

Title	IMDG Code 2016 / SUPPLEMENT / The EmS Guide / Introduction to the Emergency Schedules for FIRE
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1 BE PREPARED

1.1

Preventing a fire from occurring is the most important part of a shipboard safety programme. However, once a fire has started, a well trained crew is the best defence for bringing the fire under control. Given the complexity of extinguishing a fire involving dangerous goods, it is essential that the advice in this Guide be incorporated into the ship's training regime so that the crew will be able to respond to a fire casualty in a timely and effective manner.

1.2

This Guide should be integrated into a Safety Management System (SMS). Procedures contained in the shipboard emergency plan should be tailored to the individual ship.

1.3

The fire fighting procedures within the EmS Schedules are different for "on deck" and "under deck" stowage. For specific ship types (e.g. hatchless container ships) or cargo holds (e.g. open vehicle decks of ferries), these two procedures have to be assigned specifically to the individual ship.

1.4

Given the toxic nature of some of the dangerous goods involved, accommodation spaces should be protected from fire and smoke as far as possible (e.g. water-spray). Therefore, the ventilation systems for working and living spaces should be shut-off, closed and secured to reduce the possibility of vapours, dusts and gases penetrating these spaces. In some instances, it may be necessary to turn the ship's accommodation spaces up wind, if possible.

1.5

The safety of fire-fighting personnel is most important. Use of appropriate protective clothing (i.e. a firefighter's outfit when dealing with a fire) and self-contained breathing apparatus, to protect skin and lungs from toxic and/or corrosive liquids, vapours, dusts and gases is essential. This equipment should be suitable for each individual member of the fire-fighting team, as working with such equipment requires a high level of fitness and training. It should be kept in mind that even a weak acute illness may interfere with a crew members's fitness. In addition, pregnant crew members should not be exposed to dangerous vapours.

1.6

It is also essential to ensure that there is always an escape route for firefighting personnel despite the limitations due to narrow exit paths and the danger of falling overboard.

2 IDENTIFICATION OF THE DANGEROUS GOOD(S) INVOLVED

2.1

It is essential to identify the dangerous good(s) involved in the fire in order that the specific EmS FIRE SCHEDULE(S) for the cargo(es) may be consulted and appropriate action taken. This is important because some dangerous goods are incompatible with some fire-fighting media and could exacerbate the situation (e.g. use of a water-based extinguishing medium on water-reactive cargoes).

2.2

An identification number with four digits preceded by the letters "UN" is assigned to all dangerous goods. From the UN Number, it is possible to find the appropriate EmS FIRE Schedule. The Dangerous Goods List in Part 3, chapter 3.2, of the IMDG Code contains the names and the UN Numbers, as well as the EmS Schedule numbers. The special Dangerous Goods List Manifest and the detailed Stowage Plan required by SOLAS regulation VII/5 will also contain the proper shipping name and UN Number of the dangerous good(s) concerned. Packages will usually be labelled as well.

2.3

Specific information as to properties of dangerous goods may also be found in the Dangerous Goods List in the IMDG Code. Dangerous goods are classified and labelled according to their hazards. Labels and marks on packages provide a warning of the general risks to be encountered. Personnel should understand the labelling system.

2.4

Emergency preparedness should form part of the ship's Safety Management System as required by the ISM Code. Prepared information can reduce errors during a fire emergency. Therefore, it is recommended that the EmS Schedule(S) be identified and included on the dangerous goods manifest and stowage plan recording the stowage position of the cargo. That will enable key members of the crew to know in advance which emergency procedures could be necessary. In the event of a fire, the allocation of a specific EmS FIRE SCHEDULE via identification of cargo via the UN number takes time and is open to error, especially in mixed cargoes in one container. Furthermore, some fire fighting procedures may require specific media and operations could be affected by the stowage location of such media. The advice given in the EmS FIRE SCHEDULE should be directly usable based on the stowage information, without time consuming identification and location of the cargo involved.

