

Basic Safety Offshore

Falck Nutec

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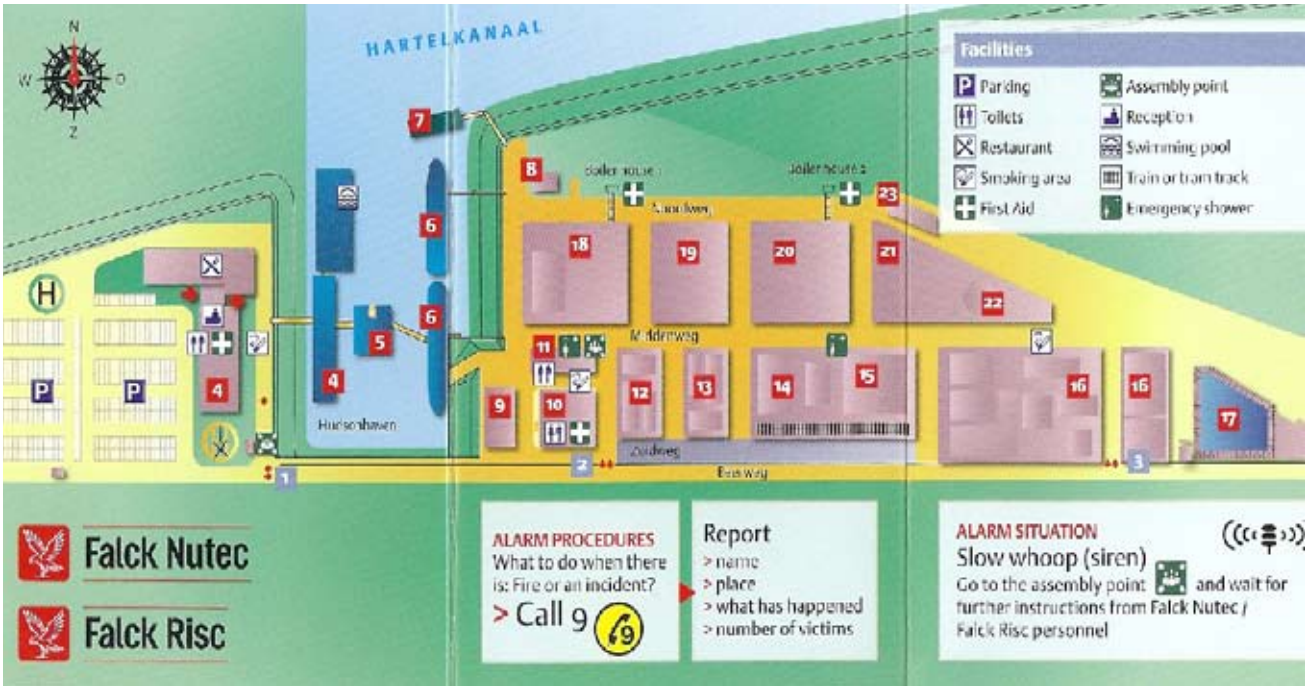
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Offshore introduction

Overview of offshore oil and gas activities.

The oil and gas exploration and exploitation can be divided into four major steps:

1. Formation.
2. Location
3. Drilling.
4. Exploitation

FORMATION

The North Sea has not always been a sea as it is now. About 300 million years ago it was a swamp often flooded by seawater, which deposited organic sediments. In this process many layers of different materials were formed. As the layers grew the pressure on the lower layers increased and temperatures rose. Because of the high temperatures coal was formed and during this process methane (CH4) gas escaped. In other parts of the North Sea dead organic material, plants and animals settling on the seabed formed hydrocarbons. The organic material was covered with other sedimentary layers with different physical and chemical properties e.g. rock and salt. Some layers are porous and permeable allowing gas & oil to escape. Other layers such as impermeable rock, completely seal the gas or oil being formed over millions of years. The areas of trapped hydrocarbons are called fields and can be very large.

LOCATION

Oil and gas exploration and exploitation started in the North Sea in the early sixties. At this time there was a growing need for independence in energy recourses. European countries started exploration programs in the North Sea, building up accurate maps of the surface indicating those areas, which are likely to contain trapped oil or gas. At some point in the exploration the gamble must be taken by the Oil Company to invest in an extremely expensive test drill. The purpose of which is to establish whether there is sufficient oil/gas present to justify investing the extremely high cost of installing a production platform, this process is called production. After the OPEC countries (Organisation of Petroleum Exporting



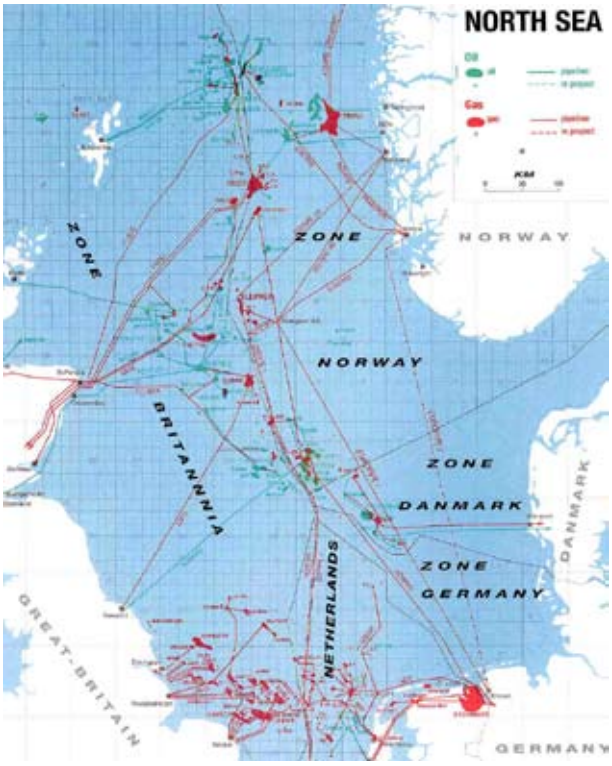
Drilling.

Countries) in 1973 decided to raise the price of a barrel of oil, the developments in the North Sea rapidly increased because the increased price made more money available for exploiration and production. A relatively new industry boomed. Exploration starts with locating or surveying a field and can be done in several ways e.g.

- Gravity survey
- Magnetic survey
- Seismic survey

GRAVITY SURVEY Gravity surveys are based on the various differences in gravitational forces in for example rock formations. By measuring these forces, geologists can tell a great deal about the properties of the layers; what type of sediment to expect and if it is possible for it to contain any oil or gas.

MAGNETIC SURVEY With this method a general impression of the different earth layers is obtained by measuring the differences in the earth magnetic fields.



North Sea (gas & oil)



Seismic survey vessel

SEISMIC SURVEY This method is based on the natural phenomena of sound waves travelling at various distances after reflections on earth-layers. The sound waves are created by means of air guns and will be reflected back to the surface by the boundaries between different layers. Differences in density cause differences in the reflection patterns. Hydro phones linked to computers scan an area and the collected data is translated into a drawing. Geological specialists can then identify "Fields of Promise". After a promising survey a drilling unit may drill one or more appraisal (tests) wells. Appraisal (test) drilling will prove the potential of the field and determine if the field is economically viable. However the oil & gas may prove to be too costly to bring to the surface.

DRILLING

When surveys indicate an area where it is likely that oil/gas may be trapped, drilling may commence. A steel derrick is used with drilling tools hanging on a set of pulleys.

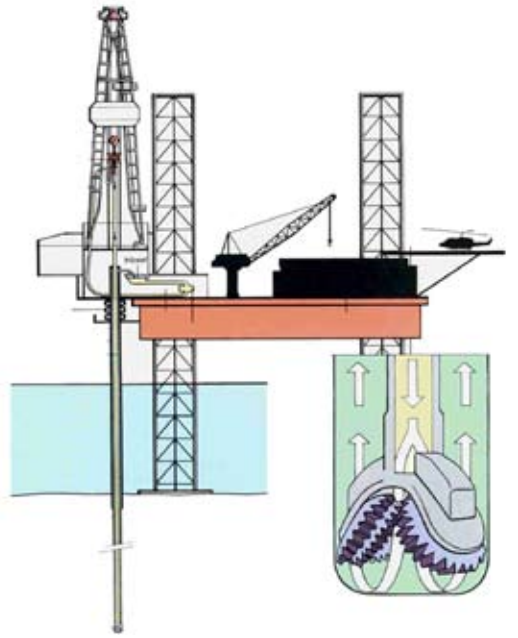
For drilling a rotary table is usually used. A drilling rig has four components:

- power system
- hoist system
- rotary system
- circulating system



Derrick top drive

The drill bit, which does the actual drilling into the earth, is fitted to the end of a long hollow pipe which is made up of 10 metre sections rather like a chimney sweep brush. The uppermost section of this pipe is square or octagonal and is called the Kelly, which hangs from pulleys on a swivel. In the middle of the drill floor is the electrically driven turntable with a hole (square or octagonal) in the centre. The drilling bit and drill pipes are lowered through the centre of the turntable till the Kelly fits into the hole. The engines revolve the turntable, and this turns the drillpipe and at the end the drilling bit rotates. The long pipe called the drill string has to be lengthened from time to time as the hole gets deeper. This is done by breaking (unscrewing two joints) the string and inserting a new length of pipe usually 10 metres (32 feet) long.



Drilling process

A hollow drainpipe is used because it allows a fluid, called mud to be pumped down the centre through the bit and up the outside of the pipe between the pipe and the wall of the hole just drilled. This is done to remove the rock debris (called cuttings) that are produced by the bit when it is drilling, and to cool down the drill bit. After a while steel casing is lowered into the borehole and cemented to prevent the sides from caving in. Each time casing is put in (called running casing) a smaller bit has to be used. The oil or gas contained within a well is at a high pressure (the formation pressure) which is balanced by the weight (hydrostatic pressure) of the mud in the borehole to prevent the oil/gas from gushing into the well. If for any reason the formation pressure increases then the (weight) density of the mud will also be increased by adding chemicals to the mud to keep the pressure at the bottom of the well higher than the formation pressure.

However the pressure of the oil/gas can increase so fast that there is no time to increase the density of the mud. Then oil/gas is forced into the mud expelling mud from the top of the well. This is called a "kick off". When a kick off occurs, a hydraulically operated safety valve called blow-out preventer (BOP) is activated to "shut in" the well at the top. As last option the whole drilling string can be sheared.



BOP Blow out Preventer

Although a single well may tell if an oilfield is going to be economical to develop, if the field is to go into production many more wells will be needed. For economic reasons these wells will all start from the same installation but will curve (deviate) away from the installation in different directions. Several different types of mobile drilling installations are used for the initial drilling operation. If the drilling is not successful the installation can be moved to another location. Different types of installations are in use:



Work-over

- Jack-up
- Semi-submersible
- Drill ship
- Land rig platform (not in this course)

The type of installation used depends on the water depth, weather conditions and capabilities of the 'rig'.

JACK-UP. A jack-up rig is a floating platform, which has legs attached to the side. These legs can be lowered to the sea bed and then jack the platform out of the water. It can be either self propelled or towed to its location. For long distance semi- submersible vessels are often used to transport the jack up rig. Once in position the legs are lowered to the seabed prior to starting drilling. The legs of the tallest platforms are as long as 120 metres. Jack-ups normally work in water depths of up to 100 metres, they rest on the seabed and have an air gap (distance between water level and lowest structure deck) to stay clear of the high seas. The rigs are used for exploration drilling and are moved from field to field. To drill a well the derrick is normally on the installation. However the derrick can be projected over the side of the platform using a cantilever and by this method the derrick can be placed overhead of a fixed production platform and can then be used to re-enter existing (production) wells for various maintenance operations. This operation is called a work over.

SEMI-SUBMERSIBLE

Unlike the jack-up a Sem-submersible (often called a Semi-Sub) is a floating drilling rig also known as MODU (Mobile Offshore Drilling Unit) the rig is supported by two large floats (similar to submarines). A ballast system allows the floats to sink to various depths and by this technique the floats are less affected by the wave motion of the sea giving it improved stability. They are ideal for operations in rough or deep seas like the North Sea or Arctic conditions. Semi-subs are often self-propelled. Once on location the MODU may use anchors to hold its position or it may have a Dynamic Positioning System or DP to hold it in position maybe with the assistance of anchors. This allows the rigs to work in various water depths.



Semi - submersible rig Eric Raud.



Dynamic positioning system.

Dynamic positioning system (Dynamic positioning is a computerised system that uses several special type propellers called thrusters which compensate for sea movements such as waves and tides thus allowing a vessel or installation to hold position even in severe weather conditions) This computer allocates engine power to the different thrusters under the hull after calculating the desired ships/installations position. The propellers are omni-directional azimuth thrusters and can give thrust in any direction as required by the computer, in order to stay in the pre-set position. The information needed for the calculations are fed into the computer by satellite navigation, beacons on the seabed, electronic positioning systems (Artemis, Syledis etc), wind, wave and current indicators.



Drilling vessel Noble Isegerius.

DRILLING SHIPS

In deeper waters mono-hull drilling ships will often be used. The drilling vessel will sail to a drilling location and kept in position by using Dynamic Positioning or anchors. The derrick is installed on the vessel. The drilling pipes are fed through a hole in the hull. Because a mono hull is more sensitive to pitch and roll a wave compensators are used, allowing the ship to move around it's drilling position.

PRODUCTION

When a geological survey and an exploration drilling establishes that there is sufficient recoverable oil/gas in a reservoir to justify the cost of recovering it then exploitation may commence. Exploitation requires special facilities depending on the water depth, costs, abilities to transport the hydrocarbons, the estimated life cycle of the platform etc., different types of production units are in use.

STEEL JACKET PLATFORM

Steel production platforms can be divided in main platforms or unmanned satellites. They are built onshore in different segments. Usually the supporting jacket, the legs of the platform that rest on the seabed, is built in one piece. When finished it is towed out on a barge and sunk into the production position.



Wintershall L5B.



Crane vessel Stanlislav Yudin

The other elements, of the platform (the accommodation, flare boom drilling and production units, the utility plants etc.) are built in segments and are placed on top of the jacket by crane barge. The process of putting the platform together and getting it operational is called the hook-up. The process of connecting the platform's production equipment to any pre-drilled wells is called the tie-ins. When the hook-up and the tie-ins are completed the platform can start to produce oil/gas. When a production platform is starting up escaping gas will be blown off. Normally three different possibilities are available to blow off the gas depending on the wind direction. Now a days gas is also produced. When oil will escape it will be flared off.



Troll A.

CONCRETE GRAVITY PLATFORM

A concrete gravity platform is built near the shore. On shore the bottom, or cells, are built. Once finished the floating cells are positioned in deep, protected waters like a fjord, where the rest of the platform will be built on top in segments. On completion the large structure will be towed out to its production location. As many as 10 strong tugboats are needed for the delicate manoeuvres of the huge platform. When the platform is in position the structure is filled with ballast and sunk to the bottom. When the



Subsea overview

wells are activated and the hook-up is completed, production can start. Pipelines are often used to carry the oil/gas to the shore for refining. The cells can be used to store oil in case the pipeline is damaged and cannot be used. This allows the platform to continue production for some days.



FPSO Bluewater.

FPSO (Floating Production Storage Off loading Vessel) These relatively new installations are mobile production units used for smaller fields where building a platform is not lucrative. When the wells run dry, the installation in its entirety can be used at other locations, saving the costs of developing and building a new installation. The former tanker vessels are converted to a production installation and storage tank. The ship is moored on a single buoy, allowing it to move with the current and the wind. The flow lines from the well are connected to the bow of the installation and oil is stored in the storage tank. Shuttle tankers are used to transport the oil stored in the FPSO to the shore.

SUBSEA WELLS

Not every well head requires a complete platform to be built. Sometimes complete fields are developed by having the control equipment on the seabed. The well heads are connected by a pipeline to a central manifold tied into a nearby platform. By means of a hydraulic system (the hydraulic fluid is pumped through a flexible pipe called the umbilical) the wells can be controlled and operated from the central platform. The platform will act as a collection and booster platform. The oil/gas is cleaned for transportation and pressures are 'boosted-up' to pump the hydrocarbons to the shore. To support the offshore industry a variety of installations and ships are in use.



Allseas Calamity Jane.

Introduction to Offshore support vessels.

CRANE BARGE

When different modules are built on-shore they are transported to the location on barges, towed by tugboats. Crane Barges will install these modules on top of the already installed jacket. The biggest 'rig builder' in the world can lift 14.000 tons. This barge is a Semi sub, however mono hull crane ships are also used. Lifting heavy loads in the open sea requires a stability system and, most importantly good weather.
The crane barges performing lifting jobs have a spider's web of anchors around them to hold the exact position. Also dynamic positioning systems are used.



Saipem 7000.



Floatel.

FLOATEL

Personnel for the Hook-up of the platform are based on a Floatel (hotel accommodation) connected to the platform under construction by means of a gangway. Very often Jack-up platforms are sometimes converted from production to hotel accommodation. Seem-subs are also used. These are anchored or will stay alongside the platform using Dynamic Positioning.

SUPPLY VESSEL

Supply vessels will enter the field for the necessary supplies such as drilling equipment, stores, fuel, maintenance equipment e.q. for the production and drilling platforms. Supply vessels will return waste and separated garbage to the shore base. During adverse weather conditions the supply vessels must wait in the field because crane operations will be suspended, till weather conditions are improving.



Viking provider.

PIPE LAYING VESSEL

Pipe laying vessels are ships or barges where joints of pipes are welded together to form a pipeline in a factory on board. A piece of equipment called the "Stinger" is used to guide the pipeline to the seabed. The original pipe laying barges were not self-propelled. A tugboat was used to tow this type of installation to the location. Anchors are used to pull the installation forwards as the pipeline grows. Other more advanced pipe lay-barges are mono-hull and dynamic positioned. These self-propelled barges are often re-built ships and are much faster in laying because no anchors are used. The new generation of pipelayers, often have their own propulsion and are using dynamic positioning systems to keep the vessel in place. This will mean that the vessels are faster then conventional pipi layers. Pipelaying is devided in "J laying" and "S laying". Still know a days records are broken, fater and in deeper water.



Supply vessel

STANDBY VESSEL

Stand by vessels are part of the emergency preparedness organisation. Their main purpose is to evacuate personnel from the installation during an emergency. The standby vessels nowadays are better equipped and the crew is better trained then before. Modern standby vessels have daughter crafts onboard. When particularly hazardous work is being carried out the stand-by vessel is usually brought nearer to the job site. In circumstances when it is necessary to evacuate the platform personnel can be taken to the standby vessel. Standby vessels are also used as 'chasers'. They will chase away any vessel that comes too near to the platform's safety zone. (500 metres around the platform)



Tog More Allseas

ANCHOR HANDLING VESSEL

Non-self propelled barges need anchor-handling vessels to assist them. They can tow the installation to its location. When pipe laying the anchors have to constantly be brought from the rear of the operations to the front to allow the pipe layer to pull itself along. Off course if weather conditions will worsen the activities must be suspended.



Anchor handling vessels.



Seaway Patrol

DIVING SUPPORT VESSELS

Diving support vessels are used for all kinds of Sub Sea work such as inspections, installing maintenance equipment, and safety equipment for the well heads. The diving support vessels are working with divers or ROV 's (remotely operated vehicle). The ROV's are more often used nowadays because diving is a dangerous profession and there are limitations for what divers can do. The ROV's are remotely controlled machines equipped with underwater camera's, lamps and arms.

On board the vessel divers in diving bells are monitored and supported. The vessels are equipped with diving installations. Sometimes air diving is sufficient but at greater depths and for extensive projects mixed gasses or saturation diving is used. Saturation divers stay in special pressurised tanks for the duration of the project allowing them to work longer hours underwater because decompression is not needed after each dive. Only at the end of the project the divers are decompressed to normal surface pressure. On board the vessels special recovery systems are installed to recover the diving chamber in case of an emergency on board.



ROV



Offshore diver

FSO (FLOATING STORAGE OFFLOADING)

Instead of expensive pipelines and production platforms for economical and operational reasons a storage tank or vessel is used to store and produce oil. The tanks/vessels are converted tankers or purpose built single point mooring buoys. The oil is transported to the shore by shuttle tankers.



FSO Floating Storage Off loading



Dockwize Kizomba project

Off course there are more vessels supporting the Offshore activities think of rock dumpers, trancers, dredgers or ice breakers.

SEMI SUBMERGIBLE HEAVY LIFT VESSELS

Semi submergible heavy lift vessels are used to transport jack-up's or other floating material to their location. Also the vessels can be used in transporting parts of an offshore installation for building on the spot.



Balder Viking Ice breaker





FAMILIARIZATION AFTER ARRIVAL ON AN OFFSHORE INSTALLATION

Arrival on a platform or installation.

Living and working on an offshore installation means that you will work on a more potentially hazardous area. Because you work with a large crew on a relatively small area, this will mean you must be able to work and live together. After landing on the helicopter deck you will be supported by the HLO (Helicopter Landing Officer) and HDA (Helicopter Deck Assistant) in the safest direction to clear the helicopter deck. One deck below the helicopter deck lifejackets will be collected and handed over to the persons flying back to the shore.



Report to radio room

SAFETY BRIEFING

Arrived at the radio room or reception you will receive a cabin number and you will be informed about your assembly point in case of an emergency. If this is your first time on the platform you will receive a safety tour in combination with a safety DVD and safety booklet or card. In the safety briefing the following important issues are covered:



Report to radio room

- Layout of the platform or vessel.
- The visual and audible alarm signals.
- Muster (assembly) stations. Often a place in the accommodation or an area close to the lifeboats is used.
- Emergency Response duties.
- Safety rules and required personal protective equipment PPE's.
- Permit to Work system.
- House rules, work and rest times and hygiene.

MAKE YOURSELF FIMILIAR

After arrival on the platform or vessel make yourself as soon as possible familiar with the layout . Use the safety drawings for this purpose. The station bill will give you all information about the alarms and how to act on those. During the safety tour important area's will be highlighted such as:

- Assembly sations and altarnative assembly stations
- Lifeboats
- Alternative lifesaving equipment
- Escape routes
- Control room
- Hospital
- Accomodation, messroom, radioroom e.q.
- Helicopter deck
- Work area's



Muster list cabins colour coding

LIVING AND WORKING OFFSHORE

Tho work offshore will mean that you must be medically fit and have followed the proper safety training. Also you must know that offshore companies are checking on alcohol and drugs abuse. Alcohol is not allowed Offshore.

WORKING ROUTINE

- A working shift is normally 12 hours and a working day is divided in a day shift and night shift.
- Outside the accomodation you have to use the prescribed personal protective equipment.
- You have the obligation to participate in the Safety Management System SMS
- All incidents, accidents, first aid cases and illness must be reported.



Personal protective equipment

PERSONAL PROTECTIVE EQUIPMENT (PPE)

All personnel must use the compulsary personal protective equipment (PPE). The PPE must be the proper type for the job carried out.

The following minimum PPE is required:

- Safety helmet (hard hat)
- Safety glasses.
- Orange (conspicous colour) and fire retardant coverall
- Work gloves
- Safety shoes or boots (rig boots)

DRILLS AND EXERCISES

On a regular base safety drills are carried out. This can be a simple one such as sounding an alarm to see what the response is according station bill and muster list or a large table top exercise in combination with the company onshore staff and local authorities, such as search and rescue organizations. Those exercises are evaluated to see if the timeframes menitioned in the Emergency Responce Plans are met.

SAFETY MEETINGS

Daily and weekly safety meetings are organized to discuss daily routine work but also non daily routine work. Also "Tool Box meetings" are used to discuss how certain work is carried out. In this tool box meetings safety related issues are also discussed.



Station Bill.



Muster list.

SPARE TIME

After a shift it is possible to relax from a hard day's work. Leaving the platform is not possible so, as an alternative their are facilities to relax such as a fitness area, television/video room, game computers. Also there are facilities to communicate with the home front think of internet and public phone (cell phones will not work in most cases and some oil companies refuse cell phones).

SMOKING, ALCOHOL AND FOOD

Smoking and alcohol are not allowed offshore, most companies have a smoking policy what will mean that certain area's are dedicated as smoking area's. Also companies will try to focus on healthier food with less fat.



Two person cabin



Poolbiljart





International and national laws and regulations.

Safety rules and laws and regualations.

The last 20 years the offshore legislation has changed significantly, following Lord Cullen's recommendations from the Piper Alpha inquiry in the United Kingdom. In Europe all members of the European Union have agreed on a more goal setting approach towards safety. This means a less complicated system of rules and regulations, emphasising more on general terms, rather than details. This gives more responsibilities to both the employer and the employee. Also suppliers and manufacturers have responsibilities under the new legislation. The governmental control consists of auditing safety management systems rather than checking whether details comply with regulations.



Piper Alpha 1988

The framework for offshore legislation is set by international agreements. Within the EU a complete new system was introduced. The Norwegian legal system stood as an example. As part of the agreement between EU countries, the European framework must be implemented in national law as a minimum standard. Higher levels of legislation are allowed as long as the basic requirements are met.

For safety legislation this resulted in health and safety at work acts.

- In the UK: the Health and safety at work act (HASAWA).
- In The Netherlands: the working environment Law (Arbowet in Dutch).
- In Norway: the working environment and worker protection law. (Norway is not an EU member)

The general scope of the acts is the same. The enforcement varies due to differences in the legal system.

