



BEST PRACTICE GUIDANCE FIRE PREVENTION & FIGHTING

Revision I

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ABOUT PLATFORM ZERO INCIDENTS

The Platform Zero Incidents (PZI) is an initiative of the inland shipping industry. As the name suggests, PZI aims at 0 (zero) accidents in the inland shipping industry. PZI wants to achieve this by:



A platform in which near misses and incidents are shared among the members.



Preventing the recurrence of near misses/incidents by developing best practices and encouraging their use, based on research and analysis of (trends of) near misses/incidents.



Building lasting relationships with stakeholders.








Raising awareness and responsibility of safety within the industry.



PZI will be the center of expertise in the field of prevention of safety and environmental incidents in inland shipping.

This publication helps to achieve PZI's mission and vision. The document has been developed by and for inland navigation.

It can be used for various purposes, such as:

-  Reference for crew members and fleet managers.
-  Training of crew members.
-  Input for safety meetings on board.
-  Lesson material for educational institutions.
-  As a basis for procedures and work instructions.

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1. INTRODUCTION

1.1. Why this document?

Fires can occur on board. By means of this *Best Practice Guidance (BPG)* of the Platform Zero Incidents we would like to draw attention to two parts, namely the prevention of fire and the fight against it.

The most important thing is to prevent fires and this document provides a summary of the type of fires that can occur and how these can be prevented.

The second point is the fight against the fire by the crew. In case of fire, the crew is initially dependent on themselves. This document provides guidelines on which steps can be taken.

1.2. How to use this document?

This document does not replace current systems or documents that are already available on board, such as emergency plans. Also pay attention to special circumstances. Developments such as the use of alternative fuels are moving very fast and cannot all be included at the time of development of this BPG. Consider prescribed legislation that may differ from the general scenarios described in this document.

In addition, this document is not all-encompassing and there may be situations that are not covered in this document. This BPG focuses mainly on barges that transport goods and not on passenger vessels.

You can use the document as a reference, but also for familiarization with the barge and/or to train your crew members. You can also handle the document during safety meetings with your crew.

It can increase safety awareness on board and thus prevent the risk of accidents.

If you have suggestions to further improve this document, please contact Zero Incidents Platform.

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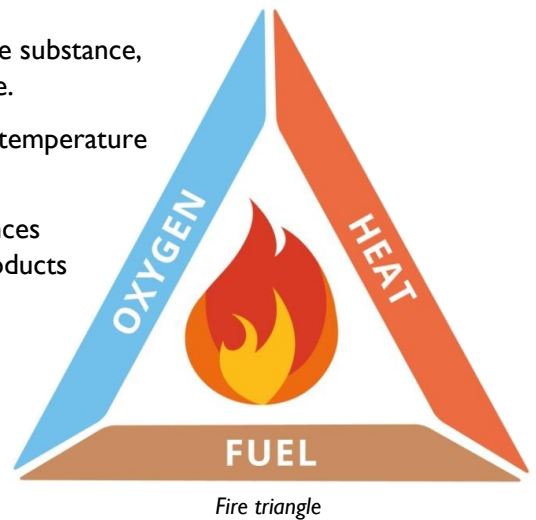
2. THE FIRETRIANGLE

Fire can occur when three elements come together: a flammable substance, an ignition source and oxygen. This is also called the fire triangle.

The condition here is that the heat is at least up to the ignition temperature of the flammable substance.

With a flammable substance you can think of dangerous substances that are being transported, but also cleaning cloths, cleaning products or even (parts in) electronic equipment.

In the following sections we will go deeper into the type of fires that can occur on board. Although an attempt has been made to name all types of fires, there may be situations that are not foreseen. Take this into account and be aware of the 3 elements from the fire triangle.



When there is a fire on board, this can in some cases be extinguished by the crew. However, in many cases it is necessary to call emergency services. Do this quickly!

It may be useful to enable location determination on the mobile phone, sometimes the exact location can be shared with emergency services.









































Also contact the office / owner (if relevant). Follow the emergency plans.

3. EXTINGUISHERS

3.1. Overview of fire extinguishers and use

Below an overview of the extinguishers that could be on board and an indication for which type of fires they can best be used.