3 COOL AND SUFFOCATE

3.1

In general, fires require heat (energy) and oxygen to start burning. Only a limited number of chemicals do not need oxygen from the air. Therefore, the aim of fire-fighting is to exclude oxygen and to cool the cargo(es). On board ship, this is generally carried out by using water-spray or gas extinguishing systems.

3.2

Some burning cargoes will need special fire-fighting media (like dry inert material) to suffocate the fire. In such circumstances, normal fire-fighting procedures are often impracticable and concentrating on cooling nearby cargo and ship structures is recommended in such cases.

3.3

Fire-fighters should be made aware of the hazards of opening doors of an over-heated space or freight container which is suspected of containing cargo on fire. There may be a lack of oxygen inside and fresh air from outside the space may instantly start a fire, and cause a flash-back that could injure the fire fighters. Cool down the container first!

4 SEEK ADVICE

4.1

Expert advice should be sought irrespective of how insignificant the fire may seem to be when dealing with dangerous goods fires. Such advice could be given by:

- .1 ship operating companies (e.g. designated persons);
- .2 emergency information centres (such as CHEMTREC in the USA);
- .3 specialized agencies;
- .4 professional responders;
- .5 port state authorities;
- .6 coastguard;
- .7 fire brigades; and
- .8 manufacturers of the products.

5 EVACUATION

Within some EmS FIRE SCHEDULEs the phrase "Sudden or short-term events (e.g. explosions) may endanger the safety of the ship" has been introduced. Depending on the type of ship and on the volume of dangerous goods allocated to this specific FIRE SCHEDULE, it may be necessary to consider abandoning the ship at an early stage. In this case, the master should be aware of the hazard and should decide whether the ship requires assistance.

6 FIRE-FIGHTING MEDIA

6.1

Water

6.1.1

Water is the obvious fire-fighting medium at sea and is recommended for most fires involving dangerous goods. However, it should be noted that shore-based fire-fighters may use a different medium.

6.1.2

When water is applied to a burning cargo, the temperature is reduced and the fire will be extinguished when the temperature drops below the ignition point. However, water is not suitable to extinguish all fires involving dangerous goods. Different fire-fighting media should be used if so indicated on the specific EmS FIRE SCHEDULE.

6.1.3

If the fire is under deck, consideration should be given to the stability of the ship when flooding the hold with water.

6.1.4

Some dangerous goods will react chemically with water, producing flammable and/or toxic gases. The most effective way to extinguish a fire involving these dangerous goods is to smother them with a dry inert powdered material. However, the availability of suitable inert material on board is limited. It may also be dangerous to approach the fire in order to use inert material properly. Consequently, the most appropriate method of extinguishing the fire may be to use copious quantities of water. This would have an overall cooling effect on the fire even though the water may react with the dangerous goods involved.

6.1.5

Ships are equipped with a number of dual purpose spray/jet nozzles as required by SOLAS. Most EmS FIRE SCHEDULEs recommend that the nozzles be set to spray when used to fight fires. Water-spray may also be achieved by using water jets from some distance. This method of producing water-spray is generally recommended. However, it is dangerous to direct a water jet onto the fire at close range because this could result in the spread of burning material.

6.1.6

The term "copious quantities of water" used within the EmS FIRE Schedules refers to the minimum total quantities of water provided for optimal fire-fighting using four jets of water, as required by SOLAS regulation II-2/4. The master and crew should know the practical limitations that may be encountered at specific stowage locations in this respect.

6.1.7

Following the advice "use of copious quantities of water" or "water spray from as many hoses as possible" may interfere with the safety of the ship with regard to the ship's stability. Stress forces on the hull due to increased quantities of water in the ship should be considered.

6.2

Fixed gas fire-extinguishing systems

6.2.1

If a fixed gas fire-extinguishing system is used for incidents under deck, all hatches and vent dampers should be closed and ventilation shut-off before the system is activated. If smoke is seen coming from around the hatches, the leaks should be sealed with any suitable material available.

