Easy to Understand with Illustration !!

Guidelines for Safe Operations on Board

- To prevent oxygen deficiency and gas intoxication accidents during operations in enclosed spaces -

The Maritime Human Resource Institute, Japan

About These Guidelines

Oxygen deficiency and hazardous gas intoxication accidents during work in coasting or ocean-going vessels take people's precious lives. These guidelines describe important points to prevent such tragic casualties, providing cases based on actual accidents and safety measures using examples.

These guidelines do not necessarily provide measures that must absolutely be taken to prevent accidents, but give recommendations as effective safety measures. Make use of them to learn safety knowledge, for example, by using them in safety and health committee meetings on board.

People forget and make mistakes. So read these guidelines repeatedly for your own safety and that of your colleagues.

Contents

What is an Accident ?

Marine accidents never stop

Numerous accidents are reported to us each year. You think "It will never happen to me," don't you? Well, everybody thinks so. But in fact, oxygen deficiency or gas intoxication accidents on board occur almost every year. Do you know why?

Why does an accident occur ?

Most accidents occur when there is a defective part of some equipment or facilities, or a mistake occurs in an operation or task. It is never due to occasional "bad luck." Oxygen and hazardous gas are invisible, while their status changes depending on environmental conditions, and that makes their risk difficult to notice.

Background risk

As you know, to ensure safety in an enclosed space, it is extremely important that you ventilate the area and measure necessary values, as well as use respiratory protective equipment as necessary. Perhaps you are thinking, even if you haven't said it yet, "it will be same as usual," "I'll get it over with quickly," or "it's too much bother," aren't you ? Well, an accident always has a root cause.

A "remote chance" still has a possibility !

Usually we are not afraid of an accident because we expect it will never happen. If an accident occurs, however, we often use "unexpected" or "don't believe" or other words, but it's too late. To avoid such a situation, we must understand the risks and take preventive measures, as well as prepare for an accident should it occur. In other words, we should take necessary safety and disaster-preventive measures.

Chapter 1

Basic Knowledge to Prevent Accidents in Enclosed Spaces

Various risks lurk in vessels. Factors peculiar to vessels, such as severe environments, and vessel structures/equipment that can endure such environments, as well as dangerous cargos, will all lead to various risks. One of them is a watertight structure, which causes a lot of accidents in enclosed spaces.

In this chapter, we will give an overview of major risks in enclosed spaces, as well as cautions for and preventive measures against such risks.

1-1 Risks in enclosed spaces

An enclosed space refers to an area isolated from the outside and not always ventilated, such as cargo spaces, tanks, pump rooms, chain lockers, a zone such as double bottoms, or unventilated stores or passages leading to enclosed spaces. Such areas do not have an ordinary atmosphere due to various reasons, and therefore involve the following risks almost without exception.

1 Immediate oxygen deficiency

When air contains insufficient oxygen, a man could die immediately, because oxygen in the blood becomes insufficient. Perform sufficient ventilation and testing (the normal oxygen concentration is 20.9%).

P4: Column 1

2 Various intoxications

Hazardous gas has diverse toxic effects on blood, nerves and organs. Certain types of gas are harmful even when the concentration is 0.0001% (1ppm) or less. Perform sufficient ventilation and testing when working to ensure that the concentration does not exceed the threshold limit value (TLV).

P4: Column 2

3 Explosion of combustible gas

Combustible gas such as petroleum could explode at certain oxygen and gas concentrations, when an ignition source is present. To prevent explosion, ensure that the gas concentration does not exceed one-tenth of the lower explosive limit (10% LEL), or 1% LEL to secure work safety in an enclosed space.

P4: Column 3

1-2 Points for safety measures to prevent oxygen deficiency and gas intoxication accidents

The following efforts are essential to prevent oxygen deficiency and gas intoxication accidents.

1 Adequate ventilation

Never fail to perform mechanical ventilation before work. The effect will change, so take enough time to ventilate as a pre-work operation, and continue ventilation during work.

2 Sufficient preparation for safe entry

The level of oxygen deficiency substantially changes depending on the situation in enclosed spaces. Moreover, the effects of hazardous gas on human bodies largely differ depending on the type of gas. Therefore, thoroughly check the risk of hazardous gas at the pre-work meeting.

3 Proper testing

Never fail to do testing without mistakes so as not to overlook a dangerous condition in enclosed spaces.

4 Ensuring the safety of workers

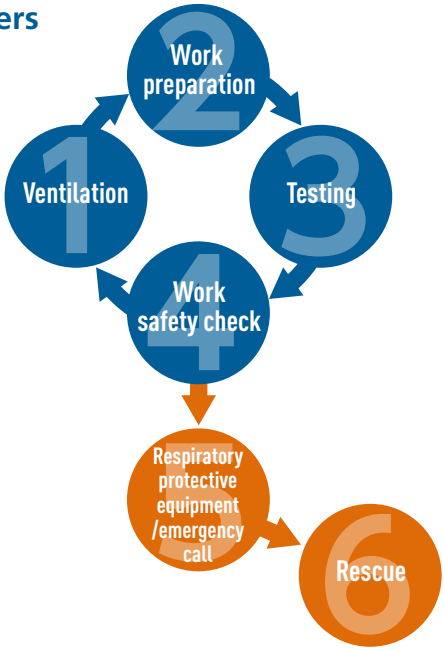
An attendant must keep checking the safety of a worker, because the worker may faint during the work.

5 Correct use of respiratory protective equipment

Since respiratory protective equipment is the last preventive measure, always check them and never make a mistake in using them.

6 Performing rescue activities calmly

A victim tends to panic, resulting in outrageous actions. In such a case gather all staff together to handle the situation.



Column 1

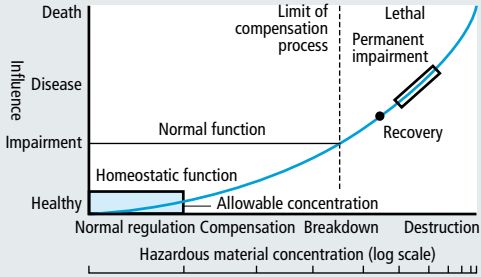
Oxygen in the blood changes with the oxygen concentration in air.