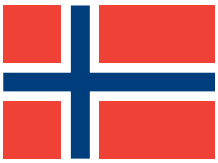
THE GENERAL SCOPE

To create a safe and healthy working environment by promoting, stimulating and encouraging high standards, applying to all employers, employees, manufacturers, suppliers and the general public'. The National laws or acts have more detailed regulations for specific industries. Codes of practice are guidelines from the government on how to comply with these laws and regulations but have no legal binding. In the next paragraphs we will go in the start of the oil and gas industry in different North Sea countries and we compare some off the different rules and regulations for the Offshore industry.



Statoil Ekofisk Field

1. A NORWEGIAN APPROACH



Norway is now the third largest world petroleum exporter after Russia and with a total production of 1.6 billion barrels of oil equivalent per year. It manages a large network of sub sea pipelines and has become a leader in offshore engineering, production of large rigs, sub sea completions, liquid natural gas production and transport systems.

The present-day success had its start in 1969, after the discovery of the giant Ekofisk field in the North Sea. Norway decided it needed a fully competitive domestic oil industry to complement international oil company expertise. The Norwegian offshore petroleum management system used a "forced marriage" approach to build a national oil company, subsequently called Statoil, which would work with private partners to develop rich North Sea and Norwegian Sea prospects within Norwegian coastal waters. Norway's government initially gave Statoil special startup advantages. Mindful of earlier problems in state-controlled Scandinavian enterprises, Statoil was designed to be successively withdrawn from government subsidy and now competes without financial advantages.

Since early 1980, Norway also made a national decision not to conserve oil or gas reservoirs for the future, but to develop its offshore energy resources rapidly. As part of that rationale, most of the profits from exports were allocated to a fund, authorized in 1990. This fund was designed to stabilize fluctuations in petroleum income and help in the transition to the time when offshore resources would be fully depleted. That fund has now grown to $130 billion.

From the outset, Norway integrated strong environmental emphasis into planning and management of exploration, leasing and production. It introduced environmental impact statements in the mid 1970s, but did not formally codify them until 1996. Unlike the U.S. system, which, besides having minutely detailed leasing regulations, involves more than a dozen federal laws as well as various federal agencies, state laws and agencies, and courts the Norwegian system has moved toward cooperative, performance-based models.

Norway has very few parliamentary acts. The main relevant Norwegian laws include the Petroleum Law of 1996, the Pollution Control Act and the Public Safety Act. Regulations are administered jointly by the Pollution Control Agency (part of the Ministry of Environment) and the Petroleum Directorate (Ministry of Petroleum and Energy), along with the newly separated Petroleum Safety Authority (Ministry of Labor and Government Administration).

OLJEDIREKTORATET

PETROLEUM SAFETY AUTHORITY NORWAY

Environmental progress continues in Norway with more formal inclusion of environmental organizations and public access to policy development. In 1996, Norway became the first nation to initiate burial of carbon dioxide in offshore strata (currently 1 million tons per year, largely in the Sleipner field). And Statoil has announced plans to achieve zero harmful discharges from its offshore platforms by 2005. Notwithstanding its strong commitment to the environment and sustainability, Norway has set in motion development of giant gas fields in the Barents Sea. In Norwegian legislation enterprises must have a total internal control system to demonstrate compliance with the laws and regulations to the government. The companies must show how the different aspects of the law are implemented in the enterprise. The result is that all those involved also have responsibilities to carry out.

Norwegian Rules & Regulations:
The Norwegian Petroleum Directorate (NPD) is a public body that has been delegated authority to regulate the exploration & exploitation of petroleum resources, to secure a safe and appropriate conduct of activities.
The framework of petroleum activities is a regulatory concern of the NPD, and matters of safety and working environment are being supervised (audited) to see if standards are perfectly acceptable as is required by law.

Safety and working environment
In the field of safety and working environment the ultimate regulatory responsibility lies with the Ministry of Local Government and Labour, but the NPD has been delegated supervisory responsibility within this field for petroleum activities on the continental shelf. This responsibility is being exercised through the Safety and Working Environment Division. The Division incorporates a Supervisory Activities Branch with seven heads of supervision, a Technical and Working Environment Branch with six executive sections, and a Strategy



Branch. Additional responsibility of a licensee/operator. Anyone taking part in petroleum activities, has a responsibility of regulatory compliance placed upon him with respect to his own activities. But a licensee/operator has the additional responsibility of ensuring the regulatory compliance of those who work for him, including contractors. A licensee is a company that has been given official permission(s) to explore for, exploit and produce petroleum resources on the continental shelf; and/or carry such production by pipeline. Production covers extraction, processing and storing of petroleum; plus construction, placement and operation of installations for such activities. On granting a production license (a license gives an exclusive right to explore for, drill for and produce petroleum within a limited area. The licensee becomes the owner of the petroleum produced). A company usually the licensee is appointed operator to run the subsequent day-to-day activities.



Internal control

Anyone, who is responsible for petroleum activities, is required to ensure regulatory compliance and, as a consequence, has to take systematic action in order to attend to that responsibility. The most favoured means of action is to establish and operate management systems. The principle of internal control has a special place in our regulation of safety and working environment and is therefore central to our legislation and our supervisory activities.

The legal framework

The legal framework consists of acts, regulations and guidelines, and anyone participating in petroleum activities, is required to comply.

Central acts

The petroleum activity act, the worker protection and working environment act and the pollution and waste act are the more important acts for petroleum activities on the continental shelf. The petroleum activity act deals with exploration, exploration drilling, exploitation, production and pipeline transport on the shelf, and it applies to anyone who is actively engaged in these activities. Activities are to be conducted in a safe and appropriate way, to grant safety to personnel and environment. The worker protection and working environment act demands a working environment that is not physically or mentally detrimental to the worker, and an occupational activity that has a purpose and is meaningful. Some parts of the act do not apply to petroleum activities on the continental shelf, provisions on working hours, for instance. The pollution and waste act expresses a general duty of preserving the environment, so pollution and waste will not induce damage to nature, be harmful to health or adversely affect the well being of people in general.

Central regulations

The regulations of safety, of internal control and of working protection and working environment are stipulated by Royal Decree and take precedence over other regulations.



Norwegian laws and regulations

THE SAFETY REGULATIONS

The purpose of the regulations is to establish and maintain a perfectly acceptable level of safety, and to develop it further by means of internal control systems. The regulations deal with the consents by which a company is licensed to conduct petroleum activities, and they require that such activities be conducted in a perfectly safe manner (the petroleum act).

THE INTERNAL CONTROL REGULATIONS

Require the licensee to take systematic action within his own organisation, so that he himself can ascertain and ensure that his own activities, and those that carry out work for him, comply with laws and regulations. As a rule, an independent unit within his own organisation will supervise (audit and monitor) this internal control system, and he must not unduly restrict or interfere with its freedom of action. The worker protection and working environment regulation tells how and when the namesake act is to be used in petroleum activities on the continental shelf. The regulations thus contain provisions which are written specifically for the shelf, for instance those on the working hours and periods of stay. The NPD is also in the process of writing/compiling regulations on systematic follow-up of working environments in petroleum activities. A collection of requirements to this end has not been put together before.

SYSTEMS REGULATIONS

The regulations of risk analyses and emergency preparedness are often referred to as system regulations since they deal with systematic approaches/analyses to enhance safety. The risk analyses regulations require that such analyses are implemented and used in petroleum activities. Risk is here the probability of an accident to happen and its consequences. Risk analyses are used to pinpoint accidents that can happen (risk assessment), in order to take precautionary action in the form of risk-reducing measures. Measures, which reduce the probability of accidents, are to have priority over those, which reduce the consequences of such accidents.

The regulations require the operator to set his own safety goals. This implies that his own criteria will determine the level of risk which he then finds acceptable, set against a background of the normative safety level at the time (also a function of technical and social development).

He will have to evaluate the results of risk analyses in relation to his accepted risk level, to see if any risk-reducing measures must be implemented in order to sustain that level. In other words, results of risk analyses have to go into the decision-making process of the operator if he is to ensure that his safety will comply with regulations, his own safety goals/criteria for an acceptable risk level. The emergency preparedness regulations require that such preparedness is established, maintained and developed to secure that the level of safety is always perfectly acceptable. The operator is required to carry out an emergency preparedness analysis to adapt his emergency pre-

paredness to his own, requirements (of risk analysis). Emergency preparedness is here the technical, operational and organisational measures that are taken to prevent a dangerous situation from developing into an accident. If there is an accident, such measures are meant to prevent or reduce harmful effects. Measures, which are meant to prevent accidents, are to take priority over those, which are meant to reduce the effects of such accidents. Emergency preparedness are to be integrated in all phases of activity. A special contingency plan is to incorporate all the measures that are to be implemented in case a dangerous situation should arise, or an accident should happen.

TECHNICAL REGULATIONS

In total there are eleven technical regulations which cover:

- The sectors drilling and well activities (and geological data collection)
- Manned underwater operations
- Environmental data
- Pipeline systems
- Load bearing structures
- Process and auxiliary facilities
- Lifting appliances and lifting gear
- Electrical installations
- Explosion and fire protection
- Safety and communication systems
- Marking of installations



Drilling activities.

FUNCTIONAL REQUIREMENTS OF REGULATIONS

You will find an extensive use of functional requirements in the regulations; not the traditional detailed ones. Since a functional matter relates to the way in which something works or operates, such requirements are about what to achieve, and not about how to achieve it. So to meet a functional requirement, you must come up with your own requirements as to how something is going to be done, since there are no mandatory (technical) solutions to choose form.

GUIDELINES (NOT LEGALLY BINDING).

As there are several ways in which to meet one functional requirement, our guidelines provide helpful information on such requirements and offer examples of solutions that are at a perfectly acceptable level of safety. In this way the guidelines become useful sources to understand the safety norm of the regulations at the (then) present stage of technical and social development. Since our guidelines contain more examples of how to meet a functional requirement, they are not legally binding in the way that regulations are. You may well depart from the examples of (technical) solutions that are found in our guidelines, but you may not lower the level of safety (the norm) which constitutes the legal duty or basis of the regulations. If you depart, you must show that your approach represents an equally valid way of regulatory compliance. You may, for example, take appropriate action to compensate for departures that are detrimental to safety.

THE ARRANGEMENT

The general provisions on consents regulate petroleum activities by means of main consents for phases of extensive operation and consents for more limited activities. The main consent phases are exploration, field evaluation, engineering, fabrication and operations. Examples of consent activities are exploration drilling, placement of installations and start of production. The arrangement of giving a consent per phase is one by which licensees and authorities can call on experience from earlier phases of operation to asses and decide on activities for the next ones, and one which constitutes a suitable approval regime on the part of the authorities.

APPLICATION AND CONSIDERATION

An application for consent will contain planned petroleum activities, choice of (technical) solutions, implementation and use of internal control systems, departures from regulations, which may affect safety, and measures taken to balance these departures. When applications are under consideration, we call on expert advice to assess the quality of submitted documentation, and/or we conduct systems audits in order to verify given information. If applications are consented to, the applicant/licensee may start activities as soon as he has obtained a written consent. Later on he may not alter the basis on which he obtained it, unless such alterations are discussed with and accepted by the NPD. Should we find that he has not adhered to the original basis, we may require him to apply for a new consent.

SUPERVISION (AUDITS) SUPERVISORY ACTIVITIES

The consent arrangement should be seen in relation to supervision of safety in petroleum activities. An applicant is namely given consent to conduct petroleum activities on a condition of compliance with the regulations of safety and of internal control; i.e. perfectly safe.

Before and after consent is given, Supervisory Activities Branch will audit the licensee/operator to see if he has the management system (i.e. the internal control system) he is obliged to have to ensure the regulatory compliance of his activities, and to see if the system functions properly. Supervisory activities consequently look into the basis of his application for consent, to find out if its elements are or were as put forward originally. For instance if installations, equipment, procedures, personnel, supply and transport services and emergency preparedness will or do give the perfectly safe activity that was planned to be conducted – and fully documented – in his application. In performing such supervisory activities, we co-operate with other public bodies and/or private institutions, but the NPD alone has been delegated the authority to supervise safety and working environment on the continental shelf. As a consequence, they also play a co-ordinating role in relation to public bodies that have been given supervisory responsibility of their own.



Safety

SYSTEMS AUDIT

On supervising the petroleum activities, we mostly carry out audits of management systems. What we do, is to examine some of the activities of a licensee or an operator to see if his internal control system ensures that his activities are planned, organised, carried out and maintained in compliance with laws and regulations. Our audits thus concentrate on the systems that are designed to secure that standards of safety and working environment will be perfectly acceptable. What the audit team is after, then, is how the licensee/operator has organised the many aspects of his activities to secure (as licensee/operator) such standards, i.e. that his activities are according to regulations; his own procedures, own criteria and own requirements. As a rule, we do not inspect the actual work or activities, but a systems audit may well check on them at random to verify the extent of accordance with the relevant specifications or procedures.

AN ESSENTIAL PREREQUISITE

The regulatory compliance of all those who take part in petroleum activities, is probably the essential prerequisite for high standards of safety and working environment. The licensee's system of internal control must be expedient and of the highest order. Supervision (auditing) of such systems is the major regulatory concern of the NPD.

DUTIES AND RESPONSIBILITIES FOR THE EMPLOYEE:

- Take care of yourself and others ('buddy watch')
- Use things properly (proper tools for the proper job)
- Don't do things if you don't know how to do them safe. (Don't know means.....'ask')
- Report dangers and hazards
- Work according the employer's safe working procedures

Employers duties & responsibilities:

Your employer must tell you:

- Hazards about the job. (pre-job safety meeting)
- How to do the job safely. (job responsibility)
- What is done to protect health and safety.
- How and where to get First Aid treatment.
- What to do in an emergency. (station bill!!)

Additionally your employer must provide:

- Training to do the job safely. (a personal mentor)
- Personal Protective Equipment.
- Information posters & signs.
- Regular drills and safety meetings.



Sunset.

For good and structured communications each installation is divided in safety areas. Each safety area will have an elected person as safety representative who will represent the workers trying to raise safety issues in safety meetings. When the workers have rights and responsibilities, they must have their voice in decision making. The Safety Representatives have special powers (The Safety Representative Regulations 1977) and are therefore specially trained. They do their normal work and have some time allocated to work as a safety rep.

UNITED KINGDOM.



THE MOST IMPORTANT OFFSHORE LAWS OR ACTS IN THE U.K. ARE:

- HASAWA (Health and Safety at Work Act).
- Mineral Working Act.

The HASAWA consists of four parts:

- Part 1. Includes provisions on: Health and safety for people at work Protection of thers Control of dangers Controlling emissions
- Part 2: Establishes the employer's medical advisory services.
- Part 3.: Amends previous laws relating to safety aspects of building regulations.
- Part 4.: Contains a number of general and miscellaneous provisions.

Specific technical aspects and responsibilities are included in the Mineral Working act. Both the HASAWA and the Mineral-working act are framework acts. The framework acts are further specified in detailed regulations.

Some regulations:

- The workplace (Health, safety and welfare) regulations
- The Manual Handling regulations
- The Personal Protective Equipment at Work regulations
- The Noise at Work regulations
- The Reporting of injuries, Diseases and Dangerous Occurrences regulations

HSE
Health & Safety Executive

H.S.E. (Health & Safety Executive) is responsible for governmental control. By promulgating guidelines they issue a translation for the Operators and Contractors on how to implement the Acts (codes of practise) An important requirement among the regulations is the Safety case regulation. A safety case is a care system, revised and updated which is revised and updated when necessary. Before an installation can work a safety case must be presented to the HSE. It includes:

- The Safety Management System (structure). Assuring a system in controlling safety aspects.
- Risk assessment. The analysis of risks identified for the installation and her future work.
- How can we mitigate the risks in designing the installation or procedures? Risk reducing measurements. If risks can not be mitigated, introduce ways to control the risk by reducing them to an acceptable minimum.
- Emergency Response Procedures must be in place to cope with unforeseen calamities. Less governmental interference and a better working environment and circumstances can only be achieved by workforce involvement, where both the employer and the employees have clear responsibilities.

THE NETHERLANDS

THE LEGAL FRAMEWORK IN THE NETHERLANDS:

- Constitution: Gives fundamental rights to every person on Dutch territory and sets out the form of government including its authority.
- Statute Law: A procedure that has binding regulations to each person.
- Order of Council: The implementation of a decision without approval from the Parliament that has binding regulations to each person.
- Ministerial Provision: A disposition power to the Minister to elaborate the requirements and provisions of an Order of Council.
- Policy document: A matrix designed by Law whereby a Ministry or other government institutions state how authority from legal regulations will be used.
- Labour Information Pages: A series of indications on how to deal with Legal Regulations put together by the Labour Inspection.

Responsibilities for policies and guidlince in the offshore industry are:

- Department of Economic Affairs
- State Supervision of Mines SodM
- Netherlands Oil and Gas Exploration and Production Association NOGEPA

In the past there were various laws and regulations for the gas and oil industry:

- The Mining Act 1810/1903
- The Mining Act Continental Shelf
- Mineral Locating Act

Practical supervision is executed by the State Supervision of Mines SODM SodM. Under the authority of the Inspector General the inspectors have a sweeping authority. At the moment a harmonisation between Dutch Laws and guidelines set out by the EEC were implemented in the Dutch laws and guidelines. Laws also change because of social and jurisdictional developments under the influence of:

- Inspections
- Technical developments
- Incidents/accidents both National or International

In 1996 the government began with the intention to create a new Mining Law for the Dutch part of the continental shelf in the North Sea. Within those laws and guidelines the supplements from EEC-guidelines were implemented. Also the Onshore Dutch Labour Law was intigrated in those guidelines and taken over as an act.







Safety Awareness

1. Offshore hazards.

In common with all heavy industries there are many hazards offshore. Many of the problems arise because there is so much activity contained in a relatively small area. Comparative industries on-shore use a far more spacious set-up. This means a problem in one area can have an effect on the adjacent areas. For this reason personnel must be aware that their actions could directly influence the safety of others on the installation. Another difference with similar on-shore activities is the location offshore. The sea, as a workplace is a hostile and remote environment. If problems force us to abandon an offshore installation we can not simply walk off. It is also much more difficult for outside agencies such as the Coast guard or Fire brigade to be of immediate assistance. This makes the industry focus on safety and emergency response. It is a legal requirement to do a risk assessment of all operations on an offshore installation and to install systems that control and mitigate hazards. By identifying possible risks, technical, organisational and personal factors can be adjusted to control or mitigate the risks. Also if not daily routine work is carried out before commencement Task Risk Assessments TRA's or Job Safety Analysis JSA's are carried out.

The control of hazards and risks starts at the design of a platform. There are many regulations covering the design and operation of an offshore installation such as regulations for:

- Strength of materials.
- Layout of the installation.
- Separated danger zones.
- Protection by blast walls and sprinkler systems.
- Detectors for gases smoke and fire.
- Emergency shut down systems.

The acceptance of the recommendations made by the public inquiry into the Piper Alpha disaster led by Lord Cullen has led to world wide requirements for safety management systems (SMS) and safety case regulations.



Amoco.

Training is one tool to reduce possible problems caused by human factors. By making people aware of hazards to be encountered, personal behaviour can be influenced, minimising the human element as a risk factor. The industry has set up and continually improves training for safety awareness and emergency response. This training makes people aware of the hazards and the resulting risks and teaches personnel to cope with critical situations by using safe working procedures.

HIGH-PRESSURES

Oil and gas wells contain hydrocarbons under high pressures. To control a possible blow out (which is an uncontrolled flow of oil and gas from the well under pressure), Blow Out preventors (BOP's) are installed. BOP's are emergency valves that will shut down the well completely when the pressure rises above a pre-set value. In extreme cases the pressures are so high that the complete well shaft is blown out and the BOP can no longer prevent an uncontrolled flow of hydrocarbons, very often resulting in explosions and fires and environmental damage is then inevitable.



Blow out Ensc 51



Blow out Sedco 7

There are three variations of blow outs possible:

1. Surface blow out.
2. Underwater blow out.
3. Derrick blow out.

Underwater blowouts can cause gaseous water (shallow water) causing stability problems to floating installations and ships. To control the flow of hydrocarbons during normal production a Christmas tree is installed on the platform. These main valves will regulate the amount of oil and gas entering the platform from the well. The Christmas tree also allows us access to the well with tubing's to monitor and influence the production process from the inside.



Control room



Christmas tree

HYDROGEN SULPHIDE. (A LETHAL GAS)

H2S-gas or Hydrogen sulphide is a by-product in the drilling and production process. The gas is lethal and there for it must be detected as soon as possible. Special detectors indicate its presence. The dangerous thing about the gas is that you can only smell the low concentrations. The smell at lower concentrations is like rotten eggs. As the concentration gets higher the gas will affect the central nerve system and can be dangerous/lethal. The maximum exposure level is set at 10 PPM. This year reduced by the European countries to a lower level from the 1st of Januari it is reduced to 1,6 ppm of 2,3 mg/m^3. It is safely to work in an environment without breathing protection if you don't exceed the maximum exposure limit this is the lowest concentration for 8 hours a day or 40 hours a week safe to work in. Apart from being toxic the gas is also flammable. When burned the gas sulphur dioxide is produced which is also toxic.

As the gas is heavier then air it will flow to the lower parts of the installation. In case of a gas alarm we should there for use alternative muster stations near or on the helicopter deck. H2S gas sensitive installations must take extra precautions to prevent gas leaks, must have special personal detectors, a continuous measuring system and alarm systems in place. They must also train personnel in how to cope with gas alarms.



H_2S contineous measuring

STRUCTURAL DAMAGE BY COLLISION

Offshore installations are not alone at sea. Many of the installations are situated near and sometimes even in the shipping lanes. Although ships movements are controlled by shore based radar systems and traffic separation zones the chances of a collision still exist. To minimise the chances of a collision offshore drilling and production units have a 500-meter safety zone around the platform. No ship is allowed in this zone without permission of the platform. Because of this risk the Dutch goverment hired a special ocean going tug to prevent these kind of incidents. The Waker is on duty at open sea in stormy weather.



Waker



Vessel adrift towards a platform.

2. Personal and occupational risks.

CHEMICAL HAZARDS

In a typical offshore environment many different kind of chemicals occur. Different chemicals develop different risks:

- Poisonous usually referred to as toxic substances.
- Corrosives - acids and alkalis causing burns and severe corrosion.
- Chemicals that cause fires and explosions.



Chemical substances

The poisonous chemicals can cause short-term and long-term effects. Short-term effects: the symptoms show almost directly after the initial exposure.

- Problems with breathing.
- Problems with skin and eyes.

Chemicals causing long-term effects are: the difficulties with long term effects are the incubation time before they show.

- Asbestos.
- Alcohol (abuse).
- Tar.
- Some metals. (Mercury)

The proper actions to cope with chemical hazards are therefore focused on prevention. The first step in controlling and mitigation is trying to replace the dangerous chemicals for less harmful substances. If not possible we must try to minimise exposure by using a totally enclosed system and ventilation. But also by job rotation, changing the properties of the chemicals (pellets instead of powder) using personal protective equipment and of course making people aware of the hazards. Special Chemical data sheets (MSDS Material Safety Data Sheet) and work permits are used to identify the risks in working with chemicals and supplies the worker with a safe working procedure to minimise the risks. Work permits have to be used for the work with chemicals.



Label, markings and signs..



MSDS sheet..



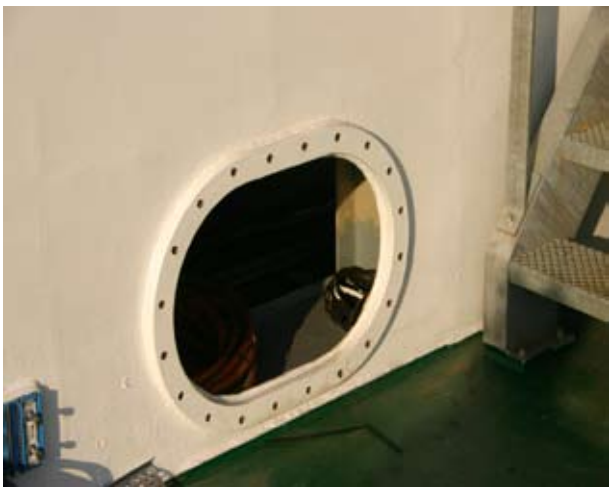
CONFINED SPACES

Although we are aware of the hazards in confined spaces every year people die because of a lack of safety precautions taken before entering. Confined spaces are tanks, bulkheads, pump rooms etc. The hazards of confined spaces are within the environment inside. The air inside can contain toxic or combustible substances, in some occasions the air does not contain enough oxygen for us to breathe. The work should only be carried out following strict working procedures. Before work can commence inside confined spaces, we must ensure that the environment is safe by ventilating and gas testing. If not safe then we must take extra precautions prior to entering. The work requires a work permit stating that the gasses inside the tank should be tested and monitored, respectively before and during the job.

If gas levels exceed the required levels work can not commence or continue. In some occasions a breathing apparatus must be worn. Always have one person at the entrance of the confined space. In case of an emergency this person will be able to help, don't enter without breathing protection. It is important to discuss the job before starting; a toolbox meeting. A procedure with a checklist is often used before entering a confined space.

During this meeting all the involved persons discuss the different aspects of the job:

- Sequence of the work
- Responsibilities / allocation of tasks
- Risk assessment
- Work permits
- Communication
- Tools and equipment check
- Safety and emergencies
- Job site checks
- Monitoring



Confined space.

ELECTRICITY

Electricity is a non-obvious hazard for non-electricians. You can not see, smell or feel it (unless it is too late!). Precautions to work safe with electricity are: isolation to make sure "wires are dead". Also called the logging and tagging system. As a rule you should not work on "live" installations. Safeguarding that the installations can not be switched-on again during the job is vitally important. Working with electricity is a specialist job and is covered under the permit to work system. Electricians are trained in these specific job related hazards.



