpentine, toluene, xylene
	FED	Evaporate, dissolve, float	Butyl acetate, isobutanol, ethyl acrylate
	F	Float	Phthalates, vegetable oils, animal oils, dipentene, isodecanol
	FD	Float, dissolve	Butanol, butyl acrylate

Fate	Group	Properties	Examples of Behaviour
Dissolve	DE	Dissolve rapidly, evaporate	Acetone, monoethylamine, propylene oxide
	D	Dissolve rapidly	Some acids and bases, some alcohols, glycols, some amines, methyl ethyl ketone
Sink	SD	Sink, dissolve	Dichlorometane, 1,2-dichloroethane
	S	Sink	Butyl benzyl phthalate, chloro-benzene creosote, coal tar, tetra ethyl lead, tetramethyl lead

Table 3. Categories of HNS behaviour and the physico-chemical characteristics (density, vapour pressure and solubility) on which the categorisation is based (the density is specified as 1023 Kg/m^3, this might vary in different locations depending on the saltinity). *Source: BONN Agreement Counter Pollution Manual*

Behaviour classes	Density	Vapour pressure		Solubility		
		Kg/m^3	Pascal	Gas	Liquid	Solid
Gases, Evaporators	Evaporator	<1023	>3000	≤10	≤1	–
	Evaporator/ Dissolver			>10	>1	
Floaters	Floater		<300	–	≤10	>10
	Floater/ Evaporator		300-3000			–
	Floater/ Evaporator/ Dissolver				0.1-5	
	Floater/ Dissolver		<300			10-99
Dissolvers	Dissolver		≤300		>5	>99
	Dissolver/ Evaporator		>1000			–
Sinkers	Sinker	>1023	–		≤0.1	<10
	Sinker/ Dissolver				>0.1	10-99

Often the hazard classification is combined with the substance's behavioural classification, in which case the following six categories can be distinguished: explosive gas clouds, toxic/carcinogenic gas clouds, explosive and toxic gas clouds, floating stable masses, toxic/carcinogenic/bioaccumulative masses in the water body, and sinking stable substances.

Individual HNS may have a number of chemical names or may be separated into different product names, so identifying a substance can be time-consuming. According to the IMDG, the charterer should deliver the information regarding the HNS to be shipped to the parties responsible for the transport. In case of accident, this information is available for the purpose of identifying and itemising the substances from the master of the vessel, the ship agent or the ship operator/shipping company. The IMO Dangerous Goods Manifest, a standardised form for the transport of dangerous substances, contains the Proper Shipping Name (PSN), UN number and category and information on its polluting effects in a marine environment. In order to more precisely specify a substance or compound, more detailed information is often needed, including the Chemical Abstracts Service (CAS) number, the substance's specific properties and the risk factors associated with it. This information is available from the Material Safety Data Sheet (MSDS).

HNS is transported by sea either as bulk cargo (liquid/solid) or packaged. The objective of the regulations laid down for transporting dangerous substances is to reduce the risks associated with transport and handling. These international regulations and decrees are founded on efforts to reduce the damage to people, property and the environment caused by the possible leakages of these substances. International regulations giving directions on the transport of HNS include the International Convention for the Safety of Life at Sea (SOLAS, 1974) and the International Convention on Maritime Pollution (MARPOL 73/78). The documents of the International Maritime Organisation (IMO) supplement hazardous and noxious substances according to transportation mode and cargo type. These include the following codes:

- International Maritime Dangerous Goods Code IMDG. The IMDG Code includes standardised requirements for packing,

marking and documentation for the transportation of HNS in packaged form.

- The International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC). The IBC Code sets the safety standards for transporting chemicals in liquid form. The code includes substances and compounds divided into categories X, Y, Z and OS, based on the possible hazard to either marine resources or human health.

Photo: Balex Delta

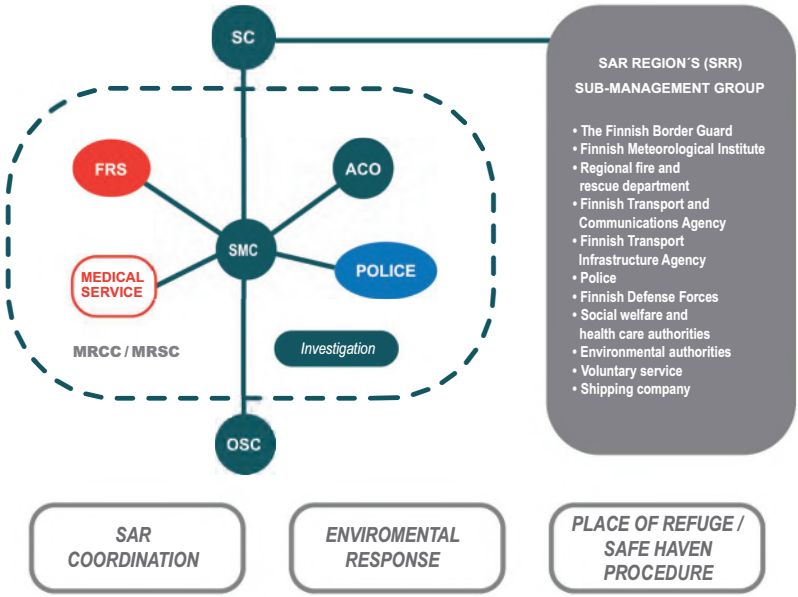
- The International Maritime Solid Bulk Code (IMSBC). In the IMSBC Code, the cargo is categorised into the following three different groups: A-cargo that can liquefy, B-cargo that poses chemical risks, and C-cargo that does not liquefy and does not pose any chemical risks.
- The International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC). The IGC Code sets the standard for transporting liquefied gases and some other compounds by sea.

Table 4: Examples of IMO Conventions and Codes providing HNS lists.
Source: ITOPF Technical Information Paper 17

HNS material	Conventions & Codes
Oils carried in bulk	Appendix I of Annex I to the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL73/78)
Bulk liquids	Chapter 17 of International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and also Appendix II of Annex II to MARPOL 73/78
Gases	Chapter 19 of International Code fo the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)
Solids in bulk	Section 9 of International Maritime Solid Bulk Cargoes Code (IMSBC Code) if also covered by IMDG Code in packaged form

Command

When the maritime HNS incident involves a threat of danger to human life or health, a Maritime Search and Rescue (SAR) operation will be executed. These rescue operations are guided by both international and national laws and regulations. The responsibility for maritime rescue operation is assumed to always be on the Rescue Coordinating Centre (RCC) – usually the Maritime or Joint Rescue Coordinating Centre (MRCC/JRCC) – that is responsible for the Search and Rescue Region (SRR) where the incident has taken place. The Search and Rescue Mission Coordinator (SMC) in RCC is the official temporarily assigned to coordinate the response to an actual or apparent distress situation. The general command responsibility for a specific SAR task is with SMC.



Picture 1. Example of the SAR plan (incl. SRR's sub-management group – MRSC Helsinki/MRCC Turku, Finland)

To find out HNS properties related to the incident and make a risk assessment, national and international HNS databases should be used. The international databases are Safety Data Sheets or Material Safety Data Sheets (SMS/MSDS) and EMSA Marine Chemical Information Sheets (MAR-CIS), among others. Some of the databases and systems most often used in rescue operations are also listed in the ChemSAR databank section. In addition to acquiring HNS information and making preliminary drifting estimations as well as a risk assessment and a rescue action plan, it is also important to consult experts and if necessary call together the advisory/coordination group (e.g. Search and Rescue Region's (SRR) sub-management group) at the RCC. Members of any advice-providing or assisting group should include rescue operations experts, an expert in HNS (chemical expert), a maritime safety official, an environmental official, a safety official, a shipping company specialist and (optionally) representatives of civil authorities.

Communication

In rescue operations, communications are managed using operating models that are in line with the Global Maritime Distress and Safety System (GMDSS). If the incident takes place far from the shore and out of reach of the commonly used VHF radio frequencies, communications between the distressed vessel and the RCC should be carried out using any alternative means.

During rescue operations on-scene, situations can often arise where it is necessary to form separate communication groups or to reserve other radio channels for the use of units involved in the operations. Individual actors or rescue teams also have their own communication systems for internal communications within the team or unit. In such cases, the team leader should nevertheless have a connection to either the national command operating in the area or the on-scene coordinator (OSC). In these situations, it is nevertheless of prime importance that communication channels between the distressed vessel, the RCC and OSC are continually available.

Occupational Safety

Maritime incidents involving HNS are usually classified as high-risk tasks for the following reasons:

- Boarding the distressed vessel is challenging, and the vessel is a difficult operational environment due to its structure or type of cargo.
- The incident may involve a wide range of challenging situations, including fires, leaks, chemical reactions, explosions and other such events.
- The dangers arising in the incident may include HNS, risk of fire or explosion, corrosive substances or any combination of the above.

Occupational safety laws and regulations vary between states, so every actor participating in an incident involving HNS should act in accordance with national laws and regulations and with their own organisation's regulations. In order to follow the above principle, every unit participating in rescue operations (rescue teams, for example) has to operate in cooperation with their national command, based on the instructions of the SMC and OSC. This person-in-charge from each national organisation is responsible for occupational safety matters for the unit or organisation in question.

Photo: Swedish Coast Guard

General Preparation and Training

Preparations for HNS incidents vary greatly between countries, organisations and individual actors. Compared to incidents taking place on land, the challenges involved are often long distances, a limited number of competent units, and the task of getting these units on-scene in time. In HNS incidents at sea, the first actor is in fact the crew of the distressed vessel. Depending on the type of incident, the vessel's crew may in the worst case be forced to seek shelter inside the vessel or to abandon the vessel entirely. In the first-mentioned case, a rescue operation requires that the units participating are capable and have the capacity of operating in such a situation without assistance on board.

An essential part of preparations for an incident is the development and maintaining of preparedness. The most important matters relating to this are developing the plans, having sufficient resources and equipment, training and exercises, and regularly testing of communication and coordination capabilities. Actions carried out in rescue operations during HNS incidents should be systematically coordinated. In managing incidents like these that involve HNS, key matters include clarifying roles, responsibilities and capacity, activities related to monitoring and reporting, and the correct choice of operating procedures.

When establishing HNS incident operations, the safety of personnel involved in operations must be taken care of. It must be ensured that all have the appropriate training, capacities, skills, protective equipment and special equipment needed for the task. The equipment used must be appropriate for the HNS in question. For the efficient and safe completion of the task, it is necessary that those involved in the operations have the relevant information about the incident and the substances involved. If the rescue operations are carried out without sufficient information or equipment, this may endanger both the rescue operations and the rescue personnel themselves.

Rescue vessels – Chemical recovery vessels

When working in the dangerous area of an HNS incident where there is the possibility of direct contact with the HNS which have been dispersed, the crew of the rescue vessel must understand the related risks. In addition, the vessel must be equipped with robust protection systems so that a safe operating environment can be guaranteed for the rescue operations. In any hazardous atmosphere caused by the leakage, safe rescue operations can be carried out only by pressurised vessels which can continually monitor the gas concentrations in their surroundings.

Different kinds of vessels are involved in HNS incident rescue operations, and the tasks should be assigned to each vessel according to their capacities and capabilities. Some of the vessels can operate outside of the danger zone, isolating the area from other maritime traffic, some can observe and monitor the situation, and some can act as support vessels for the rescue operations. Vessels capable of operating in the danger zone are often support vessels for the rescue teams and can be involved in preventing the HNS incident from causing further damage by using e.g. emergency towing capacity.

Vessels operating outside the dangerous

Photo: The Finnish Border Guard

area are not required to have protective or specialised equipment. If a vessel is used to transport personnel to the vessels operating in the danger zone (hereafter 'warm zone'), that vessel must be prepared for decontamination of persons and equipment and have medical first aid facilities. Similarly, there may be within the warm zone some vessels with limited capacities for operating in the zone of immediate danger (hereafter, hot zone), as well as vessels that are able to operate in these zones for longer periods of time. The former category may be able to operate for brief periods in the hot zone by using pressurised accommodation and working spaces for example, and thus be able to rescue casualties from the distressed vessel and then return immediately to a less dangerous area. The latter category is often designed or modified so as to be capable of different HNS-related tasks. These vessels have a completely gas-proof and pressurised citadel and other specialised systems for operating in hazardous environments. The use of these vessels for high-risk tasks in the danger zone should nevertheless be considered only in situations where there are no other alternatives for rescuing persons.

Vessels capable of operating in hazardous environments are known as Chemical Recovery Vessels (CRVs) or multipurpose vessels. That means that they are constructed in accordance with the regulations of the relevant classification societies. Such vessels must be built in such a way that they are able to protect their crew from flammable and toxic gases in the manner outlined in the regulations.

Vessels other than those specially designed and constructed for dealing with HNS may be used in HNS incident rescue operations only if the operating area does not have a hazardous atmosphere. Preparations must be made for the possibility that a hazardous atmosphere may also develop in that area during the operation – for example due to gases being released drifting with the wind to the vessel's position.