The former Class E is not mentioned in this document. The E stands for electricity. Since electricity itself does not burn, but usually a class A or class D component is involved, electrical fires fall under these classes. Each extinguisher may be used on electricity up to 1000 volts at a distance of 1m.

					
Substance	Materials	Liquids	Gases	Flammable metals	Oils and fats
Examples	Wood, paper, textiles	Oil, petrol, fats	Butane, propane, natural gas	Magnesium, aluminum, sodium	Frying fat
Type of extinguisher					
Water					
ABC-powder*					
D-powder*					
CO ₂					
Grease extinguisher					
Spray foam					
Fire blanket					
Fixed extinguishing gas system	For use in case of a fire in the engine room. For more information see Appendix 01: .				
Sprinklers	Serves to cool the deck or cargo.				



= dangerous to use extinguisher for this type of fire



= unsuitable extinguisher for this type of fire



= suitable extinguisher for this type of fire

* = Shake every three months to prevent clumping. Also include this in the monthly maintenance lists.

3.2. Maintenance extinguishers

During the year, fire extinguisher should be checked for presence, pressure loss, sealing and damage. Powder extinguishers should be shaken every three months to prevent clumping. Also include this in the monthly maintenance lists. Even a fixed extinguishing gas system must be checked regularly for pressure loss and for pressure increase.

In addition, fire extinguishers should hang, because an extinguisher standing on the ground can fall over and because can then be moved less easily.

Ambient temperature

Because the room in which the installation is located heats up, an increase in pressure can occur. Think, for example, of batteries that heat up, (emissions from) the engine and summer temperatures that can heat up the room. The pressure can become so high that the breakage disc in the valve of the fixed extinguishing gas system breaks and all extinguishing gas is expelled. In addition to the high costs, there is also a chance that the engines (if they suck their air from the engine room) will stop. So keep an eye on the temperature in the room (especially the engine room).

Also pay attention to the location of the extinguishing resources and the ventilation in the room. See ES-TRIN.

3.3. Detection and detectors

Provide suitable smoke and fire detectors and check them regularly for operation. Also check whether they hang in the right places. Together with the inspection, consider whether the detector is still in the right place, for example after a change in the engine room.

Take into account that there are also detectors in the living areas.

When an alarm goes off, carefully open the door to the room. By opening, extra air/oxygen can reach the fire, allowing it to spread more quickly.

Type of detectors

There are different types of detectors (alarms). It is important to install the right detection system in the room. Below is a list of detectors and what they detect:

- Smoke detectors: detect smoke development.
- Thermal detector (heat detector): does not detect smoke but at a temperature above 60 degrees Celsius.
- Carbon monoxide detector: detects carbon monoxide.
- Combination meter: smoke detector and carbon monoxide detector in one.
- H₂S meter: detects hydrogen sulfide.

4. TYPE OF FIRES

4.1. Spontaneous combustion in machineroom or inside deck box

Causes

Spontaneous combustion in the engine room or in the deck box occurs regularly. The combustible products on, for example, cleaning cloths that are stored in buckets or boxes can reach their ignition temperature (flash point). When the oil dries, a chemical reaction takes place that produces heat, the heat that is released during the drying of these oils cannot escape (especially if a cloth is stored somewhere as a wad). It can happen that the temperature rises to a point that the material smelts and a fire occurs.

Heat can accelerate this. In engine rooms, and in the summer on deck, it can get very hot which can accelerate heating. When oxygen is present, a fire may occur.

Prevention

Spontaneous combustion can hardly be prevented, but a number of measures can be taken:

- Remove polishing cloths as quickly as possible;
- Put buckets and deck boxes in as cool a place as possible;
- Separating cloths from other means such as paint, bottles of thinner, brushes, etc .;
- Let the cloths dry fully;
- Be alert when opening a closed bucket / box, oxygen will be added which may cause ignition;
- Take care that when there are plastic bags in a container, the lid may not close properly and oxygen may get in;
- Keep the amount of product as minimal as possible (hand washing with less flammable products and use cloths as little as possible when cleaning);
- Painting the deck boxes in a light color (they become less hot than dark colors);
- Insulate deck boxes;
- Be aware of the ignition points of the products used;
- Check buckets and deck boxes regularly on spontaneous combustion.