Work	Oxygen concentration	Effects, etc.
Normal	20.9%	Normal condition
Caution	18% or more	Safety limit, mechanical ventilation required
Prohibited	16%	Headache, nausea
	12%	Dizziness, muscle weakness
	8%	Fainting, unconsciousness, death within 7-8 minutes
	6%	Immediate coma, respiratory standstill, death

- If the oxygen concentration in inhaled air decreases, the oxygen absorbed into the blood will also drop, resulting in oxygen deficiency.
- In a severe oxygen deficiency environment, in-blood oxygen is exhaled to the air. Unlike breath holding which gradually suffocates, severe oxygen deficiency immediately makes a person "faint," just as if they were choked in Judo.

Column 2

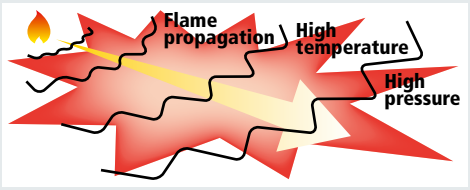
The higher the concentration of hazardous materials, the heavier the impairment.



- Hazardous materials of high concentration will lead to human death or after-effects that last for lifetime.
- The concentration at a worksite shall be managed within the threshold limit value, which means limiting the concentration so that it does not have adverse effects on the health of workers.

Column 3

Combustible gas ignites when three factors -oxygen, gas, and an ignition source- come together in burning conditions. In enclosed spaces, the temperature and pressure increase at an accelerated pace, causing an explosion of combustible gas.



- In normal air, the mixing ratio of oxygen and gas when burning falls between the lower and upper explosion limits.
- Gas with a low ignition point tends to easily ignite, and its flame propagates rapidly, generating huge energy.

Chapter 2 Learn from Past Accidents

Quite a lot of accidents have occurred on board to date. We should learn lessons from such tragic accidents to prevent their recurrence. It is the only way for us to make the most of the precious lives of victims lost in past accidents.

This chapter describes three cases based on past accidents. Let's learn about the background situations and causes for each case, and consider preventive measures against them.

P12: Column 4

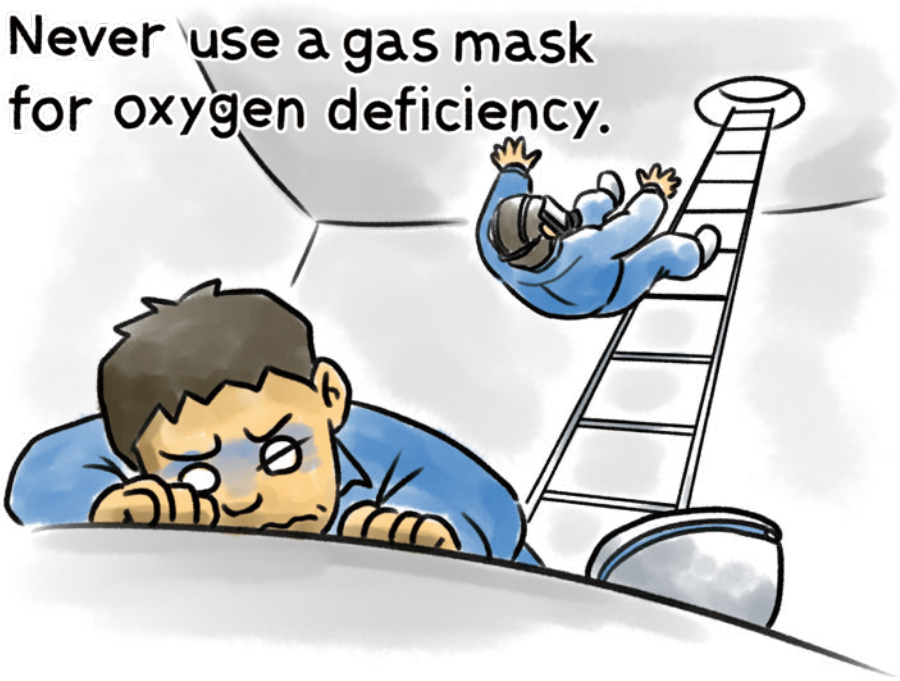
2-1 A gas mask was used in case of oxygen depletion

Case

When the chief officer entered the tank to attach a drain plug, he fainted and fell over. The bosun thought it was a crisis, immediately put on a gas mask, and entered the tank to rescue him. But the bosun also felt dizzy, fell down, and died.

Background Factors

1. Inert gas was filled inside the tank to prevent explosion.
2. The chief officer and the bosun were coworkers who had known each other a long time, and were really good friends like brothers.
3. The company was equipped with gas masks, but had not explained how to use them.



Causes

1. The oxygen concentration was not tested before entering the tank.
2. The bosun was too upset about the accident of a comrade to call rescue staff.
3. The bosun was not familiar with the use of a gas mask.

Preventive Measures

1. Crew members must make it a habit to take along an oxygen meter every time when entering an enclosed space.
2. The company must provide crew members with training useful for emergency.
3. Crew members must be trained to never use a gas mask but to use self-contained breathing apparatus, when the oxygen and gas conditions are unknown.