Working over the side.

NOISE

Noise can be defined as dangerous sound levels above 80 dB(A). Exposure to sound levels > 80dB(A) for a long period can damage the hearing. (When exposed to 80 dB(A) for 8 hours, 50% will suffer from hearing damage). Also short high peaks (like a air-gun shot) can cause damage. The damage is irreversible and should therefore be prevented. Law states that noise levels should be reduced at the source by using silencers and noise absorbing materialif possible. The next step in reducing the hazard is to isolate the work from the worker, e.g. control rooms. Also



Locking and tagging

WORK OVER-THE-SIDE

When working 'over-the-side' e.g. scaffolding, there is a change of falling in to the sea. Precautions in order to carryout jobs safely are stated in the work permit and can include:

- Risk assessment.
- Task Risk Assessment
- Safety Job analysis.
- Precautions to take.
- Personal protective equipment such as fall protectors, working jackets, proper clothing.

In some occasions the stand-by boat is called in to keep an eye on the work 'over-the-side'. Should somebody fall overboard immediate actions can then be taken without delay. Restrictions for weather conditions and environmental circumstances are included in the safe working procedures.

Compared sound levels	
10-15 dB	rustling leaves
60-70 dB	Average office
100-110 dB	Pneumatic hammer
120-130 dB	Aircraft taking – off

Bruel en Kjaer taken from: ARBO en binnenmilieu 1996

good maintenance and proper organisation of the work can reduce noise levels. The last step is wearing hearing protection. (see PPE). On the next photo you will see compulsory signs what to wear working on this area of the installation. The Personal Protective Equipment PPE are pointed out in blue compulsary signs.



Cumpolsary signs

MANUAL HANDLING

When people are at work they are dealing with ergonomics. The man - machine interaction is an example of ergonomics. This is the body position in relation to the task of the machine. Another example is manual handling. Manual handling includes lifting, pulling, pushing and carrying. The body posture during jobs including manual handling is vital to prevent injuries. Incorrect handling of materials can cause strains and pains. Most of the problems caused by manual handling are sited in the back.



Ergonomic work.

Safe lifting techniques are developed to reduce back injuries caused by incorrect handling:

- Is there a possibility to use lifting equipment?
- Can the load be lifted by one person (< 23 kg)
- or are more persons needed?

When lifting:

- Keep your back straight.
- Keep the load close to the body.
- Before lifting, check the load (point of gravity, where to hold and how, instabilities etc.).
- When lifting, use your legs.
- Before moving the load make sure the path is clear of obstructions.
- Don't lift the load higher than shoulder level. (if so use stairs or lifting equipment).

For pulling and pushing similar techniques are developed.

LIFTING MATERIAL

For lifting specific requirements are used offshore. On board offshore installations there are many different lifting materials present. Most offshore installations have deck cranes and other lifting equipment to move materials. Before use check the SWL (Safe Working Load) of WLL (Working Load Limit) is present on the lifting equipment. What is the weight of material to lift. Many offshore companies also use the yearly colour code.



Yearly colour code

RADIATION

Radiation is energy transmitted, emitted or absorbed as particles or waves. Various sources in the industry emit radiation but it is also a natural feature of the environment. Continuously we are exposed to radiation from radar, microwaves and radios, (TV) screens etc., mostly with adverse effects. In the industry high radiation levels are used for non-destructive testing or navigation systems. Also production wells can be radioactive because of the earth's radiation area's effected by radiation are called LSA Low Sensative Activity area's. The hazards from radiation can not be seen, the effects to the human body show later. Years later people suffer from blood cancer or diseases in the reproductive organs.



LSA information.

When working with radioactive sources special precautions should be taken:

- Only use radioactive sources if other, less dangerous equivalents can not be used.
- All sources of radiation should be clearly marked with appropriate safety information.
- Under the Health and Safety at Work regulations there is a requirement for a written risk assessment.
- Protective equipment to be supplied and worn. The equipment must be appropriate and well maintained.
- Entry of the workplace only for authorised and classified personnel!
- A specialist must be appointed to monitor and advise on use, precautions, controls and exposure.
- Emergency plans.
- Written authorisation by permit.

TRANSPORT TO INSTALLATION

The level of safety depends on people's behaviour, design, competence of crew. It is very important that passengers travelling offshore are aware of the hazards and follow all instructions. Different methods are being used to transport offshore workers to the platforms such as:

- Helicopter
- Boat transfer
- Personnel Basket
- Boat transfer with swing rope



Helicopter transportation.



Boat Transfer.



Personnel basket transfer.

The use of the helicopter will be discussed in the chapter helicopter safety of this book. But this is off course the most common way of transport to an installation. It is safe and fast. By boat is something what you see more often a special designed boat approaching and berthing to an unmanned platform or windmill which doesn't have a helicopter deck. Often additional training is required. The "personnel basket" is back but in an upgraded version. A lot of offshore companies still will not allowe this. The "swing rope" is not used on the North Sea but it is still used in the Far East. With a boat you will be transported to the platform and with a swing rope transferred to the platform. The "boat transfer" is something what is increasing more and more. Off course this is depending on weather conditions but with the grow of developping windparks you see this is a common way of transportation.

ENVIRONMENTAL ASPECTS

Each individual must have an environmental awareness. In practise this means that one should keep his workplace tidy and that 'dumping' waste into the sea must be avoided at all times. Because there are national and international rules and regulations developed and maintained, on board special waste treatment programs are in place. Waste products must be collected in separate skids and transported to the shore. To control and mitigate hazards operators must comply with the offshore legislation. On this photo you see remains of oil product wich are separated and stored.



Waste disposal.

3. Personal Protective Equipment.



PPE.

PERSONAL PROTECTIVE EQUIPMENT

Safety is dealing with the existing hazards. A hazard is an event that can cause harm to people, the installation and/or the environment. It is best to eliminate hazards at the source (where practicable). The last option is to protect people against hazards. This means we allow a risk/hazard to exist. The worker is protected against injuries by using Personal Protective Equipment (PPE). How efficient it is depends on the situation and whether it's used properly. The best protective equipment however is that which you carry with you all the times.

Your brains.

USE OF THE EQUIPMENT

Always use protective equipment when a job or the conditions warrants its use. On offshore installations outside the accommodation a standard 'PPE' must be worn, normally consiting of a conspicuos, fire retradant coverall and safety shoes or boots. Additionally safety glassess are required. Also use work gloves and hearing protection when needed. For specific jobs other protective equipment must be used, such as respiratory protection, fall protection e.q. Make sure you know when and what equipment must be used. You should have a 'Questioning Attitude'. 'What happens if I don't use the equipment'?

HEAD PROTECTION

Protective headgear must be worn outside the accommodation and control rooms. Safety helmets must fit and should be put straight on the head.
Safety helmets must be kept in good condition, not be modified by painting, decorations or engravings.
Special provisions should be made to issue welders combined safety helmets, safety face shield or screen units. Chinstraps must be used when walking or working in windy conditions or working at elevated locations.



Hard hat accident.



Working at height.



Welding and cutting protection.

SAFETY BELTS, HARNESSES AND LINES

This equipment is used to prevent injuries by falls.
Safety harnesses or belts must be used when working at any height, under the decks, or 'work –over-the-side'. The equipment must be stored dry and away from sunlight!

BODY PROTECTION

For day to day working overalls should be sufficient. These overalls form adequate protection against minor abrasions, cuts, or spray from pressure leaks or spray guns etc. When handling chemicals, appropriate protective clothing such as aprons gloves and eye protection must be worn in addition to other PPE. Coveralls with cuts or ragged sleeves should be replaced as they present a hazard near running machinery. They should be worn over boots to prevent any foreign objects or substances entering the boots.

HAND PROTECTION

The use of gloves of the appropriate type protects the hand against:

- Injuries/abrasions/burns
- Corrosive/poisonous substances
- Skin diseases

Each job requires a particular type of protection. Regular heavy fabric gloves will minimise injuries.
Leather or leather palmed gloves must be used when working with hot equipment. Rubber or neoprene gloves must be used when handling chemicals. Long gauntlet types are preferable, except when working with moving machinery.

RESPIRATORY PROTECTION

The aim is to protect the lungs and body from damage by:

- Poisonous/irritant gases
- Asphyxiate gases
- Dust (airborne particles)

Protective Equipment consists of:

- Dust filters.
- Fresh air masks.
- Canister respirators (protection against organic vapours).
- Self-contained breathing apparatus.



Respiratory protection.

FOOT PROTECTION

The aim is to protect the feet from an injury by:

- Sharp objects.
- Dropped objects.
- Corrosive splashing.
- Sparks
- Slipping.

Shoes or boots must have steel toecaps, steel sole plates, oil and chemical resistant soles and ankle padding.



Foot protection.

EAR PROTECTION

Deafness develops when people are exposed to noise levels above 80 dB, for a longer period of time.

The aim of ear protection is to protect the hearing against dangerous noise levels.

In use are:

- Earplugs.
- Ear muffs or ear caps.

High noise area's have signs placed at entrance doors, obey these signs. Make sure you know what to use and when to use it.



Hearing protection.

4. Permit to Work System.



Permit to Work PtW.

THE PERMIT TO WORK SYSTEM PTW

In the Offshore it became clear that after the Piper Alpha disaster the permit to work system was an important part of the general safety on an offshore platform. One of the recommandations from the investigator Lord Cullen was to implement one harmonized permit to work system for all the contractors working in the Offshore industry. In the United Kingdom the Health & Safety Commision HSE introduced the "Guidance on permit to work systems in the Petroleum Industry".

In the Netherlands a few years later also a simulair action was introduced as the permit to work system designed by "Europoort Botlek Belangen EBB" now called Deltalinqs. This sytem was already in use onshore and now taken over by the Offhore operators in the Dutch sector of the North Sea. A permit to work is compulsary for potential dangerous work. Also for non daily routine work a permit to work is required. A permit to work system is sub devided in the following steps:



Electrical work.

STEP 1: RAISING THE PERMIT.

RAISING THE PERMIT (STEP ONE):
A permit to work must be obtained prior to starting the work, it is required that permits are issued for:

- Hot work (welding, grinding, cutting etc.)
- Cold work (maintenance on pumps)
- Electrical work (installation/maintenance)
- Work over-the-side (scaffolding/ painting over the side)
- Entering confined spaces
- Working with dangerous substances (chemicals)
- Pressure testing
- Diving operations
- Maintenance on safety systems
- Working at high levels > 2.0 mtr.

ISSUING AUTHORITY:
Normally the permit must be applied for 24 hours before the work will start. In some cases such as entering an enclosed space it may even be 48 hours before the work will start. Nowadays contractors in the Netherlands can enter a web based site to make a request for a permit to work. The advantage of such a system is that before departure too the platform the necessary measures and precautions are taken to start the work on arrival at the platform.



Control room.

AREA AUTHORITY:

The person responsible for a certain area will visit the work site with you and will help with assessing the hazards of the job. This is also called a "Task Risk Analyse TRA".

ISSUING AUTHORITY:

After the area authority identifies the hazards of the job the issuing authority will fill in the described work and location, the precautions to be taken and take the permit to the authorising authority (normally the Offshore Installation Manager OIM). or the appointed operator.

STEP 2: STARTING THE JOB.

The performing authority (person carrying out the work) will visit the work site to take the precautions such as described on the permit. For example gas testing, isolating or safeguarding. Then he will retrieve the activated permit signed by the issuing authority and the authorising authority and distribute copies as required. The performing authority will brief the team and a copy of the permit is displayed at the work-site.

STEP 3: DURING THE JOB.

Site visits will take place by the auditing authority (normally the safety officer) and he will audit if the work permit is used and understood. He will also visit the workplace as the responsible person for that area.

PERMIT VALIDITY AND EXTENSIONS:

A permit is normally valid for 12 hours (shift period). The issuing authority can extend the permit. He will review the work and will verify if there is no conflict with other work or another permit written out. The issuing authority will sign for every extension. The maximum extension is normally a further 12 hours shift.

PREMATURE CANCELLATION:

If an alarm sounds or for operational reasons a permit can be cancelled or suspended. After an alarm the performing authority will make the work site safe and obtain information or respond to the alarm. Normally followed by an announcement from the OIM on the Public Address (PA) system. After the issuing authority will give permission if work can be continued.



Alarm signal and Public Adres System.

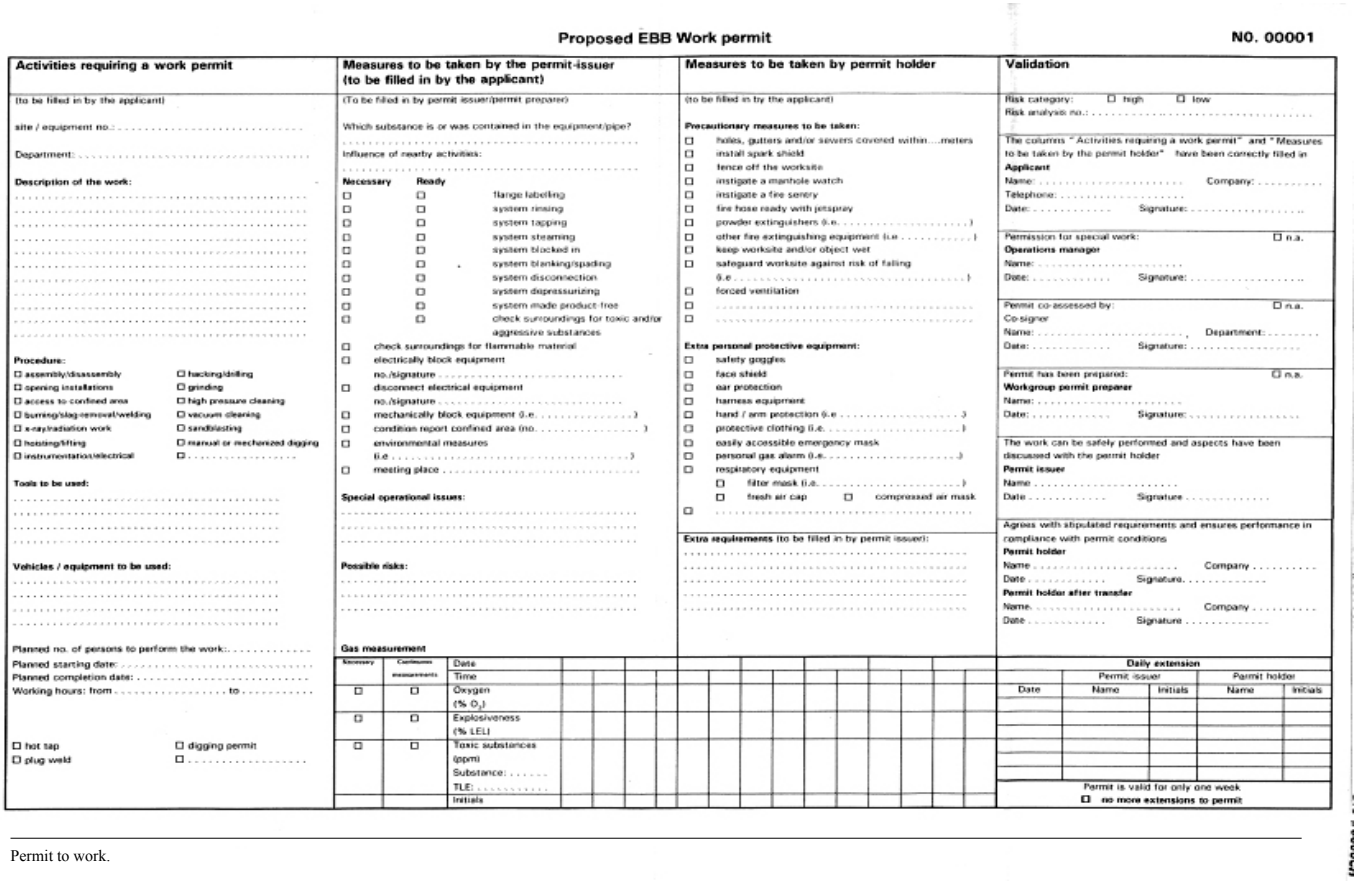
STEP 4: COMPLETING THE JOB.

The performing authority will complete the work properly and clear the work site from tools, equipment and materials to assure that the work site is left clean and tidy and that the plant is again in a safe condition. This we call good housekeeping. Also if the work is not completed within the time described on the permit, the work must stop and the permit returned to the resposible person. At that moment the responsible person will see if the permit can be extended or not.

The performing authority will inform the area authority that work is completed and ready for re-instatement. The permit will be signed off and returned to the issuing authority. After testing the issuing authority will sign the permit for completion, then the isolations and precautions are removed and the permit is cancelled.



Restricted work area.



Proposed EBB Work permit

NO. 00001

Activities requiring a work permit

(to be filled in by the applicant)

site / equipment no.: .....

Department: .....

Description of the work:

.....

Procedure:

- ☐ assembly/disassembly
- ☐ opening installations
- ☐ access to confined area
- ☐ burning/slag-removal/welding
- ☐ x-ray/radiation work
- ☐ hoisting/lifting
- ☐ instrumentation/electrical
- ☐ hacking/drilling
- ☐ grinding
- ☐ high pressure cleaning
- ☐ vacuum cleaning
- ☐ sandblasting
- ☐ manual or mechanized digging
- ☐ .....

Tools to be used:

.....

Vehicles / equipment to be used:

.....

Planned no. of persons to perform the work: .....

Planned starting date: .....

Planned completion date: .....

Working hours: from ..... to .....

- ☐ hot tap
- ☐ plug weld
- ☐ digging permit
- ☐ .....

Measures to be taken by the permit-issuer (to be filled in by the applicant)

(To be filled in by permit issuer/permit preparer)

Which substance is or was contained in the equipment/pipe?

.....

Influence of nearby activities:

.....

Necessary	Ready	
☐	☐	flange labelling
☐	☐	system rinsing
☐	☐	system tapping
☐	☐	system steaming
☐	☐	system blocked in
☐	☐	system blanking/spading
☐	☐	system disconnection
☐	☐	system depressurizing
☐	☐	system made product free
☐	☐	check surroundings for toxic and/or aggressive substances

- ☐ check surroundings for flammable material
- ☐ electrically block equipment no./signature .....
- ☐ disconnect electrical equipment no./signature .....
- ☐ mechanically block equipment (i.e. .....)
- ☐ condition report confined area (no. .....)
- ☐ environmental measures (i.e. .....)
- ☐ meeting place .....

Special operational issues:

.....

Possible risks:

.....

Gas measurement

Necessary	Continuous measurements		
		Date	
		Time	
☐	☐	Oxygen ($\%\ O_2$)	
☐	☐	Explosiveness (% LEL)	
☐	☐	Toxic substances (ppm) Substance: ..... TLE:	
		Initials	

Measures to be taken by permit holder

(to be filled in by the applicant)

Precautionary measures to be taken:

- ☐ holes, gutters and/or sewers covered within ....meters
- ☐ install spark shield
- ☐ fence off the worksite
- ☐ instigate a manhole watch
- ☐ instigate a fire sentry
- ☐ fire hose ready with jetspray
- ☐ powder extinguishers (i.e. .....)
- ☐ other fire extinguishing equipment (i.e. .....)
- ☐ keep worksite and/or object wet
- ☐ safeguard worksite against risk of falling (i.e. .....)
- ☐ forced ventilation
- ☐ .....
- ☐ .....

Extra personal protective equipment:

- ☐ safety goggles
- ☐ face shield
- ☐ ear protection
- ☐ harness equipment
- ☐ hand / arm protection (i.e. .....)
- ☐ protective clothing (i.e. .....)
- ☐ easily accessible emergency mask
- ☐ personal gas alarm (i.e. .....)
- ☐ respiratory equipment
  - ☐ filter mask (i.e. .....)
  - ☐ fresh air cap ☐ compressed air mask
- ☐ .....

Extra requirements (to be filled in by permit issuer):

.....

Validation

Risk category: ☐ high ☐ low

Risk analysis no.: .....

The columns "Activities requiring a work permit" and "Measures to be taken by the permit holder" have been correctly filled in

Applicant

Name: ..... Company: .....

Telephone: .....

Date: ..... Signature: .....

Permission for special work: ☐ n.a.

Operations manager

Name: .....

Date: ..... Signature: .....

Permit co-assessed by: ☐ n.a.

Co-signer

Name: ..... Department: .....

Date: ..... Signature: .....

Permit has been prepared: ☐ n.a.

Workgroup permit preparer

Name: .....

Date: ..... Signature: .....

The work can be safely performed and aspects have been discussed with the permit holder

Permit issuer

Name .....

Date ..... Signature .....

Agrees with stipulated requirements and ensures performance in compliance with permit conditions

Permit holder

Name ..... Company .....

Date ..... Signature .....

Permit holder after transfer

Name ..... Company .....

Date ..... Signature .....

Daily extension

	Permit issuer		Permit holder	
Date	Name	Initials	Name	Initials

Permit is valid for only one week

☐ no more extensions to permit

Permit to work.

5. Personal Responsibility for Safety (PRfS).

The implementation of Personal Responsibility for Safety (PRfS) must be tackled in a structured way. If we want personnel the implementation of Personal Responsibility for Safety (PRfS) must be tackled in a structured way. If we want personnel to consistently exhibit the "right" behaviours we must provide a support structure which ensures the right level of support and encouragement. A change in behaviour requires consistent reinforcement and practice and it is all too easy to inadvertently stop this evolution through inconsistent management action, loss of focus or the sending of mixed messages. This Guidance is made up of the following 9 elements:

1. Clear Expectations
2. Effective Communication
3. Personal Leadership
4. Personal Risk Awareness
5. Planning
6. The Right and Duty To Intervene
7. Accountability
8. Self Evaluation
9. Develop, Encourage and Sustain Safe Behaviours

The elements are each divided in two distinct parts. The first part is Personal Requirements (or the desired personal actions and behaviours) and the second part is the Support Systems (or the systems and processes which need to be in place). This document contains some duplication between elements which has been deliberately retained so that if the Guidance is being used to address a particular area of weakness, it is not essential to review the whole publication. This Guidance is intended to be used as a reference document and tool kit by Company Leadership and HSE Professionals. An Overview of Personal Responsibility for Safety has also been developed to introduce the initiative to the industry (PRfS Overview). The CD Rom which accompanies this Guidance contains a PRfS Gap Analysis Tool / System Checklist which can be used to assess the integrity of the existing support system within your organisation. There are also two maturity matrices which can be used to assess the current maturity level within your organisation. One of these matrices can be used by an individual or group to assess their alignment with PRfS and the other can be used to assess the maturity of the organisation overall.



Personnal Resposibility for Safety (PRfS).

The Guidance Document also contains reference material* which the PRfS work group has identified as "good practice" (the practice exists, is working, and is already delivering results within one of the companies involved in our industry). This "good practice" can be adopted "as is" or modified to fit within a company's existing systems. This document is not intended to be distributed to all personnel within the industry. To support industry wide engagement roll out materials will be supplied to assist you in communicating the right messages to your staff. Part of this will be regular promotions on key elements. The PRfS Work Group has recognised that additional analysis will be required to identify where the biggest change in behaviour is needed. From this analysis scheduled campaigns will be implemented to address these specific areas using a range of engagement methodologies and media. In this way we will prevent overload or initiative fatigue and achieve progressive behaviour change.

1. CLEAR EXPECTATIONS

- Make safety as important as any other personal priority (make it a big deal)
- Ensure you know what is expected of you and your colleagues
- Follow the rules and procedures and encourage colleagues to do the same (doing the job right is more efficient that rushing).
- Ensure that you live up to the safety standards you expect of others.
- Communicate what you expect of others and check their understanding of your message.
- Help create a culture of safety within your organisation.
- Play your part to create a safe and healthy working environment.

2. EFFECTIVE COMMUNICATION
- Where possible use face to face communication.
- Remember to listen and ask open questions.
- Check understanding and where appropriate agree actions.
- Be sincere and be sure your actions and body language consistently support what you are saying (Remember the messages you communicate will be much stronger if you are seen to have a strong personal belief in safety).
- Choose the correct time, place and media to get the message across.

3. PERSONAL LEADERSHIP
- Lead by example, be consistent and follow procedures.
- Recognise safe behaviour, give praise and say thank you where deserved.
- Have courage to do the right thing and do not tolerate unsafe behaviour.
- Demonstrate personal commitment to safety at work and at home.
- Believe that you can make a difference and follow up commitments.
- Be enthusiastic, open and take time to interact on safety matters.
- Give and welcome feedback.
- Even when facing conflicting priorities maintain your safety standards.
- Openly share your personal safety commitments.

4. PERSONAL RISK AWARENESS
- Get involved in discussions about risks on the job, questioning anything you do not understand.
- Share your experiences with others and encourage them to do the same.
- Get involved in practical work site inspections and always stay aware of your surroundings.
- Even when undertaking a routine activity that you believe is safe always consider the consequences of the worst possible outcomes (personal, family, company, legal etc) and act in a way that reduces the risk.
- Practice your observation skills away from the workplace.
- Continually assess the potential influence of changes to the operation.
- Be aware that alcohol and drugs may impair risk perception.

5. PLANNING
- When planning ensure input from all involved, consider any limitations, ensure you have the time and resources to do the job safely and request help where needed.
- Take time to fully familiarise yourself with the safety aspects of the agreed scope of work and question any areas that are not completely clear to you.
- Understand your interaction with other people involved in the plan.
- Where changes to the plan occur stop work safely and take time to reassess the situation
- Look for improvement opportunities whilst conducting the job and provide feedback for inclusion in future plans.