6.2.2

The majority of the fixed gas fire-extinguishing systems use carbon dioxide (CO₂), but some use nitrogen (N₂) as the extinguishing medium. The instructions on board should be followed. The fire control plan will sometimes specify a given volume of gas to be applied to a given space. No advantage will be gained by exceeding this volume of gas where burning dangerous goods are involved.

6.2.3

It is important to realise that it will take an appreciable time for the space to cool after the fire has been extinguished. Therefore it would be extremely dangerous to reopen the hatches since the extinguishing gas would escape and air would enter the space again, thus allowing the fire to re-ignite. The ships' on-board instructions for such cases should be followed.

6.2.4

Fixed gas fire-extinguishing systems are not effective against all fires. EmS FIRE SCHEDULEs may contain specific information in this regard.

6.3

Fixed pressure water spraying systems

6.3.1

In some ships (e.g. ro/ro ships and car ferries), some cargo spaces may be fitted with a water drencher or spray system instead of a fixed gas fire-extinguishing system. There will be instructions on board which should be followed.

6.3.2

A closed cargo space should be ventilated to clear it of smoke and toxic gases after the fire has been extinguished and the space has cooled. The ventilation equipment should be of a certified safe type for smoke removal. Evidence that the space is cooling down can be obtained by monitoring adjacent bulkheads and decks. Thereafter, a fire-fighting team should look for any small remaining fires and inspect the surrounding cargo. After the fire has been extinguished, the cargo should be kept under surveillance until its normal temperature is reached.

6.4

Foam

In general, foam is an effective fire-fighting medium for fires involving flammable liquids. The foam forms a layer on the liquid thereby excluding oxygen and reducing heat. However, it is less effective on solid substances on fire. Most foams contain water and should not be used on fires where the use of water is restricted because of adverse chemical reaction.

6.5

Dry chemicals

Dry chemicals may be an effective extinguishing medium for fires involving water-reactive substances and metals. The dry chemical should not react with the dangerous goods involved in the fire. Some dangerous goods require a specific dry chemical to extinguish a fire.

7 DANGEROUS GOODS EXPOSED TO FIRE

7.1

Rupture and cooling

7.1.1

Where possible, packages should be removed from the vicinity of the fire. In general, heated material will expand thus needing more volume and creating pressure in the package. This will affect the integrity of the package which could lead to rupture and dispersal of the contents. Effective cooling can lower the possibility of rupture.

7.1.2

Where there is a danger that heat will have already started to cause a chemical or physical change to the dangerous substance, packages should not be moved. Care should always be exercised, for example, with those substances liable to polymerise, as this reaction may continue for a long time after the removal of the heat source. Provided no discharge or pumping overboard problem arises, cooling should continue for many hours after the fire has been extinguished. After heat evolution has ceased, cooling with water may be stopped. A careful watch should be kept on the stability of the ship.

7.1.3

The EmS FIRE SCHEDULES advise that a number of dangerous goods should be removed or jettisoned if there is a likelihood of their involvement in a fire. However, where full or nearly full cargo transport units are involved, such guidance may be impractical. In that case, the advice should be taken to indicate that the goods are particularly dangerous. Personnel on board should fight the fire and cool nearby cargo as far as possible. It should be borne in mind that some heated dangerous goods may have already damaged the packaging or may explode during handling. Consequently, moving or jettisoning burning cargo should only be attempted with utmost caution.

7.2

Spillage

7.2.1

It should be remembered that leakage of dangerous goods can be very dangerous for the crew and for the ship. Fire and explosion can rupture nearby packages or tanks, creating a spillage.

7.2.2

If a leak is discovered, the hazards associated with that leak should be ascertained immediately. In cases involving leaks of flammable liquids or flammable gases (class 3 and class 2.1 labels respectively), the crew should withdraw to a well protected position. Air-vapour and air-gas mixtures are liable to explode and such an explosion may injure crew members and damage the ship.