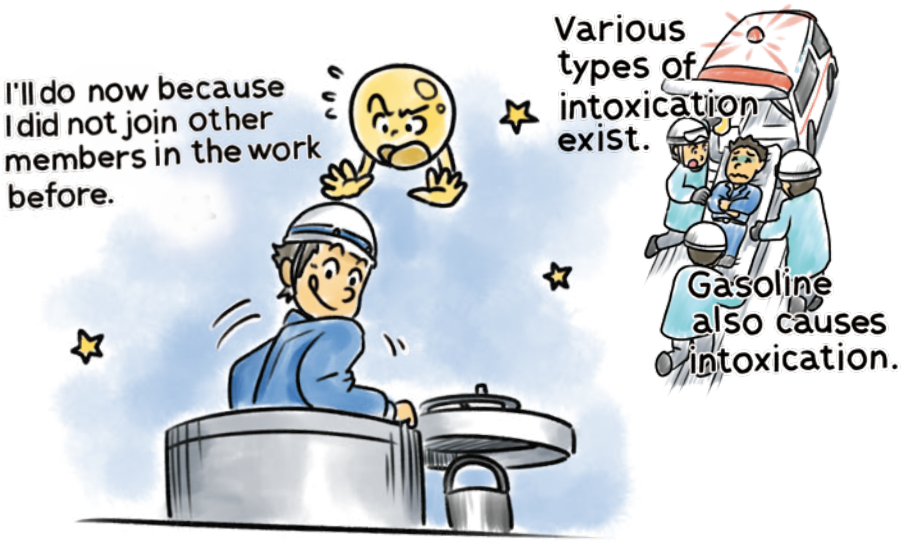
2-2 Ventilation in the tank was insufficient

Case

After finishing unloading of gasoline, the vessel went to sea while performing ventilation cleaning. When crew members entered the tank to wipe off residual liquid, the master ordered the work be suspended because the tank was filled with a strong odor. But an officer, who had not joined in the cleaning work at that time, did not follow the master's instruction, and entered the tank alone to wipe off the liquid while other members were having a rest. As he did not come out from the tank, another officer on duty noticed something was wrong, and let crew members rescue the officer inside the tank. After an emergency docking at the nearest port, the officer was hospitalized, but died later.

Background Factors

1. It was raining, and the temperature was low.
2. The officer intended to be nice to his colleagues because he did not join in the initial tank cleaning work when other members did.
3. Gasoline contains toxic substances such as benzene and toluene.



Causes

1. Mechanical ventilation was carried out in enclosed spaces, but its efficiency deteriorated due to the temperature and humidity at that time.
2. The officer did not follow the master's instruction, but entered the tank alone to work at his own judgment, trying to be nice to colleagues.
3. The company did provide safety training, but mainly on ignition and explosion. It did not give training on toxicity.

Preventive Measures

1. The required ventilation time changes depending on the type of cargo or environmental conditions. So crew members must take enough time to confirm the safety of the space by testing gas concentrations, while continuing ventilation during work.
2. The master must thoroughly instruct crew members to keep out of an enclosed space before confirming safety, and a worker must obtain the master's permission to enter such an area.
3. The company must periodically visit vessels, provide training and instruction on dangerous goods, and confirm the implementation status of operating standards to keep crew members thoroughly informed about them.

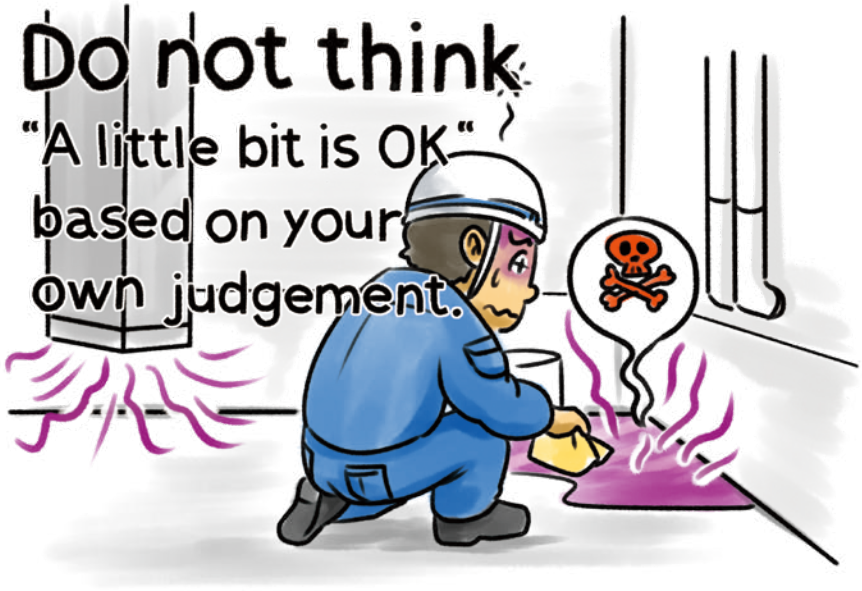
2-3 Hazardous chemical gas was not tested

Case

After unloading chloroform, the liquid leaked from the sealing at the pump axis, which spread over the pump room floor. A worker wiped off the liquid, and continued maintenance work. Later he felt bad, but still continued the work. After dinner, he became sick, and went to a hospital. He was diagnosed as intoxicated and hospitalized, but died 2 days later.

Background Factors

1. Liquid had often leaked in the pump room due to a defect of the pump axis sealing.
2. Detection and protective equipment were checked only at vessel inspection.
3. Chloroform not only has acute adverse effects on nerves, but also delayed adverse effects on liver and kidney functions.

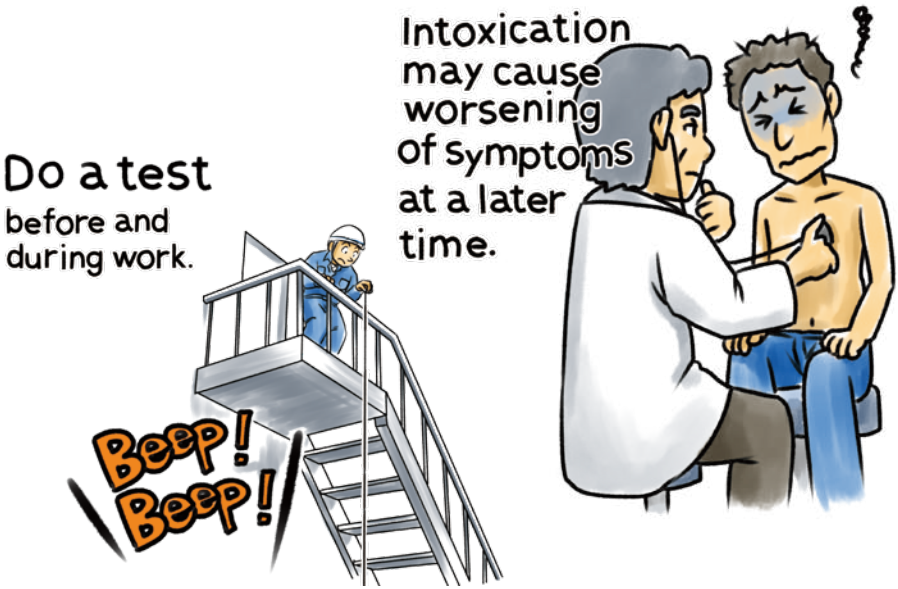


Causes

1. The pump axis sealing had not been repaired since the parts had not been delivered.
2. Testing was not carried out, since there were no gas-detecting tubes of analysers. Moreover, protective equipment was not used.
3. The worker did not know the hazardous effects of the liquid. Therefore, he continued working alone even after he felt sick.