Special rescue teams

In some Baltic Sea states, specialised teams are established to handle challenging rescue operations at sea. One example of these units or teams is MIRG (Maritime Incident Response Group), which operates by using a helicopter or surface vessel to get on scene. Some of these MIRG teams are also specialised in dealing with HNS/hazardous materials

and therefore can also be used in maritime HNS incidents. In a larger-scale HNS incident, there is a need for multiple rescue units from several countries as well as special rescue units intending to take the situation under control. To enhance cooperation between MIRG and other authorities as well as between MIRG teams from other countries, there are already developed some international-level guidance (e.g. Baltic Sea MIRG and MIRG-EU) regarding this kind of cooperation.

Special equipment for detecting and measuring substances

Many gases and vapours are colourless, meaning that it is impossible to observe a gas cloud without detection or taking samples. The purpose of fixed and mobile gas warning and detection systems is to monitor the concentrations of compounds in the air and their toxicity, flammability, reactivity, acidity and corrosiveness. The most common risks in HNS incidents relate precisely

Table 5. Measuring tools for evaporators. *Source: Spillresponse.nl*

Device	Principle	Measurement unit	Application
Electrochemical detector	Chemical reaction and ion flow	Concentration	Toxic gases
Photo ionization detector (PID)	Ionization	MAC/TLV	Toxic gases
Flame ionization detector (FID)	Ionization	MAC/TLV	Toxic gases
Semi-conductor sensors	Ionization	Concentration	Toxic gases
Thermal conductivity detector	thermal conductivity	LEL/MAC/TLV	Toxic and combustible
Solid-state detector	Ionization	LEL/MAC/TLV	Toxic and combustible
Catalytic detector	Chemical reaction burning heat	LEL	Combustible gases
Infrared absorption detector	Optical	MAC/TLV	Combustible gases
Explosion meter	Chemical reaction burning heat	LEL	Explosive gases
Radiation meter	Radioactivity	mSv	Radioactive gases
Oxygen meter	Electrochemical	O2	Oxygen gases
Carbon monoxide meter	Electrochemical	CO	Toxic gases
Perception by smell	-	MAC/TLV	-
Visual perception	Optical	-	-
Chemical reaction tubes	Chemical reaction / Optical	MAC/TLV	Toxic gases
Gas Chromatograph (GC)	Chemical adsorption	Concentration	Toxic gases
High Performance Liquid Chromatograph (HPLC)	Chemical adsorption	Concentration	Toxic gases
Mass Spectrometer (MS)	Ionization	Concentration	Toxic gases
UV/VIS spectrometer	Optical	Concentration	Toxic gases
Infrared spectrometer	Optical	Concentration	Toxic gases

to substances' toxicity, explosiveness or flammability, especially in the case of volatile or gaseous substances.

The operating principles for measuring devices are different, and they measure different parameters of the HNS release. These devices have limitations and methods of use which differ from each other. Based on that, a person using a device should understand that particular device's operation principle, calibration, limitations and maintenance requirements. Selection of a device for a particular task depends on whether or not the leaked HNS is known – in other words, whether sampling is needed to determine the substance in question. The most common method for detecting and measuring these properties from the air is gas ionisation. This method is based on the way gases can cause changes to reflectivity, temperature or ion flow, and these changes can be measured with different detectors and sensors.

Protective Equipment – Evacuees

When planning rescue operations, consideration must be made of the protective equipment to be provided to those being rescued and evacuated from the distressed vessel. Hazardous substances have different exposure routes to the human body based on substance-specific characteristics. These substances can affect the body by skin contact, inhalation or ingestion. Personal protective equipment for evacuees should consist of different kinds of protective masks, air-purified respirators, supplied-air respirators (e.g. rescue masks) and protective clothing.

Personal Protective Equipment (PPE) – Rescue team

A rescue operation on board a distressed vessel in a hazardous environment is defined to cover the reconnaissance, rescue, protective and other types of tasks that are carried out in the hot zone and which require the use of self-contained breathing apparatus (SCBA) and appropriate chemical protection suits.

When rescue activities are conducted in a situation where HNS contamination is known or suspected to exist, personal protective equipment must be worn. PPE refers to the clothing and respiratory equipment necessary to protect a person from the hazardous properties of chemicals and is designed to prevent/reduce skin and eye contact as well as inhalation or ingestion of the chemical substance.

The equipment of a rescue team member in the hot zone includes base and middle clothing layers, a fire helmet, an inner hood, fire gloves, chemical resistant fire boots and SCBA. Depending on the type of incident and substance(s) in question, the chemical protection suit can be either gas-, liquid-, splash- or dust-proof. In addition to this basic equipment, other special protective equipment may be needed.

The basic idea is to describe the PPE level required to respond the known or assumed threat. If the substance has not been identified, a worst case scenario should be assumed and responders working under the hazardous environment should wear the highest level of protection. Personal protective equipment to protect the body against contact with known or anticipated chemical hazards are usually divided into four category levels: A, B, C, and D (US) or into types 1–6 (Europe). In the level A–D classification system, A marks the highest level of protection, whereas level D is considered as a work uniform and should only be used when it is certain that personnel will not be exposed to HNS. In the European categorisation system (types 1–6), type 1 stands for protection against liquid and gaseous chemical products and vapours, and is more or less equivalent to US level A, and type 6 has only limited protection against liquid chemicals.

Level A states that an encapsulating gas tight protective suit with SCBA inside is required. Correspondingly in the European classification, type 1 is divided into subgroups 1a–1c, depending on whether the SCBA location is inside or outside the suit or if the suit is connected to a breathable airline. Basically there are no differences in protection if the SCBA is worn inside or outside the suit. If SCBA is worn inside the suit, there is no need to decontaminate the device; but if the SCBA is worn outside, the device can be changed without removing the suit.

The type of working environment and the overall level of personal protection should be revaluated periodically, as the amount of information concerning incident and current status increases and the rescue team is required to perform different tasks.

Special caution and care should be taken in situations where multiple chemicals have been released at the same time. In such situations, the combined effect of the resulting chemical combinations

on personal protective equipment has not normally been tested. In addition, it is important for the rescue team members to be able to estimate their capacity in situations where the protective equipment is damaged or its operating duration is exceeded while the responder is still in the danger zone.

Requirements, training and practice exercises

Training requirements should be set and planned for all persons participating in HNS incidents. These should also correspond to national and international training requirements. The IMO model courses (Preparedness and Response to Maritime Incidents involving Hazardous and Noxious Substances (HNS)) serve as introductions to preparations and training for HNS incidents. There are two different types of courses, one aimed at the operational level and the other at the strategic level. The EMSA (European Maritime Safety Agency) is currently developing a course related to operations in HNS incidents.

General information on hazardous substances and HNS training can also be found in the ChemSAR e-learning materials.

Because rescue work in an HNS environment is classified as a type of first response and involves both internal and external risks, these tasks have special requirements regarding health, operating abilities as well as training and practice exercises. Internal risks include deficient equipment, improper equipment maintenance, insufficient response organisation, training, practice or operating capabilities. The external risks include all threats posed to the first responder by the incident location or its environment. Various national actors organise practical courses for rescue operations in HNS incidents.

Trainings for HNS incident rescue operations should be held at regular intervals both for particular vessels and between all individuals participating in an incident – from rescue command to rescue team members and decontamination measures, in all levels.

Shipping Company Preparedness

The actions of the crew of the distressed vessel (DV) during an HNS incident are guided by a number of different regulations and instructions. In addition to the previously mentioned SOLAS, MARPOL and IMO codes, these also include the Emergency Response Procedures for Ships Carrying Dangerous Goods (EmS Guide), Medical First Aid Guide (MFAG), International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code), and Emergency Response Plan (ERP).

In general, every crew member with assigned emergency duties related to HNS incidents shall be familiar with these duties. If they have rescue responsibilities, they shall be both familiar with the equipment that will be used in such situations and participate in drills on board the ship on a regular basis. Before assigned for on board duties, every crew member has passed at least basic safety and basic firefighting courses, carried out on accordance with IMO Model Courses. If ship is carrying dangerous goods, crewmembers dealing with cargo, have passed special courses for dealing with such cargo. Therefore, it can be expected that shipboard emergency procedures are in place and on board crew is familiar with both the procedures and equipment. Only properly trained and equipped personnel should perform rescue operations.

Ship itself is always considered her best lifeboat. Generally, every ship is equipped with safety equipment and built to constructional safety standard, ensuring survivability as per trading area and possible limitations implemented.

The actions of the DV crew in a particular HNS incident is very dependent on situational circumstances. Things like weather conditions, location, seriousness of leakage and HNS properties as well as the skills and operational capabilities of the crew all have an impact on the extent to which the crew can respond to the incident. In smaller cases, the crew can stabilise and take the situation under control; but in severe incidents, evacuation might be the only option. Therefore, even though there are general guidelines for initial response

actions, each case and the opportunities/ limitations can be different.

Shore-based personnel shall be trained according their duties, roles and responsibilities related to the transportation of dangerous goods. In case an employee has not received the required training, they should only perform tasks under the direct supervision of a trained person. The training shall also be supplemented with refresher training in order to keep needed skills and knowledge up to date.

According to ISM Code, all ships are required to maintain the Safety Management System (SMS), where emergency response procedures for all potential shipboard emergencies are described. Whenever accident occurs, ship can immediately initiate response action and during first response assess the emergency for further actions. SMS involves also shore based support from Company and shore-based rescue agencies. In the event of a fire or spillage where HNS are involved, initial actions should be carried out in accordance with the shipboard emergency plan and the EmS Guide as applicable.

According to SOLAS, all ships carrying dangerous goods, four sets of full protective clothing resistant to chemical attack (chemical protective equipment type and protection level shall correspond dangerous chemicals carried) - should be provided and well-maintained. The crew shall have regular training in using self-contained breathing apparatus.

The safety of human life has always the highest priority, where finding and rescuing casualties should be the first concern after identification of the HNS. The number of substances and compounds being transported can place large demands on response measures, and it cannot be assumed that the vessel's crew would have the professional skills, experience or equipment for combating a wide-scale HNS incident on the vessel. At sea, resources are limited, so in most cases involving spillage of HNS, the most effective response will most likely be washing the substance overboard or by jettison it if possible. If the situation permits, in order to minimize harm to the marine environment, the HNS can be washed into a separate tank. Direct contact with the HNS, such as attempts to repack the HNS in question or attempts to repair a leak, might expose the emergency team to unreasonable

risk. The emergency team should take all reasonable precautions when dealing with the leak and ensure their own safety at all times.

In general, even though the crew will be trained both for the procedures and for use of relevant equipment, there are still limitations to their capabilities (limited air supply, limited crew size – both physical and emotional stress, possible restrictions to access spillage due to shifting of cargo etc.)if the arrival of external help will take long. Working under a high level of stress with both chemical suits and breathing apparatus offers a very limited time to perform tasks and poses a high level of strain on the physics of the emergency team. It can be that one person is only capable of performing tasks for less than an hour, after which they are physically worn out. These kind of limitations should be taken into account when making an action plan, allocating resources and delegating tasks. An option of not doing anything should also be taken into account, for example in a case where the HNS incident site can be isolated and sealed. Seeking advice, support and consultation from a chemical expert is very important as is informing the closest rescue authorities about the situation on board.

Evacuation

Depending on the situation, evacuation should be taken into account. Even though the crew is trained to use evacuation equipment on board, particular circumstances of the HNS incident might hinder evacuation, such as rough sea and high waves or severe list.

In severe HNS incidents in vessels without passengers, free-fall rescue crafts are a means to evacuate the crew within minutes. Chemical tankers and gas carriers that transport cargoes emitting toxic vapours and/or gases shall have totally enclosed lifeboats with a self-contained air support system. According to IBC Code, with certain chemicals transported in bulk, every person on board shall be provided with suitable self-contained breathing apparatus with a minimum duration of 15 minutes, emergency escape respiratory protection and sufficient eye protection for emergency escape purposes.

The need for evacuation will be considered on a case-by-case basis by the master of the vessel together with the SMC.

Decontamination

For transportation of chemicals in bulk, suitable marked decontamination showers and an eyewash shall be available on deck in convenient locations, which shall be operable in all ambient conditions.

Decontamination in general cargo and RoPax vessels can vary from fixed decontamination showers to simple fire hoses. In case of a loss of power and blackout, emergency fire hoses will be functional for a limited time.

The amount of cargo on board also poses challenges for sea transport of hazardous substances. It can easily be that one-third of the containers being transported contain HNS. The markings on the transported substances may also be deficient, and the hazardous substances may not have been noted in the cargo report. In addition, although vessels are often large and stable may present no problems with fixing the cargo to the vessel, there may be problems with the packing of the cargo within the transport unit (trailer, container) so that if the HNS starts to move, a hazardous situation can result.

Photo: Swedish Coast Guard

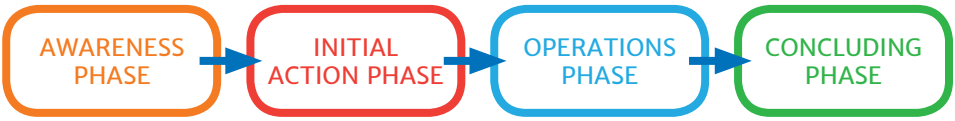
Photo: The Finnish Border Guard

Operational Plan

Operational Plan for Rescue Operation

This operational plan is supplemented by the ChemSAR SOPs and its accompanying attachments (ChemSAR SOP Checklists).