7.2.3

Many toxic gases are odourless and colourless. A number of liquids will produce toxic vapours if exposed to heat. In an emergency, the ship should be manoeuvred to keep the bridge, living quarters and crew up wind as far as possible.

7.2.4

The EmS SPILLAGE SCHEDULES should be consulted when dealing with a leakage.

8 PERSONAL PROTECTION

8.1

Ship's personnel

8.1.1

Many vapours and gases of dangerous goods produced by a fire are hazardous to health. In the case of fire, the use of a firefighter's outfit and self-contained breathing apparatus is essential. Only trained personnel should use this equipment which should be well maintained. Particular attention should be given to ensuring that toxic vapours or fumes do not penetrate occupied areas of the ship (e.g. bridge, living quarters, machinery spaces, working areas, etc.).

8.1.2

According to the ship's fire emergency plan, ventilation systems to living and working spaces should be shut-off, closed and secured to reduce the possibility of vapours, dusts, and gases from penetrating these areas.

8.2

Fire-fighting team

8.2.1

Chapter II-2 of SOLAS requires firefighter's outfits, full chemical protective suits and self-contained breathing apparatus to be readily available on board. Masters are reminded that personnel will need regular training in the use of self-contained breathing apparatus and that special attention should be given to ensure that face masks fit satisfactorily at all times.

8.2.2

Self-contained breathing apparatus is essential for fire-fighting because dangerous goods on fire produce various substances hazardous to health. Handling water jets from some distance or cooling of heated cargo may not require the use of self-contained breathing apparatus. However, decisions not to use self-contained breathing apparatus should be undertaken carefully and on a case-by-case basis.

8.2.3

Fire-fighting outfits offer only limited protection from dangerous goods. Fire-fighting outfits are not chemical suits. Chemical protective clothing is designed to protect against specific properties of chemicals. In general, there will be no such thing as a single type chemical protective suit on board. Therefore, contact with dangerous goods should be avoided. Chemical protective clothing is not resistant to fire or heat.

9 FIRST AID AND ACTIONS AFTER TERMINATION OF FIRE-FIGHTING

9.1

Any contamination with hazardous material should be immediately removed from the skin and then washed, for example with copious quantities of water. Information on medical first aid is provided in the IMO/WHO/ILO Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG) published by IMO. Be prepared to use the MFAG!

9.2

Cargo may re-ignite after a fire has been extinguished. An efficient patrol should be maintained in the spaces in which the fire occurred and in any adjoining spaces to ensure that any new ignition or leakages are dealt with promptly. Fire-extinguishing systems should remain on stand-by. Post a fire watch.

9.3

After extinguishing the fire, all emergency team personnel should ensure that all contamination of equipment and protective clothing is removed and washed immediately. Equipment should be restored and restowed for use.

9.4

There are Reporting Procedures under SOLAS and MARPOL which have to be followed (see Reporting Procedures).

10 SPECIAL NOTES ON CLASSES OF DANGEROUS GOODS

10.1

Explosives - class 1

10.1.1

In the event of a fire, everything should be done to prevent the spread of the fire to containers which contain class 1 goods. If it is not possible to prevent the spread of the fire, all personnel should immediately withdraw from the area.

10.1.2

Many explosives will burn to the point of an explosion. The Master's main concern will be whether or not there is likely to be a mass explosion. Such an explosion could damage the ship. If goods of division 1.1 or division 1.5 are involved, this likelihood will exist. The time between fire reaching the explosives and the subsequent mass explosion will be of the order of a few seconds to minutes. The Master should ascertain how large a quantity of such explosives is involved. A few kilogrammes are unlikely to sink the ship, but above this a clear risk to the safety of the crew and the stability of the ship should be considered. Sudden or short-term events may endanger the safety of the ship.

10.1.3

Explosives of divisions 1.2, 1.3, 1.4, and 1.6 are unlikely to explode en masse. Irrespective of the division of the explosives, any fire-fighting should take place from behind substantial cover. If the risk to fire-fighters is too high, hoses could be lashed to the rail or other suitable fixtures and left unmanned.