Preventive Measures

1. Defects of equipment or devices must be promptly repaired.
2. The company must provide vessels with easy-to-use analysers to test hazardous gas concentrations at a worksite.
3. Workers must immediately stop working if they feel sick, and promptly seek medical advice.

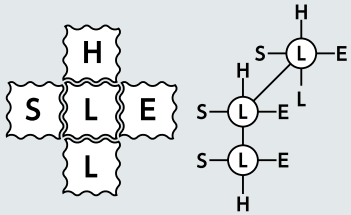


Column 4

To prevent recurrence of accidents, the International Maritime Organization (IMO) established guidelines for the investigation of accidents based on the following two aspects in 1999.

SHEL

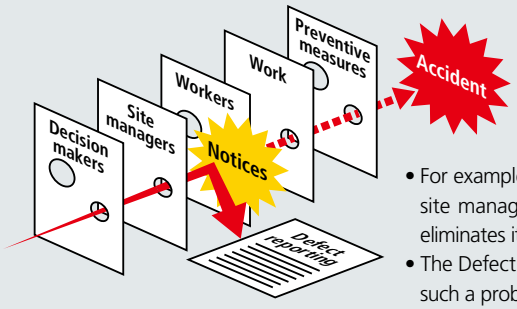
Accidents occur due to a variety of factors. The SHEL model in the following figure illustrates the relationship between the worker (L on the middle), relevant parties (L on the bottom), procedure/method (S on the left), facilities, materials and equipment (H on the top), and working environment (E on the right).



- SHEL particularly focuses on defects in the relationship between the worker and other factors.
- Link in SHEL
  Since individual workers are interrelated, SHEL is a link between individual workers.

Multiple safeguard

In an organization, decision makers, site managers, and workers all have their responsibilities; and workers have responsibilities in their work directly related to an accident, as well as for preventive measures should an accident occur. Multiple safeguard is a way to prevent problems (holes in the following figure) from occurring at any level, thereby promoting safety.



- For example, when a problem remains at the site manager level, if a worker notices and eliminates it, an accident will be prevented.
- The Defect Reporting System aims to correct such a problem.

Hybrid model

Combination of "SHEL" and "multiple safeguard"

Chapter 3 Measures to Prevent Accidents

There are quite a lot of onboard operations as a result of which a mistake or an error often occurs, leading to an accident. In the following pages, the work flows of onboard operations are organized, and tips for individual jobs are provided. The details are classified and assigned different colors of tags as follows. Refer to the corresponding section number and color tag to easily access a desired page.

3-1 Adequate ventilation

Never fail to perform mechanical ventilation

1 Ventilation efficiency is low at first

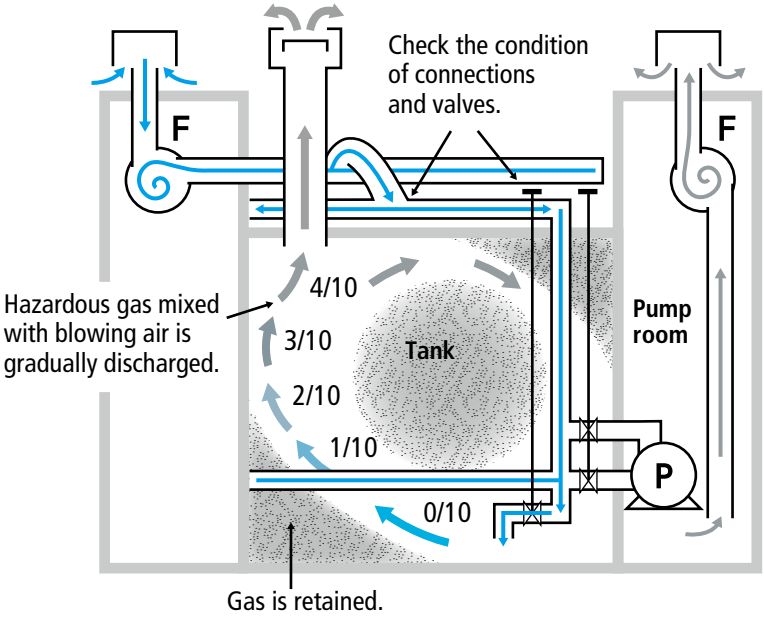
Air from the ventilator mixes with air inside the tank, and is discharged little by little. Thus, the ventilation effect gradually increases.

2 The amount of air from the ventilator varies

The amount of air from the ventilator varies depending on obstacles in the inlet or exhaust vent, as well as the length or bending of pipes or ducts.

3 The gas concentration varies from place to place

Air from the vent does not easily reach the corners or the bottom, as a result of which, the gas concentration varies from place to place; gas heavier than air tends to accumulate at the bottom, while gas lighter than air rises to the ceiling.



Step 1 Prepare for ventilation

Normal ventilation facilitates air intake, blow, and exhaust efficiently.
To ventilate the tank, connect blower pipes to the cargo lines after cleaning, and adjust each valve to obtain an appropriate amount of air in the tank.

Tips!

- Check for any residual liquid in the cargo line.
- Never fail to connect and disconnect ventilation hoses.
- Adjust valves for ensuring well-balanced ventilation in all tanks.