Example of the rescue operation phases:



1. Awareness phase

Needed information

In the early stages of an incident, a challenge in having sufficient situational awareness is one of the issues that can complicate the assessment of the current situation and the planning of rescue operations. Information is needed about the incident type and the substance(s) involved, communication, the weather conditions on-scene and how these will effect the rescue operation. The behaviour of the substance involved and external impact (e.g. temperature, wind, waves, currents, rain) should also be taken into account. Responders' capabilities of working on the distressed vessel (incl. the vessel's stability and possible changes to it) also have a significant impact on the action plans that can be executed.

In the initial stages of an incident, it is not necessarily clear which HNS is in question. Identifying the substance in

the earliest phase possible is important when determining the possible hazards involved, which are effected by both the incident type and the properties of the substance involved. The identification of these hazards is essential for making a situation assessment, selecting an appropriate operating procedure, and choosing the personal protection level and any response procedures. Often first aid instructions are also substance-specific.

Information about an HNS incident may come to the RCC either directly from the distressed vessel, a VTS centre or from some third party such as a nearby vessel that has observed the situation. The information received about the incident may also be an anomaly report by the vessel which the vessel's crew is nevertheless able to handle on their own. This information received must be then confirmed and available additional information collected to execute an effective risk assessment and decision-making process.

More detailed information about the incident (including information about the cargo and its location on board) can be obtained from the following: the vessel's master, the shipping company, the ship agent, the departure or destination harbour, the cargo owner, the agent, the cargo sender and/or receiver, customs, databases, VTS centres or other actors involved in the monitoring and guiding of sea traffic (e.g. National Single Window – NSW). For improving awareness of the situation in the early stages of an incident, additional information is often also available from other sea traffic within the area and also from possible airborne units in area (incl. use of possible Remotely Piloted Aircraft Systems (RPAS)).

Information Gathering

Especially in incidents involving HNS, communication between the relevant rescue coordination centre (RCC) and the distressed vessel (DV) should be based on regularly updated information about planned and executed actions, the situation on board and possible changes in that. In the early stages of an incident, the aim of the communication between the rescue coordination centre and the vessel is to create a common understanding of the situation and situational awareness of the incident. Based on this, the required rescue operation can be planned and resourced efficiently.

Important issues that should be clarified upon first contact between the RCC and the DV include whether immediate

help is needed, the vessel's position, the estimated time for assistance to arrive (ETA) and how significant a threat by the incident is to other persons in the vicinity and the surrounding environment (e.g. sensitive areas). In addition to the above, the following general details needed for a maritime rescue operation are also important for the planning of the rescue operation: vessel type, name and other registration details; number of people on the vessel; number of deceased/missing/injured; and available alternative means of communication.

Individualising the incident

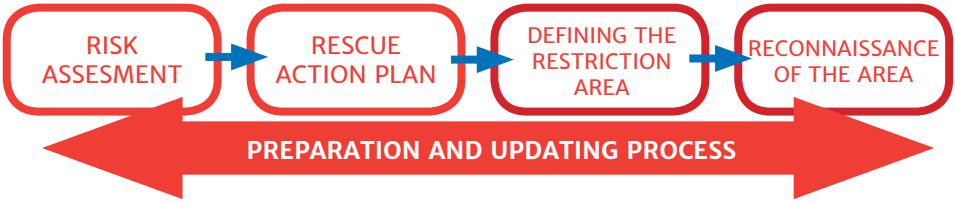
In HNS incidents, the nature of the event is of prime importance (fire, explosion, leakage or other phenomena). This determines the required and applicable rescue measures. In addition, the possibility of malicious damage or a terrorist act must be taken into consideration.

Note! In a situation where the substance involved is unknown, an assessment of the situation should be considered dangerous.

Determining the HNS and its behaviour in the current circumstances is often critical information when assessing the incident. In relation to the above, it must be found out whether the crew of the distressed vessel have the capacity to manage the situation on board and the capability to organise an evacuation or if there is any possibility of an uncontrolled abandoning of the vessel. It is important to consider the possibility of the situation to get worse and to prepare for consequences from an uncontrolled situation that can lead to secondary damages, stability problems or possible sinking of the vessel.

The most important results of the data-gathering process are information on the distressed vessel's safety status (regarding the people on board and other facts), an understanding of the situation's development based on factors already identified, different possible results and scenarios (including the worst-case scenario), and the probability of these possibilities taking place.

2. Initial action phase



During HNS rescue operations, the primary goal is to rescue persons that are in danger. A secondary goal is to prevent damage to the environment and to property. The most important tasks when making a situational assessment are to determine the appropriate and available resources and operating procedures to carry out these goals.

Risk assessment

HNS incidents often demand immediate action for rescuing persons. In situations where the crew and passengers have already abandoned the distressed vessel and are no longer facing immediate risk to life and health by the leaked HNS, the possibilities for rescuing these persons increase. In such situations, the effect of the HNS is reduced, and there might not be a need for special HNS protective measures when saving human lives. In these situations, detection and monitoring should be established in order to get an early warning if the situation gets worse, e.g. by a gas cloud spreading to the area where the casualties are present.

One aid when making situational assessments is the Vessel Triage system, in which the situation is assessed using the same criteria by both the RCC and the DV.

The following information is relevant in maritime rescue operations involving HNS and also generally in rescue operations. Taking into account these issues may help in assessing an incident's impacts and making a risk assessment:

- Determining the plan of action, including task prioritisation and specifying the nature of the danger;
- Finding out the sufficiency of the personnel, equipment and special equipment for the situation in question and for the planned tasks;

- Determining the appropriate measures for the situation involves clarifying the operational possibilities. For example, the need for immediate rescue measures on board the distressed vessel, the possibility of monitoring and isolating the area, or the need for additional information about the substance or substances in question and their behaviour in the current circumstances.

It should be noted that HNS incidents are often dynamic, with new factors emerging as the situation develops, which means that the situation can change rapidly. It is of prime importance that backup plans are developed alongside the main rescue plan already in the early stages of the incident. For example, one factor that could limit operational capabilities would be the evaporation of a very flammable HNS that has leaked into the sea. In such a situation, it should be considered whether vessels are able to operate in the area at all. Another issue to take into account is the maximum time period that the rescue team can operate in the hazardous atmosphere area with SCBAs. That is often limited between 10 to 20 minutes, depending on the time taken for the transfer phase to get on board the DV or the specific location on board and off and the required personal protection level.

In an HNS incident, the rescue operation on-scene should begin only after the situational assessment and risk assessment have been completed, and only with the use of the protective and special equipment required for the situation. The SRU arriving on-scene should have relevant and updated information about the leaked substance and its hazardous properties to establish effective decontamination and first aid facilities. In addition, information should be obtained about the quantity of the substance on board the distressed vessel, the prevailing conditions and an estimate of the velocity of evaporation of possible floating chemicals and the concentration of the vapours or gas clouds. When assessing the situation, attention must be paid especially to the impact of the weather conditions on-scene and its development (sea state, wind, tide and most recent weather forecasts).

Rescue Action Plan

Sufficient information concerning the incident and its special features is important when assessing the rescue action plan. To alert and consult an HNS expert or specialist group (as well as other

necessary officials and departments, e.g. SAR, maritime safety, environmental and safety officials, rescue and medical services and special units such as MIRG) as early phase as possible enables the timely execution of the correct rescue and response measures. In addition to this, national resources available and the possible need for international assistance have to be re-evaluated.

Measures initiated before the substances in question have been identified can significantly worsen the situation. Depending on the substance(s) in question, possible incorrect measures can include the use of water when it is not applicable by HNS characteristics, use of an inappropriate absorbing material, or a lack of decontamination measures. Executing the rescue operation in a situation when there is doubt about the substance in question, the maximum level of protection procedures and equipment must be assured. Safe working conditions on-scene for both the crew of the distressed vessel and other rescue personnel participating in the rescue operations must always be ensured by the use of gas detection devices, sampling equipment or other appropriate means.

Depending on the nature of the incident, rescue and possible response actions on board a distressed vessel are primarily to be carried out through the crew's own actions and only secondarily with the external assistance. The former would include situations in which the vessel's own crew can get the situation under control through their own actions by rescuing the persons who are in danger and stopping or reducing the identified leakage. The latter would include situations where external assistance has an impact to get the situation under control, for example by changing the heading of the vessel by using emergency towing or by sending a rescue team to the vessel to assist the rescue operation on board. Depending on weather conditions and other circumstances, the vessel can be emergency towed to a sheltered position. There the needed rescue operations can be effectively carried out on board or people can be safely evacuated.

Defining the restriction area

The situation assessment also includes determining the restriction area for other traffic. This area includes both the zone of immediate danger (hot zone), the danger zone (warm zone), and the safe working area for rescue operations (cold

zone). The purpose of determining this restriction area is to set a safe area for other maritime traffic and at the same time to ensure an isolated area for the rescue operation on-scene.

The dangerous area (hot and warm zones) is generally defined around the distressed vessel; but depending on the substance, its quantity or other information that may emerge later on, the area may be set or later reduced to only part of the distressed vessel. In the early stages of the incident, when no detailed information about the incident is available yet, the dangerous area (i.e. the restriction area), should be made sufficiently large.

If there is no detailed information about the incident and HNS leakage, a sufficient restriction area should be set already at the limits of the possible dangerous area. If the substance in question or the size of the leakage is not known and it is not possible to take any measurements, the possibility of larger risks should be taken into consideration when determining the restriction area. In a large leakage of liquefied toxic gases, the restricted area, based on the gas concentration, can extend up to 20 km from the spillage location. When setting the restriction area limits, attention must be paid especially to the weather conditions and any expected changes to them. Any maritime traffic (and air traffic), other than those vessels involved in the rescue operations, is to be directed to stay clear at a sufficient distance, and rescue units must maintain upwind at a distance assessed to be adequate. If necessary, preparations must be made for warning the population about possible explosion hazards or the threat of spreading toxic gases.

The following table no. 6 can be used as an aid in estimating the spread of gas clouds when assessing the situation. This should be based on the information already received.

Note! Estimations are not a substitute for detection and monitoring processes.

When assessing the consequences of a release, information should be available on the gas concentrations on-scene. There are computer models and modelling systems based on the substances' physiochemical parameters, but the results derived from these models cannot be completely trusted. Inaccurate results can be caused by wrong values or the parameters may be deficient. The reliability of these results also depends on the model's internal structure and how valid the system is.

Table 6. Example of forecasting the spread of gas clouds in air can be estimated very roughly for the Groups G and GD.
Source: HELCOM Manual on Co-operation in Response to Marine Pollution Volume 2

Release	Health risk		Fire / explosion risk
	Ammonia, vinyl chloride, chlorine	Methane (LNG), propane (LPG), butane (LPG), ethylene, butylene-butadiene	Ammonia, vinyl chloride, methane (LNG), propane (LPG), butane (LPG), ethylene, butylene-butadiene
Tonnes	metres / nautical miles downwind	metres / nautical miles downwind	metres / nautical miles downwind
0.1	1,000 / 0.62	200 / 0.12	200 / 0.12
1	2,000 / 1.24	400 / 0.25	400 / 0.25
10	5,000 / 3.11	1,000 / 0.62	1,000 / 0.62
100	10,000 / 6.21	2,000 / 1.24	2,000 / 1.24
1,000	20,000 / 12.43	4,000 / 2.49	4,000 / 2.49

The actual concentration levels for making the hazard assessment can only be made by using measurements. Detecting and analysing the substance(s) in the incident's early stages is essential in order to clarify its properties and potential hazards as well as to define the restriction area and its form. These prediction models are nevertheless effective tools in estimating the size of gas clouds or the danger zone prior to the detection or measurements.

Reconnaissance of the area

Measurements taken during reconnaissance can be used to assess the danger of explosion or toxicity and the safety limits associated with these. The concentrations in the air and water of any substances that have already leaked out are also possible to detect by measurements. Personnel carrying out monitoring and measurement tasks should be equipped with the appropriate PPE and have appropriate training in the measurement equipment as well as the equipment functionality. Based on the first detections, the limits of the danger zone are set (warm zone). Approaching the location of the leakage and observing the rise in concentration levels to hazardous levels, the limits of the hot zone can be set. Based on the measurement taken, it is also possible to estimate the personal protection level required for the task at different distances. With more detailed information obtained through reconnaissance, measurements and expert help, the danger zone can if necessary be reduced or increased in size. In practice, however, the limit of the area is set at the measuring points where the most distant readings have been observed. The areas should be made large enough to take into account the fact that gases and vapours do not spread or move evenly in the atmosphere. Alongside devices for measuring the risk of toxicity and explosion, the devices' measuring oxygen content should also be used.