Measures for control

When spontaneous combustion or a fire happens, the first step is to remove the oxygen supply. This can be done by closing the box or bucket well or by using an extinguisher.

If the fire cannot be extinguished by yourself or if there is any doubt about this, please contact the authorities. This can be done via the emergency number 112 and also via VHF with traffic posts or locks. Inform other shipping traffic as well.

4.2. Equipment (engine)

Causes

Most equipment becomes warm when in use. In addition, flammable liquids are often used, for example to lubricate or clean. This combination (together with oxygen) can lead to ignition. A number of causes:

- Start motor that stalls;
- Slippage of v-belts;
- Leakage / mist formation;
- Smoking in the engine room (cigarette butts or sparks);
- Flammable products on hot surfaces (oil or other dirt on the engine, a cloth / rag);
- Filters operating poorly;
- Sealed air supply.

Prevention

Ignition of equipment can be prevented by taking the following measures:

- Proper cleaning of equipment;
- Clean up cloths and (cleaning) agents after use;
- Communicate well when maintenance is done (also use the Lock-out / Tag-out method, a procedure for locking and marking equipment or piping systems in maintenance to prevent unexpected activation);
- Keep the air supply to the engine room free;
- Check the gas oil hoses for (drought) cracks;
- Check the filters and tubes and replace them on time.
- Also take into account specific measures depending on the fuel (see also Appendix 03).

Measures for control

When fighting a fire in the engine room, a number of factors are very important. There is fire detection devices that warns the crew. It is important to switch off equipment (you take the heat source away) and small fires can be extinguished manually if the fire occurs when you are in the engine room.

If a fire arises and there are **no crew members in the room**, the fixed extinguishing gas system can be used (if present). Ensure that the ventilation openings are closed and mechanical ventilation has stopped. The fuel supply must also be closed in consultation with the captain. See Appendix 01 on the use of the fixed extinguishing gas system.

The fuel also plays an important role in fighting a fire. Be aware of the characteristics of the fuel used.

If the fire cannot be extinguished yourself or if there is any doubt about this, please contact the authorities. This can be done via the emergency number 112 and also via VHF with traffic posts or locks. Inform other shipping traffic as well.

4.3. Lithium-ion Batteries

Causes

Batteries are 'naturally' warm. The danger is that the battery internally reaches too high a temperature and self-ignites. The battery can also ignite due to external factors such as a too high ambient temperature.

Extinguishing lithium-ion batteries is extremely difficult, so be aware of what type of batteries are on board, so that the emergency services can take the right actions.

There is no risk of spontaneous combustion/thermal runaway with lead batteries. The risk with these batteries is that if they are not charged with ventilation, hydrogen gas (also known as explosion gas) can be released.

Prevent

Protection against high temperatures. Ensure sufficient cooling through ventilation. Investigate the possibility of continuously cooling the battery in, for example, a container of water. Do not store empty/broken batteries in a deck box due to at risk of overheating.

See Es-Trin article 10 regarding battery storage requirements.

Protect against mechanical damage.

Control measures

Lithium-ion battery fires are extremely difficult to extinguish. Complete submersion for a long time (sometimes tens of hours) seems to be the only way of extinguishing. In the event of a lithium-ion fire, therefore, contact the fire brigade as soon as possible and ensure your own safety.

Own safety:

- Try to find out where the smoke is coming from;
- Be aware of secondary sources of fire caused by shooting battery cells (guarantee return to the outside/safe zone, watch out for your own safety);
- Avoid contact with the smoke, this is very toxic;
- Move to a safe location;
- Inform the surrounding area and contact the fire brigade as soon as possible.

4.4. Electricity

Causes

An electricity fire can have the following causes:

- Dirt, such as dust or oil or other liquids;
- Loose outlets;
- Heat in the electricity cabinet;
- Short circuit;
- Friction / fire in the wheelhouse column (cables that tear or heat up);
- Damaged cables;
- Cables that heat up, for example reels and plugs.