Ventilator operations

1 When using the ventilator, the drop in concentration slowsdown as the ventilation time passes

Since blowing air is first mixed with air in an enclosed space and then discharged, the gas concentration decreases with ventilation. The discharged amount of gas decreases accordingly, resulting in a gradual decrease in the change of concentration.

2 The drop in concentration slows down due to evaporation of residual liquid

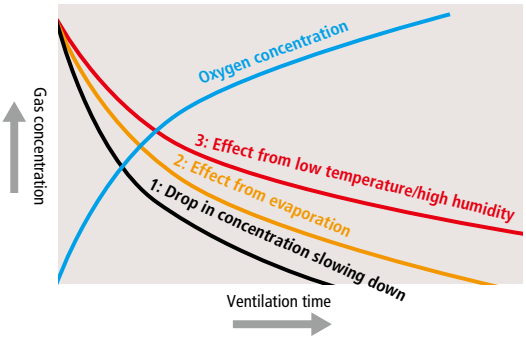
Cleaning water or residual liquid tends to remain at the corners and dents in the tank. Liquid with low volatility or high viscosity, in particular, takes a long time to finish evaporating.

3 The drop in concentration varies with temperature and humidity

At a low temperature or a high humidity, water or liquid evaporate slowly, just like at the laundry, which requires more time than usual to ventilate.

4 Some substances may temporarily lead to a high gas concentration

For some chemical products diluted in water, even with small volatility, the gas concentration may sharply rise when chemicals evaporate just before the water dries up.



Step 2 Ventilator operations

Ventilator operations must take enough time, because the ventilation effect, which is usually determined by the tank capacity, air volume or ventilation time, varies depending on the type of cargo or environmental conditions.

Tips!

- On the blackboard or the like, clearly indicate the time when and by whom the start switch of the ventilator was turned on, together with a KEEP OUT notice.
- Take a longer ventilation time than usual at a low temperature or a high humidity, because the ventilation efficiency decreases under such conditions.
- Take a longer ventilation time than usual for liquid cargo with low volatility or high viscosity, because such cargo tends to remain in dents, etc.
- Stop the ventilator 10 minutes before testing, and resume ventilation after testing.

3-2 Sufficient preparation for safe entry

Understanding the risk of oxygen deficiency and hazardous materials

1 Understanding the risk of oxygen deficiency

- Oxygen deficiency will often cause instant fainting followed by death.
- In an enclosed space, oxidation of rust or cargo, aspiration of sludge or liquid cargo, or evaporation of residual liquid will all spontaneously lead to oxygen deficiency.
- A tank injected with inert gas has an oxygen deficiency.

2 Understanding the risk of hazardous materials in the Safety Data Sheet (SDS)

- Hazardous effects mean irritation and burn resulting from contact with liquid, as well as acute and delayed adverse effects from gas inhalation.
- The threshold limit value (TLV) means the limit of concentration which does not have adverse effects on health in daily work.

3 Understanding appropriate testing equipment

- Use an oxygen analyser for oxygen concentration testing (normally 20.9%).
- For hazardous gas testing, check if a volatile organic compound measuring instrument can be used.

4 Understanding appropriate protective equipment

- To prevent contact, use protective goggles, protective suits, protective gloves, or protective boots.
- To prevent oxygen deficiency and inhaling high concentration gas, use self-contained breathing apparatus.
- For hazardous gas, use a gas mask only when oxygen deficiency does not occur, and the type and concentration of gas are identified.

Step 1 Checking SDS

Check SDS for materials to be used.

Submit the checked SDS.

The degree of hazard greatly varies depending on the type of hazardous material. Therefore, it is important to check the SDS.

Tips!

- Even when handing liquid cargo that was previously handled, check the SDS each time due to the possibility of misunderstanding or poor memory.
- Accurately match the name of the liquid cargo to the substance in the SDS to confirm the degree of hazard.
- When a substance name is not clear from the product name, consult the company.

Pre-work meeting

1 Never fail to hold a pre-work meeting

- During work, a necessary process might be omitted if each person's duty is not clearly defined.
- Never start work with a lack of understanding. When safety is confirmed, an "ENTRY PERMIT" must be explicitly posted.

2 Prepare necessary equipment/materials

- Preparations will progress smoothly without mistakes if "who handles what" is decided.
- Make analysers, protective equipment, and rescue materials/equipment available for immediate use.

Do not work or let anyone work with a lack of understanding.

Step 2 Pre-work preparation of materials and equipment and pre-work meeting

Prepare necessary materials and equipment, and confirm the work flow in a pre-work meeting.

Tips!

- At the meeting, all seafarers involved in the work must confirm the work plan, while a responsible person must instruct personnel on their roles.
- Confirm the ventilation start and elapsed time, and continue ventilation during work.
- Place necessary materials and equipment, such as analysers or protective equipment, at a location near the entrance to a worksite.

3-3 Proper testing

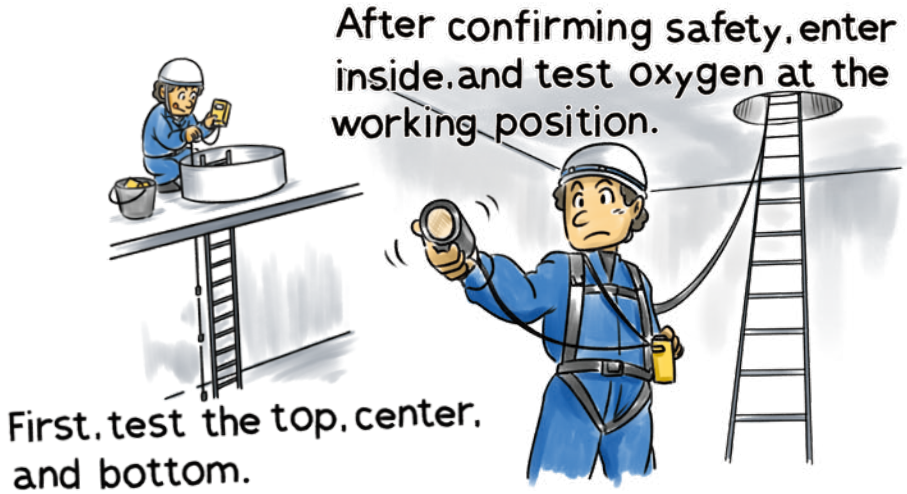
Oxygen concentration testing

1 Never fail to carry out testing

- If a work area is in oxygen deficiency, it often causes instant fainting, followed by death. The time to reach oxygen deficiency status varies depending on various conditions. So never rely on past experience, nor fail to carry out testing.
- Testing must be carried out from the top of the tank, in order from top, center, and bottom of the tank. Moreover, after confirming safety, enter the tank, and test oxygen at the working position by extending the tip of the sensor.