6. THE RIGHT AND DUTY TO INTERVENE
- Believe you can make a difference and have the courage to challenge unsafe acts.
- Lead by example and take action (think about the consequences of turning a blind eye and remember you have a right and moral duty to intervene).

- Welcome interventions from others and accept them in a positive manner
- Intervene in a way which is positive, constructive and considerate.
- Intervene to learn and to praise positive and safe behaviours as well as to challenge unsafe behaviours.

7. ACCOUNTABILITY

- Follow the rules, they are there to keep you safe.
- Take responsibility and ownership for safety in the environments that you live and work in.
- Take action and offer solutions to prevent accidents.
- Take time to think about the positive and negative consequences of the actions of yourself and your colleagues.
- Have the confidence to stop any job that you believe cannot be completed safely.
- Be a positive influence on others and set a good example.

8. SELF EVALUATION

- Write down your personal commitments to safety on an annual basis and share them with colleagues, include measurable targets.
- Periodically check how you are doing against your commitments.
- Ask for feedback from others who work with you and be prepared to give feedback to others
- Use feedback generated to guide self improvement.

9. DEVELOP, ENCOURAGE AND SUSTAIN SAFE BEHAVIOURS

- Start every day by thinking of how you can keep yourself and others safe and make continuous improvement a personal goal.
- Make Risk Recognition a Habit and having identified risks always implement actions to overcome them.
- Consistently do things the safe way at work and at home.
- Provide feedback and encouragement on things that work and constructive criticism for things that don't.
- Explain why the rules and procedures are there.
- Share good practice and intervene to change bad practice.
- Give and act on positive and negative feedback.Continually look for opportunities to learn from others.
- Keep communicating the benefits of sustained safety.



Abandonment and survival techniques

Group survival equipment and personal survival equipment.



JSAR helicopter on standby at Den Helder heliport.

When an offshore installation or vessel must be abandoned it is important to set priorities. If abandonment is the only option, different group or personal survival equipment can be used. A few group survival equipment are:

1. Lifeboats (conventional and free fall)
2. Liferafts
3. Group descending systems

If we think of personal life saving equipment we have the following personal equipment available:, such as:

1. Survival suits
2. Lifejackets
3. Lifebuoys
4. Personal descending devices

Off course the platform it self the best option to stay on, and a total abandonment must be prevented. Beside this thir also better options to abandon such as evacuation by gangway or helicopter.

1. LIFEBOATS

Different type of lifeboats can be used for a group evacuation. The lifeboats can be devided in three groups:

- Conventional lifeboats (single and double falls)
- Skid free fall
- Free fall (vertical drop)

When boarding a lifeboat you move away from the entrance as quickly as possible to limit the boarding time. The coxswain is in charge of the abandonment.



Skid free fall lifeboat.

Once boarding the lifeboat think of the three S's; Sit down, Strap in and Shut up. Four point seatbelts are installed in some lifeboats. Conventional boats (not free-fall) are equipped with a gravity lowering system. That means that the boat will drop into the water when the brake, via remote control, is released. The following step is to detach the boat from the falls by means of a 'on load' system. The On Load hooksystem makes it possible to open the hooks, even when the falls are under tension. The On Load system is protected against miss use by a hydraulic inter lock so that the boat cannot be released premature. Once in the water the release handle can be used.



Conventinal lifeboat (two falls).



Aft On Load hook.

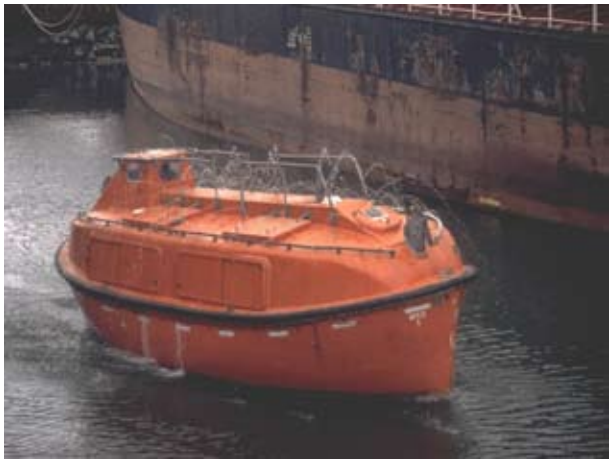
This can be done manually in an emergency! Watch out! Deaths have been caused by incorrect use!

The coxswain will move away from the installation to a safe area after the abandonment from the platform. At a safe distance he will order to deploy the sea anchor and wait for rescue. Another name for lifeboat is TEMPSC (totally enclosed motor propelled survival craft). An air supply system is installed in the boat and will provide breathable air for at least 8 minutes. This air supply is necessary for 3 reasons:

- Persons on the boat need air.
- When all the hatches and ventilation ducts are closed and the air supply system is open, there will be over-pressure in the boat which will keep poisonous gases out.
- The engine uses air from in the boat.

The lifeboat's hull must be made from a water-proof, fire-resistant material. Material used could be:
- Polyester (RGP).
- Steel.
- Aluminium.

The lifeboat must be strong enough to be able to fall from a height of 3 metres. The boat is not heat-resistant enough when the water surface is burning. So a spray or sprinkler system is mounted on the boat. A pump is connected to the engine on the boat. ±600 litre of water per minute will flow over the boat when the engine turns and the suction valve is opened. The pipelines and sprinklers are to found on the outside of the boat. A diesel engine has been used in the lifeboats because it is very reliable and the flashpoint is higher than a petrol motor. It should be possible to start the engine in 2 ways. A main system and a back-up system.



Deluge or drainage system.



Fire test.

The minimum speed of the boat amounts to 6 knots per hour and there must be enough fuel for 24 hours of travel. The lifeboat has a double hull and a low centre of gravity and is therefore self-righting and unsinkable. The hull is filled with hard polystyrene. It is important that everyone remains seated with their safety belts on because of the low centre of gravity. This is the first thing you do when you take your place in a lifeboat. The SOLAS convention (Safety of Life At Sea) and the LSA (life Saving Appliances) code will provide general regulations for lifeboats and rafts. The regulations provide information about: construction, stability, propulsion, equipment and signalling. Such as: the lifeboat must be orange so that the boat is visible on the open sea also a minimum inventory can be found on the boat in accordance to the SOLAS standard. For Offshore installations exemptions can be made.

LAUNCHING SYSTEMS

Generally used launching systems are:
- Fixed davit system. (A-frame)
- Gravity davit system.
- Free-fall launching system.



A frame.



Gravity davit.

The davit system with double or single fall is provided with a winch and brake, so that a controlled descending is possible. Once in the water the hooks must be opened to release the falls. The free-fall boat is launched without falls. It slides from the launching arrangement and drops into the water. This system cannot be used in shallow water or when there is ice or debris in the water.

LIFEBOAT HOOKS

Every lifeboat is equipped with a hook system it can be a hook system to release the falls when the boat water-borne or it is a release system when the boat is position such as a free fall lifeboat. For the basic offshore course we will not go in details because every lifeboat has different launching systems and release hooks. But the trained coxswain is familiar with the system on board his/her platform.

ASSEMBLY OR MUSTER

It is important to know how many persons have been divided between the various lifeboats in an emergency situation. The names of those present are handed to the control room after being checked. Each coxswain has a lifeboat and life raft assigned to him. The assembly station is in or outside the accommodation but close to the boats or rafts.

THE COXSWAIN MAKES SURE THAT:

- The name list is checked.
- The persons are clothed properly.
- There is radio contact with the control room.



Interior Whittaker lifeboat.

BOARDING

You will receive permission to board after being checked. This is because you could be assigned to another boat if there are problems with the first. Permission to board and launch can be given by the control room and is done on the initiative of the boat commander. The commander is responsible for the boarding procedure, most passengers are requested to take their places at the back so that the propeller and rudder touch the water.

THE PASSENGERS MUST:

- Board in a disciplined fashion.
- Use all entrance hatches.
- Keep the entrance hatches clear.
- Share the weight around and sit down.
- Fasten the safety belt.
- Remain calm.
- Be as quiet as possible.
- The last passenger closes the hatch.
- Extra actions when the boat is launched into a burning sea surface:
- Shut all hatches and ventilation ducts.
- Switch on the sprinkler system.
- The air system is turned on.

The lifeboat should be ready for use but should be checked again by the boat's crew before launching. The coxswain will check the boat while the muster checker calls out the list of names.

CHECK POINTS AT THE BOAT

- The railing work should be open.
- The maintenance service wires must be loose.
- The entrance hatches must be open.
- The plug in the bottom must be in place.
- Carry out an engine check.
- Check the VHF radio.
- Check the rudder stand.
- Check the escape course.

Normally the maintenance and safety wires will not be attached. These cables prevent the boat dropping down during maintenance work.



Safety or maintenance chain.

2. LIFERAFTS

Their are two types of liferafts, the TOB Throw OverBoard and the DLL Davit Launchable Liferaft. The TOB is relatively easy to use and always ready to use. The TOB can be quickly launched and will provide relatively good protection. It also requires a minimum stowage space and don't require a launching facilities.

The liferaft shall be packed in a container that is:

- Constructed as to withstand hard conditions encountered at sea.
- Sufficient inherent buoyancy, when packed with the liferaft and its equipment, to pull the painter from within and to operate the inflation mechanism, should the installation sink or capsize.
- As far as practicable watertight, except for drain holes in the container bottom.



TOB liferaft.

CONSTRUCTION OF LIFERAFTS

Every life raft is constructed to be capable of withstanding exposure for 30 days afloat in all sea conditions. The liferaft is constructed that when it is dropped into the water from a height of 18 m, the liferaft and its equipment will operate properly. If the liferaft is to be stowed at a height of more than 18 m above the waterline in the lightest seagoing condition, it shall be of a type which has been drop-tested from at least that height. The liferaft and its fittings are constructed to be towed at a speed of 3 knots in calm water when loaded with its full complement of persons and equipment and with one of its seaanchors streamed. Unless the liferaft is to be launched by an approved launching appliance the total mass of the life raft (including container and equipment) are not more than 185 kg. Inflatable life rafts are designed for 4 persons till 148 persons. The liferafts are packed in containers including the special designed emergency equipment.

POSITION OF THE LIFERAFTS

The liferaft including the emergency equipment is packed in a polyester container or rubber bag. If the distance from sea level is higher then 25 meters a davit launchable liferaft is required. The container and raft are so designed that the raft can be launched with a davit.

DESIGN

Rafts are made from heavy duty rubber on both sides. The topside is usually bright orange and the underside is black. All parts of the raft are glued. The quality demands are controlled by international and national authorities such as described in SOLAS convention and Life saving Appliances LSA code.

COMPONENTS OF THE RAFT:

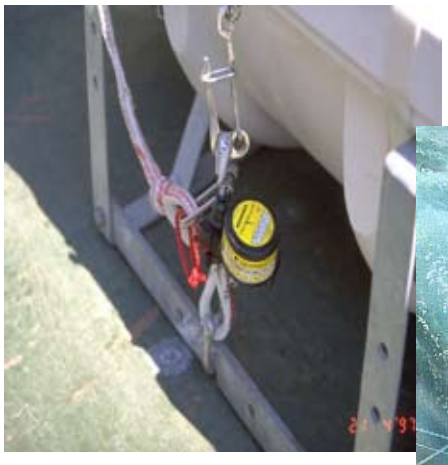
- Separate inflatable compartments.
- Inflatable canopy supports.
- Inflatable canopy.
- Inflatable floor.
- Sea water batteries.
- Stability bags.
- One or two entrances.
- Over pressure valves.
- Extra inflation valves.
- Automatic lights.
- Lifeline.
- Self deployed sea anchor.



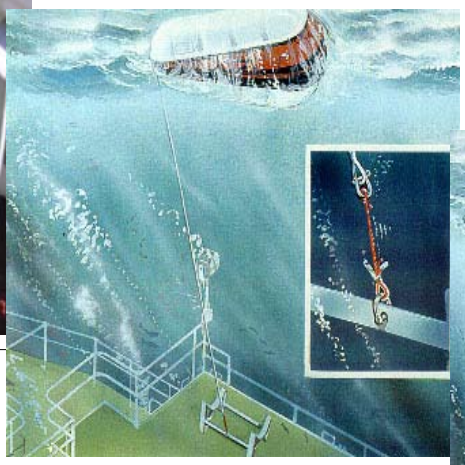
Inflated liferaft.

THROW OVER BOARD RAFT

A painterline runs from the raft container which is fixed to a Hydraulic Release Unit HRU. The painterline is stored in the container and is fixed by a steel cable with a steel cylinder of compressed gasses (CO_2 and N_2). When the raft is thrown overboard the painterline will activate the cylinder. The painterline is connected to the liferaft and prevent that the liferaft will drift away. The painterline is connected to the installation or HRU. Between the painterline and the HRU is a break line, if the installation should sink the break line will snap through by the upwards buayancy. Then the liferaft will float to the surface. After launching the liferaft you should pull the painter out of the container, if there is any resistance you should tug sharply so that the pressure cylinder is activated, the raft will then inflate and come out of the container.



HRU.



HRU.



HRU.

Where should the liferaft launched?
Important points:

- Is there a fire on board (smoke and heat)?
- Is the surface of the water burning?
- Can you reach the leeside?
- Is there debris where you wish to go overboard?



Launching TOB.

It could be necessary to launch the raft elsewhere in these situations. Untie the painter and carry the raft to another position, fasten the line and throw the raft overboard. Check the painter. It is of course of great importance that the painter remains in place until everyone is in the raft because the raft would otherwise drift too far away in a strong wind or current. It is possible to tow the raft with a specially attached towing piece. The strengthened towing piece should be used to connect several rafts together. The speed of towing a raft should if possible be restricted to 2 knots. Before entering the raft you should remove sharp objects such as tools. Enter the raft by means of a (rope) ladder, scramble net, rope or from the water, try to ensure that you stay dry. You could jump into the raft from a not too great a height but it is not recommended, the shell of the container could cause injury. Never jump into the raft if other persons are already in the raft.



Inflating liferaft.

Launch procedure for a throwable liferaft:

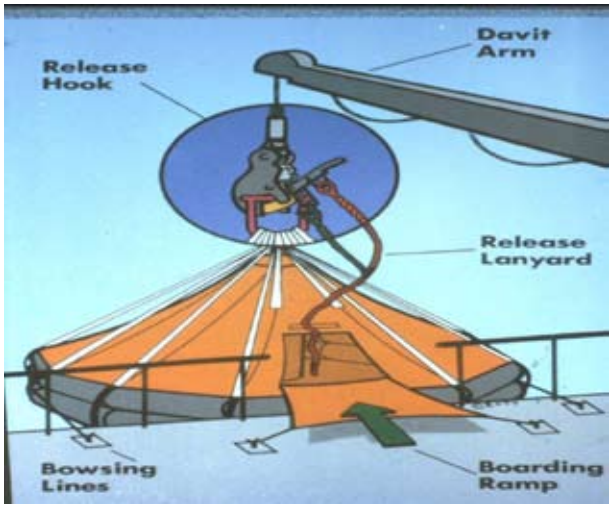
- Ensure that the painter is attached properly.
- Check whether it is clear overboard.
- Remove the sea lashing around the container and take the raft to the railing.
- Remove the railing if necessary.
- Throw the raft out.
- Pull the rest of the painterline sharply out of the container to activate the CO2 cylinder.
- The raft will inflate in ± 60 sec

Davit Launchable Liferaft DLL

These liferafts have a special method of launching but can also be thrown overboard. The advantage is that you enter the raft dry and don't have to climb down. The disadvantage is that launching will take more time and you need to know how the operate the DLL. The hook and **d**avit with a single wire are special designed for the DLL. After launching the liferaft the hook that opens automatically when the raft makes contact with the water, as long as the safety pole is removed! The operator should lock the hook if it is fixed to the raft. When the raft nears the water (± 0.5 m.) the lock should be set to 'acute'. The hook will only open when the weight of the raft no longer hangs on the hook. Make sure the safety pole only opens at 0.5 m. from the water.



Off load hook.



DLL.

Turning a raft.

If the raft is inflated upside-down or turns over, you must turn it back again.

- Climb the ladder on the side onto the raft where the CO2 cylinder can be found.
- Stand on the float and while holding the turning line gently lean backwards.
- If you are lying on your back with the (soft) raft on you, pull yourself from under the raft with the turning line.
- Then climb into the raft.

The last years we have seen a development that life rafts are self righting.



Turning liferaft.

New developments

The last few years more platforms will be equipped with personnal and group descending systems. These group descending systems will replacing the scramble nets. The painterline is linked to the scrable net. Instead the descending systems have a painter link to enter the liferaft easy. Those systems will replace the scramble nets and ladders to descend from platform to sea level.



Personnal descending system.



Liferaft and scramble net..

New developments to evacuate a large number of people in a quick and save manner are introduced into the offshore industry. One of those systems is called the SES Sky Scape. This system is launched from a container stowed on deck. After launching the system will be lowered to sea level. At the bottom part of the system a boarding raft is attached . This can move up and down depending an waves and swell. At this raft more liferafts are attached which can be activated manual.



SES Skyscape.

Personnal survival techniques.

3. Personal life saving equipment

There are three different ways to enter the water:

- Without survival suit or lifejacket.
- With lifejacket.
- With survival suit and lifejacket.



Water entry with lifejacket.

Entering the water without survival suit and lifejacket, then the risks of drawning and hypotermia are high. Swimming demands energy to initiate muscle action. The heat loss incurred due to submergence in water will be far greater than that which the body can produce, resulting in the rapid development of hypothermic symptoms. Blood flow to the muscles will be impaired. Therefore swimming is not the most ideal method. Is it still necessary to swim, think of a life raft floating by then swim as a group.



Water entry with survival suit and lifejacket.



HELP position.

THE BEST METHOD TO SWIM

The best method to swim is a compromise, where on the one hand energy is used and on the other hand won, because the victim turns on his back and by paddling with his hands he can choose the best position against sea and wind. In this situation clothing should never be removed (with the exception of heavy boots), as clothing provides a little insulation. Spare your energy in as much as possible; do not waste it by calling for help for example.

The H.E.L.P. position. H.E.L.P. stands for Heat Escape Lessening Position. If you're wearing a life jacket you have an important safety appliance at hand. The life jacket provides you with buoyancy so that the risk of drowning is reduced; it allows you to concentrate on preserving your body heat. A good method to keep the body temperature as high as possible is to reduce muscle activity by using the H.E.L.P. position. If you're with more people the HUDDLE position can be used. Because you lessen your body surface, your loss of heat is also reduced.

Lifejackets (conventional)

- Also lifejackets must comply with the life-saving appliances LSA code this will mean:
- A lifejacket shall not sustain burning or continue melting after being totally enveloped in a fire for a period of two seconds.
- At least 75% of persons, who are completely unfamiliar with the lifejacket, can correctly don it within a period of 1 min without assistance, guidance or prior demonstration.
- After demonstration, all persons can correctly don it within a period of 1 min without assistance.
- It is clearly capable of being worn in only one way or, as far as is practicable, cannot be donned incorrectly.
- It is comfortable to wear.
- It allows the wearer to jump from a height of at least 4.5 m into the water without injury and without dislodging or damaging the lifejacket.

An adult lifejacket shall have sufficient buoyancy and stability in calm fresh water to:

- Lift the mouth of an exhausted or unconscious person not less than 120 mm clear of the water with the body inclined backwards at an angle of not less than 20° from the vertical position.
- Turn an uncionscious person clear of the water in not more than 5 seconds.
- An adult lifejacket shall allow the person wearing it to swim a short distance and to board a survival craft.



Conventional lifejacket.



Lifejackets.

Nowadays lifejackets are also equipped with a buddy line and a spray hood, however this is not a requirement. Attention in the chapter safety we will come back on work jackets, it is pointed out those working vest are not qualified as approved lifejackets.

Lifejackets (inflatable)

Additional inflatable lifejacket must have:

- They must at least have two separate compart - ments.
- Inflate automatically on immersion.
- Be fitted with a device to inflate it manual.
- Be equipped with tubes for oral inflation.

The jacket is automatically inflated when the user falls into the sea, or manually by pulling a toggle hanging from the side. The inflation usually works as follows: a tablet dissolves in contact with water and activates a CO2 cylinder. There are also systems with a hydrostatic release device.



Inflatable lifejacket.

LIFEJACKETS ARE FURTHER EQUIPPED WITH:

- Reflective material.
- Obvious colour.
- Whistle.
- Emergency light.
- Indication of approved body.
- Floating capability in Kilo Newton.
- Inspection date inflatable lifejackets.



Inflation device.

IMMERSION SUITS

An immersion suit will give isolation and buoyancy a heliopter transportation suit dosn't, see chapter helicopter safety. In the life saving appliances LSA code we find information about survialsuits. The immersion suit shall be constructed with waterproof materials such that:

- It can be unpacked and donned without assistance within 2 min, taking into account any additional clothing.
- So constructed that, can be worn in conjunction with warm clothing and a lifejacket.
- It will not sustain damage or continue melting after being totally enveloped in a fire for a period of 2 seconds.
- It will cover the whole body with the exception of the face. Hands shall also be covered unless permanently attached gloves are provided.
- It is provided with arrangements to minimize or reduce free air in the legs of the suit.
- The immersion suit is to be worn with a lifejacket (if not different requirements).
- Immersion suit continues to provide sufficient thermal protection, following one jump by the wearer into the water from a height of 4.5 meter.
- To ensure that when it is worn for a period of 1h in calm circulating water at a temperature of 5°C, the wearer's body core temperature does not fall more than 2°C.

A SURVIVAL SUIT IS FURTHER EQUIPPED WITH:

- Safety harness
- Buddy line
- Reflective material
- Whistle
- Safety light

New developments in immersion suits are survival suits for the Offshore industry with intigrated re-breather system and additional buoncy chamber, see picture. Alternative developments are immersion suits for the Offshore with a combination between survivalsuit and lifjacket. With the advantage that an unciouse person will turn over the side of the body.



Helly Hansen rebreather system.



Self righting lifejacket.

LIFE BUOYS

There should be a certain number of life buoys onboard. A lifeline should be fixed around the buoy to make it easier for the person in distress to hold on to it. All approved buoys should be either white/red or orange coloured, carry a reflecting band and the identification of the installation/ship. Should the ship or installation be abandoned, life buoys may prove valuable in helping to save persons who are in the water and unable to reach a lifeboat or life raft. Therefore throw as many life buoys in the water as possible when abandoning.

BUOY LIGHT/SMOKE SIGNAL

Some of the buoys carry a self-igniting buoy-light that will burn for at least 2 hours. The buoys may also be equipped with buoyant lines and/or smoke signals. The smoke signal gives orange smoke for at least fifteen minutes. You can enter the lifebouy by putting the lifebuoy over your hat and lean with your arms on the lifebuoy.Try not to move to reduce heat loss. When you trow the lifebuoy overboard make sure that the victim can reach for the floating line.



Lifebuoy with light and smoke signal.





Location aids

Mayday Mayday
Mayday.



GMDSS equipment.

1. RADIO COMMUNICATION

On offshore platforms requirements are determined for offshore installations, often offshore platforms have direct telephone communications with the shore or alternative satellite communication.

Movable platforms have depending on the area where they operate equipment on board according the Global Maritime Distress Safety System GMDSS. Hereby is the world devided in area's A1, A2, A3 and A4. Depending on the operations and area of a mobile installation requirements are set for the emergency radio equipment.

On the picture on the left you will see a general GMDSS setup with the nescecarry transmitters and receivers. Beside those equipment most offshore platforms are equiped with commercial satelite communucation also called INMARSAT.

On board of survival crafts there are several means of communication. Probably the most effective and reliable is radio communication because it is possible to contact rescuers on a long distance. Not all the systems are permanently installed and should be brought to the lifeboats (and rafts) in case of an emergency abandonment. The different systems presently in use are:

- VHF radio (Very High Frequency)
- EPIRB (Emergency Position Indicating Radio Beacon)
- SART (Search And Rescue Transponder)



VHF radio lifeboat.

VERY HIGH FREQUENCY RADIOS

VHF installations come in two types, fixed and portable. Portable sets are used for communication on board the installation. The range and capacity of the batteries of these handsets are limited. In case of an emergency the handsets are used for communication between muster points and control room/bridge, the handsets can be taken inside life boats- and rafts for communication.

The law requires the following channels to be installed:

Channel 6	Intershipl
Channel 15	Intership
Channel 16	Ship to ship
Channel 17	Intershipl
Channel 67	Search and rescue working
Channel 70	Digital Selective Calling DSC



Portable VHF.

The fixed installations are built into lifeboats and will generally have more channels to choose from, but will at least have the above mentioned. The range of a maritime VHF installation working on full power (25watt) will have maximum 30 –60 nautical miles, depending on weather conditions and antenna height. In case of an emergency, channel 16 can be used to transmit a Mayday call; however this not anymore guarded for 24 hours. So use the digital selective calling frequencies instead. By a spoken message is case of an emergency we always use the Standard Engisch Marine vocabulary. An emergency call will be send as:

MAYDAY MAYDAY MAYDAY!

This is: (name and call sign 3x)

MAYDAY!

This is: (name and call sign 1x)
Our position is: (degrees/minutes or distance/bearing, name of installation or vessel)

Give necessary info:

- Nature of distress.
- What assistance is required.
- Amount of people involved.
- Other useful information.



Ocean Odyssey.