Prevention

An electricity fire can be prevented by keeping electricity clean and checking regularly for damage. Rollout the cables completely when using them, for example with reels. Do not tie cables together, but within moving parts, put a sock around them. Ensure earthing of the equipment.

In addition, when something goes wrong with the electricity, there is often a particular smell. Be aware of this.

Measures for control

There are a number of measures that can be taken when there is a fire:

- Remove the power from the relevant device / circuit;
- A powder extinguisher can be used, but can cause collateral damage to the electricity;
- Use a foam extinguisher to fight the fire;
- CO2 extinguisher as an addition to the powder or foam extinguisher;
- If the fire is of such a size that hand extinguishers are not suitable, the extinguishing gas system can be used (if present). See Appendix 01 on the use of the fixed extinguishing gas system.

If the fire cannot be extinguished by yourself or if there is any doubt about this, please contact the authorities. This can be done via the emergency number 112 and also via VHF with traffic posts or locks. Inform other shipping traffic as well.

4.5.Hot work

Causes

Hot work or other fire hazardous activities can immediately cause a fire. Also, indirect causes such as sparks can cause ignition. It is therefore important to be aware of this. Below are a number of activities that are associated with fire hazardous activities:

- Welding;
- Soldering (or soldering iron that is somewhere against);
- Scaling;
- Sharpening;
- Sanding;
- Paint stripping;
- Irradiation of heat, for example when doing carpentry or drilling;
- Heat and / or sparks are generated by friction, so that they can serve as sources of ignition (and other means or gasses in the environment can ignite);
 - Smoldering of paint and rust;
 - Wood and insulation that catches fire due to sparks;
 - Thinner or oil stains that catch fire due to the heat.

Prevention

For the prevention of ignition of substances, please take into account the following points:

- In case the fire cannot be extinguished by yourself or if there is any doubt about this, please contact the authorities. This can be done via the emergency number 112 and also via VHF with traffic posts or locks.
- Make agreements with the parties that perform the work (permit to work);
- Get approval from the captain and inform other crew members of the activity to be carried out;
- Ensure earthing of the barge;
- Use of spark-free tools;
- Wear antistatic clothing;
- Work in a clean work environment;
- Carry out gas measurements where necessary and ensure a safe environment;
- Be aware of the environment (materials in the environment and adjacent spaces);
- Remove flammable materials, cover the environment with the proper means;
- Cool the room and elements if possible;
- Clean and tidy up, also pay attention to how you leave the area behind (for example do not leave hot appliances).

Measures for control

Before starting activities, ensure that there is a fire watch if activities are carried out in confined spaces. Also, close fire doors and keep extinguishing equipment ready so that in case of emergency the damage is limited.

If the fire cannot be extinguished by yourself or if there is any doubt about this, please contact the authorities. This can be done via the emergency number 112 and also via VHF with traffic posts or locks. Inform other shipping traffic as well.

4.6.Cargo

Causes

The cargo that is being transported may ignite because of the following reasons:

- Incineration and self-combustion:
 - Friction that can cause heat and fire;
 - Warming up of the cargo causing (flammable) gases to be released that ignite by a low temperature.
- Ignition of:
 - Explosive / flammable gases;
 - Scrap, paper, wood;
 - Drilling and turning curls.

Prevention

Fire in cargo can be prevented by taking into account the following elements:

- Ventilate, cool / cover the load (remove ignition sources);
- Earthing of the ship;
- Carry out gas measurements and checks in order to take timely measures if necessary;
- Product knowledge to take timely measures. For example, specific measures may apply to the load (also on non-ADN products).

Measures for control

If a fire occurs, it is necessary to extinguish the fire. This can be done, for example, by using the sprinklers. In the case of a dry cargo vessel, spraying the cargo may cause instability and/or it may be necessary to unload the cargo. Please discuss this as soon as possible. With the shipper.

If the fire cannot be extinguished by yourself or if there is any doubt about this, please contact the authorities. This can be done via the emergency number 112 and also via VHF with traffic posts or locks. Inform other shipping traffic as well.