2 Oxygen analyser

- Use an oxygen analyser of which the reliability has been confirmed by a detection sensor still within its operating lifetime.
- In an enclosed space, hydrogen sulfide from sludge or carbon monoxide from burning is easily generated, which is not detected by oxygen testing. Use gas detectors in such cases (See "Complex gas monitor" on page 25).



Step 1 Oxygen concentration testing

Portable type (example)
RIKEN KEIKI Co., Ltd.

A portable oxygen analyser can carry out testing at a remote position by extending tip of the sensor. A personal monitor can be taken along during the work, and carry out testing on the spot.

Tips!

- Turn on the oxygen content analyser, and check if the indicator value is 20.9% in fresh outside air. Misreading the indicator value may be dangerous.
- While confirming safety, extend the tip of the sensor to the working position.

Gas testing/detection

1 Hazardous gas testing

- Hazardous gas is invisible, and has adverse effects through inhalation. Some hazardous gases have no odor, or a slight odor that workers easily get used to. Never judge if gas is present or not by smelling.
- A hazardous gas detector indicates ultra-low concentration (in ppm: 1ppm=0.0001%) through physical/chemical reactions with coloring reagents in glass tubes (detection tube-type analyser), or ultraviolet ray emission lights (volatile organic compound measuring instrument).

2 Combustible gas detection

- Combustible gas such as in oils may explode even with a concentration within the explosion limit. Check that there is no risk of explosion.
- A combustible gas detector indicates the risk of combustion as a lower explosive limit (LEL: 1 to a few percent for many substances) rather than a gas concentration itself.

3 Two test values are different things

When doing any testing, test the top, center, and bottom of the space as well as the working position, while confirming safety. Do not confuse hazardous gas testing with combustible gas detection: they are totally different in purpose and method. They cannot be used interchangeably.

Step 2 Hazardous gas testing and combustible gas detection

Typical hazardous gas detector

Volatile organic compound measuring instruments

RIKEN KEIKI Co., Ltd.

SHINOHARA ELECTRIC Co., LTD.

Detection tube-type monitor

GASTEC Corporation

Typical combustible gas monitor

RIKEN KEIKI Co., Ltd.

Typical complex gas monitor

RIKEN KEIKI Co., Ltd.

Most chemical products can be tested by two types of instruments: the volatile organic compound measuring instrument on the left, and a detection tube-type monitor*. To prevent explosion, use the combustible gas detector (at top right). It is also useful to use a complex gas monitor (at bottom right) which integrates oxygen, hydrogen sulfide, and carbon monoxide sensors, in addition to a combustible gas detector.

*Some instruments have their own name, such as "Kitagawa Gas Detector Tube System" or "Dräger Tube."

Tips!

<Volatile organic compound measuring instruments>

- Turn on the equipment, and confirm the results of automatic stand-by checking.
- Select a target substance from the tested gas selection menu. If a wrong substance is selected, the indication value will substantially differ, which may lead to a certain risk.
- Confirm a zero indication in fresh air.

3-4 Ensuring the safety of workers

Points during work

1 Never enter an enclosed space without records and permission

- Prior to entering an enclosed space, confirm safety, and test and record oxygen and gas concentrations.
- Obtain permission to enter the enclosed space from a responsible person and approval to enter from the workers doing the work, and record them.
- To observe the above points without fail, use a checklist.

2 Supervise workers at work

- An attendant must stand outside, and keep talking to the workers at work to consistently check on their safety.
- A responsible person shall carry out concentration testing as necessary.
- Always have rescue materials and equipment ready for use just in case.

Step 1 Supervise the work

An attendant must confirm safety, record the permission to enter, and always supervise the workers during the work.

Tips!

- A responsible person must check on safety including oxygen deficiency, give permission to enter, and record it.
- An attendant must stand at a position from where the lower levels and the tank bottom can be seen, and should frequently talk to the workers at work, directly or by using a transceiver, at regular intervals to check on their safety.
- If the attendant feels anything is wrong, even very minor, immediately make the workers at work evacuate the worksite.

Points after work

1 A responsible person must check the safety of workers at work, and record the results

There is a risk of placing a manhole cover while a worker remains in the tank, leaving him alone.

2 A responsible person must take safety measures after work

Never fail to close the entrance of the enclosed space, and take measures to prohibit entering.

3 A responsible person must make used materials and equipment ready for use next time

Clean, check for abnormality, and store them.

Step 2 Work completion

After the work, a responsible person must check the safety of the workers, and clean and check materials and equipment before storage to make them ready for use next time.

Tips!

- A responsible person must gather all workers involved in the work to the meeting, and check the safety of all of them.
- A responsible person must check working conditions, the status of drain plugs, etc.
- A responsible person must maintain and check materials and equipment before storage to make them ready for use next time.