DSC

With the implementation of the GMDSS convention we also changed from spoken emergency calls in DSC Digital Selective Calling. Sending in digitale language is more clear and will be less disturbed by bad radio signals. For DSC special frequencies are appointed for use.

EPIRB

Emergency Position Indication Radio Beacons are required on ships and offshore installations. The beacons are self powered by means of batteries and transmit signals to satellites. These satellites are from the Cospass/Sarsat system, an international co-operative search and rescue effort. The system ensures a global coverage, 24 hours a day and contributes to help saving lives of seaman in distress. The E.P.I.R.B., once operated, automatically transmits a signal that is recognised by the satellite as an emergency call. The satellite will determine the position of the beacon and will then pass the information through to an earth station. From here the information is transferred to the Rescue Co-ordination Centre, nearest to the emergency position of the beacon. From this centre the SAR operation starts or the information is relayed to another SAR centre. Additionally the EPIRB's will send a signal out that can be picked up by SAR helicopters and also vessels equipped with the necessary homing devices. The homing devices will send the searching party straight to the person or persons in distress.



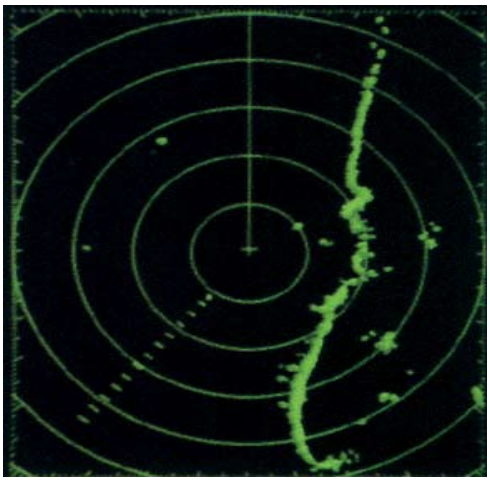
EPIRB.

SART

The Search and Rescue Transmitter SART is a transmitter which can be used to take with you in the lifeboat or life raft. It can also be possible that the life boat is equipped with a SART. This is by the way not a requirement. The Search and Rescue Transmitter SART is a passive beacon until interrogated by radar frequency. It will then automatically transmit series of pulses, which are displayed on the radar screen of passing aircraft or vessels. The pulses are very obvious and therefore easy to recognise by the radar operator. Once recognised the navigator can plot the emergency position, the system is only for short range.



SART's.



Radar screen.

Pyrotechnical distress signals.



Distress signal.

2. Pyrotechnical distress signals

Pyrotechnics are part of the signalling equipment found in the inventory of lifeboats, life rafts, ships, aeroplanes and helicopters. They may play a vital part in locating persons in distress. WARNING: All pyrotechnics should be handled with care. They can be dangerous when safety is disregarded. Since there are many different types of pyrotechnics and various manufactures, always make sure to read the operating instructions first. In order to ensure a safe way of activating the signal, even by people who do not know how to read the instructions are also depicted in so-called pictograms. **Never activate pyrotechnics facing the wind!**

Rocket/parachute flare:

A flare is a good pyrotechniqs to attract attention over great distance. Useable during day or night, not with fog and low clouds. The visibility in clear weather is ranging from 30 to 40 sea miles. When a parachute flare is activated, a rocket is fired to a height of approximately 300 meters. When the flare is ignited a bright light burns for about 1 minute, the parachute keeps the flare in the air as long as possible. During the ascent of the rocket, the wind influences the tail in such a manner that the rocket turns into the wind. The flare will drift over your position when hanging on the parachute, giving an indication of your location.Never use flares when helicopters are nearby! They may damage the aircraft and interfere with your own rescue!



Parachute flare.

HAND FLARES

Hand flares are used to pinpoint your position. Effective both day and night, not with foggy weather. The visibility is around 6 sea miles in clear weather. Never look into the flare. The light may damage your eyes. These flares provide their own oxygen when burning which means that splashing waves will not extinguish the flare. They will continue burning even when held under water. These hand-held flares burn for about 1 minute.



Handflare.



Smoke signal.

SMOKE SIGNALS.

The use of the smokesignal is to pinpoint your position and to indicate the wind direction. Effective only in daytime, not with foggy weather. The visibility depends on the wind force. After the smoke signal is activated it must be thrown in the water. The signal will get very hot so don't hold it. The signal produces an orange coloured smoke for approximately 3 to 5 minutes. Make sure that the wind blows the smoke away from you, since the chemicals may suffocate you.

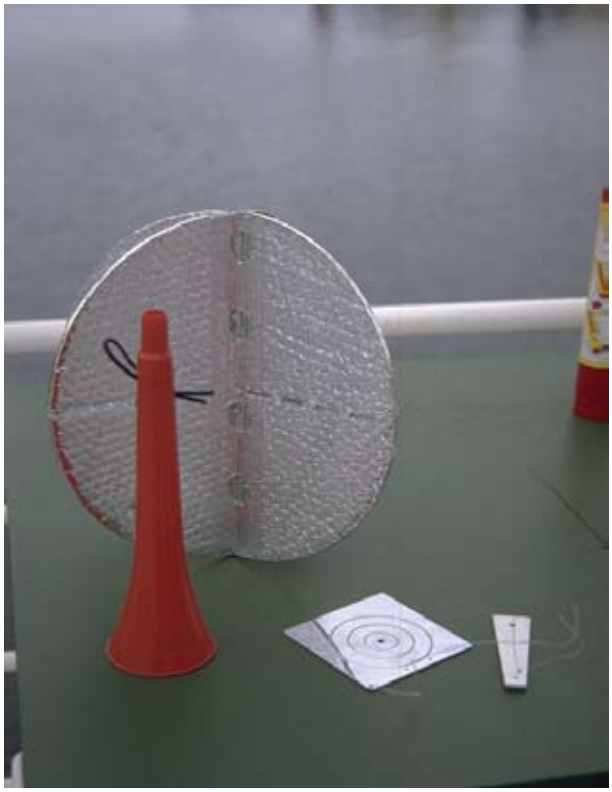
3. visual and audible distress signals

Signal mirror or heliograph
It is possible to attract attention over long distances, up to 20 miles by reflecting the sun rays to a ship, aeroplane or coastline. The limitations are that the sun must be shining and it doesn't work 360 degrees around.

Signalling torch. (Flash light)
Very valuable source of light inside your life raft/life boat. It can also be used to attract attention at close range for instance to contact other life rafts or lifeboats. Morse code can also be sent. The torch is waterproof and spare batteries are provided as well.

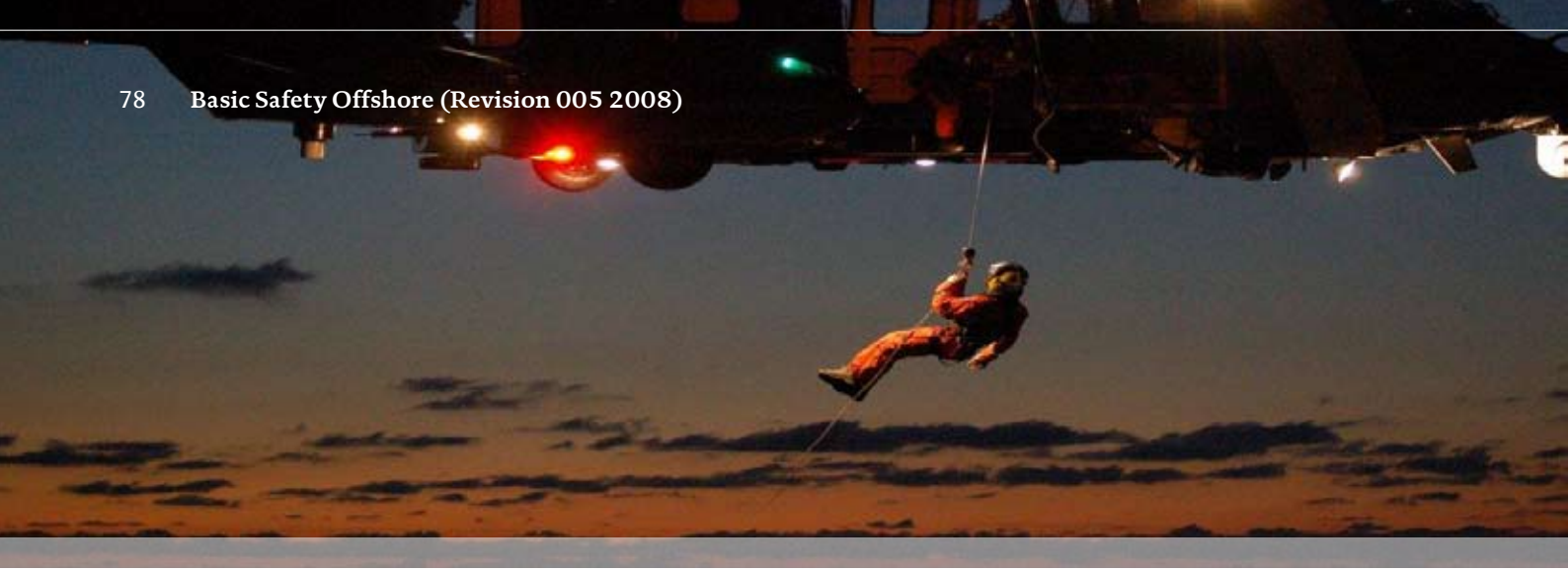
Whistle
In the inventory we also find a whistle, just like the ones we have on our life jackets or survival suits. Not very effective, since the sound of waves and wind will in most cases overrule the whistle.

Radar reflector
This will provide in a better reflection on the radar screen of a searching vessel, airplane or helicopter.
It is important that the radar reflector is installed in a correct way. (Not to be used together with SART)



Distress signals.





Search and Rescue SAR organization.

1. SAR organisation

Search and rescue (SAR) comprises the search for, and provision of aid to, persons who are feared to be, in need of assistance. The two operations search and rescue may take many forms, depending on whether they are both required, on the size or complexity of the operation and on the available staff and facilities. It is necessary that the available resources are so organised and co-ordinated that effective and extensive search and rescue operations can be assured. This requires the establishment of a search and rescue organisation provided with a SAR plan and the means for carrying it into effect.



Den Helder coatsquard.



SAR organization.

International Search and Rescue organisations.

Search and rescue is organised on national and international levels. The most important thing in rescue organisations is that people in distress have confidence in them. It is therefore necessary that people have insight in the basic principles of the rescue organisation. As an important date in SAR organisation the sinking of the Titanic in April 1912 must be mentioned, although it took till 1960 before most seafaring countries signed an international treaty. On December 7th 1944 Search and Rescue for people involved in aircraft accidents was already settled on a small scale international basis, by means of the so-called ICAO-doctrine which was taken over by all NATO partners. As from that date it was compulsory for all NATO members to have a national SAR organisation. The ICAO-doctrine was unchanged so it could also stay in use for non-NATO partners.

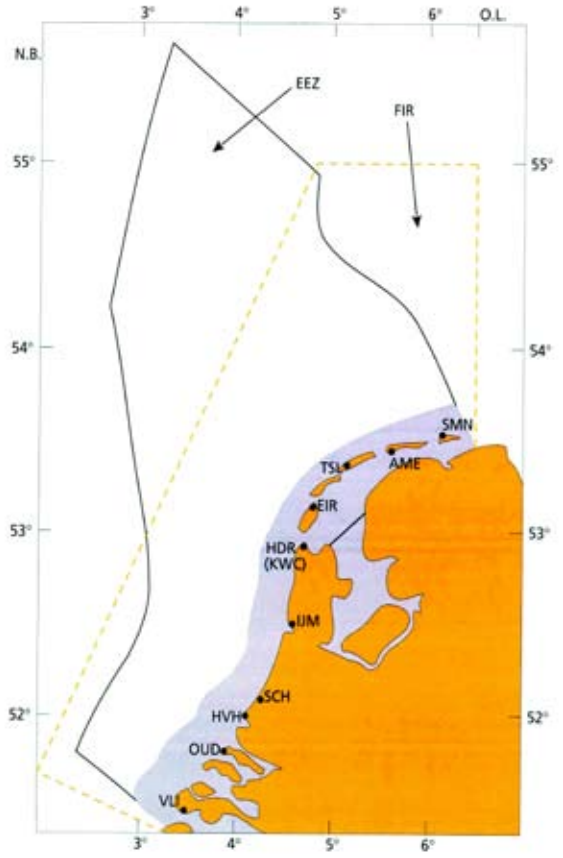
The most remarkable and important date in Search and Rescue organisation is the formation of the United Nations in 1945. Under auspices of UN we find several organisations, such as:

- ILO , International Labour Organisation
- WHO, World Health Organisation
- WMO, World Meteorological Organisation
- IMO, International Maritime Organisation

In the field of SAR, IMO is the most important organisation in UN. As mentioned before 1960 was a remarkable year in SAR. In 1960 all IMO members signed the SOLAS convention. SOLAS stands for Safety of Life At Sea.

In the SOLAS convention all members agreed on the following:

- Each member is responsible for a so-called Search and Rescue Region (SRR).
- International emergency frequencies are laid down.
- All participants are obligated to render assistance in case of an accident.



Exclusive Economical Zone (EEZ) & Flight Information Region FIR .

Nowadays SAR can be translated as:

- SAR units are on voluntary base.
- Specially trained SAR units.

In order to get SAR operations started it was agreed that in case of an accident the country in whose SRR the accident took place is responsible for the co-ordination of SAR actions, irrespective of the nationality of the person or object in distress. If the position of the accident is not exactly known the most probable SRR country is appointed as the co-ordinating country and remains responsible until the exact position of the calamity is known.

HOW DOES THE INTERNATIONAL SEARCH AND RESCUE OPERATE?

The cooperation between the IMO International Maritime Organization and ICAO International Civil Aviation Organization is described in the IAMSAR International Aeronautical and Maritime Search and Rescue manual. In the Volume I, II and III. SAR actions can be divided into two main sections:

- On the shore.
- On the spot.

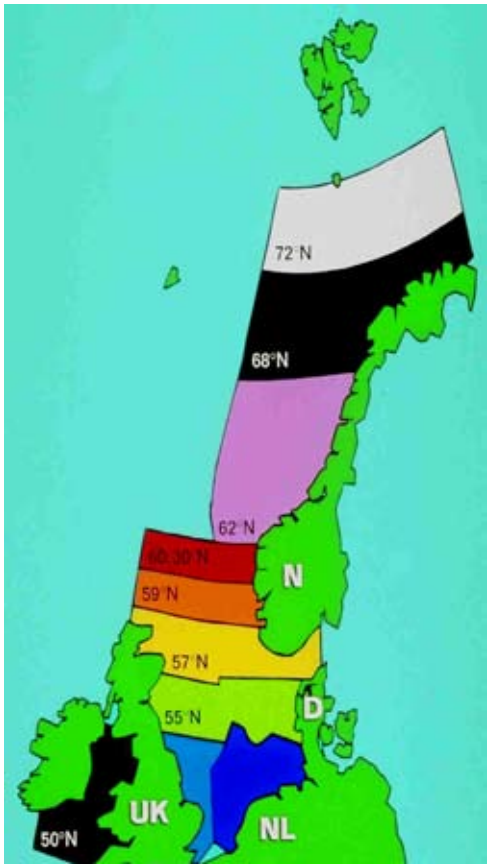
Actions ashore are co-ordinated by a so-called Rescue Co-ordination Centre. Actions on the spot are co-ordinated by either an OSC On scene commander or a CSS (stands for Co-ordinator Surface Search). However with the increase in the extent and complexity of the offshore oil and gas industry and the facilities available ffshore, it is accepted that the offshore operators can successfully deal many SAR incidents in the vicinity of offshore installations with themselves, using the local facilities. Due to the remoteness of offshore installations the oil industry recognised the need for a self-help system.

IN 1979 THEY INSTITUTED THE NORTH SEA SECTOR CLUB

This "Club" operates by dividing the North Sea into six sectors each given a colour. The co-ordinator in any one of these sectors is usually the main operator in that area. In the event of an emergency in their sector they would take the role of co-ordinator under the overall control of the Coastguard. Facilities available for use during an emergency will be logged in the co- ordinators' computer giving the Coastguard or OSC, accurate and up-to-date information on types of equipment, number of units available and where each unit is situated.

IN THE EVENT OF AN EMERGENCY

If a situation occurs where a Search and Rescue mission is to be initiated the normal course of events would be to alert the Coastguard who would take overall control of the incident. However, in the oil industry the Sector Club utilising facilities already present in the area could handle any mission of a smaller scale. The industry's own personnel will co-ordinate, unless the incident eventually rows to the extent where the operator requests the Coastguard to take over, or when rescue service facilities are required.



North Sea sector club.

If the nature of the emergency requires the assistance of the Coastguard, they will assume total control until the rescue is complete or the search abandoned. Due to their geographical location, the Coastguard will delegate specific tasks to a person close enough to the scene of the emergency to be able to monitor the situation in detail and who can co-ordinate developments as required. Depending on the situation this may be the OIM of the nearby installation, the master of a safety or supply vessel or the captain of a suitably equipped aircraft. The OSC will modify any plans if the local weather conditions change affecting flying conditions or the safety of any surface craft. He will also establish direct communication links with the shore base co-ordination centre and report directly to them at regular intervals giving details of the situation as its develops. Any unit arriving on the scene should report to the OSC and work through him unless told otherwise.

In any large-scale emergency the OSC may also designate tasks. If the number of surface vessels is sufficient, a C.S.S. may be appointed to control the surface search and report to the OSC. For the air search a helicopter co-ordinator can be appointed to liaison with receptor platforms, organise routing of helicopters and refuelling arrangements. In some instances he may also assist with air traffic control.

RECEPTION OF EVACUEES AND SURVIVORS

If personnel is evacuated or picked up by helicopter, they will be taken to a receptor platform or, if the location is close to land, onshore. Any installation, which is to be used as a reception point, will be chosen for its medical facilities, helicopter refuelling capabilities and accommodation levels.
If evacuation is by life raft or life boat, the reception point could be a rescue ship which will then transfer personnel by helicopter, or if weather conditions are adverse, evacuees will remain onboard until conditions improve or the ship reaches land.
In any of these situations, the rescue team will be trained to deal with such circumstances. Survivors must do as requested by these teams. The more co-operative you are, the easier their tasks become, thereby ensuring the chances of a safe rescue and recovery.

RESOURCES AVAILABLE

Offshore, the oil companies provide rescue ships (sometimes only by mobile installations) with accommodation for large numbers of survivors along with treatment areas and first aid trained crews. Operating from these ships and from some platforms and semi-submersibles are fast rescue crafts which are utilised for the pick up of survivors or to tow life rafts or TEMPSC clear of danger. In addition to these dedicated services, the Coastguard can call up and ask assistance from any vessel in the vicinity, military or civilian. Under the SOLAS agreement these crafts must respond to the call unless circumstances make this impossible.



Coastquard vessel Barend Biesheuvel.



Stand By vessel Viking Sentinel.

FIXED WING AIRCRAFT

The Royal Airforce operates Nimrod aircraft for Search and Rescue purposes. As the aircraft is fitted with sophisticated communications and search equipment, in any incident the commander of the Nimrod is likely to take the role of O.S.C. if required by the Coastguard. The Norwegians operate a similar service with Orion Aircraft.

HELICOPTERS

Rescue by helicopter can be effected from a shore base or offshore location. In the North Sea a field shuttle aircraft may be used for SAR by fitting a rescue winch and crewing aircraft with trained crews. SAR helicopters are available in the Brent, Forties, Ekofisk, Frigg and Statfjord fields. Norway, U.K. and Belgium use Sea King (Sikorsky S61) helicopters. It is a longer-range helicopter with a rescue winch and an all-weather capability. The endurance is 6 hours giving a range of some 600 nautical miles at a normal cruising speed of 100 knots. The helicopter can carry 19 survivors in a sitting position or 9 stretcher cases, and they have excellent communication-, navigation- and search and rescue equipment. Another helicopter in use by SAR is the Bell 412. Sometimes they are equipped with infra red radar, night vision, searchlight etc. At each station one helicopter is available at 15 minutes readiness, plus another within 1 hour during daylight. The final stage of the rescue itself can prove hazardous if the person to be rescued is unfamiliar with techniques and procedures. In attempting to help h e may actually hinder operations.



SAR.



Coastquard "Waker"





Helicopter safety and HUET.

Transport by helicopter to an Offshore platform.

The use of helicopters in the offshore industry is quit common now a days. Its a fast and safe way of transportation. The alternative way supply boat and crew basket or swing rope are more dangerous and depending on the weather it can be suspended. This is the reason that a majority off the offshore operators don't allow crew changes by crew basket.

A safe means of transportation

Helicopters can be considered a safe means of transport. Helicopter pilots are well prepared for their job. They have all completed an extensive training and have all carried out emergency landings as part of their training.

Why this course?

Mechanical malfunctions and human error may incidentally result in problems. The response to an emergency-situation differs for each person. It is a proven fact that people who know what to do in a certain situation have a better chance of coping with that situation. By knowing more about the things that can happen and how to behave in a distress situation, one may be able to anticipate problems and use the knowledge acquired in this course to survive a helicopter emergency.

Helicopter Safety

- Check in at the heliport.
- Regristration.
- Boarding card.
- Luggage.
- Prohbited items.
- Wriiten carry permit.
- Waiting for boarding.

CHECK IN AT THE HELIPORT

Normally if you fly offshore you must be 45 till 60 minutes before departure on the heliport.

REGISTRATION

Your flight is booked and you have to show your passport, remember you leave the country. Also it can be that you have to show your personal safety logbook or safety pass.



Heliport.

REGRISTRATION.

You will be booked for the flight and you have to show your passport because you are leaving the country. Also it can be possible that you have to show your safety passport or other document that you have done the proper basic safety course. In some countries compagnies are using a central database with information about your medical and basic safety course as an example the Ventage sytem. You will receive a boarding card with the flight number and sometimes the boarding cards are colour coded. At the heliport a monitor is available to check the departure time. A final call for the flight is annaounced by intercom.



Departure times, boarding card and luggage tag



Heliport.

LUGGAGE

The weight of the luggage you can take with you is 20 or 30 pounds (10 or 15 kg.) Make sure that the luggage is in soft hand holds and they can be closed with zippers. Don't bring loose items with you such as pens, newspapers, glasses e.g. In an emergency situation those loose items can fly around and causing injuries. The luggage can be handed over to customs and will under go security checks. Make sure that a luggage tag with your destination is well connected to your baggage.

FORBIDDEN ARTICLES

- Weapons, ammunition and explosives.
- All types of lighters.
- Alcohol and drugs.
- Pressurised containers.
- Battery powered equipment, unless batteries are removed.
- Magnetising materials.
- Radio active materials.
- Corrosive materials.
- Mobile phones.
- Medicines.
- Cameras are not allowed on some platforms.
- Some platforms have their own regulations.



Dangerous goods.

If in doubt ask in advance the helicopter operator or the oil company if this declarable item is accepted.

Written declaration for declarable goods

For some items a written carry permit is required, such as:

- Medicines
- Radios and other equipment with batteries
- Equipment with unclear ownership, for instance cameras and video
- Tools, instruments etc
- Documents relating to the installation
- Food and provisions
- Knives

The security guards will help you to complete the carry permit. The carry permit must accompany the items on both the outward and return journeys.



Declare dangerous goods

Waiting for boarding

After the baggage has cleared customs it is time to collect a helicopter transportation suit. The oil companies for which you are going Offshore has a stock of helicopter transportation suits. Also think of the correct under clothing, in winter time when the water is below 10 degrees Celsius it is compulsory to wear three layers of under clothing. Pay attention! At the heliport they will check this. Donning of the suit can wait till your flight is called by the intercom system. Make sure that your passport and other important documents are kept in the empty pocket on your suit. Remember you still personal have to pass customs.



Heliport waiting lounge



Heliport waiting lounge

Safety briefing video at Heliport.

It is compulsory for the helicopter operator to show you the helicopter safety video of the helicopter you are flying with before departure. Make sure you watch this video carefully also for the old hands in the offshore. On the heliport personal will guide you to the helicopter, your luggage will be brought to the helicopter by trolley.



Safety briefing..



Trolley's.

Boarding procedures/helicopter with no turning rotors "shut down".

- The helicopter crew will always guide the passengers to the helicopter.
- On some heliports you will find yellow markings.
- Heliport personal will load the helicopter.
- You will receive a helicopter lifejacket to put on, check each other.
- You will asked to take a certain seat, depending on the flight route.
- The doors will be locked by the heliport crew.
- The pilots will keep a safety briefing before departure.



Boarding.



Safety briefing by pilot.

In flight requirements:

- Sit where directed and put on the seatbelt.
- Use earplugs or if available headsets.
- Read the safety leaflet and orientate yourself.
- Obey the seatbelt and no smoking signs.
- Do not interfere with helicopter equipment.

Disembarking helicopter

- After the helicopter is landed and stable the Helicopter Landing Officer will open the correct door.
- It can be possible you have to wait till the rotors and engines are stopped. This for instance can happen if refuelling is the case.
- Leave seat only when instructed.
- Your luggage will be ready on the helicopter deck.
- Clear the helicopter deck and stay low, pay attention some helicopter decks have netting.
- One deck lower the lifejackets will be handed over.
- Report at admin.