10.1.4

Neither exclusion of air nor the use of smothering material is likely to be effective against a fire involving explosives. The use of the largest possible quantity of water in the shortest possible time is the only means of attempting to prevent a rise in temperature that could affect the chemical stability of the explosives.

10.1.5

Some dangerous goods of this class have been wetted or immersed in water. As they dry, they become unstable. The Master should seek advice (see section 4 above).

10.2

Gases - class 2

10.2.1

Gases are substances usually transported in cylinders, flasks, portable tanks, aerosol dispensers and bottles under varying degrees of pressure. The gases may be flammable, toxic or corrosive and may be compressed, liquefied or refrigerated.

10.2.2

Gases will not start burning at the valve, unless there has been an ignition source nearby (e.g. fire or heat). The location of the burning gas needs to be identified because it may be the heart of the fire. The heating of the receptacle is the most serious danger because of the possibility of rupture, rocketing or explosion. In the event of a fire, receptacles containing gas should be liberally sprayed with water to keep them as cool as possible.

10.2.3

Non-burning leakages from receptacles of flammable gases may give rise to explosive mixtures in air. If a fire caused by the ignition of leaking gas is extinguished within a cargo space before the leak is stopped, accumulation of gas will occur. This will result in an explosive mixture or a toxic or suffocating atmosphere. The EmS SPILLAGE SCHEDULES should be consulted.

10.2.4

Extremely low temperatures around leakages of some liquefied gases are an additional hazard (other than flammability and toxicity). Emergency teams should avoid contact with such leakages and the immediate vicinity.

10.3

Flammable liquids - class 3

10.3.1

It is dangerous to direct a jet of water onto a fire involving flammable liquids. Many flammable liquids float on water and the water jet would spread the liquid, thus creating a greater danger. Closed containers exposed to fire will become pressurized and a rupture will occur.

10.3.2

Heated flammable liquid will release vapours that may start burning instantly with explosive effect. Consequently, fire-fighting personnel should stay in a well protected position and use water spray on the area of the fire. This will cool down the temperature of the liquid and the air-vapour mixture.

10.4

Flammable solids - class 4.1

10.4.1

This class of substances includes flammable solids, water-wetted explosives (i.e., desensitized explosives) and self-reactive substances.

10.4.2

Flammable solids will easily ignite, and the appropriate EmS FIRE SCHEDULE should be consulted. In the event of a fire, water-wetted explosives (i.e., desensitised explosives) will effectively have the properties of a class 1 product. The special notes on class 1 explosives (see 10.1) and the relevant EmS FIRE SCHEDULES should be consulted.

10.4.3

Self-reactive substances are sometimes transported under temperature controlled conditions where the control temperature will depend upon the specific properties of the substance being transported. If the control temperature is exceeded, the refrigeration unit has to be inspected. If the temperature control cannot be restored, the manufacturer should be consulted as soon as possible. The manufacturer should be similarly consulted if smoke is observed. The cargo should then be kept under surveillance.

10.5

Spontaneously combustible substances - class 4.2

10.5.1

This class of substances includes pyrophoric substances, which will instantly burn on contact with air, and self-heating substances, which lead to spontaneous combustion.

10.5.2

Although the use of dry inert powdered material to smother the fire would be the preferred option, in most circumstances such a procedure may not be possible. Two methods of dealing with such a fire are possible:

- .1 Controlled burning: Stay in a well protected position. Let the product burn as long as no other cargo is in danger from the ensuing fire. The fire in the product should be left to burn out completely. Nearby cargo should be cooled down with water spray from as many hoses as possible.
- .2 Fight the fire from a safe distance: Refer to the relevant EmS FIRE SCHEDULE since it is possible for the product to explode.

10.6

Substances dangerous when wet - class 4.3

10.6.1

This class of substances reacts violently with water evolving flammable gases. The heat of the reaction is sometimes sufficient to initiate a fire.