3-5 Correct use of respiratory protective equipment

Self-contained breathing apparatus

(for air supply in case of oxygen deficiency or dangerous hazardous gas environment)

1 Apparatus constitution

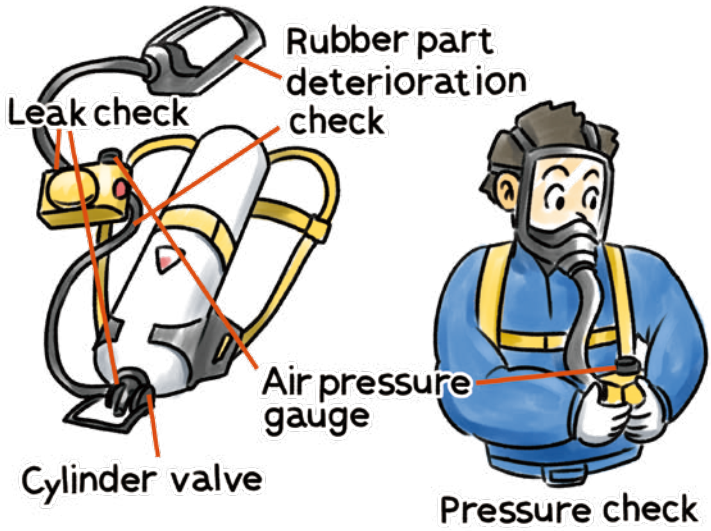
The apparatus consists of a high pressure gas cylinder, pressure reducing valve, cylinder valve, pressure indicator, facemask, attaching belt and frame. It decompresses a certain amount of air, and ventilates it to the facemask.

2 Precautions

- Firmly tighten the belt, and put on the facemask to achieve a fit for preventing an air leak.
- The amount of air in the gas cylinder is limited; it can be used only for a short time if the respiration amount is large.

3 Maintenance of apparatus

In a vessel, check the gas cylinder air pressure, deterioration of rubber and other parts, and leak at the hose connection. On land, periodically undergo the manufacturer's inspection.



Step 1 Use of self-contained breathing apparatus

SHIGEMATSU WORKS CO.,LTD.

Thoroughly familiarize yourself with the use of the apparatus, as it will be used in case of emergency.

Tips!

- Check that the gas cylinder air pressure is sufficient before use.
- Train yourself to smoothly fasten a number of belts (to put on the apparatus within one minute).
- After wearing, check that the facemask closely fits the face.
- Use the apparatus cautiously so as not to use air excessively, by watching the pressure indicator.

Gas mask (to reduce exposure to hazardous gas)

1 Apparatus constitution

The apparatus consists of a cartridge, facemask, and fastening belt. The cartridge contains an adsorbent for gas, which generates no oxygen. Adsorbents for organic gas, acid gas, ammonia gas, and others are currently available, which are used case by case, depending on the target gas.

2 Three conditions for use

1. Do not use in oxygen deficiency conditions (20.9% oxygen by volume by oxygen content meter).
2. Identify the hazardous gas, and make sure no other gas is present.
3. Use a gas mask with a cartridge appropriate for the target hazardous gas in an area with a limited concentration for a limited duration of time.

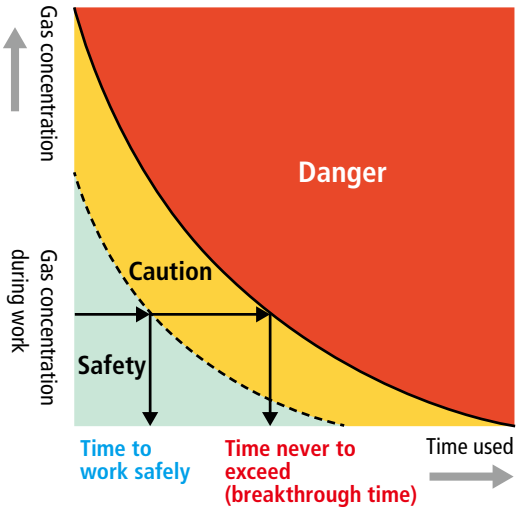
3 Management of cartridge

- The adsorption breakthrough curve (in the following figure) indicates the limit of usable time of the cartridge.
- The cartridge requires sealed storage. Even if sealed, the cartridge will deteriorate. Replace a deteriorated cartridge promptly with a new one.

4 When feeling sick

If you detect an odor during use, or feel sick, immediately stop working, go outside where you can breathe, and then remove the mask.

The capacity of the cartridge has a limit



Step 2 Use of gas mask

Examples of gas masks

Test oxygen and gas concentrations first. SHIGEMATSU WORKS CO.,LTD.

Misuse of gas masks has often led to death. Obtain permission from a responsible person, and use the mask correctly.

(Note) Misuse of gas masks includes: using the mask in oxygen deficiency conditions, mismatch of the type of cartridge to the target gas, and using the cartridge after exceeding the usage limit.

Tips!

- A responsible person must confirm environmental conditions to determine if a gas mask can be used.
- Attach a cartridge which is appropriate for the target gas and has enough time left for use.
- Wear it securely so that the facemask closely fits the face.

3-6 Performing rescue activities calmly

First actions to be undertaken

1 If you find an abnormal condition of a worker at work

- The attendant must not leave the safe place, but instruct the worker to evacuate by himself.
- The attendant must also ask anyone to call a rescue team. Never enter an enclosed space without safety measures.

2 If a worker becomes unable to move

- The attendant must ask anyone to call a rescue team. Never enter an enclosed space without safety measures.
- The master or other person must immediately call a Maritime Rescue Coordination Center (MRCC) without hesitation.
- Check the operation of mechanical ventilation equipment, and intensively ventilate the tank where the worker is.

Step 1 Training and initial action

For rescue, keep yourself calm, and prepare thoroughly.

Tips!

- The attendant must call crew members in the vessel, while the master or other person must call for rescue.
- The rescue team must wear self-contained breathing apparatus and a harness.
- Other crew members must set lifting blocks and a rope.