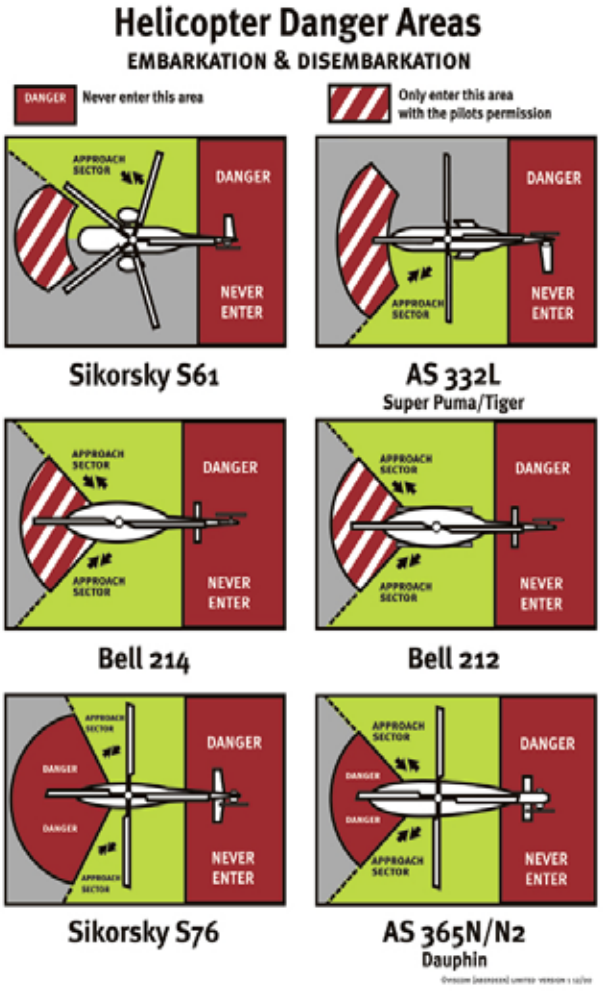
In flight.


Disembarking.

Remember HLO's and HDA's are responsible for all activities on the helicopterdeck!

Boarding procedures with engine and rotors running

- Wait on the appointed place of the HLO, in most cases this one deck lower.
- Be aware of loose articles. (bags, newspapers, etc.)
- You receive a helicopter lifejacket, done it correctly and help each other.
- You receive permission from the HLO or HDA Helicopter Deck Assistance to enter the helicopter deck.
- For a safe approach do not run.. Walk lining up.
- Line up. Never approach the helicopter when anti-collision light is burning or when the red light is rotating.
- Always crouch slightly when approaching or leaving the helicopter. STAY LOW!
- In view of the crew, 45 degrees from either side of the nose from the helicopter
- NEVER from the rear. (tail rotor)
- NEVER from the front. (main rotor-blades are slightly tilted)



Safe approach sectors.



Safe approach information.

2. Helicopter emergency procedures

Helicopters are know to be very trustworthy, they fall under a strict preventive maintenance scheme. However because of technical or personal mistakes helicopters can have to deal with emergency situations, with the possibility to make an:

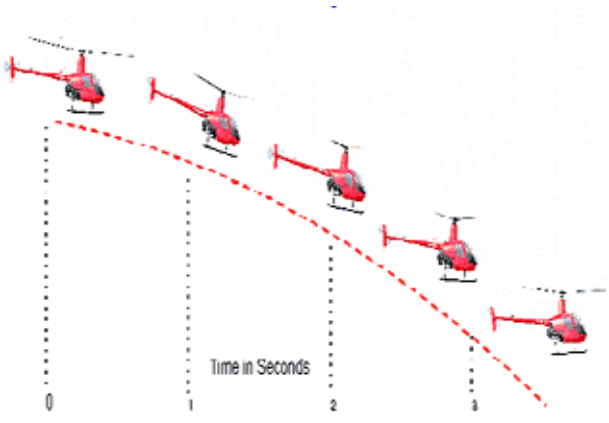
- Emergency landing on land.
- Emergency landing on the platform.
- Emergency landing on water.

Helicopters in general, but especially helicopters flying for oil companies are equipped and have to deal with stricter regulations such as:

- Equipped with two engines.
- Two pilots.
- Amphibious.
- Fixed and/or inflatable floaters to make the helicopter more stable on the sea surface.
- A sea anchor to ensure that the helicopter remains with its nose into the wind to avoid capsizing.
- Equipped with helicopter life rafts.
- Equipped with distress beacons.
- Personal survival gear.
- Auto-rotation.



Helicopter ditch.



Autorotation.

Helicopter pilots have the ability to perform a controlled landing using auto-rotation in case of an engine failure. When the rotors of the helicopter turn fast enough the pilot can transfer forces into a vertical lift. As the helicopter approaches the sea-surface, the pilot carries out a manoeuvre that will minimise the vertical and horizontal speed of the helicopter to zero. Result: a minimum impact.

HELICOPTER LIFE RAFT

Helicopter life rafts are placed on strategically places. This can be under the chairs or on the inside of the helicopter doors. You can find the helicopter life raft in a yellow valise or special container. We talking about a dedicated or non dedicated helicopter life raft. The helicopter life rafts of the new helicopter Augusta Belt 139 are situated at the outside of the helicopter (see picture). This is an advantage if the helicopter is floating reversed at the sea, the life rafts are then still to operate.



RFD Heliraft.



Heliraft AB139.

RFD HELICOPTER LIFE RAFT

The life raft is on both sides exactly the same. Often it is a 10 persons life raft, that is the reason that in most helicopters you will find two helicopter life rafts. After ditching of a helicopter the pilots will give instructions which side to launch the helicopter life raft, this is depending on wind and wave conditions. On the top of the tube a safety knife is situated, to cut the mooring lines. The life raft is equipped with two mooring lines, a short one partly coloured blue with a length of 92 cm and a long mooring line coloured partly red from about 12 meters long. The short mooring line is normally connected to the helicopter with the purpose to activate the life raft after jetting son.

OPERATING THE HELICOPTER LIFE RAFT (STEP BY STEP)

- Activate
- Boarding
- Clear helicopter
- Collect inventory
- Deploy sea anchor
- Close canopy
- Switch on emergency beacon
- Wait for rescue



Heliraft package.

The emergency equipment is connected to the life raft in watertight bags pointed out with inventory. The sea anchor is situated at one of the boarding ramps. The sea anchor you have to deploy yourself. On each side of the life raft you can find the canopy, which is easy to connect with buckles and velcro straps. On the way the canopy will make the life raft wind and water tight. On top of the canopy a stroboscope light is placed and after deploying the raft the battery will be activated in the water. If a helicopter rescue will take place you have to open the canopy again, because of the downwash of the rescue helicopter.

3. personal life saving equipment

- Thermo clothing
- Transportation suit
- Helicopter life raft
- Personal Locator Beacon PLB
- Emergency Breathing Device EBD

Thermo clothing

A certain survey identified that 70% of helicopter passengers flying offshore were wearing inadequate thermal protection beneath the transportation suit. For this reason the operators on the North Sea decided to make certain thermo clothing compulsory. In the summer from the 1st of June till the 1st of November when the water temperature is higher then 10° Celsius 3 layers of clothing is required underneath the transportation suit. This will mean suitable underwear/T-shirt, shirt with long sleeves, jumper sweater and long trousers. In the winter the 1st of November till the 1st of June an extra layer of isolation in connection with the suit will be supplied.



3 Layers.



Under clothing.



Transportation suit.

Transportation suit

The transportation suit is not an approved SOLAS (Safety Off Lives At Sea) survival suit. This will mean the isolation is less and hypothermia will set in faster. Instead the transportation suit is giving more comfort and it is also watertight. The hood and gloves often made from neoprene are situated in the pockets or/and sleeves. The suit is tighter around the legs and on the site of the legs a zipper or elastic bands will make it easier to don the suit.

Important points during donning the suit:

- Make sure you have the right size, by bending your knees and rising your arms above your head you can check if you have the correct size.
- Be careful with watches and bracelets during donning, they can damage the seals.
- Check if the hood and gloves are in the pocket.
- The suits are equipped with fixed socks, take of your shoes and put on the suit. After this you can put on your shoes again.
- The zipper must be closed completely, sometimes a extra device will make sure that the zipper is closed.
- Don't walk without your shoed it will damage the suit.
- Take good care of the suit, the zipper is very venerable , prevent bending.
- The watertight seals around neck and wrist are also very venerable.
- If the suit is damaged or even you will find grease on the suit it is not watertight anymore.
- If in doubt change the suit, you also have to fly back with the same suit.



Zipper.



Over shoes.

Lifejacket

A helicopter lifejacket is an approved lifejacket by the CAA "Civil Aviation Authorities". The helicopter lifejacket is a semi automatic lifejacket that only can be activated manual. Off course it should not be activated when water will enter a ditched helicopter. A helicopter lifejacket is equipped with the following items: activating mechanism, a CO^2 bottle, a whistle, lifeline, oral inflator, reflective material and a spray hood.



Aviation lifejacket.



Spray visior.

Emergency breathing device EBD

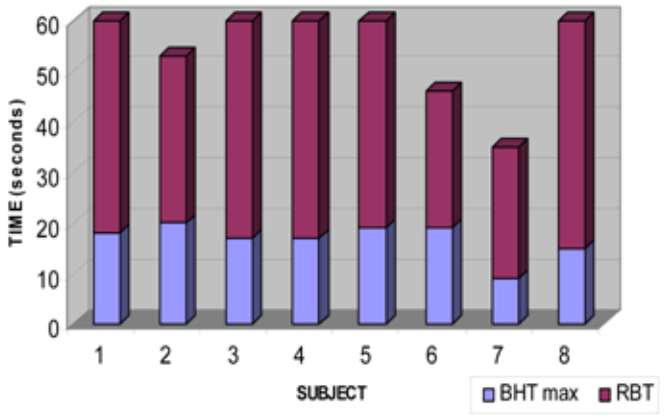
After the results from studies done by Shell EP from the 1st of June 2002 it became compulsory to use the air pocket plus re breather system. At first the air pocket plus was a separate unit on top of the lifejacket. The reason that re breathers were implemented was shown in different studies. In water of 10° Celsius a average person can hold is breath between 17 and 39 seconds. After a helicopter ditch when the helicopter is reversed upside down it is calculated that you need at least 40 to 60 seconds to escape.

The Air Pocket plus

The AP+ consist of a counter long with a content of 5 Litres. To the long a hose is connected with a mouth piece and a nose clip. A small bottle with compressed air is activated automatically or manual to supply a additional 3 litres of breathable air. Between the hose and the mouth piece a two way valve, operated by a red knob is installed.



LAP.



BHT.

The lifejacket Air Pocket LAP

The next development in the emergency breathing devices is a combined rebreeding system integrated in the lifejacket or survival suit. The Air Pocket Plus was integrated in the lifejacket, that's why this is called the Lifejacket Air Pocket LAP. Also this lifejacket is approved by the civil aviation authorities" CAA.

Helly Hansen emergency breathing system

In Norway helicopter operators are flying with survival suits, in the latest one an emergency breeding device is installed. This system is also activated manual or automatic.

Personal locator beacon PLB

Nowadays a number off oil companies supply offshore workers with an emergency beacon. On some offshore platforms homing devices installed are installed to pick up the for this emergency signal. After the PLB is activated a man overboard alarm will be activated in the control room. On a digital nautical chart the position and drifting direction is shown. Also on the fast rescue craft a homing device is installed that will pick up the signal on the frequency of 121.5 Mhz. Also search and rescue helicopters can home in on this signal.



Intigrated rebreather in survival suit.



Personnal locator beacon.

4. Helicopter emergency landings

Still it can happen that helicopters are forced to make an emergency landing. Off course pilots and passengers have to deal with panic, injuries, disorientation, shock and fire/explosions. At sea also buoyancy, cold shock and hypothermia are additional problems. What to do?:

Emergency procedures for passengers at:

- Emergency landing on land.
- Emergency landing on helicopter deck.
- Emergency landing on water.

Emergency landing on land

With an emergency landing the crew will take precautions and everybody is asked to maintain a brace position. The brace position is depending on the type of seat belts , it can be 4 point or 2 point harness seat belts. Also the type of chair can be an issue, is it a high or low seat. After the emergency landing the crew will direct the passengers how to evacuate the helicopter on the best possible way. This is depending on the rotor blades and possible fire or explosion risk. Best practice after evacuation to stay low because of the rotor blades and proceed up wind. During evacuation help each other and take emergency equipment with you.

Emergency landing on Helicopter deck

With an emergency on the platform, the fire team will be standby by to cover the helicopter with a foam blanket, with the purpose to prevent a fire or explosion. Also in this situation the crew and the fire team are in charge. Make sure that after opening the door leave the helicopter deck fast and safe.

Emergency landing on water (Ditching)

We can make an option between:

- Emergency landing on the surface.
- Emergency landing on the water, after which the helicopter partly or completely roll over and water will enter the cabin.

Emergency landing on the surface

If the helicopter will sat afloat the helicopter must be abandoned on a orderly manner after the helicopter life raft is activated. In helicopter with more then 25 passengers a flight attendant is present in the cabin to abandon the helicopter on an orderly manner.

Submerged

Still their is a high change that the helicopter will turn over directly after the ditch. This will depend on a few factors, such as wind, waves, damage to the helicopter and the gyroscopic effect of the rotor blades.

Escape procedures with a submerged helicopter:

- After the brace position slowly sit up and operate the Air Pocket/EBD.
- Locate your exit.
- Prepare emergency exit, but do not open.
- Wait till the motion of the helicopter stopped and the rotor blades or snap off, prevent disorientation.
- Locate the exit and open it. The best option to open a push out window is in the corner.
- Hold the exit with one hand and open your seatbelt.



Surface evacuation.

- Use this as an orientation point and pull yourself out of the helicopter after you released the seatbelt.
- Do this on your back, so you are always in the position to push yourself away.
- Inflate your lifejacket at the surface and with spraying water put on your spray visor.
- Board the life raft, search and help others.

Emergency exits

Helicopters are equipped with mechanical and push out windows. Doors of the hinged type can be released in an emergency by pulling over an emergency handle. Also there are helicopter equipped with sliding doors. On all exits is described how to open the exit in an emergency. Al emergency exit have emergency lighting around the exit and at the operating devices. Very important is that you get familiar with the exits of the helicopter you are flying with.



Brace position.



Brace position.



Brace position.





First aid and hypothermia

First aid in case of accidents and immersion in could water



Sickbay or Hospital.

FIRST AID definition: First Aid is the help given to a person who has been the victim of an accident or a sudden oncoming illness.

AIM OF FIRST AID:

- Save life.
- Relieve pain.
- Prevent further worsening.
- Promote recovery.
- Bridge the time between the accident and the arrival of professional help.

ACTION IN EMERGENCY:

- Safety:
- Yourself.
- Buddy and/or bystanders.
- Casualty.
- Take away the cause of the accident or remove the casualty from the danger.

WHAT HAS HAPPENED/WHICH INJURIES:

- Observe.
- Use senses.
- Make a diagnose.
- Use as much information as possible.
- Give immediate, appropriate and adequate first aid.

REASSURE CASUALTY:

- Keep talking.
- Help facing away from the injury.
- Explain what you are doing.

ALERT MEDICAL ATTENTION:

- Your name and telephone number.
- The exact location of the incident.
- An indication of the type and seriousness of the accident.
- The number of casualties.
- What first aid has been given?

HELP ON THE SPOT:

- If there's no danger for the casualty do not remove the casualty.
- If there's any chance that the casualty's condition might worsen because of danger, remove the casualty.
- To move the casualty to a safe area for a short distance, you can use the Emergency grip of Rautek.

1. FIRST AID

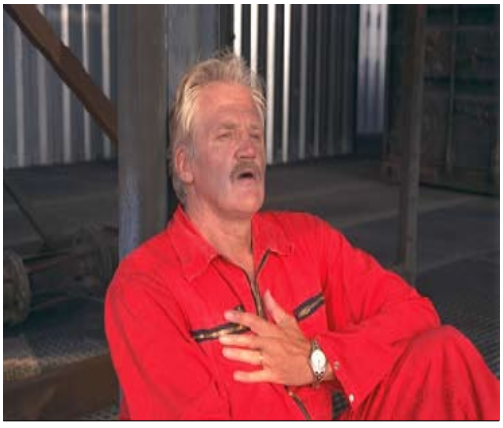
Consciousness is an awareness of our surrounding. Unconsciousness is a damage of this awareness that can vary from being confused to being in deep coma. Unconsciousness is the result of an interruption of the normal activity of the brain. The level of consciousness can be gauged by testing the casualty's response to stimuli such as sound or pain. The most important function of a First Aider is to ensure that the casualty's breathing is sufficiently.

Unconsciousness can be a life-threatening situation!

RESPIRATIONPROBLEMS: To check if someone is breathing, you can feel movement of the chest or abdomen with your hand.

REASONS FOR RESPIRATORY PROBLEMS:

- Illness of the airway system.
- Accidents.



Breathing problems.

- Inhalation trauma.

THREATENED BREATHING DUE TO FACIAL INJURIES, LUNG DISEASE, BURNED AIRWAYS

Symptoms:

- Difficult breathing.
- Conscious.

Conclusion:

- Threatened breathing.

Action:

- Half-sitting position.
- Constant observation of breathing.
- Alert medical attention.



Emergency Call Point.

OBSTRUCTED BREATHING:

- Symptoms:
- Conscious:
- Blueness of lips, ears or face.
- Gripping the throat.
- Gasping for air.
- Unconscious:
- Breathing is audible, snoring.

Conclusion:

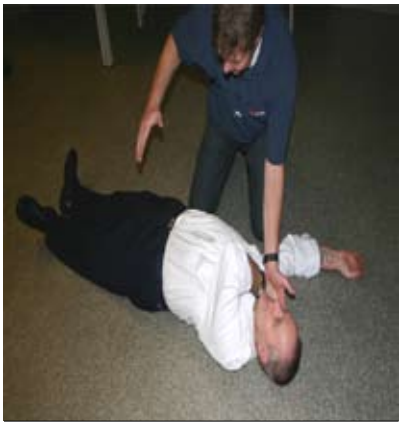
- Obstructed breathing, choking.

Action:

- If choking: Clear airway.
- Firm hits between the shoulder blades.
- Heimlich's manoeuvre (abdominal thrust).
- Mouth to mouth ventilation.

If unconscious:

- Clear airway.
- Recovery position.
- Alert medical attention.



Recovery position.



Recovery position.



Recovery position.

INSUFFICIENT OR NO RESPIRATION

Symptoms:

- Deep unconsciousness.
- Possible blueness of the face.
- No respiration.

First Aid:

- Open tight clothing.
- Clear airway.
- Alert medical attention.
- Start CPR

Better do something then nothing and certain don't walk away!

CPR. (Cardio Pulmonary Resuscitation)
With CPR we mean to give compression and mouth to mouth breathings. We try to bring oxigyn to the brains.

Symptoms:

- Deep unconscious.
- No breathing.
- No circulation.
- Pale.

Action:

- Start CPR and alert medical attention.

WE GIVE CPR BY ONE FIRST AIDER:

- Start with chest compression. (30x)
- Followed by mouth–to-mouth. (2x)
- Continue with the above in the following sequence: 30-2-30-2-30-2-30-2-30-2 cq.

The rhythm that you should use is 100 compressions per minute. The depth of the compression of an adult is 5 cm. You have to check for a pulse with regular intervals. (The first time after 1 minute).

You will continue till:

- Breathing is returned
- Professional first aider on the scene
- Exhausted and nobody to take over
- Danger for yourself

With more first aiders change on a regular base, for example every 5 minutes (5 times 30-2). Always give the CPR by one person.

On most offshore platforms “Automatic External Defibrilators AED”are present. Those AED are made in such a way that you can not make mistakes.



Chin lift.



Compressions.



Mouth to mouth.

WOUNDS AND BLEEDINGS

Wounds can be both internal and external.

- Internal wounds are complicated because treatment to such a wound is not possible for a first aider.
- External wounds can cause complications because germs can enter and infect the wound.



Bleeding.

As a first aider it is important to remember that there is a chance of infection and therefor you have to work as sterile as possible when dealing with a casualty with an external wound.

It is also important to keep in mind that the sight of blood can influence the behaviour of both the casualty and the first aider.

The seriousness of a bleeding depends on:

- Type of blood vessel involved.
- Quantity of blood loss.
- Speed of the blood loss.
- Location of the bleeding.

BLEEDING:

Symptoms:

- External wound.
- Loss of blood.
- Pain.

First Aid:

- Let the casualty either sit or lay down.
- Elevate the injured part of the body.
- Stop the bleeding by covering the wound with a sterile dressing.
- Remove watches, rings etc.
- Refer to medical attention.



Bleeding.

SEVERE ARTERIAL BLEEDING:

Symptoms:

- External wound.
- Severe loss of blood.
- Pain.

First Aid:

- Let the casualty either sit or lay down.
- Elevate the injured part of the body.
- Apply pressure on the correct pressure point.
- Cover the wound with a sterile dressing.
- Apply a wound pressure bandage.
- Remove watches, rings etc.
- Support the elevated part of the body.
- Reassure the casualty.
- Alert medical attention.

BANDAGES

Dressings or dressing pads are used to cover a wound and can be put over a wound when it is sterile, in order to prevent (further) contamination. Bandages can be used to keep a dressing pad in place and you can also apply pressure in case of a more severe bleeding.

TO APPLY A WOUND PRESSURE BANDAGE YOU MUST:

- Elevate the wounded part of the body. (if possible)
- Apply a dressing. (preferably sterile)
- Apply a circular layer of synthetic cotton wool.
- Give pressure with a cambric roller bandage or a narrow- or broad folded triangle cloth.

After you have applied a wound pressure bandage you must keep the injured part of the body some what elevated and supported. For an arm you use a sling and for a leg elevation.



Support.

AMPUTATION:

Symptoms:

- Bloody stump.
- First minor blood loss.
- Pain.
- Fear.

First Aid:

- Lay casualty down.
- Reassure casualty.
- Apply pressure bandage.
- Elevate wounded part.
- Alert medical attention.
- Amputated part sterile covered in a plastic bag and packed in a plastic bag with water and ice.

BURNS AND SCALDS:

Burns can be caused by:

- Dry heat.
- Electricity.
- Chemicals.
- Radiation.
- Friction.

CLASSIFICATION OF SKIN BURNS

Symptoms:

- 1st degree: Redness, swelling and painful.
- 2nd degree: Blisters, which might be open.
- 3rd degree: Black burned or white cooked
- skin, no sense of pain.



First degree burns.



Second degree burns.



Third degree burns.

First Aid:

- Immediate cooling; 10 minutes under slowly running water.
- Minor burns: 2nd degree must be covered sterile.
- Severe burns: 2nd/3rd degree must be covered sterile.
- Lay the casualty down.
- Arrange urgent removal to hospital.

DO NOT:

- Break blisters or remove any loose skin.
- Remove anything that is sticking to a burn.
- Apply lotions, ointments or fat to the injury.

THE RULE OF NINES

When 9% or more of the body surface is burned or scalded to a depth of the second and/or third degree there is a chance of the development of shock!

SHOCK

Shock is an absolute or relative shortage of circulating blood (liquid) in the Cardio vascular system.
Shock is not an injury or an illness but a "friendly" self-defence mechanism. The shock mechanism is a system that tries to keep the body (brain) as long as possible in a good condition.

Casualty who's in a shock is in a life-threatening situation! Some causes of shock can be:

- Severe internal and external bleeding.
- Burns and scalds.
- Poisoning.
- Heart attack.
- Crushing of larger parts of the body.

SHOCK:

Symptoms:

- Casualty looks pale.
- Sick impression.
- Cold/clammy skin, forehead, upper lip.
- Thirst.
- Confused.

First Aid:

- Lay casualty down.
- Stop severe bleedings
- Alert medical attention SHOCK!
- Protect against cooling down (no heating up).
- No drinking, smoking or eating.
- Try by talking to keep the casulty consious



Shock.

POISONING

Symptoms:

- (intense) Pain on lips, in mouth, gullet and stomach.

First Aid:

- Let the casualty drink water as soon as possible. (1-2 glasses) Not if casulty is unconsiou or with oil products.
- Arrange urgent transport to hospital.
- Find MSDS sheet.
- Take along containers such as bottles or pillboxes.

If oil or petroleum product are involved act as follow:

- Do not vomid
- Don't give something to drink
- Alert medical assitance
- Collect information MSDS sheet

Important! If unconsious apply recovery position.



Offshore hospital.

SWALLOWED NON-CORROSIVE POISON

Observe:

- Ask what happened if still conscious.
- Sometimes clouded consciousness.
- Dazed impression.
- Sometimes aggressive.
- Sometimes asleep.

Action:

- Attempt to induce vomiting, however:
- Not with petrol products.
- Not if unconscious.
- No drinking.
- Alert medic.
- If unconscious:
- Clear the airway.
- Check breathing.

POISONING BY INHALATION OF IRRITANT, ASPHYXIATE OR TOXIC GAS OR VAPOUR

Symptoms:

- Persistent coughing.
- Pain when breathing.
- Shallow and weak breathing.

Action:

- Transport to (open) fresh air.
- Let casualty sit up straight in case of irritant or corrosive poisoning.
- Lay casualty down when asphyxiate or toxic gasses are involved.
- Advise casualty not to move.
- Alert medic.
- If unconscious: secure breathing.

It is very important to be aware of the danger of your own respiration. Protect yourself before entering the area.

POISONING THROUGH THE SKIN

Symptoms:

- Muscle cramp.
- Respiration problems.

Action:

- Remove the infected clothing; watch your own safety!
- Wash for ten minutes with slowly running water.
- Alert medic.

It is very important to be aware of the danger of contamination of yourself, in the area and in contact with the casualty. So protect yourself.