5. EXTERNAL FIRE: ON SHORE/OTHER VESSEL

Be aware that fire can also take place somewhere else. For example, when loading and discharging activities takes place and there is a fire on the shore. Keep communication open with the parties so that the right actions can be taken; provide assistance, keep distance or evacuate. Keep the following matters in mind:

- The position of the barge, is the barge up or downwind;
- The dinghy is ready for use;
- Be aware of the environment;
- Are you familiar with the alarms and escape routes ashore?

6. SPECIFIC AREAS

6.1. Living areas and wheelhouse

Fire can also break out in the living areas. Possible causes and measures are listed below.

Causes

- Heating of chargers or devices that are being charged;
- Dust filters in dryers;
- Dirty extractor hood;
- Polluted (bathroom) fans;
- Frying pan of which the (old) fat is overheated;
- Electricity (see electricity);
- Leakage of gas installation.

Prevention

- Charging equipment or equipment that is switched on or left unattended in standby mode;
- Maintenance of household appliances according to the manual;
- Use of original supplied parts;
- Do not leave open fires (candles, gel fireplaces, etc.) unattended;
- Heating appliances must be fixed;
- Provide fire detection in the living areas and wheelhouse.

Measures for control

First switch off equipment and/or turn off the gas supply during gas fires. Then use manual extinguishers and/or a fire blanket.

6.2. Car/dinghy

Be aware of the following:

- Gas formation in the hood of the engine of the dinghy;
- The fuel tanks;
- In case of electric/hybrid cars, ignition of the batteries. Then contact the emergency services as soon as possible (see also Chapter 4.3).

7. FIRE DRILLS

In order to be well prepared for emergency situations like a fire on board, it is important to practice regularly. This way everyone knows what the expectations are, what actions need to be taken and by whom. It also provides more clarity about what resources are available, where they are located and how to use them.

Every second counts.

An example of a fire drill is given in Appendix 02.

CONSULTED SOURCES

Laws, regulations and standards
CESNI (ES-TRIN)

ADN

Other

Havenbedrijf Amsterdam N.V. (19-04-2021), Onderzoek externe veiligheid bunkeren van alternatieve brandstoffen voor de zeescheepvaart, Rapport Nr.: 10246009-1, Rev. 1, Document Nr.: 11HYLEZF-2
(https://www.portofamsterdam.com/sites/default/files/2021-11/DNV%20POA%20Finaal%20Rapport_Onderzoek%20externe%20veiligheid%20bunkeren%20van%20alternatieve%20brandstoffen%20voor%20de%20zeescheepvaart_Rev1_19-04-2021.pdf)

Revision overview

Revision nr	Changes	Date
I	<p>Vision</p> <p>1.2 Contact Information</p> <p>3.1 Explanation missing class E, updated icons</p> <p>3.2 Ambient temperature</p> <p>3.3 Detection and detectors</p> <p>4.2 Reference alternative fuels</p> <p>4.3 Batteries</p> <p>4.6 Addition of spraying dry cargo ship</p> <p>6.1 Addition of fire detection in living areas</p> <p>6.2 Electric cars</p> <p>Sources</p> <p>Appendix 3 Alternative fuels</p> <p>Throughout document: contact with authorities under measures</p>	01-aug-2023

APPENDIX 01: FIXED EXTINGUISHING GAS SYSTEM

Make sure that the instruction is visible and in a language that the captain can understand.

The instructions must include the following elements:

- Activation of the fixed extinguishing system into operation;
- The necessity of checking that all persons have left the area;
- Before activating the fixed extinguishing system, the engine in the area that draw in air from the room must be taken out of operation.
- Proper handling of the crew in case of activation and entering the space after activation, in particular with regard to the possible presence of hazardous substances;
- Proper handling of the crew in the event of a breakdown in the extinguishing system.

Activation fixed extinguishing system

When it is decided to use the fixed extinguishing system, follow the instructions carefully. Below an example of an instruction manual:

1. Evacuate the area because of toxic gases and the expulsion of oxygen.
2. Close doors and openings to prevent the extinguishing gas from leaving the protected area and the entering of fresh air.
3. If engines use air from the protected area: switch off engines.
4. Open the control box and the alarm sounds and ventilation stops.
5. Pull handle.
6. Installation is in operation.
7. If the extinguishing system does not function: leave the doors and openings closed and do not enter the room.
8. Because of toxic gases, only enter the room after it is released. Release can be done by agencies such as the fire brigade, port, safety advisor and environmental service. They have the right measuring instruments and protective respiratory protection and clothing for this.