Rescue is not easy

1 Familiarize yourself through training

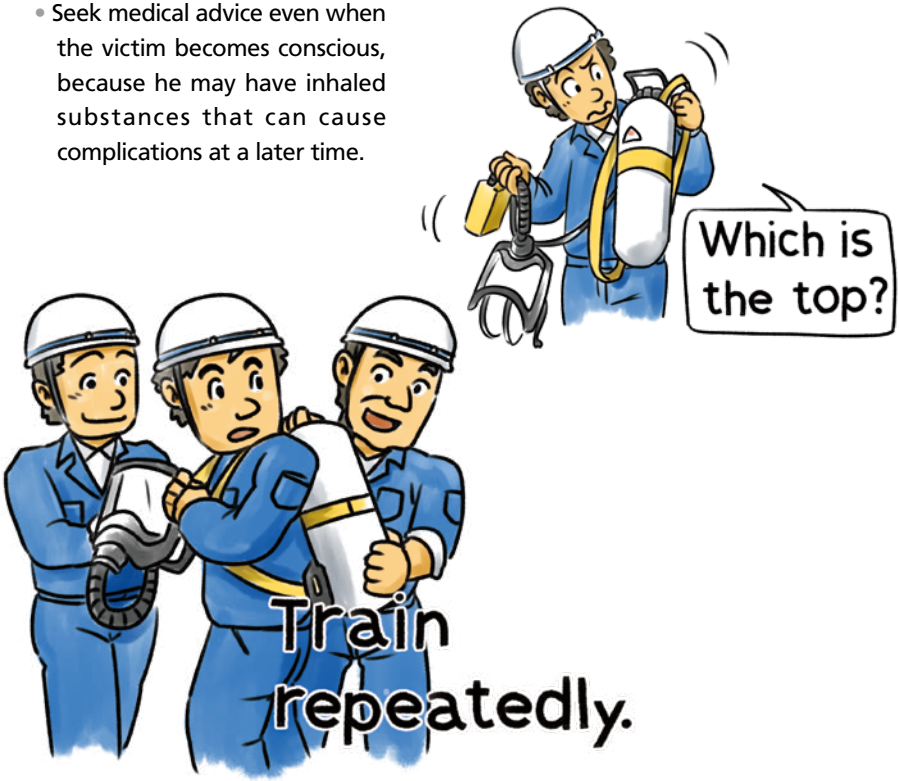
- Rescue activities must be conducted by a nominated responsible person, and trained officers and crew.
- When entering an enclosed space, never fail to wear self-contained breathing apparatus.

2 If rescued

- Move the victim to a breathable place with fresh air, check breathing and heartbeat, and give artificial respiration or cardiac massage, as necessary.
- If an emergency squad arrives, smoothly and skillfully cooperate with the squad.

3 When the victim becomes conscious

- Seek medical advice even when the victim becomes conscious, because he may have inhaled substances that can cause complications at a later time.



Step 2 Rescue activities

To lift the victim, support him so as not to bump the adjacent wall, etc., hold him securely to prevent falling, and when he is lifted above the manhole, hold him by his underarms.

Tips!

- Approach the victim, and attach the lifting rope by a trained method.
- Carefully pull the lifting rope, while checking the victim's condition.
- After lifting up, hold him by his underarms to take him to a safe place, and lay him down. Use cardiopulmonary resuscitation methods as necessary.

Summary

Key Points

- ☐ Adequate ventilation
- ☐ Accurate testing
- ☐ Correctly use protective equipment
- ☐ Discuss before the work
- ☐ Never enter without permission / supervision
- ☐ Gather everyone together, and keep yourself calm in case of abnormality

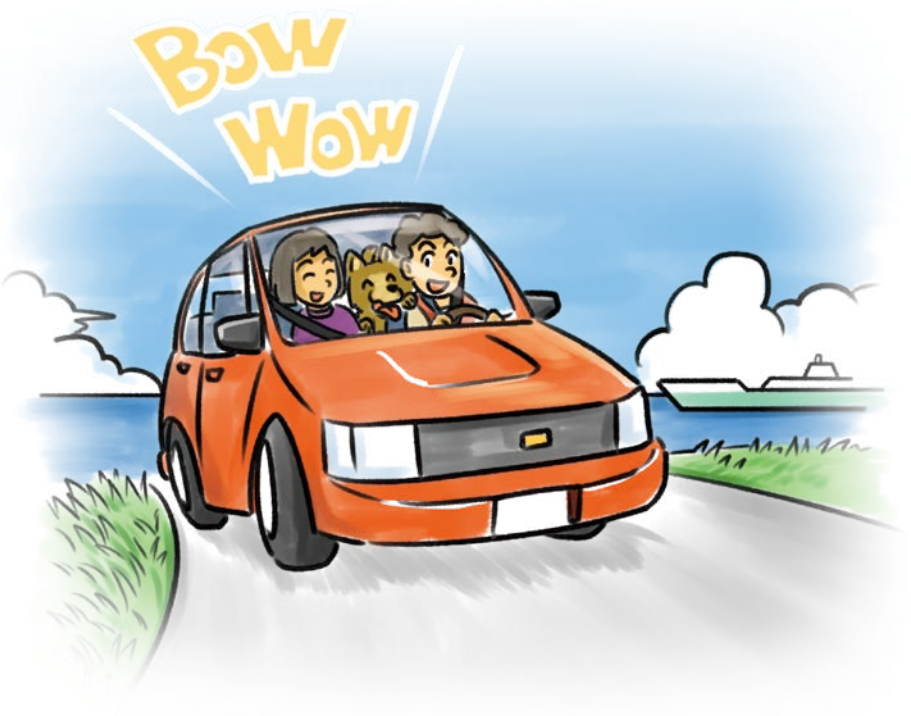
Message

Now you understand what risks exist on board or in enclosed space, and how to prevent accidents, don't you? However, knowing and doing are two different things; you may lose your calm or get confused when you face an emergency. Thoroughly familiarize yourself with preventive measures and rescue activities, so that you can do them without any difficulty.

Laws stipulate obligations of testing and use of protective equipment when necessary. Therefore, the company must make necessary equipment as convenient as possible, and ensure that crew members never fail to use them.

Do enough training on a regular basis, so as to handle any abnormality, if it occurs, calmly. Losing your calm can lead to secondary accidents.

Such attitudes and practices will be useful not only for seafarers themselves, but also for their families and acquaintances, as well as for the company. We hope all of our readers never have an accident.



Easy to Understand with Illustration !!

Guidelines for Safe Operations on Board

- To prevent oxygen deficiency and gas intoxication accidents during operations in enclosed spaces -

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