BRUISE/ SPRAIN

Symptoms:

- Pain.
- Partial movement.
- After a time swelling and change of colour.



Injury.

Action:

- Let casualty sit or lay down.
- Cool for ten minutes with slowly running water.
- Cold dressing or "ice pack".
- Elevate injured part.
- Consult medic.
- Remove watches, rings, jewellery, etc.

CLOSED FRACTURE:

Symptoms:

- Pain.
- Loss of normal movement.
- Swelling.
- Sometimes deformity.
- Sometimes abnormal (uncontrolled) movements.

Action:

- Immobilise the fractured bone.
- Support and reassure.
- For arm, wrist and hand a sling. For shoulder, upper arm and elbow a broad fold triangular cloth. For lower limbs a rolled up blanket.

MEDICAL ASSISTANCE ON A PLATFORM

On platforms sick bays are present with the nesecarry medical equipment. In the Netherlands it is a requirement to have an Offshore paramedic on board if their are more then 25 persons on the platform. If their is less personel on board one of the operators will act as a medic.



Sickbar or Hospital.

RADIO MEDICAL SERVICE (RMD).

When their is a severe casulty or sickness on a platform the medic can ask advice from an onshore organization called RMD. This radio medical service is operated by the Dutch Lifebaot association called the KNRM. The RMD will have dockters available to give medical assitance.

The Radio Medical Service is manned by five dockters (dockters with a nautical background) those dockters work in different shifts during the week and in the weekend. They will be informed and within 10 minutes they can make contact with the platform. The dockter is familiar with the platform and the possibilities. The dockter can determine by radio, satelite or telefhone what the symtons are.

Depending on the situation the dockter can describe medicines or give the advice for a medevac. Yearly the dockerts deal with 800 advices.

Medical Evacuation (MEDEVAC)

If a casulty or sick person is in a such condition that medical assistance from the shore is needed the coastquard in good cooperation with the RMD dockter will decide to carry out a MEDEVAC. Within the Dutch SAR region the Navy or the KNRM will carry out the MEDEVAC. In most cases a dockter will escort the MEDEVAC to threat the person on the spot and prepare for transportation.



Search and Rescue Helicopter.

2. HYPOTHERMIA

"Hypo"is standing for low and "therme" for heat, so hypothermia is standing for low (core) temperature. The body temperature usually varies between 36.9o and 37.4o C. At 35.5oC hypothermia sets in.

Three forms of hypothermia:

- Cronic
- Sub-acute
- Acute

CHRONIC: Hypothermia in elderly people and alcoholics. As chronic hypothermia especially affects elderly and/or alcoholics, it is not within the scope of this syllabus to discuss this form of hypothermia.

SUB-ACUTE: Hypothermia caused by exposure for example to cold air. The most simple form of hypothermia in terms of protection and treatment. Heat loss because of exposure should not be overlooked. Hypothermia sets in, slowly but steadily. The victim itself is not aware of the fact that he is affected by hypothermia. A dangerous situation can develop, since hypothermia can lead to loss of co-ordination between thinking and doing. Putting on enough clothing can easily prevent exposure. An important precaution in the first place in order to prevent this form of hypothermia is to make sure not to get cold.

ACUTE: Hypothermia caused by immersion in cold water. Acute hypothermia is the result of immersion in cold water. In the North Sea the surface temperatures varies between 2oC to 6oC in wintertime and 15oC to 170C during summer. The temperature of coastal waters strongly depends on the air temperature, but the North Sea is always cold to very cold.

What happens after immersion in cold water?



Sickbar or Hospital.

The reaction of the human body to sudden exposure to cold water is:

- Quick breathing that can lead to hyperventilation
- Gasping for air
- Increasing blood pressure
- Increasing hart rate
- Disorientation
- Panic
- And will result in a so-called 'Cold shock'.

COLD SHOCK CAN LEAD TO:

- Inhalation of seawater
- Reduce swimming capability
- Drowning, within first 2-3 minutes

WHAT TO DO TO PREVENT COLD SHOCK?

- Wear protective clothing. Clothing serves in dual purpose. In clothing a considerable amount of air is trapped. This air helps



Dress for survival.

you to stay afloat for a while. It gives our body time to adjust to the cold water temperature.

- Do not jump in the water, whenever possible. Try to get into the water gradually. Use a life raft or lifeboat, or use a personal escape system.
- Mental preparation. As soon as you enter the water your only concern is to control your breathing. This control can only be achieved by a positive mental attitude. BE PREPARED!

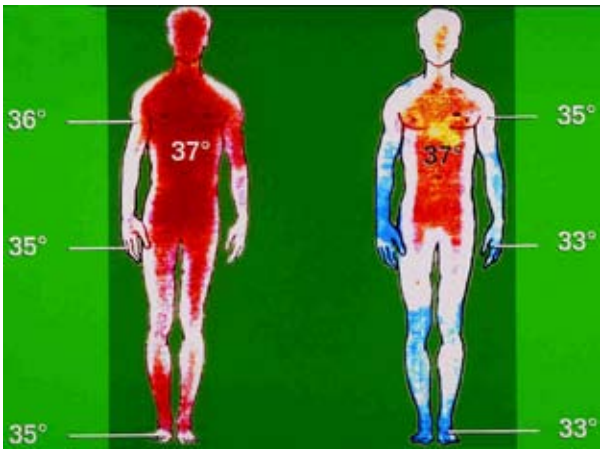
HYPOTHERMIA:

After initial cold shock hypothermia will slowly but steadily set in. A number of factors will determine how quickly someone will become hypothermic:

- Water temperature
- Air temperature
- State of the sea
- Age, size, body, sex (not the amount)
- Layers of insulation
- Physical condition
- Mental condition

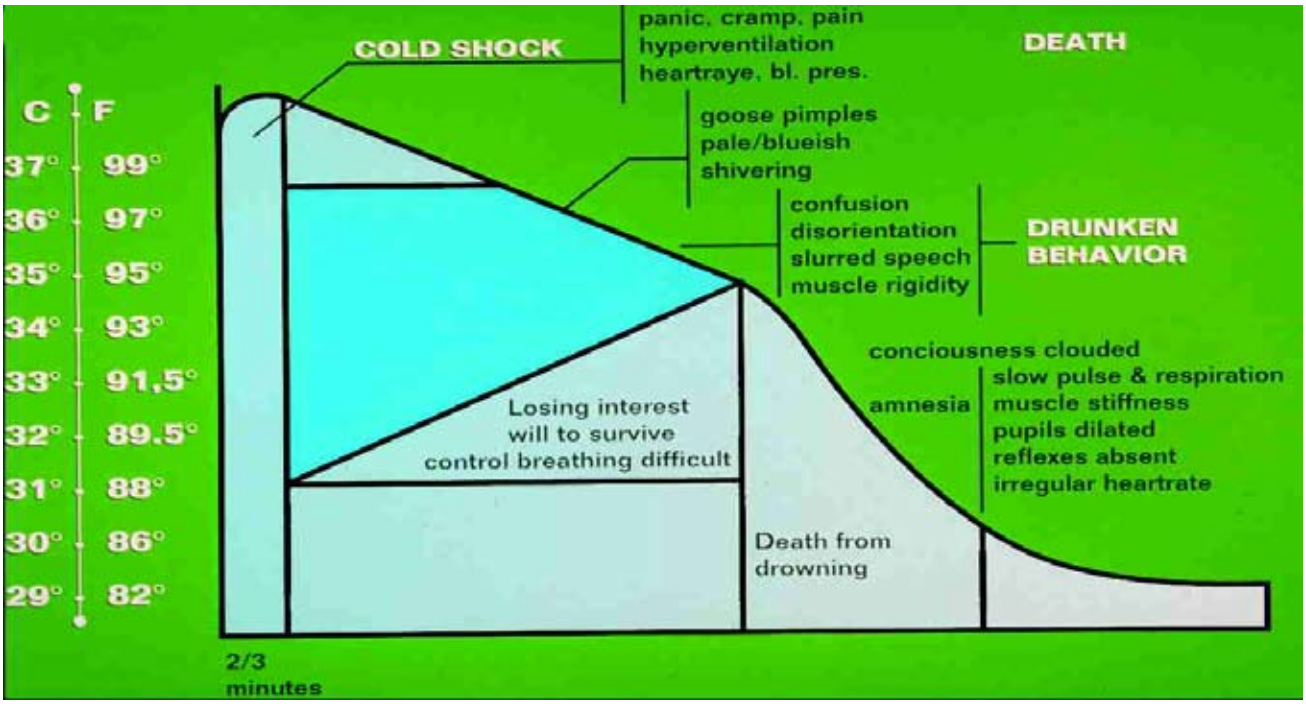
Prevention: If working on places where falling overboard is possible, make sure that you have a lifeline and life jacket.

Body heat loss.



Core temperature.

When a person is immersed in cold water the body cools down very fast. However it may take 10 to 15 minutes before the core temperature stars to drop. The greatest areas of heat loss are head and neck, chest, armpits and groin region.



Timeframe immersion in cold water.

WHAT CAN YOU DO TO PREVENT HYPOTHERMIA?

Without a life raft or other floatation device a person in the water must swim to keep her/his had above wather, especially with waves. In this situation there are two problems:

- Drowning
- Cooling down.

Swimming produces heat, but because the body is completely exposed to the cold water, heat loss will be larger than the heat production. Another important factor is that is not possible to swim for a long time. Conclusion: **Do not swim!**

WEARING A PFD

If an immersed person wears a PFD, his only concern is to stay warm because his PFD will keep him/her afloat. To stay warm the best thing you can do is:

- Minimise your activity.

HELP POSITION



HELP position.

Reduce exposure by assuming the Heat Escaping Lessening Position. Bring your arms close to the side of your body.

- Cross your ankles.
- Keep your legs close and pull up your knees.
- Search the most comfortable position
- Protect face from spray water

HUDDLE position.

If you are with more persons in the water the Huddle position might help in some cases. (moral, injured persons, etc.)

- Wrap your arms around each other.
- Form a circle facing the others.
- Keep bodies as close as possible together.
- Fill up the inner circle.



Huddle.

Do not change anymore. The HUDDLE position reduces heat loss by limiting the body surface exposed to the water and helps SAR-units in locating you.

WEARING A SURVIVAL SUIT

A survival suit keeps you afloat and warm. However in case of an unconscious person a survival suit does not turn the victim into the right position. Therefore a life jacket has to be worn.

WINDCHILL FACTOR

When somebody is on the water also the windchill factor is an important factor to deal with. By means of wind the air temperature will feel lower, called the windchill factor see the next table.

WINDCHILL FACTOR		The Risk of Frostbite on Bare Skin												
Wind Strength			Air Temperature											
Beaufort Scale	Wind	MPH	+10	+5	-1	-7	-12	-18	-23	-29	-34	-40	-46	-51
0	Calm	0	10	5	-1	-7	-12	-18	-23	-29	-34	-40	-46	-51
2	Light Breeze	4.2	9	3	-3	-9	-15	-21	-26	-32	-38	-44	-50	-56
3	Gentle "	8.8	5	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71
4	Moderate "	13	2	-6	-14	-21	-29	-36	-43	-50	-58	-65	-73	-80
4	" "	17.3	0	-8	-16	-24	-32	-40	-47	-55	-63	-71	-79	-87
5	Fresh "	22.3	-1	-9	-18	-26	-34	-42	-51	-59	-67	-76	-84	-92
6	Strong "	26	-2	-11	-19	-28	-36	-44	-53	-61	-70	-79	-87	-96
6	" "	30.3	-3	-12	-20	-29	-37	-45	-54	-63	-72	-81	-90	-98
7	Moderate Gale	34.7	-3	-12	-21	-30	-38	-46	-55	-64	-73	-82	-91	-100
		Low Risk of Frostbite					High Risk of Frostbite			Very High Risk of Frostbite				

Wndshill factor.

BASIC FIRST AID IN CASE OF LIGHT HYPOTHERMIA

First aid:

- Get professional help.
- Lift patients horizontally.
- Remove wet/cold clothing, but only if that is easy.



Hypothermic casualty.

- If the patients wants to drink (only if they can drink), let them drink warm, sugar doped liquid.
- Put patients horizontally, legs up, head lowered in order to obtain maximum blood supply to the heart region.
- Wrap patients up warmly, prevent any further heat loss. **Shelter, beware of wind chill. Basic first aid in case of hypothermia.**

Important is to know what NOT TO DO!

- Do not rub the patient.
- Do not warm up the patient with warm/hot water.
- Do not lift the patient vertically.
- Do not administer drugs.
- Do not allow patients to drink alcohol.

BASIC FIRST AID IN CASE OF SEVERE HYPOTHERMIA

First aid:

1. Lift the casulty horizontal
2. Don't move the casulaty
3. Do not remove wet clothing
4. Put the casultay in a horizontal position with the feet raised
5. Put the casulty in warm blankets
6. Protect victim against the wind
7. Get professional help.

FIRST AID FOR A HYPOTHERMIC VICTIM IN A LIFE RAFT OR LIFEBOAT.

In all lifeboats and liferaft we find an amount of Thermal Protective Aids TPA's depending on the capacity. This is 10% of the capacity. The TPA's will prevent more heat loss by the wind and the casulty will warm it self up again by its own body temperature. The TPA's are not designed to use in the water.

PREVENTIVE CLOTHING.

Prevention is also important, think about that you have to work on or around the water, use in this case a lifejacket or workvest. Also if you go on open water for a drill or real man overboard situation use for the correct protection.



Eye and face protection.



Hypothermic casualty.





Fire prevention and Self Rescue on Offshore platforms



Bombay High..

1. FIRE FIGHTING

THE COMBUSTION PROCESS

Oxidation is a chemical process between a reactive material and oxygen. During this process energy is generated in the form of heat

Fire is a fast oxidation process between an inflammable material and oxygen. During this process spontaneous energy is generated, mostly in the form of heat and light in the form of flames.

All materials occur in one or more forms (physical condition);

- solid matter
- liquids
- gas or vapour

All materials consist of molecules. Each molecule must be encircled by oxygen molecules for good oxidation. Only the molecules of gas are not joined and can move freely and lick with oxygen molecules can burn. When an inflammable solid or liquid is heated molecules will be released.

These molecules mixed with oxygen molecules can make an inflammable mixture. They will ignite at a certain mix ratio and ignition temperature. If the energy is released is sufficient to set up a chain reaction, it is called fire.

THE FIRE TRIANGLE

As shown already there appears to be three requirements for combustion.

- Fuel.
- Oxygen.
- Heat (energy).

The three conditions for fire are illustrated in a fire triangle



Fire triangle..

FIRE FIGHTING

The fire triangle also illustrates two important factors in preventing and extinguishing fire:

- When one side of the fire triangle is missing there can be no fire.
- When one side of the fire triangle is removed the fire will go out.

LEAVING THE FIRE TO BURN OUT

The removal of fuel.
Example:

- Burning oil flows out a leaking flange.
- Turn the valve off.
- The fire will go out from lack of fuel.

SMOTHERING THE FIRE

One side of the fire triangle indicates the oxygen concentration. A concentration of 15 % is needed for a flaming fire. A smouldering fire actually only needs 4% oxygen to remain 'alive'. Stop the oxygen supply.

Example:

- Stop the supply of oxygen by adding foam to a burning liquid
- Or suppress the oxygen by steam or CO2.
- The fire will be smothered.

LOWER THE TEMPERATURE

By lowering the temperature the vaporisation of an inflammable material will be decreased or stopped.
Example:
Cooling/ extinguishing with water.
The fire goes out because the chain reaction is stopped.

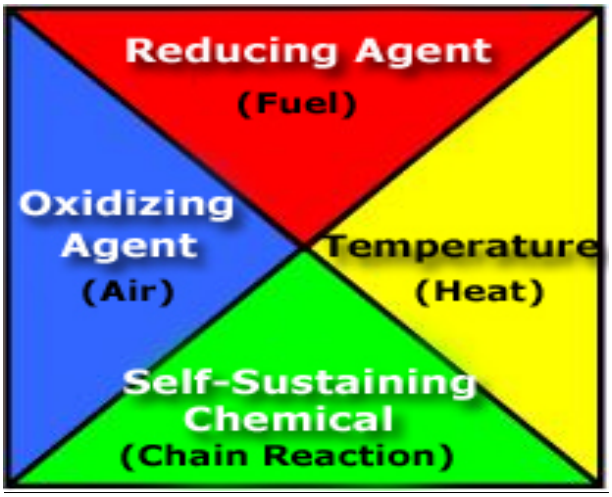
CHAIN REACTION

Part of the heat releases more gas and another part raises the temperature of the gas to ignition temperature. At the same time air is sucked into the area where the flames and gas meet up.
The result is a chain reaction.
The burning gas produces heat which releases and burns more gas. The released gas burns, produces more heat causing more gas to be released.
And so on. After a while the gas is released at maximum tempo causing the combustion process to work evenly. This goes on until most of the fuel has been used. Then the burning process will fall apart.

CATALYST

Sometimes fuel, oxygen and energy are present in the correct ration but there is no fire. There is then a catalyst needed to start off the combustion reaction. A sugar cube will not burn, but can burn when it is sprinkled with the ash of a cigarette. A catalyst is a material that "interferes" in some way with the combustion reaction, without itself taking part.

THE FIRE PENTANGLE



Chain reaction..

The fire triangle is a simple form to illustrate the conditions necessary to create fire. It does not however show which components fire is made from or the chain reaction of a fire. The fire pentangle is a better presentation of the combustion process. The fire pentangle shows the chain reaction because each side is in contact with the other sides of the three components. The fire pentangle illustrates how a combustion process is fed and maintained by the chain reaction. To a certain extent the side of the chain reaction ensures that the other three sides remain together. This is an important point because modern extinguishing agents attack the chain reaction and stop it.
The fire pentangle consists of the following elements:

ACTION OF EXTINGUISHING MATERIALS

An extinguishing material is a medium that smothers the fire. Every extinguishing material works by attacking one or more sides of the fire pentangle.
Specific techniques for this are:

- **Cooling off**. This is a direct attack on the temperature side of the fire pentangle.
- **Smothering**. This can be seen as an attack on the corner of the fire pentangle where fuel and oxygen meet.
- **Decreasing the oxygen**. This is a direct attack on the oxygen side.
- **Interrupting the chain reaction.** This is an attack on side of the chain reaction.

Progress of fire and risk of explosion
What happens during combustion of material? Combustion is a chemical reaction in which the fuel begins a connection with oxygen from the surrounding air. When an inflammable liquid is heated by an energy source flammable gasses are released.
The inflammable gasses can react with oxygen if sufficient energy is added.

Heat (energy) is released by this combustion reaction. If sufficient energy is released the rest of the fuel is further heated so that the combustion reaction is maintained. The type of fuel determines how much energy must be added in the first instance to start up the combustion. Inflammable gasses usually only have a small ignition source (spark) necessary to start a reaction. Solid matter such as wood must first be heated for a time before they stay burning.

A solid matter fire is slow to *develop*. We recognise a number of phases:

- the smoulder stage
- the flame stage
- the glow stage

The *smoulder stage* is the first phase of combustion. When heated all the inflammable gasses are released but not yet enough to get the combustion really started. A cigarette in a waste paper bin can smoulder for 1 to 2 hours. Smouldering can put itself out (when lacking in oxygen, fuel or energy) or move over to the flame stage.

The fire can support itself when the flame stage has started. The flame stage is usually accompanied by a rapid rise in temperature within 5 to 15 minutes. All the fuel present is heated and many inflammable gasses start to combust quickly.
(graph of fire development)

A temperature of about 900oC is reached when the fire is completely developed. All the inflammable matter burns. A glowing layer remains when all the inflammable gasses from the fuel have been burnt: the glow stage has started. Extinguishing will now take longer because the glowing parts of the fuel are less accessible to the extinguishers.

Liquid and gas fires develop faster and reach a higher temperature than fires of solid matter. These fires only have a flame stage.

Constant vaporisation takes place on the surface of *liquids*. The higher the temperature, the more vaporisation. When there are sufficient vapours above the surface and they are well mixed with oxygen from the air they can be ignited. The *flash point* is the lowest temperature (at atmospheric pressure) that the vapour given off by the liquid and mixed with the surrounding air can be ignited by a flame or spark. The flash point is shown in degrees Centigrade.

Inflammable gas or inflammable vapour could, in the correct proportions, form an explosive mix. When too little inflammable vapour / gas is present in a mix it is too 'poor' and is under the *lower explosion limit*. A mix with too much inflammable vapour / gas is above the *upper explosion limit* and is too 'rich'.

OEG		BEG
Te arm	Brandbaar	Te rijk
100% lucht 0 5 gas		0% lucht 100% gas

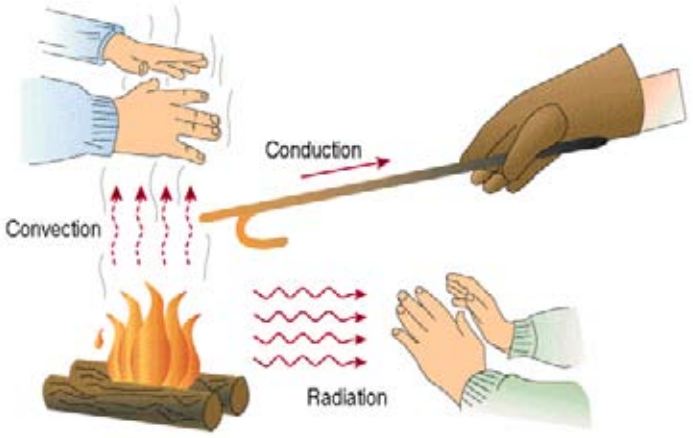
An explosive gas / air mixture can come about quickly when there is leakage of gasses and liquids.

SPREAD OF FIRE

The fire can spread if there is sufficient inflammable matter and oxygen available. A fire mostly spreads with the wind outdoors. Heat and inflammable gasses are 'transported' along with the flames and smoke. A fire can spread because inflammable matter in the direct vicinity is heated up.

The transport of heat occurs by means of:

- conduction



Transfering heat.

- radiation
- convection

Conduction is heat transport via the matter. The heat is spread quickly by a conducting matter such as metal.

Radiation is transport by means of energy waves. The enormous radiation heat of a fire can often be

felt at a distance. Heat transport takes place for 80% by radiation.

Convection is heat transport resulting from the conduction of gasses (air) or liquid. Central heating in homes is based on this principle.

THE SPREAD OF FIRE

An enormous heat can develop when a fire continues without control. The fire can spread in two ways:

- Fire penetration
- Fire transport

Fire penetration is the movement or spread of a fire through walls. This is possible by burning the material, the through pipes or the cable work.
Fire transport is the movement or spread of fire between two objects not connected. This could be by heat radiation or the flow of heated combustion gasses.

DIVISION OF CLASSES OF FIRE

Fuels react in their own way to fire and should therefore be extinguished in different ways. Fuels are divided into a number of classes with specific characteristics during fires so that the fire fighter knows which extinguishing agent should be used. We recognise:

Brandklasse indeling	
Klasse A	Vaste stoffen
Klasse B	Vloeistoffen
Klasse C	Gassen
Klasse D	(licht) metalen
Klasse F	Oliën en vetten

CLASS A FIRE



Class A.

Solid matter fires (e.g. wood, rubber, paper).
Solid matter must first change into a gas before it can burn. This process is known as pyrolysis which is generally defined as a chemical decomposition through the influence of heat. When the gas has mixed with enough with air and is heated to a high enough temperature combustion begins.

CLASS B FIRE



Class B.

Class B fires are liquid fires (e.g. gas oil, oil and paint). Inflammable gasses are released by the liquid vaporising. Highly inflammable liquids vaporise at room temperature and could then combust, think of turpentine and benzene. One spark (energy) can be sufficient to set fire to these liquids. Heavier liquids such as oil and fats must first be heated to above the flash point before an inflammable mixture can be formed.

CLASS C FIRE



Class C.

Class C is formed by gas fires such as propane and natural gas. No heating is necessary because the fuel is present as inflammable gas. Some gasses are lighter, others heavier than air. An inflammable/ explosive mixture can be formed quickly through mixing with air when there is a gas leak

CLASS D FIRE



Class D.

Class D concerns fires of (light) metals, magnesium and aluminium for example. Metals burn from the formation of glow, at extremely high temperatures (approx. 2500 oC). These fires can often not be extinguished in the normal way. Extinguishing is only possible by complete and long-lasting smothering or with the help of special extinguishing agents.

CLASS F FIRE



Class A.

Class F indicates that the extinguishing agent is suitable for extinguishing very hot oils and fats, the quantity being more 5 litres, large deep-fryers for example.

ELECTRICAL FIRES

Fires involving electricity deserve special attention. Extinguishing is possible but depends on tension and voltage. The label on the extinguisher shows whether it is suitable for extinguishing live parts. An expert must always be warned in the case of high voltage. The current must always be switched off. If there is no residual current left, extinguishing can start in the normal fashion.



Electrical fire.

1. CHARACTERISTICS OF EXTINGUISHING MATERIALS

- Water.
- Foam.
- Carbon dioxide (CO2)
- Dry chemicals. (powder)

WATER

Water can be found (almost) everywhere in large quantities and is a good and cheap extinguishing material. The greatest extinguishing effect of water is cooling off. Water absorbs much heat from the vicinity. 1 litre of water can produce 1700 litres of steam. The steam has a smothering effect in a closed room.

EXTINGUISHING CHARACTERISTICS

When water is added to a wood fire (or a similar fuel) the effect, in principle, is the cooling of the fuel still to be burnt which stopping the vaporisation and then the extinguishing of the flames which feed on the vapour. This happens n almost the same way with certain oils, such as heavy fuel oil, lubricating oil or asphalt. They will not vaporise to any great degree under normal pressure and at normal temperatures until they are heated to a higher temperature.