Preparation and updating process

The continuance of rescue operations should be ensured by organising effective decontamination measures and confirming the availability of extra personnel, materials and any required specialist equipment. Reports on the situation should also be provided at a sufficient interval to other authorities and to any other people within the incident's area of influence.

In the early stages of the incident, the decisions made should be assessed and updated as the situation develops. This means that the plans should be updated based on the latest available information received, thus enabling a continual process of reassessment and situation updates.

3. Operations phase

Crew actions taken on the distressed vessel:

In the situation's early stages, the persons with the best opportunities to affect the HNS incident and minimize the threats it poses are the distressed vessel's own crew. Once the authorities receive information about the incident or event, the vessel's crew may already have affected the situation through actions taken, or may have planned measures for taking the situation under control.

The vessel's master is responsible for rescue operations on board the distressed vessel, and these operations on board are supported by the rescue organisation. The vessel's crew should nevertheless understand the hazards concerning the cargo, such that in the event of an incident the operational plan made for emergency situations can be executed. For example, the IMO's Emergency Response Procedures for Ships Carrying Dangerous Goods (EmS) lists emergency procedures for a vessel's crew during incidents at sea. When the incident takes place, this should be reported to the responsible authorities as soon as possible after it has been detected, even if the situation can be taken under control by the crew's actions. This enables and speeds up the task of getting assistance on-scene if a need for external assistance should arise later on. Through the RCC it is also possible to have expert help on the HNS in question, including information of its behaviour and drifting estimations.

In HNS incidents, knowing the facts about the matters mentioned above helps authorities to make preparations and provide the right kind of assistance. These include the nature of the event (incident/criminal act/ terrorism), whether the situation is static or dynamic,

and the actions planned or already initiated on the vessel.

The required measures are often easier to execute in the initial stages of the incident than in cases where the situation or possible HNS leakage has continued for some time. In HNS incidents, the crew's timely and sufficient initial actions handling the situation are essential. Possibilities for carrying out rescue and response operations on the distressed vessel are nevertheless greatly dependent on the nature and scope of the prevailing conditions.

External assistance:

Assistance from rescue authorities always takes time to get on-scene, and in certain weather conditions help may take a long time to arrive. Note that external assistance in HNS incidents at sea may in some situations be limited or the time required for such help to arrive may be substantial, due for example to the great distance or other prevailing circumstances.

A successful rescue operation requires well-organised and effective command and coordination, functioning communications, efficient information flow and professional rescue operations on-scene. Reconnaissance, rescue and evacuation tasks should be carried out as quickly as possible to ensure both successful rescue operations and occupational safety. An important initial action to be taken in HNS incidents is the safety risk assessment. When making a risk assessment, the special characteristics of the HNS incident should be assessed. These include time-related critical factors, such as an itemised and clear situational picture and situation awareness for the purpose of initiating the correct rescue action plan and getting assistance on-scene on time and the identification of the leaked substances. In addition to these, the dangers and consequences involved should be assessed in order to find out possible ways that the situation could deteriorate. The information given to the rescue personnel should be verified to ensure the correct choice of equipment and procedures. In addition, preliminary preparations should also be made for mass decontamination measures.

Information on the personnel participating in the operation, equipment used and other relevant data should be collected and documented. These other issues include the specific rescue processes carried out, any realised or possible exposure to dangerous substances, and medical procedures undertaken. Any

health and casualty-related information should also be documented and stored.

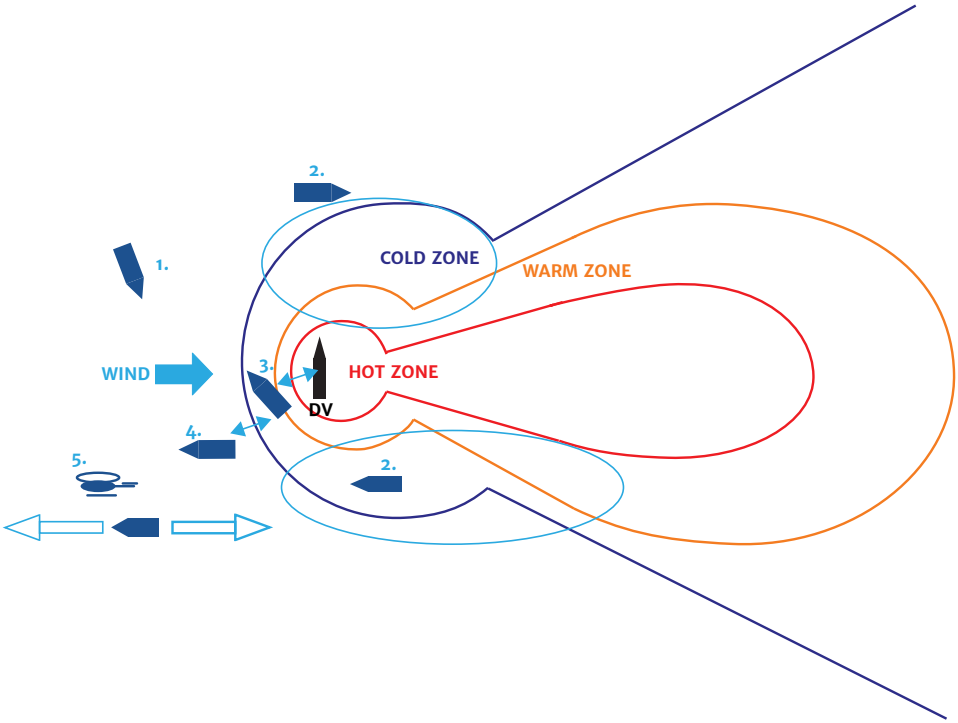
When planning rescue operations during HNS incidents, the role of initial information and initial reconnaissance is essential. The information obtained from the distressed vessel is supplemented with information and risk assessments from other sources, such as the shipping company's Designated Person Ashore (DPA) and chemical or rescue operations experts. In the early stages, it is important to clarify the situation regarding casualties, the number of injured and the symptoms of those who have been injured and/or exposed to the hazardous substances. In HNS incident, information and identification of the HNS in question, the amount of the HNS, possible other substances in the vessel, the type and scope of the incident and it's possible consequences are essential in order to assess the impact and risks for inhabitants and in the area.

HNS incidents are often consequence of a substance leaked from a container or system which then leads a danger to the surrounding environment. The required actions for HNS incidents rescue operations are carried out in order of priority, but depending on the situation they may be done in sequence or in parallel. When making a rescue plan, consideration must also be given to the possibilities for reducing or stopping the leakage, transferring the dangerous substance back into its containers, neutralising the substance or allowing it to evaporate safely. These kinds of preliminary response measures may significantly facilitate the rescue operations as well as prevent the situation from getting worse, thus making the situation also safer for the rescue tasks of first responders.

On-scene, the primary task of the rescue units is to execute reconnaissance procedures. This should be done from upwind of the actual incident, maintaining a sufficient distance from the distressed vessel. When approaching the DV, one aim is to avoid making the situation worse through the SRU's own actions. The purpose of reconnaissance is to discover the risks posed by the HNS to the rescue operations and the special measures required. In this stabilisation phase, the operational capacity of the rescue units on-scene is limited by the units' capabilities of operating in the HNS' area of influence.

Putting rescue vessels at risk unnecessarily should be avoided, and it is important to monitor the situation using the vessel's

fixed gas warning and measurement systems, mobile measurement devices operated by the detection and monitoring team, or long-range observation and measurement systems (e.g. cameras or other systems fixed to the vessel, an aircraft or a RPAS/unmanned surface vehicle). Real-time detection and monitoring is used to estimate toxicity and danger of fire or explosion, as well as in designating the safe working zones and areas separated from other traffic.



Picture 2. Possible tasks for the SAR units in HNS incident
1. Surveillance, isolation and monitoring
2. Measurement and sampling
3. Command and support - rescue operations
4. Support and transport – casualties, personnel, equipment
5. Transportations to and from the shore (helicopter/vessels)
Source: SYKE Ympäristöopas 94, Henkilökohtaiset suojavarusteet kemikaalipäästötilanteessa merellä"

The measurements taken also determine the required personal protection level (PPE level). HNS release and its effect on changes to the danger zone should be monitored continually using gas detection and other measuring systems.

An HNS incident on a vessel can also lead to the formation of a non-visible or transparent gas clouds or vapours. As these move with the wind, there is a risk, both to persons on board a distressed vessel (vapour or gas entering accommodations) and to vessels involved in the rescue operation.

Only vessels that have the capacity for operating in a hazardous environment caused by the leaked HNS can operate in the established (calculated or measured) warm and hot zones. Operating in these danger areas – where there is a risk of contamination by the leaked HNS – requires significant protective measures from both the crew of the rescue vessel and the protection procedures of the vessel itself entering the area. The rescue personnel should be aware of the risks related to the task and have the necessary skills for executing the task. The vessel's systems must be sufficient for enabling safe operations carried out on-scene, e.g. decontamination and first aid facilities, and if necessary also nearby the distressed vessel (possible hot zone). The methods to be used for limiting the possible spread of HNS as well as to control or decrease the area's danger level (explosiveness, toxicity) includes 'guiding' or 'dropping down' gas clouds by using water spray and foaming or recovering floating substances.

Action options

1. Emergency towing

Using emergency towing procedures, the vessel's position and heading can be altered in order to direct vapours or gases away from the accommodation. In some situations, the vessel must be shifted by emergency towing to a more sheltered location, e.g. to enable evacuation or to shift the DV to position further away from the vicinity of an inhabited or otherwise risk-sensitive area to reduce the HNS impact on these surrounding areas.

2. Place of Refuge

When the vessel in HNS distress or in danger causes remarkable risk for environmental disaster, the coastal state can appoint a place of refuge for the vessel. On the other hand, the request for the place of refuge can also come from the vessel in distress. In that

situation, the coastal state needs to assist the vessel by all means and bring the vessel to a safe area or to the designated place of refuge. A place of refuge may be needed in the situation where a ship has suffered an incident and is damaged. It can be continuation of a search and rescue operation or environmental recovery operation or it can be just a vessel's request for a place of refuge. The procedure starts when the request for the place of refuge is done by the master of the vessel in need of assistance or by the representative of the shipping company or when authorities of the coastal state make the decision to force the vessel to the place of refuge. The request can also come from the authorities of a neighbouring coastal country.

Bringing a ship to a place of refuge near a coast may endanger the coastal state, both economically and from the environmental point of view. Countries have different legislation and responsible authorities, and the process varies among coastal states. Although many countries have plans for a place of refuges included in their maritime emergency plans, the decisions are made case-by-case to minimise the risks and to prevent damage and pollution. In decision-making, many things are taken into consideration, e.g. the condition and features of the vessel, weather conditions, rescue options, environment protection, etc.

3. Evacuation

Evacuation of the distressed vessel should be considered and discussed with the master of the DV already in the initial stages when making the situation assessment. Depending on the severity of the situation, immediate evacuation may be the only option if there is a risk of the HNS situation getting worse on the vessel. The nature of the incident, the prevailing conditions, possible risks posed to evacuees and rescue personnel, and finally the decision of the master of the Search and Rescue Unit (SRU) have an influence on whether rescue actions can be carried out by the SRU on-scene.

In situations where there are HNS vapours or gases are widely spread, evacuation of the vessel can be carried out at a later stage through this hazardous or toxic atmosphere only if the evacuees have the possibility of wearing protective equipment that enables a safe exit (e.g. a filter mask, Emergency Escape Breathing Device (EEBD) or equivalent, and protective clothing). Preparations should be made already in the very early stages to arrange the transport of this clothing and equipment to the rescue vessels in the

area and onwards to the distressed vessel (e.g. by helicopter to a support vessel). In some HNS incidents, the safest place for the crew and passengers is within the distressed vessel's accommodation or in some other compartment of the vessel where the effects of the dangerous substances are not present. This alternative approach, depending on the severity of the situation and assessments of its likely development, is to arrange shelter for the individuals in the vessel's accommodation and to make these spaces hermetically sealed or pressurized if possible.

4. Rescue operations for saving human lives on board distressed vessel (DV)

Rescue operations are led by the RCC responsible for the area in question in cooperation with the master of the distressed vessel.

When assessing a possible rescue plan, consideration must be given to the resources required for executing rescue operations on the distressed vessel. Additional needs arise if the situation is prolonged (e.g. sufficient number of first responders, options for decontaminating a larger number of persons and equipment, and emergency medical care for victims and transport for further treatment).

In general, rescue actions under HNS impact on board a vessel are always challenging and they are high risk activities based on the special characteristics of the operating environment. Before executing the rescue operation on board, decontamination arrangements and clear exit routes have to be ensured for the rescue team operation. To fulfil this requirement, the safe exit routes and spaces must be confirmed beforehand by the crew of the distressed vessel, or at least before the actual operations begin (safety plan, etc.). Furthermore, a decontamination station or emergency decontamination point must be established, set up and tested. First aid capacities and the availability of required personnel must be confirmed.