APPENDIX 02: FIRE DRILL

Scenario

Drill

Scenario

Fire in engineroom front.

Description

During the loading of containers the barge is moored at the terminal. The captain is busy with the administration behind the computer in the wheelhouse. The helmsman is off duty and is sleeping. One of the sailors supervises the loading of the containers and is on deck. The other sailor is busy changing the oil filters of one of the generators in the engine room of the stern.

A leaking fuel line in the engine room of the fore section sprays a mist of gas oil on the rotating generator. Over time, the leaked fuel heats up to a point that it catches fire. The fire then switches to a number of cardboard boxes that are stored there and gives a considerable smoke development.

The sailor on deck, who supervises the loading, sees the smoke coming out the ventilation openings of the engine room.

Discuss the following questions:

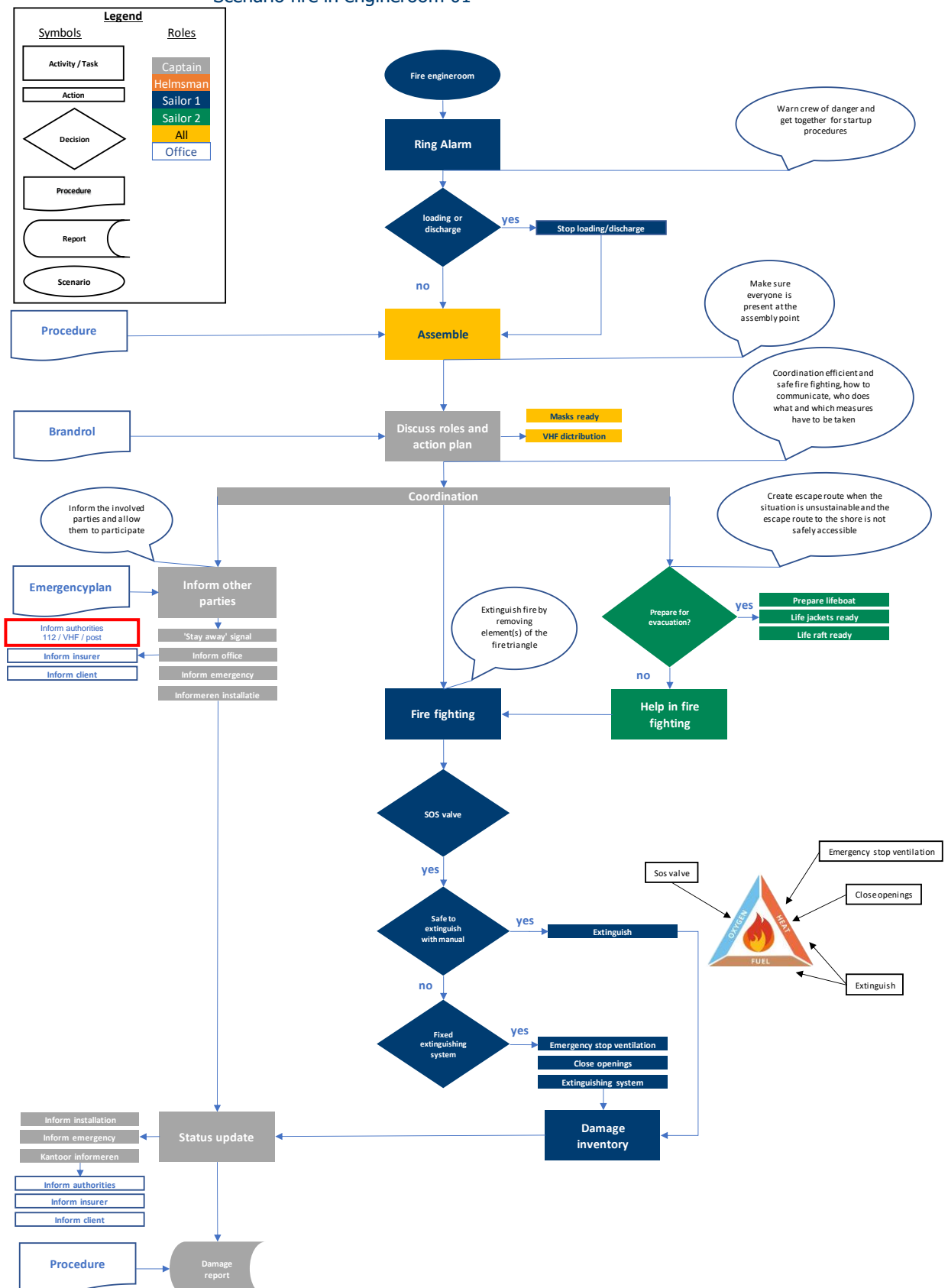
1. What actions does the sailor have to take?
2. How can the fire be fought safely?
3. Which persons have which role?
4. How and who are informed?
5. What is described in the procedures for the above situation?
6. What is arranged in the emergency plan?
7. Which PPE can be used?