10.6.2

Although the use of dry inert powdered material to smother the fire would be the preferred option, in most circumstances such a procedure may not be possible. Two methods of dealing with such a fire are possible:

- .1 Controlled burning: Stay in a well protected position. Let the product burn as long as no other cargo is in danger from the ensuing fire. The fire in the product should be left to burn out completely. Nearby cargo should be cooled down with water-spray from as many hoses as possible.
- .2 Fight the fire from a safe distance: Refer to the relevant EmS FIRE SCHEDULE since it is possible for the product to explode.

10.7

Oxidizing substances - class 5.1

10.7.1

This class of substances is liable to evolve oxygen and therefore to accelerate a fire. These substances, while in themselves not necessarily combustible, may cause the combustion of other material (e.g. sawdust or paper) or contribute to the fire leading to an explosion.

10.7.2

Fires in which these substances are present are difficult to extinguish, because the ship's fire-fighting installation may not be effective. Everything possible should be done to prevent the spread of fire to containers containing these dangerous goods. However, if fire reaches the cargo, personnel should be withdrawn immediately to a well protected position.

10.8

Organic peroxides - class 5.2

10.8.1

This class of substances is liable to burn vigorously. Some substances have a low decomposition temperature and are transported under temperature controlled conditions, where the control temperature will depend upon the specific properties of the substance being transported.

10.8.2

If the temperature control cannot be restored, the manufacturer should be consulted as soon as possible even if evolution of smoke has ceased. The cargo should then be kept under surveillance. The surrounding area should be kept isolated because liquid may be ejected from relief arrangements.

10.9

Toxic substances - class 6.1

Substances of this class are poisonous by contact or inhalation and, the use of self-contained breathing apparatus and fire-fighters' outfits is therefore essential.

10.10

Infectious substances - class 6.2

These are substances which are known or reasonably expected to contain pathogens, (i.e. micro-organisms that are known or reasonably expected to cause infectious disease in humans or animals). Pathogens may survive the fire and self-contained breathing apparatus should therefore be used.

10.11

Radioactive material - class 7

10.11.1

Many radioactive materials are transported in packages designed to retain their containment and shielding in accidents. However, under extreme fire conditions, failure of containment or loss of shielding or criticality safety could result in significant hazard to personnel. Long-term exposure of any class 7 package to extreme heat should be avoided and in emergencies should be kept as cool as possible using copious quantities of water. If a packaging of radioactive material has been exposed to any significant fire, expert advice should be sought. Suspected contamination of safety and fire-fighting equipment should be removed as quickly as possible.

10.11.2

Some packages may have a class 7 label and other hazard labels. Such additional hazards may be greater than the radiation hazard. In that case, actions as specified in the applicable EmS Fire Schedule should be followed.

10.11.3

Although radiation monitors are not required by regulation on board ships, applicable relevant provisions on segregation, separation or radiation protection programmes (e.g. paragraphs 1.1.3.2 and 7.2.9.7 of the IMDG Code) or the INF Code may require monitors on board. For ships carrying radiation monitoring equipment, monitoring of radiation levels is recommended.

10.12

Corrosive substances - class 8

These substances are extremely dangerous to humans, and many may cause destruction of safety equipment. Burning cargo of this class will produce highly corrosive vapours. Consequently, wearing self-contained breathing apparatus is essential.

10.13

Miscellaneous dangerous substances and articles - class 9

This class includes those substances, materials and articles which are deemed to possess some danger, but which are not classified within the criteria of classes 1 to 8. No general guidelines are applicable to these goods. They have been allocated to the relevant EmS FIRE SCHEDULE according to their hazards in the event of a fire.

10.14

Marine Pollutants

10.14.1

A number of substances within all of the above classes have also been designated as Marine Pollutants. Packages containing these substances will bear a Marine Pollutant mark.

10.14.2

In the case of leakage resulting from burning cargo, it is important to be aware that any spillage of a marine pollutant which is washed over board will pollute the sea. It is, however, more important to fight a fire on board a ship rather than to prevent pollution of the sea.