Transit from the hot zone to the cold zone must always go through the decontamination station. If the decontamination station cannot be set up, a shower/flush point (jet fog and provision of extra air) is the minimum requirement for the first stage emergency decontamination. The purpose of decontamination measures is to remove at least a significant remainder of the contaminants from casualties, rescue personnel, clothing

and equipment in a fast, efficient and safe manner. The decontamination station or decontamination point should be set up (depending on circumstances) outside the hot zone in the space between the warm zone and the cold zone (in situations where the rescue operation work zones can be located on board the distressed vessel). In this way, the decontamination processes form a 'corridor' between the rescue operation zones. Another alternative is to establish the decontamination station on a support vessel that is able to work in the hazardous atmosphere, provided that the rescue unit is equipped for working in this area. In the above situation, the cold zone is the pressurised interior of the vessel. In both cases, first aid and treatment areas must be located in the cold zone.

The decontamination point or station should be as close as possible to the scene of operations to prevent the spread of HNS to a wider area. In some situations, it is possible to set up the decontamination point on board the distressed vessel if the weather condition, other circumstances and the nature of the incident permit this. In any case, efforts should be made to at least set up on board the distressed vessel 'a flush point' that meets the minimum emergency decontamination requirements. Also, if the leakage is small and localised, the decontamination station may, depending of the circumstances, be set up by using transportable decontamination equipment on board the distressed vessel instead of on board the SRU. A basic requirement is that this can be done outside of the hot zone. Attention must be paid to the distance set between the hot zone and the decontamination point, taking into account the spread of the substance, to prevent the HNS from also spreading with secondary contamination.

The first unit arriving on-scene that is capable of operating in the hazardous zone at the assessed risk level should transport the rescue teams. During rescue operations on board the DV, the tasks of the rescue team are connected to different rescue and first response actions. These can be, for example, supporting the communication between the DV and RCC, risk assessment on board, supporting the master of the vessel for decision-making, preventive response measures and detection, minimizing the influence of the HNS (e.g. by restricting or stopping the leakage, neutralising the substance), emergency medical service, medical evacuation, emergency decontamination procedures and preparations for abandoning the

ship. In addition to those, the rescue team should also take measurements and carry out other preventative measures, if needed, to support the rescue operations. Planning should also include measures to transport casualties from the dangerous area to the decontamination points and onwards from there. Special attention must be paid to working on contaminated and affected areas where there is danger of secondary contamination.

A second team to arrive should be ready at the hot zone entry point before rescue operations on board will be executed. This team, referred to as the backup team, confirms the safety of the entry team as well as the decontamination measures for the casualties and their transit for further treatment and onward transport. Based on the situation, the backup team sets up an emergency decontamination point close to the entry point, unless the crew of the distressed vessel have already established this. The minimum requirement for that is an emergency decontamination point, which includes an emergency decontamination shower and provision of extra air. The backup team's other activities may include decontamination and emergency first aid for casualties, actions for isolating the danger zone, and taking measurements.

The above-mentioned rescue team tasks are highly dependent on the national, organisational and especially the unit-based procedures.

A safety briefing should be held for all those participating in the rescue operation before executing the rescue operation on-scene. This should be based on the updated risk assessment, and those participating in the operations should understand the task, risks, initial action plan and emergency plan. After the briefing and before the practical execution, all rescue personnel should be registered. During the work on-scene, all relevant actions are recorded; and after the operation, possible personal contamination, injuries, etc., are written down.

Transporting the rescue teams and equipment to the distressed vessel is often a challenging and time-consuming phase. The available options, including boarding the DV, should be discussed and agreed with the master of the DV. Initial transport measures (which can be by helicopter, rescue craft or other capable Search and Rescue Unit (SRU), for example) should also be clarified.

4. Concluding phase

The rescue operation is at the concluding phase when all lifesaving activities are completed and the situation on-scene has been stabilised. In an HNS incident, it is important to note that preventative operations will continue after the actual rescue operation has been completed. Depending on the national guidelines being followed, this may involve a change in command or the arranging of these responsibilities once the rescue operations have been completed. Tasks and operations given to participating units related to the HNS incident as well as the completed HNS rescue operations should be documented for further purposes.

Once the rescue operation is completed, particular attention must be paid to the decontamination of contaminated clothes and equipment and to record the actions carried out in the HNS zone of influence. In a situation where the SRU has been totally or partly contaminated, special attention has to put on safe and effective decontamination processes by professionals.

Other tasks related to the conclusion of rescue operations include reporting on the event and its impacts to different authorities and the media, the removal of any restrictions that have been put in place, carrying out a debriefing for all those involved, and measures to prevent subsequent damages.

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Photo: Swedish Coast Guard

Standard Operational Procedures

Note! ChemSAR SOPs and checklists are supplements to existing Search and Rescue (SAR) procedures; they do not replace any part of them.

These SOPs and checklists do not have to be used in chronological or any specific order, as they can be used on need basis: one by one, parallel, etc., depending of the actual situation.

PURPOSE

ChemSAR standard operational procedures (ChemSAR SOPs) support all actors involved in maritime SAR operations on Hazardous and Noxious Substances (HNS) incidents to perform a successful and safe rescue operation. ChemSAR SOPs are meant to support and give additional information to normal daily Search and Rescue (SAR) procedures of the Rescue Coordinating Centre (RCC), e.g. assessing the risks, rescue planning and SAR mission coordination, as well as support SAR actions on-scene under threat of a hazardous environment.

SCOPE

This document pertains to all personnel involved in the maritime SAR operation in the HNS incident.

RESPONSIBILITIES

SAR operation coordination and responsibilities are based on international agreements and national legislation. SAR operations in the HNS incident are coordinated by the Search and Rescue Mission Coordinator (SMC). SMC is responsible for the distressed vessel rescue operation procedures in the Rescue Coordination Centre (RCC). The master of the distressed vessel (DV) is responsible for rescue operations on board the DV. Local authorities are responsible for the rescue operation on board the DV in a situation where there is no person in charge on board the DV. The master of the Search and Rescue Unit (SRU) is responsible for the procedures on board the SRU. Each rescue team participating in the rescue operation will follow their national and organisational occupational safety procedures.

SOP Index

SOP 1: Assessment of the incident

PROCEDURES

Hazardous and Noxious Substances (HNS) involved in the Search and Rescue (SAR) operation have a great impact when assessing rescue plan possibilities. During the rescue planning phase, the HNS have to be taken into account when analyzing the incident and the area (1.1), assessing possible rescue procedures (1.3), resources (1.2) and rescue plan options (1.3).

1.1 Risk assessment

Information gathered from the distressed vessel and experts concerning the incident and the HNS involved gives the Rescue Coordinating Centre (RCC) the possibility to do the risk assessment of the incident and plan the best available rescue option for rescuing persons on board the Distressed Vessel (DV). A rescue operation in a dangerous atmosphere should be considered as a high-risk operation.

Detailed identification of the HNS involved is needed for the correct rescue and response measures. General information consists of the following:

- HNS name (chemical name/name of the substance)
- Proper Shipping Name (PSN)
- United Nations (UN) number
- Chemical Abstracts Service (CAS) number
- Nature of damage and/or size of the outflow (contained on board, leaked on board, leaked overboard)
- Situation of the incident (dynamic, static)
- Ongoing or planned rescue and response actions taken by the crew (also detection and measurement possibilities)

Additional information concerning the substance involved, health and other risks can be gathered from the DV, the shipping company Designated Person Ashore (DPA), chemical databases, codes and other relevant documents, e.g. International Maritime Dangerous Goods (IMDG) code, Material Safety

Data Sheets (MSDS) etc. The information is needed for the following:

- Form and package of the HNS
- Quantity of HNS, rate of release and theoretical max. release
- Reactivity and properties of the HNS
- Risk of fire or explosion
- Expected hazards for humans and the environment
- HNS-spreading estimations
- Cargo separation and cargo plan (possible other HNS)

The possibilities for monitoring the situation on-scene by measurements or at least perceptible findings (colour, form, and smell) and the possibility to take and send pictures to the RCC should also be considered when assessing the risks of the ongoing incident and planning rescue operations.

National chemical and HNS experts should be consulted for more information on the behaviour of the substance (primary and secondary risks), aggregation state and change of aggregation state at a given temperature, and the spreading estimations. Also, inform and advise a possible national environment inspector, safety agency, security agency and legal agency (depending on national organisational structures; could be police/crime investigation/national maritime authorities) and media, when necessary.

1.2 Resources

Facts from the situation on board form a need for the assistance acquired, the personal protection level, and Search and Rescue Units (SRUs) with the capacity to perform and support rescue operations in the hazardous atmosphere. A possible need for extra personnel and equipment during the rescue operation should be taken into account. National resources, e.g. Mass Rescue Operations (MRO), Multi-response Maritime Accident (MMA), the capability of the SRUs, SAR plans and agreements should be found out and activated to achieve a successful rescue operation.

In a situation where national resources

are not efficient for rescue measures, international partners (RCCs, experts, liaison officers, etc.) should be informed and consulted in the early phase. Finding out the possibility for available international resources in this phase reduces the delay for an effective SRU arrival on-scene.

1.3 Action options

Depending on the situation on board the distressed vessel, considerable action options can be one or several of following:

- No external assistance needed
- Consultation (Maritime Telemedical Assistance Service (TMAS), experts, etc.)
- External assistance needed outside the DV (emergency towing, Man over Board (MOB), etc.)
- External assistance on board the DV needed (emergency/first responders; emergency medical care, medivac, containing the leakage, etc.)
- Ship abandoning, Mass Rescue Operation (MRO)
- Intervention is impossible due to some reason (area, vessel or specific section on board defined as a NoGo area)

Evacuation of the DV in a dangerous atmosphere is always a demanding and incident-specific procedure. Find out the alternative action options; there can be more risks to evacuate a great number of people into the hazardous atmosphere than finding out the procedures for minimizing the influence of a possible leak on board. The DV crew or responders' response operations can be protective, e.g. transferring persons to the sheltered location on board or repositioning or shifting the DV by means of emergency towing, etc.

The possibility for early evacuation should be considered if the situation on board the distressed vessel gets worse (e.g. a dangerous HNS chemical reaction) and the SRU's arrival on-scene is expected to be delayed. Use of the Vessel Triage categorisation system as a tool for simplifying the decision-making process could give an impression of the status of the situation and its development. In a later stage, there can be a situation where on board rescue operations are impossible to carry out.

The need for the Place of Refuge / Safe Haven for the vessel in distress should be considered and a preparation procedure launched if needed.

SOP 2: Determination of the restriction area

PROCEDURES

2.1 First phase area isolation actions

In Hazardous and Noxious (HNS) incidents where there is a risk of flammable, explosive, toxic or irritative cloud or vapours, the dangerous area has to be isolated from maritime (and air) traffic. In general, only Search and Rescue Units (SRU) with the capability of entering the dangerous atmosphere are permitted to enter the restricted zone and only with Rescue Coordination Centre (RCC) approval.

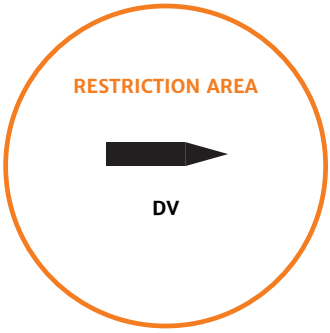
2.2 Continuous risk assessment

Information to update a risk assessment and maintaining the situation awareness are essential when defining the restrictions to respond to the actual hazards on-scene. The continuous update process of the restriction and working areas should be based on the latest risk assessment and weather conditions (e.g. wind direction and weather forecast).

2.3 Assessment of the HNS impact

The restriction area for maritime and air traffic (NO-FLY zone; e.g. possible hazards, Remotely Piloted Aircraft System (RPAS) operations, rescue operations) should be determined based on information about the incident. Defining of area should be based on the information and identification of the HNS involved. The determination is done by formulating a circular (or hemisphere if there is a NO-FLY zone) area around the distressed vessel.

In a situation where information about the HNS involved is not available in the first phase, the radius of the immediate restriction area should be at least 2NM.



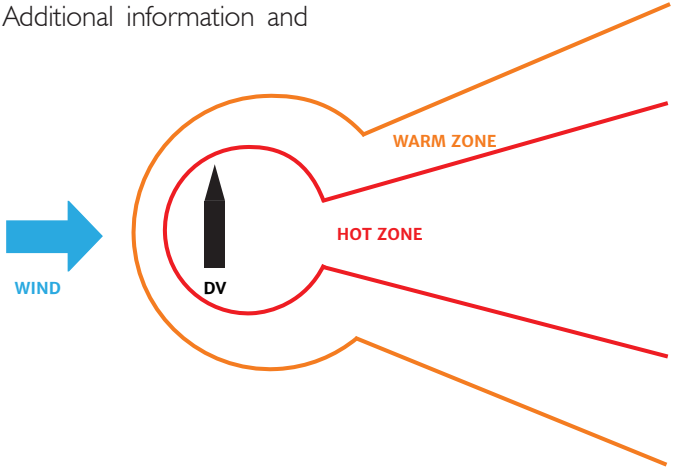
The effect of the weather and weather forecast as well as possible distressed vessel manoeuvres should be taken into account when determining the area for further restrictions. From the point of release, the gas cloud will move in the wind direction in a triangular area. The area defined from approximately a 30° angle from the release is the limit of the hot zone, and the 60° angle defines the warm zone limit. If there is a risk of the hazardous zone expanding to concern third parties (e.g. on land), continue procedures with the national land-based alarm plan.