Water exthinghuishing.

This indicates a high flash point. When a fire in these materials with a high flash point (>65ºC) has started, the supply of vapour is kept going because the flames continue to heat the surface causing the vaporisation to continue. The fire will continue until all the fuel is finished if no precautionary measures are taken.

However when water in the form of a fine spray is spread over the surface it will cool down, the vaporisation will stop and the fire will go out. So up until now, water is a good extinguishing agent for certain types of oils and extinguishing is handled in nearly the same way as for a wood fire or other ordinary fuels.

Cooling is a way of closing off the gasses that feed a fire of non-volatile or 'heavy' oils. Use water in the form of a spray or fine mist; never use a fixed jet on the surface of oil. Water jets are only effective at distance, because the water will spread itself into droplets over the distance. Water jets are also effective for cooling off steel tanks, pipes, constructions, etc., especially when they are high up.

However other rules are valid when inflammable liquids are involved which are volatile. (liquids with a flash point < 65ºC.)

These products produce sufficient vapours to be able to burn at 'normal' temperatures and pressure. The water which reaches the surface will not boil. It will probably sink without being heated too much; which eliminates the cooling properties. The actual cooling effect only occurs in the flames where small droplets of water will vaporise and lessen the heat.

Generally speaking water is not suitable as an extinguishing agent for gasses or volatile oil.



Boundary cooling..

COOLING

Water is used to cool and to keep cool. To protect buildings, constructions, tanks, etc. against heat or the influence of flames. Water, added in the correct fashion, (in the form of a mist or spray and in sufficient quantities, generally estimated at 10 l. per m2) cab absorb heat and prevent damage. (jet range 20 l. per m2) Water cools the best when it changes into steam.

Parts of the installation that are not visible through the smoke or flames are often forgotten but do also need protection. The available water should be used to cool the most critical parts. These could include parts of the installation that will come into contact with the flames and parts that will be radiated.

NOTE:

- Non-insulated smoke gathers in a 'cloud'. The 'cloud' could topple over when only one side is cooled.
- Hot pumps, compressors. Cracking can be formed by the shock effect of cold water on only one side.

THE USE OF WATER

Water can be used in two ways for an oil fire: Mist or spray jets and fixed jets. Each has advantages and disadvantages and its own area of application.



Waterhose nozzle.

In general; a fixed jet has the greatest reach and power, the wide jet (spray jet) has a short reach and offers the most protection to the fire fighter. A combination between fixed jet and spray jet, an in-between position, is in most cases preferred.
The intention is to get the water in the correct form to the correct place so that the maximum effect of cooling and extinguishing is achieved.



Waterhose nozzle.

ANOTHER WAY OF USING WATER

Most of what has already been explained is about the cooling effect of water. However water can also be used as a propulsion force.
The position of the oil fire is very important. Oil floats on water and overflow from a burning area can cause the burning oil to float to another area which could cause even more damage.

It could be directed to an area where it could burn without causing as much damage. This can be achieved by the combined effect of flotation power and the force of water jets.

FOAM



Foam.

Foam is also a frequently occurring extinguishing agent. Foam consists of 3 elements:

- *water*
- *foam forming agent (SVM)*
- *air*

A certain percentage of a foam forming agent is added to water with an inline conductor. Air is sucked into and mixed with the foam forming agent (premix) at the foam jet pipe. Extinguishing foam is formed.



Foam applications.

Foam is usually the best extinguishing agent for liquid fires (slick fires). Foam has several characteristics which allow it to be used as an effective extinguishing agent:

- Foam prevents heating by radiation, because the flames can be separated from the liquid.
- Foam represses the formation of vapour because a filmy layer and/or layer of foam is formed. The foam lies like a blanket on the liquid, so that gas cannot form just above the liquid.
- Foam cools. The foam mixture consists of 94 - 99 % water. This cools the upper layer of the liquid. The chance of re-ignition is very small after proper extinguishing with foam.

A disadvantage of foam is that it is broken down very quickly, depending on conditions such as heat, wind and rain, so that foam must be added constantly for a long time. The liquid can start to burn again spontaneously if the layer of foam breaks down.
Several 'foam blankets' can be created depending on the quantity of added air. The foaming capacity number is a measurement of the quantity of added air per litre of foam mixture. 3 classes are recognised:

Type of foam	Foaming capacity number	Jet range
Light foam	> 200	1,5 m
Medium foam	20 - 200	7,5 - 15 m

Light foam is used especially for fires in large enclosed areas. Heavy and medium foam are mostly used for extinguishing liquid fires. The biggest difference between the foams is the jet range (see table).

Foam can be used for many products depending on the type of foam forming agent. One of the most well-known types of foam is AFFF (Aqueous Film Forming Foam). The addition of AFFF provides a layer of film between the liquid and the air. Most foam types are also suitable for glow fires in solid matter. By adding foam forming agents the surface tension of the extinguishing water is decreased and the water is forced through better, for example, in cotton and paper.



Foam exthinguisher.

Modern foam concentrates work as they should with hard or soft, fresh or salt water. The mixing concentration of the foam foaming agent and water can differ from approx. 1% to 6%. This depends on the supplier and the nature of the inflammable liquid. So always follow the supplier's instructions and those on the equipment producing the foam.

CARBON DIOXIDE GAS (CO2)

The extinguishing agent CO2 is a non-flammable and non-toxic gas that represses oxygen. CO2 is always stored at a pressure of approx. 65 bar. 1 kg CO2 expands to 500 litres of gas during extinguishing.

Because of the great cooling that occurs, carbon dioxide snow at a temperature of - 80oC is released as well as CO2 gas. The carbon dioxide snow vaporises quickly into CO2. Carbon dioxide is suitable for various fires in the flame stage. The



CO_2 exthinguisher.

chance of re-ignition is large because it does not cool, with powder as well.

CO2 has the clear advantage of not being *electrically* conductive and causes almost no additional damage. Therefore it is very suitable for fires in electrical and sensitive equipment. A disadvantage is that not only the fire will be smothered but also persons.

This will only cause problems when used in large quantities in small areas. When used *in the outside air* the carbon dioxide will blow away quickly, the extinguishing effect is then small.

Carbon dioxide is not suitable for metal fires. Because during *metal fires* there is a violent reaction between the metal and the CO2 which would make the fire even worse. CO2 is used in fixed installations or in portable extinguishers.

POWDER

The extinguishing effect of powder is realised by the interruption of the reaction between fuel and oxygen. That is why the flame-interruptive action of the powder is spoken about. Furthermore ABC powders that form a crust over the fuel have a cooling effect. Powder has a long-life, is non-toxic in low concentrations and does not conduct electricity. Powder is namely suitable for liquid and gas fires.

Extinguishing powders consists mainly of salts. Extinguishing powders can be used for various types of fuel depending on the composition. The most important components are:

natrium/potassium bicarbonate, for class B and C;
mono-ammonium phosphate, for class A, B and C;

A and D powders form a (melted) layer on the burning matter and disrupt further combustion. B



Powder exthinguisher.

and C powders work as negative catalysts and break the flames down.
In enclosed spaces and especially when sensitive equipment is set out, the powder will cause must additional damage because the fine powder gets everywhere and is corrosive. The damage caused by the powder can sometimes be more than the fire damage. It is then better to use another extinguishing agent.

	A	B	C	D		F
	Fires involving freely burning materials. E.G. wood, paper textiles & other carbonaceous materials	Fires involving flammable liquids.E.G. petrols and spirits NOT ALCOHOL OR COOKING OIL	Fires involving flammable gases. E.G. butane and propane	Fires involving flammable metals. E.G. magnesium and lithium.	Fires involving electrical equipment E.G. photocopiers, fax machines and computers	Fires involving cooking oil and fat E.G. olive oil, maize oil, lard and butter
Water	✓					
Foam	✓	✓				
ABC Dry Powder	✓	✓	✓		✓	
Dry Special Powder				✓		
CO_2 Gas		✓			✓	
Wet Chemical	✓					✓

2. FIRE PREVENTION

SPECIFIC DANGERS

On a platform there is a (large) concentration of persons and equipment combined together in a small area. Industrial installations, accommodations, electricity provisions, hotel facilities and a helicopter deck all in close proximity. Specific risks are the nature of the work and the presence of dangerous materials.
The safety on a platform is under pressure:



Platform construction.

- inflammable liquid (raw oil) under pressure (up to 200 bar) can be released during an incident;
- large quantities of dangerous liquids are stored on some platforms;
- considerable quantities of dangerous materials are also used in many processes;
- the risk of leakage of gas or liquid is present because of the many processes and installations;
- work is carried out on the installations around the clock.
- large quantities of gas under very high pressure

When an incident occurs they are however *on their own and reliant on their own materials*. A high level of safety is imperative. Training is therefore indispensable.

CONSTRUCTION REQUIREMENTS

Safety guidelines have been set out to ensure that the spread of fire remains limited during an incident. And further that the safety of those present is guaranteed as much as possible, that they can escape if necessary and that the fire can be fought. The necessary provisions can be included when the platform is designed and built. The guidelines are stated in the ISO and EN standards and in the MODU code for drilling platforms and the IMO FSC (Fire Safety Code) code for ships.

A platform can be divided into a number of fire compartments. A production platform and an accommodation platform can be 'separated' from each other in this way. The intention of the compartmentalisation is to limit the spread of fire as much as possible. Compartmentalisation is achieved by placing partitions which are classified as follows:

Compartimentering	
Klasse A	Brandwerend
Klasse B	Brandvertragend
Klasse C	Onbrandbaar
Klasse H	Bestand tegen 'hydrocarbons'

Partitions of different strengths can be placed depending on the degree of compartmentalisation. In class A, B, and H the number after the letter shows how long (in minutes) the partitions are fire-resistant or fire-retardant. After the stated number of minutes the rise in temperature on the side not exposed to fire is so high that the fire will spread by means of fire transport. The fire will no longer be resisted / delayed by the partition.

H-120 is used especially as a partition wall between production platform and accommodation. This wall

is resistant to the extreme heat of a liquid fire for 2 hours.

Material with different characteristics will *react to fire* differently. During fires material can be exposed to high temperatures, smoke gasses, possible explosions and sudden cooling (with extinguishing). This can lead to:

- loss of capacity
- heat tension / expansion
- change of shape

A platform consists largely of *steel* which has the ability of absorbing and conducting heat quickly. In a short space of time a large of build-up of heat will be created when there is a fire. Through this the chance of it spreading is greater than in a 'normal' house fire. Steel is extremely strong but will soften quickly at temperatures above 300oC. At 500oC steel has lost half its strength and will collapse. The time necessary to reach the point of collapse is called the *collapse time*. The collapse time depends on the thickness of the steel and the intensity (energy) of the fire. During a pressure fire (fire where the fuel under pressure is freed) softening will occur quicker than during a slick fire / open fire. An indication of the collapse time can be found in the table:

Structuur	Plasbrand	Drukbrand
Constructiestaal 60 mm	30 min	12 min
Constructiestaal 25 mm	13 min	5 min
Constructiestaal 12 mm	6 min	2,5 min
Constructiestaal 5 mm	2,5 min	1 min



Blow out Global Santa Fe.

The greatest enemy during an incident is the time factor because of the enormous quantities of steel used in the construction of a platform. It is important to assess the situation quickly so that the correct (cooling) actions can be started.

Wood behaves completely different during a fire. Change of shape and loss of capacity occur much slower causing the spread of the fire to also be much slower. Wood burns at a speed of 4 cm per hour in a fire developed normally.

PREVENTION

The start or the spread of a fire on an offshore installation or ship should be prevented in the earliest stage possible.
That is why all the personnel on installations or ships should know the emergency procedures in the case of fire.

The fire procedure must be reported in the Contingency Plan and must be explained to the personnel. Written procedures are required on the installation to provide the personnel with a guideline in the case of fire or an explosion. It should also be mentioned here that no two fires are ever the same. There are so many variable factors that it is not possible to put together guidelines on how a fire should be extinguished. It is however possible to provide general rules for each type of fire. The first thing required in fire prevention is well-trained personnel in the fields of 'blow out' prevention,

preventive maintenance of material and the maintenance and use of fire fighting equipment.

TRAINING

Training and practice in fire safety is most important. Correct training can prevent fire starting or spreading. When a fire starts it means that something has gone wrong at a certain stage. Sometimes the fire can be blamed on a fault or an omission in the design but it is usually related to human failure. Consider work, maintenance, messy work places, smoking in bed, etc.
Correct training can limit the development of fires.

The following parts should be practised or attended at least every 7 days:

- Alarm procedures.
- Communication.
- Work procedures.
- Instruction about the various types of fire.
- Training with various sorts of extinguishing agents.
- Special courses.
- Use of fire equipment.



Fire drill.

Also important:

- Periodical medical training.
- Reporting all dangerous situations:
- To prevent emergency situations.
- The return to a safe situation.
- Learning moments. How and when can it happen?

Prevention also involves a good household policy and adequate execution of work, for example attention to welding and other 'hot' work.
Think when you are doing something like smoking in bed or in other places, throwing away matches or burning cigarettes.

Manpower is restricted on installations and that is why it is essential that everyone is alert to the risk of fire and has knowledge of the necessary preventive measures, extinguishing equipment and First Aid materials.
Specially trained teams of fire fighters are necessary to fight large fires.

Every person on board must familiarise himself with the extinguishing equipment available and how to use it and its location. Report missing, damaged or used extinguishing equipment to the Safety Officer. In this case they must be replaced immediately. All extinguishing equipment and breathing protection must be in good condition and ready for direct use.

FIRE FIGHTING PLAN

These plans show a map of the installation or the ship in relation to the fire safety rules and fire fighting equipment. Moreover they include important information about fire fighting on board.



Safety Paln J6A Living quarters 1 st Floor.

INFORMATION ON THE FIRE FIGHTING PLAN:

- Position of the water-tight doors.
- Exits.
- Emergency exits.
- Emergency stop knobs for the ventilation. (machine room, accommodation, pump rooms, etc.)
- Fire extinguishing pumps.
- Fire hose connections.
- Type and position of the fire extinguishing agents.
- Position of the international dock connection.
- Position of the alarm equipment.
- Position for operating the fixed extinguishing installations.
- Position of personal fire equipment.
- Assembly places

This information is generally given by symbols on pictograms. The meaning of the symbols is explained in the key. Everyone on board should get to know the plan and should orient themselves as soon as they come aboard. So that they become familiar with the escape routes, locations of the extinguishing agents, etc. because quick and efficient work is essential in the case of emergency.

WATERTIGHT DOORS AND EXITS

All the doors must be shut in case of fire or a fire drill. This is extremely important because combustion always needs oxygen which could flow through open doors.

TURNING OFF THE VENTILATION

The ventilation must also be switched off for the same reason. The shutters must also be closed after the ventilation is turned off. The ventilators must be turned off:

a) Nearby the ventilator.

b) As indicated on the fire fighting plan.

FIRE EXTINGUISHING PUMPS AND EMERGENCY PUMPS

Fire extinguishing pumps are usually to be found in the main machine room. The number and capacity of pumps must comply with the prescribed requirements. The emergency pumps must be situated far away from the normal fire extinguishing pumps.



Fire water pump.

FIRE HOSES

The number, the size and the length of the hoses is prescribed in the regulations. Fire hoses on an open deck must have a diameter of at least 55 mm and are the so-called 'two thumbers'. Narrower fire hoses are permitted in the accommodation.

FIRE HOSE CABINETS

These are equipped with:

- A fire tap.
- A hose and a jet pipe.
- A hose connection.

These cabinets must be positioned so that all parts of the ship or installation can be reached with at least two jets of water.



Fire hose sation.

JET PIPES

The jet pipes are usually adjustable. They must be able to alter a fixed jet of water into a spray mist when adjusted. The spray can be adapted into a fine mist.

DETECTION

One of the most important standards for fire safety is the detection a fire or a risk of fire situation as soon as possible. This offers the opportunity of taking fast action to prevent the fire or to extinguish it in an early stage.

Detection consists of testing the air composition in the area where an inflammable material is (a gas leak for example) and tracing a fire. An alarm system should warn in both cases. In the first case whether there is an explosive mixture present for which the emergency valves should be activated and the ventilation switched off. And in the second case that fire or combustion products are detected.



Fixed gas detection.

FIRE ALARM AND FIRE DETECTION

1. Depends on:
   - The construction of the installation.
   - Possible source of the fire.
   - Number of persons in an area.

2. Why:
   - To be able to localise the fire quickly
   - To fight a fire.
   - To evacuate persons.
   - To restrict damage.

3. Where:
   - All areas where persons work.
   - Unmanned areas.

4. Alarms:
   - Which type for what purpose.
   - Not general.
   - What actions to take.

THERE ARE VARIOUS ALARM SYSTEMS IN USE.



Fire and Gas Cabinet.

The sort of fire alarm and fire detection system chosen depends on the:

- Control rooms and power provisions.
- The fire extinguishing control system.
- Detection.
- Alarms:
- The automatic fire extinguishing system.

ALARMS:



Fire push button and staus light.

There are different alarm statuses, namely:

1. Alarm announced over the public adress system.
2. General gas alarm (low and high gas alarm).
3. General fire alarm.
4. Emergency Shut Down ESD.
5. Abandon platform alarm.



Shut down, fire pump and fire exthinghuis panal.

CONTROL ROOM

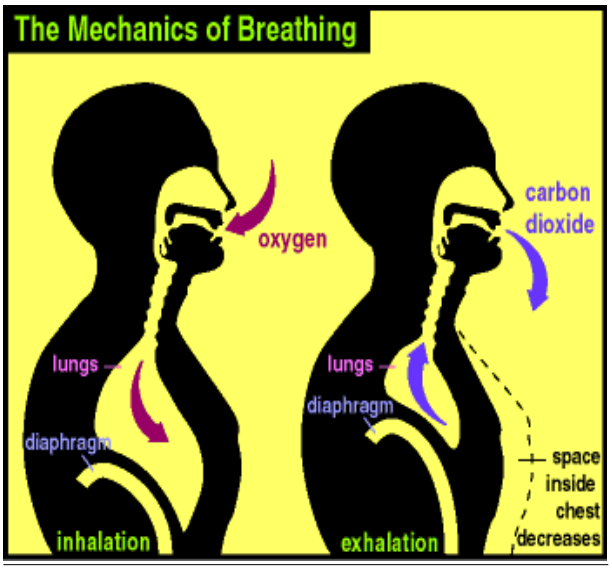
From the control room the alarms and fire fighting systems can be activated. Nowadays the platforms are equiped with sprinkler sytems in the accomodation. In the proces area's and well heads we find deluge systems. The purpose of those deluge systems are to prevent explosions and during a fire to prevent material damage.



Fire deluge sytsem.

3. BREATHING PROTECTION

THE BREATHING PROCESS



The Mechanics of Breathing.

The unrestricted inhalation of air (of the correct composition) is vitally important. The breathing organs consist of the airways and lungs and alveolus. The airways are for transporting air to and from the alveolus. The lungs are surrounded by the diaphragm (a flat sheet of muscle) underneath the ribs. Ribs and diaphragm have a function in breathing.

THE CARBON DIOXIDE CONTENT (CO2)

A group of nerve cells in the brain (the breathing centre) controls breathing. These cells react to the CO2 content in the blood. The exhaled air contains more CO2 and less oxygen than inhaled air. Carbon dioxide gas is formed in the body by (slowly) burning certain proteins. Oxygen is used during burning which is extracted from the blood. The body takes its energy from the burning. The composition of air during inhalation and exhalation.

	In	Uit
Stikstof	78%	78%
Zuurstof	21%	17%
Koolzuurgas	0,03%	4%
Andere (edele) gassen	0,5%	0,5%



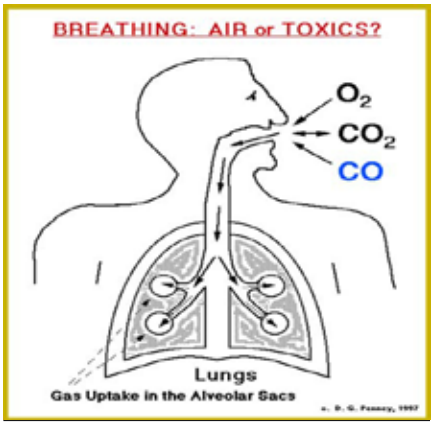
Lungs gases.

DANGEROUS SUBSTANCES IN THE SURROUNDING AIR DURING COMBUSTION

During a fire dangerous substances such as dust particles, vapour and gasses appear. Dust particles interfere with the lung function. (they damage the alveolus)

Vapours and gasses can be dangerous because:

- They can drive away the air. (lack of oxygen)
- They can damage the alveolus and the blood. (interfere with the gas exchange in the lungs)
- They can damage the nervous system. (paralysing the breathing muscles)



Breathing air or Toxics.

GASSES AND VAPOURS WHICH COULD HAVE A DAMAGING EFFECT

With a smothering effect:

- Carbon dioxide. (CO2)
- Methane.
- Butane.
- Propane.
- Nitrogen

With a damaging effect to the nervous system and the blood:

- Carbon monoxide. (CO)



CO.

- Hydrogen sulphide.
- Benzene.
- Benzene.
- Hydrogen cyanide.
- Toluene.

Substances with a corrosive effect:
Smoke.
Ammonia.
Sulphur dioxide.
Bromine and Chlorine.
Hydrogen chloride.

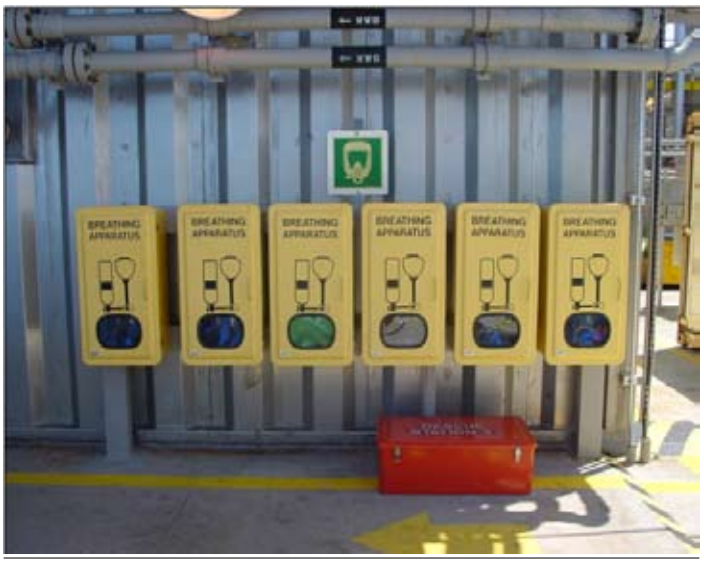
LACK OF OXYGEN

Our breathing rate at rest is 15 – 20 times a minute. The volume of the inhaled air can be divided into three amounts.
1. Amount for normal use. (at rest ± 0.5 l.)
2. Extra inhalation volume. (± 3 l.)
3. Residual volume after exhalation (dependant on age, condition, smoker, etc.)

BREATHING PROTECTION

The following breathing protection equipment is in use:

- Dust masks.
- Filter tube masks. (escape mask)
- Overpressure masks. (constant supply of air)
- Breathing masks.



H_2S Escape and rescue Breathing Apparatus on Rig floor.

Our lungs can breathe at an atmospheric pressure of ± 1 bar. Any increase or decrease of the pressure can have a disadvantageous effect on the breathing function.

The pressure is decreased by the constant pressure regulator when an overpressure mask is worn, so as on the drilling floor.

BREATHING MASK (ESCAPE SET) (INDEPENDENT BREATHING PROTECTION)

Inhaling compressed air is dangerous. The risk of decompression sickness exists with a limited over-pressure. The risk of inflation and then tearing of the alveolus exists with a higher over-pressure. That is why a reducing valve and respirator decrease the pressure of the air to a few millibars when breathing air is used. The pressure is automatically reduced in



Escape sets 10 minutes.

escape sets with independent breathing protection after activation or opening the air cylinder. The air supply is limited to a maximum 10 or 15 minutes. Follow the supplier's instructions when using.

ESCAPE MASK



Escape set.

An escape mask offers protection from smoke and dangerous gasses. Even though the mask contains a filter the amount of oxygen in the air must be above 17%. Another risk is the lack of an indicator on the mask that shows how long it offers protection for. Depending on the amount of gas and/or smoke the filter will become saturated with toxic vapours at some time and will offer no more protection. Follow the supplier's instructions when using. In the Offshore it is common use that in every cabin in the accomodation a escape set is present. The escape set consist out of the following equipment:

- Escape mask
- Fire retardant gloves
- Lamp or lightstick



Smoke hood.

Therefore the escape mask is only suitable for a quick escape attempt, for example to a lifeboat. If you use an escape mask through smoke you need to consider the following:

Escape without an escape mask:

- move into the wind
- at a fast pace
- use a safe route
- stay low
- follow instructions

Escape wearing an escape mask through smoke:
Walk:

- Feel for the ground with your foot before putting your weight down. (prevents falling and collisions)
- Keep in contact with the walls. (recognise the route)
- Hold one hand at eye level. (head protection)

Climbing stairs:

- If possible walk alongside the walls.
- Feel for the treads.

Going downstairs:

- If possible walk alongside the walls.
- Walk backwards.
- Feel for the treads.

Opening doors.

- Stay low on the ground.
- Take cover behind the door or wall.



Walking techniqs.



Stairway.



Doors.



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