In which form is the exercise performed?

☐ Incident discussion ☐ Physical exercise

Answer sheet

Scenario fire in engineroom 01



APPENDIX 03: ALTERNATIVE FUELS

Developments in the field of alternative fuels are moving very fast and cannot all be included in this Best Practice Guidance. A number of fuels are briefly listed below, along with some of their properties. The emphasis is on creating a picture of the differences in flammability and control, not a complete description of the substance. Consult the SDS (Safety Data Sheet).

LNG

“LNG mainly consists of methane (natural gas). In addition, LNG contains higher hydrocarbons (such as ethane) and inert gases (such as nitrogen).

Natural gas is non-toxic, no limit value has been set, but it poses a risk of suffocation in high concentrations (due to displacement of the air). A natural gas/air mixture has an LEL value (lowest explosion limit) of 4.4 vol% natural gas in air under atmospheric conditions. The general hazardous properties for LNG are described in PGS 33-I (Ref. /3/).”

(translated from Havenbedrijf N.V. 2021, H4.1.1)

Ammonia

Ammonia is a colorless, poisonous gas with a strong pungent odor. Ammonia is not very flammable. A cold-boiled ammonia pool does not burn in a self-sustaining manner, as most hydrocarbons do. This is caused by insufficient heat radiation from the flames reaching the pool. The flames are very transparent. When heat is supplied in a different way, for example from the ground or with water, enough ammonia can evaporate to keep the fire going.

A possible ammonia fire only poses a limited risk, because only a small amount of heat is radiated from the fire to the surrounding area. The risk of fire and explosion occurring almost exclusively exists in poorly ventilated areas.

(The general hazardous properties for ammonia are described in PGS 12 (Ref. /4/).)

(translated from Havenbedrijf N.V. 2021, H4.1.3)

Methanol

Methanol (methyl alcohol) is a colorless, volatile liquid. Methanol is flammable with a Lower Flammable Limit (LFL) of 7.3 vol%. Methanol is mainly toxic when ingested, resulting in blindness and possibly death.

(translated from Havenbedrijf N.V. 2021, H4.1.2)

Hydrogen

Hydrogen is a flammable gas with an LFL concentration of 4.0 vol% in air. Hydrogen is not toxic. Due to its small molecule, hydrogen penetrates almost everywhere, is lighter than air (about 14 times) and is also odorless. Little energy is required to ignite the gas. Depending on the pressure and outflow rate, hydrogen can be ignited at very low energy, causing a flare fire. In addition, if hydrogen accumulates in confined/enclosed areas, an explosion is possible.

Hydrogen has a colorless, barely visible flame and has virtually no heat radiation. A hydrogen fire cannot easily be detected by humans. With a larger leak in a pipe or hose at a pressure of 700 bar, virtually invisible and powerful flare fires can occur in the event of a fire.

(The general hazard properties for hydrogen are described in PGS 35 (Ref. /5/).)

(translated from Havenbedrijf N.V. 2021, H4.1.4)