2.2 Defining the restriction area

Risk assessment considering HNS in the area should be based on the support of the experts, predictive tools, databases, use of the cargo plan etc. available information. Additional information and situation reports (SITREP) from the distressed vessel (DV) (cargo information, hazards and alterations), rescue units on-scene and other maritime or air traffic will complete the situation awareness. RCC should continuously update the available HNS information.

The established area restrictions should be updated based on the performed risk assessment by increasing or reducing radius and formulating the shape of the restricted area. Definition of the area is done by means of measurements and by consulting experts for the drift estimations and calculations.

DV, SRUs, Vessel Traffic Service (VTS) (and Air Traffic Service (ATS) if needed) should be informed by the RCC considering the updates and possible cancellation of restrictions in the area.



2.3 Information

Maritime traffic should be regularly informed considering the restriction area with GMDSS PAN-PAN or MAYDAY RELAY messages. Contact VTS (and ATS) concerning the restriction of the areas. Contact relevant authorities and/or media for the issuance of warnings, access restrictions and a general warning to people in the risk area, if needed.

SRUs approaching the area require the latest information on the restrictions and isolation process. The restriction area should be under the surveillance of authorities (RCC and SRUs with surveillance capability), and maritime traffic approaching the area should be informed and rerouted if necessary. The area restriction surveillance should be performed by authorities and vessels with the capacity to monitor the area's isolation.

2.4 Determining areas for SAR operation

The three-level working zone system of area designation:

2.4.1 Hot zone

The hot zone is an area where the risk for contamination and probability for exposure to hazardous substances is highest. In the first phase, the hot zone can be the radius around the DV or a location on board the DV, based on HNS identification, measurements and calculations. The highest level of Personal Protective Equipment (PPE) is needed in this area.

2.4.2 Warm zone

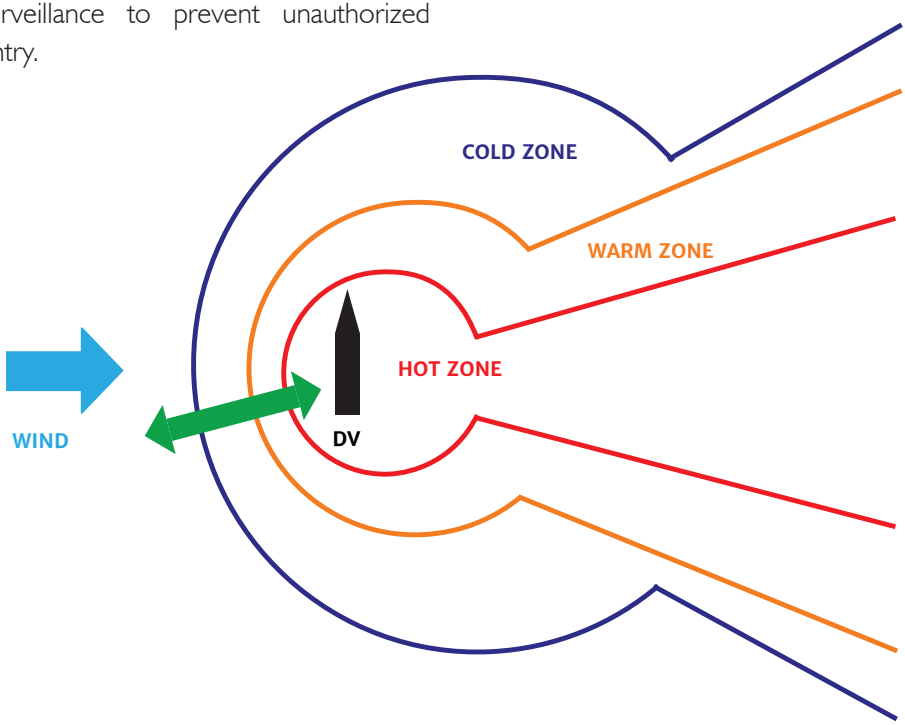
The warm zone is an area surrounding the hot zone. This area is a transition area between the hot zone and the cold zone. The warm zone can be the radius around the DV or a location on board the DV, based on HNS identification, measurements and calculations. If a decontamination process is planned to proceed on board the SRU or other vessel on-scene, the vessel is usually positioned in the warm zone or on the border of the warm zone and cold zone, if possible. The warm zone and the cold zone are then established on board the SRU to ensure an effective decontamination process.

2.4.3 Cold zone

The cold zone is an area outside the warm zone. The cold zone is free from contamination and may be used as a holding and support area. When the warm zone and the cold zone are established on board the SRU, service and treatment facilities are located in the cold zone. The cold zone defines the outer safety cordon, i.e. the limit of the restricted area that should be under surveillance to prevent unauthorized entry.

2.4.4 Entry point

Prepare to arrange controlled access to the restricted area for the rescue vessels. Entering the warm zone should be upwind and allowed only for vessels with the capacity to perform rescue operations in the hazardous atmosphere. Weather and weather forecast (e.g. changes in wind direction) should be considered when establishing the entry (and exit) point of the restricted area.



SOP 3.1: Arrival to the scene of incident (RCC)

PROCEDURES

3.1.1 Resources

To ensure correct tasks and measures for the applicable units, find out about available resources as well as the capabilities of the Search and Rescue units (SRUs) on-scene. Information on the following facts will assist the decision-making process when planning tasks for units:

- Rescue vessels with the capability of entering and working in the hazardous atmosphere (hot and warm zones – rescue operations)
- Rescue vessels with limited capability or without the capability of entering hazardous atmosphere (cold zone – isolation and support)
- Rescue craft on board rescue vessels that can be used for transport, boarding and evacuation (hot and warm zones)
- Other vessels in the area (cold zone or outside the restriction area – support and transport)
- Available aircraft for transport/ reconnaissance
- Available special groups (e.g. Maritime Incident Response Group (MIRG))

SRU-specific capabilities:

- Capacity for detection and monitoring
- Capacity for decontamination and first aid / emergency medical care
- Capacity of the available personnel
- Available Personal Protective Equipment (PPE)
- Response equipment

3.1.2 HNS risk assessment

The available Hazardous and Noxious Substances (HNS) and risk information should be requested from experts. When evaluating the risks on-scene, information on the suggested area restrictions, safe direction to approach the dangerous area, suggested working zone definitions (incl. entry and exit points), possible explosive, flammable or toxic hazard involved, drifting calculations (prediction tools) and latest weather

forecast should be available.

3.1.3 Communications

Rescue Coordinating Centre (RCC) coordinates distress communication in the area and determines the channels and frequencies that can be used in different sections of the rescue operation. Inform participating units about the on-scene communication table, including back-up channels, to ensure that all necessary information will reach all relevant units on-scene.

3.1.4 Rescue operation

Depending on the situation, the rescue action option can be offensive (e.g. rescuing persons and active efforts to minimize the effect of HNS), defensive (e.g. rescuing and evacuating persons) or even non-intervention if the situation is too risky for rescue personnel to enter the distressed vessel or response actions are impossible to execute, for example due to the chemical reaction on board the distressed vessel.

In the rescue plan, at least the following procedures should be planned and performed:

- Area isolation procedures
- Protection procedures (both vessel and personnel)
- Preparation process to receive contaminated persons
- Supportive procedures (transport, safe environment, first aid, equipment and material)
- Rescue procedures

To ensure and secure continuous and effective SAR operation, the supportive procedures such as replacement of personnel, materials and equipment have to be organised in the early planning phase.

3.1.5 Executing

After the planning process is completed and the first action plan formulated, the Search and Rescue Mission Coordinator (SMC) or On-scene Coordinator (OSC) should consult with the master of the DV and inform all SRUs on-scene. This first on-scene rescue plan should include at least the following information:

- Planned tasks and possible actions on-scene for each SRU
- HNS risk information (explosive, flammable, etc.)
- Status of the distressed vessel (HNS situation on board)
- Area restrictions
- Safe direction for SRUs to approach and authorization

process to enter the restricted area
- Detection and monitoring plan
- Entry points to the warm and hot zones
- Emergency plan (e.g. withdrawal in case of an unexpected deterioration)
- Estimations / drifting calculations
- Regular Situation reports (SITREPs) to SRUs and other maritime traffic in the area

The rescue action plan should be updated regularly to respond to alterations in the situation.

SOP 3.2: Arrival to the scene of incident (SRU)

PROCEDURES

3.2.1 Safety measures

Prior to entering the incident area, the Search and Rescue Units (SRUs) should prepare and test the vessel-specific protection systems according to the organisational, vessel-specific and system-based safety procedures. The correct function of the following systems is crucial when entering the hazardous atmosphere:

- Pressurization of the vessel (i.e. overpressurizing system, back-up systems and devices)
- Gas detection, monitoring and analysing systems
- Equipment for potentially explosive atmospheres (ATEX)
- Water curtain or water spray system
- Water and/or foam cannons and monitors
- Emergency evacuation and rescue plan

All the spaces and equipment needed in the Hazardous and Noxious Substances (HNS) incident should be tested prior to arriving on-scene. These spaces and equipment contain emergency medical care or first aid facilities, decontamination procedures for the casualties and rescue personnel, available and appropriate Personal Protective Equipment (PPE), other protective equipment and portable or hand-held detection and measurement equipment.

3.2.2 Detection and measurement

When arriving at the area, arrange continuous monitoring to detect possible HNS from the air or from the water surface. This action is needed to formulate and update areas where the HNS concentration is at the risk level due to its toxicity or explosiveness/flammability. Oxygen deficiency is also important to monitor, as the plume or cloud can initially decrease the oxygen content of the air. Monitoring should be continuous and the results of the measurements reported to the Rescue Coordination Centre (RCC) for updating the rescue plan and area restrictions. To identify the involved substance(s) and

concentration, air (and water) samples should be taken from the area if possible.

3.2.3 Remote sensors

To avoid unnecessary risk, the first stage detection should be done using remote gas detection and monitoring devices (e.g. systems using infra-red light) or specific drones designed to detect or take samples from the HNS. Using a thermal imaging system, it is also possible to detect fire or a chemical reaction on board the Distressed Vessel (DV) from a distance.

3.2.4 Fixed and portable sensors

Fixed and portable sensors have to be used for detection and measurements when the SRU intends to enter the hazardous atmosphere on a mission (e.g. rescuing casualties from the dangerous area or when executing the measurement task) or to give an early warning for the crew when approaching the dangerous area. Fixed sensors are often part of the gas detection and analysing system and this system has to be activated when there is a potential risk of HNS.

Portable and handheld devices such as gas tracing tubes, portable gas chromatographs, photoionisation instruments, flammability risk-monitoring devices, and oxygen-deficient air monitoring devices are compulsory for the teams for monitoring or identifying the substance(s) in the area.

3.2.5 Visual monitoring

To monitor a possible HNS gas cloud or leak visually, weather conditions (wind, humidity, waves) that affect the observation should be taken into account as well as current knowledge of the substance. (However, the HNS involved may not necessarily produce a visible cloud or plume.) The latest weather forecast and drifting estimation should be used to support on-scene monitoring.

3.2.6 Detection and monitoring teams

Prior to launching rescue operations in the hazardous zone, it is essential to monitor the oxygen level, flammable or explosive vapours, and the level of toxic vapours. Plan and order the task for the detection and monitoring patrols. The purpose of these measurements is to define the outer limits of the dangerous area to determine the area restrictions as well as to take samples to identify the substance and concentration involved. The applicable rescue craft or tender could be used when the possible dangerous area is around the distressed vessel. Teams should have the following information prior to executing the task:

- Sampling plan (starting point, route, safe direction and distance to approach etc.)
- Appropriate detection and measurement equipment
- Applicable rescue craft or tender and equipment (e.g. risk of explosive or flammable substance on the area)
- First team to enter dangerous area in situation where HNS is not identified should be equipped with the highest possible PPE level

3.2.7 Situation Report (SITREP)

RCC should be informed by the SRUs at regular intervals concerning the situation on-scene, weather conditions, ongoing and planned activities and results from the measurements. Request the information of the updated drifting estimation and weather forecast from the RCC or experts.

Authorization for the SRUs and other maritime traffic to enter the area should be coordinated and done in cooperation with the RCC.

SOP 4: Boarding

PROCEDURES

4.1 Risk assessment and occupational safety

Safe procedures to evacuate rescue teams boarding the Distressed Vessel (DV) should be confirmed in case of an unexpected emergency situation. Consultation with the master of the DV should be performed concerning possible escape ways and safe locations. Use the vessel's safety plan if that is available. Standby boats should be arranged as 'ready to launch' for the evacuation of the rescue teams, passengers and the DV crew in case of an emergency evacuation.

