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## Fishing Vessels – The Dangers of Enclosed Spaces

Notice to all Owners, Builders, Employers, Skippers and Crews of Fishing Vessels.

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### Summary

This note warns of the unseen risks from the build-up of gases in “enclosed” spaces including refrigerated Salt Water (RSW) tanks and provides guidance on the avoidance of such risks and of the safe entry into enclosed spaces.

#### Key Points

- Be aware that unless absolutely necessary, avoid enclosed spaces whilst at sea
- Be aware of what constitutes a dangerous enclosed space
- Be aware of the procedures for preventing toxic gases in RSW tanks

If entry to enclosed space is necessary

- Be aware of the procedures for prevention of risk
- Be aware of how to test the atmosphere
- Be aware of the preparations required before entering
- Be aware of how to work while in an enclosed space
- Be aware how to leave

### 1. Introduction

1.1 Whilst on board a United Kingdom fishing vessel operating off the west coast of Africa three crew members tragically lost their lives.

1.2 The Marine Accident Investigation Branch (MAIB) report identified the release of dangerous gases from decaying fish, fish waste or offal as the cause of the accident. The source of the gases was a Refrigerated Salt Water (RSW) tank.

1.3 The tank had not been cleaned or chilled after use and a residue of fish and sea water remained. Hydrogen, cyanide, hydrogen sulphide and carbon dioxide gas accumulated over a period of several days; the effect being accelerated in tropical temperatures.

1.4 Gases were released into an occupied working space and inhaled when a side door to the RSW tank was opened, with fatal consequences to three of the crew and injuries to others.

1.5 In another case a vessel's engineer lost his life as a result of high carbon monoxide (CO) poisoning. A portable, petrol-engined pump was being used with the pump exhausting directly into the engine room.

1.6 These incidents further highlight:

- .1 that all spaces receiving little or no ventilation, including RSW tanks, should be treated as potentially dangerous;
- .2 the need for proper training in the use of plant and equipment; and
- .3 the importance of completing a thorough safety risk assessment and of informing the crew of the measures taken for their safety and health (see MGN20).

## **2. WHAT IS MEANT BY A DANGEROUS "ENCLOSED SPACE"?**

2.1 A dangerous enclosed space:

- .1 One that is poorly ventilated or sealed with the oxygen reduced to low levels; or
- .2 where toxic and/or flammable gases have built up to dangerous levels.

2.2 Many forms of chemical reaction can cause low oxygen levels or dangerous gases to build up, for example the decay of waste material or the exhaust from machinery, one common source is corrosion or rusting, which can significantly reduce the oxygen content in a space. All enclosed spaces therefore need to be treated with caution before opening or entering.

2.3 Examples of such spaces on fishing vessels are:

- .1 RSW tanks;
- .2 Fuel tanks;
- .3 Fish holds containing decaying fish, fish waste or offal;
- .4 Fresh water tanks;
- .5 Sea or fresh water ballast tanks;
- .6 Void spaces; and
- .7 Stores containing chemicals.

## **3. OPENING OR ENTERING AN ENCLOSED SPACE**

3.1 Unless it is absolutely necessary, **DO NOT** open or enter enclosed spaces whilst at sea. It is better to wait until the vessel is in port. Then "Call in the specialists" to certify that the air in the space is safe.

3.2 If entry is necessary, the following procedures are recommended prior to opening or entering, together with others that may be identified as a result of risk assessment:-

## **4. PREVENTION OF RISK**

4.1 **Ensure** tanks are empty and not under pressure. **Be patient** and make sure that tanks are **completely empty**.

4.2 **Ensure** filling pipes to tanks are isolated, that all valves are shut and notices are put up to prevent tanks from being filled by someone else.

4.3 **Ventilate spaces THOROUGHLY**. Mechanical or natural means of ventilation may be used, with more time given for natural ventilation.

## 5. TESTING THE ATMOSPHERE

5.1 A **person competent** in the use of the equipment should test the atmosphere (air) inside a space.

5.2 When testing the air for the first time, **breathing apparatus should be worn**.

5.3 An **oxygen meter should be used**, with a steady reading of 20% before entry is considered.

5.4 A **combustible gas indicator** ("explosimeter") **should be used** to test for combustible gases where these are suspected, especially where this may be a build up of hydrogen (e.g. in fuel tanks).

5.5 **Toxic gases should also be tested for where any risk is suspected**, the test equipment being specific to the gas (e.g. for unclean RSW tanks, test for hydrogen sulphide and hydrogen cyanide).

### **REMEMBER**

**IF TESTING APPARATUS IS NOT ON BOARD AND DOUBT EXISTS ABOUT THE SAFETY OF THE SPACE, DO NOT ENTER!**

## 6. PREPARING TO ENTER

6.1 The following should be carried out before entry.

6.2 **Ensure the space is well lit**, including the entrance.

6.3 **Remove sources of ignition** from clothing, such as matches or lighters.

6.4 **Position appropriate rescue equipment at the entrance**, such as breathing apparatus, (intrinsically safe) torches, life lines and hoists.

6.5 **Limit** the number of persons entering the space.

6.6 **Place an attendant at the entrance**, who should remain there until everyone has left the space.

6.7 **Agree and test** a suitable means of communication.

## 7. DURING ENTRY TO A SPACE

7.1 Whilst inside the enclosed space, the following procedures should be observed.

7.2 **Regular communication** should be maintained.

7.3 **Continue ventilating** the space.

7.4 Every so often, **re-test the atmosphere** in the tank and **if any doubt exists, stop the operation**.

7.5 **Should an emergency occur**, the attendant at the entrance should raise the alarm and should **NOT ENTER** the space himself until help has arrived.

7.6 **Breathing apparatus MUST be worn during any rescue** from a space. Once making contact with a casualty, he must be removed to safety and given first aid as necessary.

## **8. LEAVING A SPACE**

8.1 After completion of the operation, everyone should leave the space and the entrance should be resealed (unless further entry is required).

## **9. RSW TANKS**

9.1 MAIB commissioned research into the toxic gases produced by fish as they decay. The study revealed that:-

**.1 Temperature influences the level of toxic gases** produced by decaying fish in sea water;

**.2 At 45°C**, a “half and half” mix of rotting fish and sea water produced dangerous levels of hydrogen cyanide, hydrogen sulphide and carbon dioxide after only 24 hours;

**.3 At 35°C**, similar results to 45°C were obtained;

**.4 At 20°C**, a “half and half mix” of rotting fish and sea water produced dangerous levels of hydrogen cyanide, hydrogen sulphide and carbon dioxide after just 64 hours;

**.5 At 5°C**, **only** traces of the three gases were measured after 10 days.

9.2 The research identifies the importance of the following procedure for the RSW tanks, particularly when operating in warmer waters:-

**.1 Immediately clean all un-chilled RSW tanks after use, removing all residues.**

**.2 If cleaning has not occurred immediately and a mixture of fish and sea water has been left for more than a few hours, flush the tank through (using the appropriate sea water pump) and fully ventilate the tank.**

**.3 Ensure adequate ventilation exists in spaces adjacent to RSW tanks.**

**.4 On no account open or enter RSW tanks known to contain sea water/decaying fish unless the full procedures for entry into an enclosed space have been carried out ( see paragraphs 4-8 above).**

## **10. FURTHER ADVICE**

10.1 Crew of vessels that operate at sea for longer periods, particularly on those of 24 metres and over in registered length may have need to enter enclosed spaces whilst at sea. Further guidance on enclosed spaces may be found elsewhere, such as the Code of Safe Working Practices for Merchant Seamen.

## Further Information

Further information on the contents of this Notice can be obtained from:

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