The Search and Rescue Mission Coordinator (SMC) or On-scene Coordinator (OSC) should consult with experts to determine the needed Hazardous and Noxious Substances (HNS) protection procedures. At minimum, the rescue teams have to have clear information about the level of Personal Protective Equipment (PPE), possible extra protection, detection and measurement equipment, equipment for potentially explosive atmospheres (ATEX), and decontamination procedures. Depending on the risk assessment, in some situations the transport phase for the DV has to be performed with the highest PPE level which has to be taken into account when considering the possible boarding procedures. A proscription of wearing PPE during transport (e.g. chemical protective suits and Self Contained Breathing Apparatus (SCBA) in rescue crafts and helicopters) and a very short remaining working time after transport (due to consumption of breathing air and/or physical exhaustion wearing PPE) may make boarding of the DV impossible.

Prior to boarding the DV, the participating units/teams should be informed about the action plan, their task, situation on board the distressed vessel, risk assessment, communication channel and circumstances (weather, restrictions, etc.). Basic procedure to approach the DV for boarding in the hazardous environment should contain at least the safest direction to approach (upwind, away from visible or detected gas), the use of detection and measurement

devices, the appropriate PPE level and safety equipment (e.g. life vests) and communications.

After the briefing and before the practical execution, all rescue personnel should be registered. Additional documentation includes recording the entry and exit time to and from the warm zone, the consumption of breathing air, and the progress of the rescue operation. Contamination of the body, incorporation and injuries in general should be recorded as well.

4.2 Limitations

When assessing different possibilities for transportation, the following factors have an effect on the decision or can be exclusionary:

- Result of the HNS risk assessment
- Limitations on the use of the helicopter (distance to reach the DV, and/or using a helicopter is too dangerous or impossible due to a hazardous atmosphere around the DV)
- Weather impact that affects landing or winching from a helicopter and boarding from the rescue craft
- Capabilities of the SRUs in the area

The distressed vessel's manoeuver capability and possibility to anchor should be confirmed from the master of the DV. The SMC and the master of the SRU should find out if there is a possibility to control the DV with external assistance (e.g. with emergency towing) if the DV maneuver capability of the DV is limited or if the vessel in distress is not under control.

4.3 Pre-boarding measures

Possible measures to enable safe boarding the DV should be considered and launched. Consult the master of the DV about the possibility to extinguish or cool down a possible fire or chemical reaction with water cannons and/or foam if the HNS risk assessment allows that. Prior to approaching the distressed vessel, also consider possible gas cloud control with water cannons or water jets to reduce the HNS impact and guide gas cloud and vapors, etc., away from the casualties and rescue teams. These protective measures can be done by both the DV and SRU firefighting (fi-fi) equipment when applicable.

To avoid ignition of the substance, use only devices and equipment that can be used in potentially explosive

atmospheres (ATEX) and foam the area as a precaution and use foam monitors if necessary.

4.4 Boarding possibilities

The decision on boarding the distressed vessel should be done after discussions with the master of the DV. The master of the SRU should consult with members of the boarding, entry and backup teams on issues concerning occupational safety when planning the boarding procedures. Find out the safe boarding point for the rescue craft or the entering point for a winch operation, and confirm the following preparation operations on board the distressed vessel:

- Landing or winching procedures for the helicopter in situations where the use of a helicopter is possible
- Boarding procedures for the rescue craft or tender (pilot hatch, gangway, ramps, etc.)
- Reception and guidance of the rescue personnel boarding the distressed vessel
- Assistance of the rescue personnel to establish an emergency decontamination station and first aid facilities on board, if possible
- Provision of supplementary SCBA, Emergency Escape Breathing Devices (EEBDs) or the equivalent for evacuating the casualties and as a supplementary air reserve for rescue teams.

In cases where the assistance of the DV crew is not available for boarding, consider alternative boarding measures. Options to be considered for the specific boarding team transported to the DV by the helicopter or tender:

- Preparing pilot hatch, gangway or pilot ladder,
- Lowering the rescue boat from davits, or
- Preparing the rescue boat ladders, ramps, etc. for the rescue teams to arrive.

Depending on the risk assessment, one possibility is also manoeuvring the SRU alongside and using the crane with the rescue basket for transporting the rescue teams to the DV.

SOP 5: Rescue operation on board the distressed vessel

PROCEDURES

5.1 Risk assessment

The situation should be assessed and rescue possibilities considered based on the latest information from Distressed Vessel (DV) and Hazardous and Noxious Substances (HNS) experts. If an intervention is possible, the decision regarding activities on board the DV should be made in consultation with the Rescue Coordination Centre (RCC)—the Search and Rescue Mission Coordinator (SMC) together with the group of experts—and the master of the DV. The rescue action plan should be updated to respond to possible alterations and units informed about the plan. The common situation awareness between participating units should be confirmed, e.g. by Situation Reports (SITREP).

5.2 Early phase response

5.2.1 Distressed vessel

The first rescue plans and immediate actions on board the DV have to be made by the crew on board. Often the assistance of the Search and Rescue (SAR) organisation can be delayed for several hours or more, and the rescue and/or response measures are often easier and most effective to execute in the early stage. The most important tasks to organise are protection and safety for persons on board (incl. emergency decontamination procedures and emergency medical care), preventive response measures and detection, and measurement or estimation of the leakage.

5.2.2 The Search and Rescue Mission Coordinator (SMC) / On-scene Coordinator (OSC)

Consultation with the master of the DV concerning the rescue action plan (SMC, experts) should be done in the early planning phase. The master of the DV should also be informed of the possible need to assist the rescue teams by DV crew actions. The SITREP prior to initiating the entry team boarding procedures should be requested:

Information from the DV is needed regarding the situation of the HNS release and ongoing and planned rescue or response activities by the DV crew.

5.3 Rescue procedures

5.3.1 Preparation

The master of the Search and Rescue Unit (SRU) should assign the initial entry preparations on board the SRU. The following procedures should be completed in a situation where there is an intention to execute rescue actions on board the DV:

- Decontamination station is set up, tested and operational
- First aid/Emergency medical care facilities are operational
- All persons involved have the knowledge, understanding and agreement of their role(s) and planned activities in the operation
- Ensure that a controlled boarding system is established

Rescue teams (entry team, backup team and decontamination team) should be prepared according to the organisational and/or unit-specific procedures. Protection of the rescue personnel and equipment should be based on the latest risk assessment and hazard identification. At minimum, the Personal Protective Equipment (PPE) level, detection/monitoring equipment, emergency decontamination procedures (e.g. mobile emergency decontamination shower or water hose, etc., to flush down the contaminant), communication channels and outside supervision of the teams have to be organised before launching the boarding procedures of the rescue teams. Arrange logistics for providing sufficient and suitable PPE, other consumable materials and spare parts.

5.3.2 Entry procedure

Prior to entering the hot zone, the emergency decontamination station near the entry point should be established and tested. Confirm procedures that both chemical rescue teams (entry and backup team) are at the entry point prior to authorizing the entry team to enter the hot zone. The entry team is allowed to enter the hot zone only by permission of the responsible rescue operation leader.

5.3.3 Rescue activities on board

Rescue activities are based on the rescue plan and the tasks given to the boarding rescue teams by the RCC. The first rescue teams boarding the distressed vessel can also give valuable information about the situation to the RCC for updating the risk assessment and the rescue plan.

Possible tasks for the rescue teams on board can be for example:

- Support the communication between DV and RCC
- Risk assessment on board, supporting the master of the vessel for decision-making
- Preventive response measures and detection
- Minimising the influence of the HNS, e.g.
- Restricting or stopping the leakage
- Neutralising the substance
- Emergency medical service
- Medical evacuation
- Emergency decontamination procedures
- Preparations of the ship abandoning/Mass Rescue Operations (MRO)

5.3.4 Disembarking

Safe disembarking procedures for the rescue teams and casualties should be ensured. First stage decontamination (or emergency decontamination) should be done on board the distressed vessel if possible. Chemical rescue teams that operated in the hot zone must be decontaminated, even if they were not in actual contact with the substance. Arrange a safe disembarking and decontamination process for affected and injured persons.

SOP 6: Evacuation and emergency towing

PROCEDURES

6.1 Situation awareness

The number of persons to be evacuated and the number of injured and/or affected casualties should be clarified in discussions with the master of the Distressed Vessel (DV). The current situation on board and the location of persons in danger are essential information when planning the evacuation process. If persons have partially or totally abandoned the DV, plan actions to recover them from the lifeboats, life rafts and water. The possibility of life rafts launched from the DV drifting to a hazardous atmosphere should be taken into account and prevented. Use the national and/or organisational Mass Rescue Operation (MRO) plans and procedures if applicable.

6.2 Resources

Consult the master of the DV about the capability of the DV crew to evacuate persons. Find out the capabilities and capacities of the sea and airborne units in the area to evacuate persons from the DV. Evacuation from the DV could be done using helicopters, with the Search and Rescue Unit (SRU) alongside, using rescue craft, tender or lifeboats and life rafts. Find out the need for additional assistance (e.g. SRUs) and the Estimated Time of Arrival (ETA) on-scene.

6.3 Risk assessment

The safe and executable measures to evacuate persons from the DV, including possible and suggested evacuation routes, should be ensured. The current and predicted situation of the Hazardous and Noxious Substances (HNS) release, results from the measurements, and the HNS impact on rescue personnel and evacuees have to be taken into account (when considering measures of evacuating persons from the DV). Also weather conditions (wind, waves, swell, etc.) have a great impact on the rescue operation, especially for the evacuation process; and in some situations, abandoning the vessel in distress might not be the safest solution due to the HNS situation, sea state, etc.

6.4 Action plan

When preparing the action plan for the evacuation process, consider the possibility of a partial evacuation (e.g. to evacuate all other passengers and crew except those needed for operations on board, or evacuate only injured/affected persons) instead of a total abandoning of the DV (possible MRO), what protective equipment is needed for persons to be evacuated, the need/possibility to use the boarding team or rescue personnel on board the DV to assist in the evacuation (DV crew capabilities), transport possibilities from the DV to the SRU, actions on board the SRU, and transport to the evacuation centre or further medical care. All evacuation measures should be accepted by the master of the DV.

The evacuation action plan should enable:

- Evacuating persons from the DV and/or rescuing them from the water
- Transporting persons to the SRU
- Counting and TRIAGE (sorting and allocation of treatment) of the evacuees
- Sufficient facilities for accommodation, decontamination and emergency medical care
- Connection from the SRU to shore (helicopter/vessel)
- Point of Contact (PoC) ashore to ensure further medical care, e.g. ambulances and hospitals

6.5 Measures

Depending on the HNS situation, the possibility to evacuate persons from the DV by using manned or unmanned life rafts and lifeboats sent from the SRU should be considered. Applicable (situation-specific, e.g. ignition prevented/ex-protected) rescue craft or tenders can be used if available. Manoeuvring the SRU with the capacity to enter the hazardous atmosphere alongside the DV to evacuate a large number of persons disembarking from the vessel (using possible slides, ladders, gangway, lifeboats, rescue baskets, etc.) can be the only possible option. Use of the helicopters for evacuating persons directly from the DV can often be impossible due to the hazardous atmosphere.

6.6 Operation

The evacuation process for the affected persons should be organised. When evacuating persons in the HNS area, arrange provision of the protective breathing devices for evacuees, e.g. filtration masks, Emergency Escape Breathing Devices (EEBD) (or similar easy-to-use breathing devices) or Self-Contained Breathing Apparatuses (SCBA). Find out the need for extra-protective clothing or equipment when evacuating persons. To stabilize the condition of the casualties, arrange emergency decontamination procedures and establish decontamination lines for mass decontamination when necessary. Find out HNS-specific procedures for first aid when arranging emergency medical care facilities.

Persons confirmed as deceased are left in the hot zone or on board the DV until all other persons have been evacuated.

6.7 Documentation

All evacuated persons – whether injured/affected or not – should be registered to ensure later retrieval and further necessary medical treatment. This includes:

- Identification and personal information
- Possible find spot
- Possible contamination
- Possible received medical treatment

6.8 Emergency towing

Consider the possibility and/or necessity of shifting the distressed vessel by emergency towing to reduce the impact of HNS or if there is a need to control the drifting or heading of the DV. Consult with the Search and Rescue Mission Coordinator (SMC) about a possible safe haven/place of refuge or anchorage in situations where the DV has to be towed to a harbour and the DV or parts of it are contaminated.

6.8.1 SRU

The emergency towing preparation procedures on board the SRU should be confirmed. If there is a hazardous atmosphere around the distressed vessel, the SRU-specific pressurization and gas warning system procedures should be performed if not yet completed. Inform the boarding team about the task (if a boarding team is needed). Prepare

the SRU-specific emergency towing procedures, and order the appropriate PPE level when working on the deck.

6.8.2 DV

The emergency towing preparation procedures on board the DV should be confirmed as well as guidelines from the DV-specific emergency towing booklet. Find out the DV's capabilities for emergency towing: available personnel and PPE, ship-specific emergency towing procedure and equipment, capability of using winches and possibilities for the reception and guidance of the boarding team.

SOP 7: Decontamination

PROCEDURES

7.1 Preparation

Before executing the rescue operation in the Hazardous and Noxious Substances (HNS) incident, the basic requirements for the decontamination station should be ensured. The decontamination station should be located upwind from the actual incident and have the features for effective operation (e.g. access to the hot zone, a usable water supply, the possibility to collect contaminated liquids and waste) and access to first aid facilities to ensure the prompt commencement or continuance of emergency medical care.

Finding out the HNS involved and possible specific decontamination processes is essential to ensure an effective and sufficient decontamination process. The number of contaminated persons, the type of contamination and the number of casualties on board the distressed vessel (DV) should be clarified to have recourses for carrying out planned tasks.

7.2 Establishing phase

When establishing the decontamination station, an adequate number of assisting personnel and the required level of personal protective equipment (PPE) available should be confirmed. All areas where the decontamination process takes place should be clearly marked and guided (e.g. clean and unclean sites). Service and treatment facilities should be established in the cold zone. Access to the cold zone from the decontamination station should be organised to ensure a reliable decontamination process and prevent secondary contamination.

7.3 Decontamination processes

7.3.1 Emergency decontamination

Emergency decontamination should be carried out as soon as possible to minimize the effect of the HNS by removing contaminant from casualties. A basic procedure is to have an effective decontamination process for casualties without any personal protective clothing. Emergency decontamination can be

carried out at the decontamination point, which can be fixed or portable. That can also be done through the mass decontamination line or through the responder decontamination procedure. Lifesaving medical measures have priority over (coarse) decontamination. Self-protection of the assisting and medical personnel must be assured.

Notice that due to the risk of secondary contamination; only patients who have been decontaminated will be transported. Confirm that receiving hospitals are informed and have the capacity to respond to the situation.

7.3.2 Responder decontamination

The decontamination process consists of both physical and chemical methods to minimize the impact of the possible contaminant. Responder decontamination is a basic procedure to have an effective decontamination process mainly for rescue workers wearing personal protective clothing and equipment.

The responder decontamination process can be divided into different stages, e.g. first stage decontamination, second stage decontamination, check-up point, and a final phase decontamination which includes packing up contaminated PPEs, etc.

7.3.3 Search and rescue unit (SRU) and equipment decontamination

The possibilities and procedures to decontaminate the SRU and equipment are highly dependent on the type, quality and quantity of the HNS involved. When assessing the possibilities to arrange decontamination for the SRU or equipment, it is important to consult professionals to find out the process needed for the decontamination. In some situations, decontamination of the vessel or equipment can be very expensive and time-consuming.

Special equipment inventory (e.g. detection and monitoring equipment used in the incident) should be done and documented separately for each device used.

7.3.4 Decontaminated waste

The facility and containers, etc., on board should be established for contaminated waste such as equipment, clothing and fluids. Plan and arrange for appropriate handling of the contaminated waste ashore before arriving at the port of destination.

Photo: The Finnish Border Guard

Checklists

Note! ChemSAR SOPs and checklists are supplements to existing Search and Rescue (SAR) procedures; they do not replace any part of them.

These SOPs and checklists do not have to be used in chronological or any specific order, as they can be used on a need basis: one by one, parallel, etc., depending of the actual situation.

Checklists are marked with labels which are pointing out the users to whom checklist is intended to:

Rescue Coordination Centres (JRCC, MRCC) and other coordinating and commanding units etc.

Search and Rescue Units (SRUs) and other on-scene operator, unit etc.

In the Checklists there are three tick boxes marked in issues to be confirmed. These tick boxes are marked with different colours and meant to be used as follow:

- **YES**
- **NO**
- **NOT APPLICABLE**

In need of MIRG specified tasking forms, Baltic Sea MIRG project's forms are available at www.raja.fi/MIRG

Checklist Index

SOP 1: Assessment of the incident

1: HNS INVOLVED

- HNS name, Proper Shipping Name (PSN), UN number, CAS number
- Nature of damage and/or size of the outflow
- Situation of the incident (dynamic/static)

2: ADDITIONAL INFORMATION

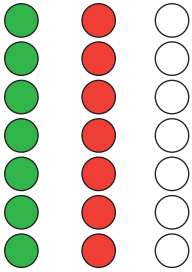
- Ongoing or planned rescue and response operations by the crew
- Weather impact (sea state, wind direction, tide, forecast)

3: HNS DETAILS

(SC DPA, databases, HNS experts etc.)

- Form and package of the HNS
- Quantity of HNS, rate of release and the theoretical max. release
- Reactivity and properties of the HNS
- Risk for fire or explosion
- Expected hazards for human and environment
- HNS spreading estimations
- Cargo separation and cargo plan (possible other HNS)

4: ACTION PLAN - HIGH RISK OPERATION CABAPILITIES AND RESOURCES



No external assistance needed
Consultation
External assistance; emergency towing, MOB – checklist 6
External assistance - entry team – checklists 4, 5
Evacuation – checklist 6
Intervention impossible caused by HNS – checklist 2
Place of refuge / Safe haven – checklist 6

ASHORE

SEA

SOP 2: Determination of the restriction area

1: RESTRICTION AREA

- No information HNS involved ⟶Determine restricted area at least 2NM radius from the DV
- Navigational warnings

2: DEFINING THE RESTRICTION AREA

- Based on HNS information and risk assessment
  - Experts, measurements, predictive tools, databases, cargo plan
  - Information on-scene
- National and local warnings

3: WORKING AREAS FOR SAR OPERATION

- Hot, Warm and Cold Zone
- Entry point

4: NAVIGATIONAL WARNINGS CONCERNING THE SAFETY ZONE

5: AREA MONITORING AND SURVEILLANCE

SOP 3.1: Arrival to the scene of incident

1: RESOURCES

- SRUs with capability enter and work in the hazardous area
- SRUs with limited capability to enter
- Rescue crafts onboard SRUs, other vessels, aircrafts and special groups

2: SRU CAPABILITIES

- Detection and monitoring
- Decontamination and emergency medical care
- Available personnel, PPE, response equipment

3: HNS RISK ASSESSMENT

- Area restrictions, safe direction to approach
- Working zones
- Hazards, HNS drifting estimations
- Weather forecast

4: EXECUTING – INFORMATION

- Planned tasks, HNS risk information e.g. explosive / flammable hazard
- Area restrictions, safe direction to approach
- Detection and monitoring plan
- Entry points to warm and hot zone
- Emergency plan
- Latest HNS drifting calculations / estimations / SITREP

SOP 3.2: Arrival to the scene of incident

1: SAFETY MEASURES

- Pressurisation
- Gas detection and monitoring systems
- EX-measures (flammable/explosive hazards involved)
- Water curtain or water spray system
- Water / foam cannons
- Emergency evacuation and rescue plan
- Facilities and equipment
  - Emergency medical care / First aid facilities
  - Decontamination procedures
  - PPE equipment
  - Other protective equipment
  - Portable and hand-held detection and measurement equipment

2: DETECTION AND MEASUREMENT

- Remote sensors
- Fixed and portable sensors
- Visual monitoring

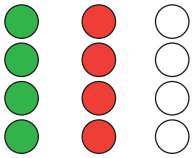
3: SAMPLING

- Sampling plan
- Equipment
- PPE level
- Weather (wind/humidity/waves) and weather forecast

4: RCC AND OTHER UNITS INFORMATION (SITREPS)

SOP 4: Boarding

1: RISK ASSESSMENT AND OCCUPATIONAL SAFETY



Emergency evacuation
Specific protection procedures
PPEs during transport phase
Boarding / entry team brief

- Action plan, task, situation onboard DV
- Risk assessment, detection and measurement devices
- Communications, PPE level, safety equipment
- Registration of the boarding personnel

2: LIMITATIONS

- HNS risk assessment
- Limitations for helicopter
- Weather impact
- Capabilities (SRU/DV)

3: PRE BOARDING MEASURES

- Water / foam systems and EX / ignition preventive procedures

4: BOARDING POSSIBILITIES

- Safe boarding point
- Landing/winching procedures
- Boarding procedures
- Reception and guidance
- Emergency decontamination / first aid on board DV
- Supplementary SCBAs / EEBDs

5: MEANS OF EMBARKATION IN CURRENT SITUATION

- DV crew assistance / boarding team
- SRU alongside / rescue basket etc.
- Hatches (pilot etc.) gangway, ladders, rescue boat

SEA

ASHORE

SOP 5: Rescue operation on board the distressed vessel

1: RISK ASSESSMENT

- Updated HNS information
- Action plan

2: EARLY PHASE RESPONSE

- Situation onboard
- Ongoing actions
- Planned actions

3: RESCUE PROCEDURES

Preparations

Rescue and response team preparation

- PPE
- Equipment
- Emergency decontamination

Entry procedure

- Support
- Risk assessment
- Response and detection
- Emergency medical service and evacuation
- Preparations to abandoning / MRO

Rescue activities onboard

Disembarking

ASHORE

SEA

SOP 6: Evacuation and emergency towing

1: SITUATION AWARENESS

- Number of persons to be evacuated
- Number of injured /contaminated and/or deceased persons
- Type of contamination

2: FACILITIES ONBOARD SRU

- Counting and TRIAGE
- Decontamination
- Emergency medical care
- Connection to the shore / POC on shore (ambulances, hospitals)

3: OPERATION

- Possibility to provision for the supplementary PPE
- Emergency decontamination and first aid / emergency medical care

4: EMERGENCY TOWING PROCEDURES

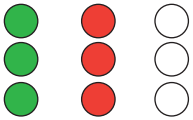
- Controlling or towing the DV to reduce the impact of the HNS
- Emergency towing procedures onboard DV (DV crew, boarding team)
- Place of refuge / safe haven

SEA

ASHORE

SOP 7: Decontamination

1: PREPARATION AND ESTABLISHING



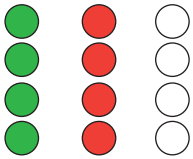
Basic requirements

Possibilities for effective operation

Decontamination process planning

- Location
- Personnel, PPEs
- Entry and exit points
- Clean and unclean sites
- Emergency medical care
- HNS specific decontamination process
- Type of contamination, injured persons

2: DECONTAMINATION PROCESSES



Emergency decontamination

Responder decontamination

SRU and equipment decontamination

Contaminated waste handling

Photo: Balex Delta/Sanna Saari

Project info

Rescue authorities have discovered and study reports confirmed that there is a lack of operational plans and standard operational procedures (SOP) for search and rescue (SAR) operations applicable to cases of hazardous and noxious substances (HNS) incidents in the Baltic Sea Region. As large quantities of different chemicals are transported by sea the risk of accidents is evident. Such demanding maritime accidents in this area are almost always international in nature, which emphasizes the significance of common procedures and a common level of know-how.

The ChemSAR project has responded to this challenge and created operational plans and SOPs needed in SAR operations involving HNS. These guidelines, when applied, increase the safety of rescue operations, both for the rescuees and the rescue crews. Swifter rescue operations also minimize the impact on the environment. In addition to these guidelines, the project has developed an eLearning environment and material to enhance and harmonize the level of know-how in the area, also having an impact on the safety of rescue operations. Furthermore, it has produced a chemical data portal to act as the basis for information seeking not only in rescue operations but also when using the eLearning material. The project result has been piloted in tabletop and simulator exercises and in an international rescue exercise at sea to test the applicability of results in practice. Feedback was collected from the exercise participants and, additionally, the live exercise was evaluated by external evaluators. These have been taken into account when finalizing the project products.

The Baltic Sea countries have different national practices for maritime HNS accidents, but these incidents call for joint rescue operations and procedures. The project partners represent the rescue authorities, i.e. the project's main target groups. Altogether nine project partners from five countries in the Baltic Sea Region have taken part in the project.

Interreg Baltic Sea Region
EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND
ChemSAR
EU STRATEGY FOR THE BALTIC SEA REGION FLAGSHIP

The total budget of the project was 2.5 million €, and it was partly financed by the Interreg Baltic Sea Region programme.

Project partners

- Centre for Maritime Studies of the Brahea Centre at the University of Turku (FI)
- Finnish Border Guard (FI)
- NOVIA University of Applied Sciences, Marine Technology (FI)
- Helsinki City Rescue Department (FI)
- Estonian Police and Border Guard Board (EE)
- Swedish Coast Guard Headquarters (SE)
- Klaipeda University (LT)
- Free and Hanseatic City of Hamburg/Ministry of Environment and Energy/ Department of Emission Control/Fire Brigade Hamburg (DE)
- Central Command for Maritime Emergencies Germany (Haveriekommando)

The objective of this ChemSAR handbook is to enhance the preparedness for international rescue operations in maritime incidents involving hazardous and noxious substances (HNS) and to clarify and harmonise the processes already in use. The operational procedures are primarily aimed at standardising the operations of rescue organisations in these kinds of incidents.

Additionally, the actors involved in rescue operations already often have their own organisation- or unit-specific instructions and operating methods during the actual rescue operations on-scene.

A secondary goal is to provide shipping companies and the vessels' crew supplementary information on the procedures of the rescue operation involving HNS. Behind the development of the standard operational procedures has been the idea that they would be applicable for use also in smaller scale HNS rescue operations, as well as in situations which do not initially pose a significant HNS danger.

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