

The Dutch Labour Inspectorate is part of the Ministry of Social Affairs and Employment

Diving Work: Managing the Risks
Working safely above and under water



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The main occupational risks in the diving sector

This brochure describes the main occupational risks affecting diving work. It contains information on what you need to do and what the Dutch Labour Inspectorate (DLI) and the State Supervision of Mines (SSM) will be looking for during inspections. Investing in good working conditions will benefit the health of both your employees and your company or organisation.

The main occupational risks affecting diving relate to:

- **working under overpressure** page 14
- **set up of dive locations** page 20
- **safety of equipment** page 23



There are other risks too, such as exposure to hazardous substances and biological agents in polluted water, excessive physical loads as well as working hours and rest periods. These issues are discussed under Other Risks on page 27.

When conducting inspections, the DLI and the SSM specifically monitor the occupational risks associated with these areas of work. This brochure will help you ensure that you are well prepared for such inspections. Other matters are inspected as and when deemed necessary by the DLI and the SSM.

The first part of this brochure relates to:

- your obligations as an employer;
- how an inspection is carried out.

The second part provides:

- a description of the main occupational risks in your sector;
- the inspection standards per occupational risk;
- references to legislation and other tools which will help you comply with the regulations.

Health and safety: your responsibility

As an employer, you are responsible for implementing the best possible working conditions policy. To this end, you must structure the work to ensure that it does not negatively impact on the health or safety of your employees. Recognising the risks is an important component, as it helps you find solutions to improve working conditions. This can be done by conducting a risk assessment and evaluation (RA&E).

RA&E and action plan

The RA&E is obligatory for every company and every organisation. The results of the RA&E form the basis for your action plan which can be prepared either by you or by a third party. You must submit your RA&E and the action plan for assessment to an accredited expert, i.e. an expert attached to your company or organisation or a certified health and safety organisation.

Different rules apply to companies with a maximum of 25 employees. No expert assessment is required in such cases. Instead, you must use the RA&E instrument provided in the collective labour agreement specifically designed for your sector.

In the action plan, you should outline:

- what improvements you propose to make;
- what improvements have priority;
- when the improvements will be implemented;
- who is responsible for the implementation.

When considering improvements, the following points are important:

- Risks must be removed at source wherever possible.
- If the risks cannot be removed at source (for technical, organisational and/or financial reasons), you will need to take measures to benefit all employees. With respect to ship inspections, for example, make arrangements with the captain and/or use visible marking on the water to warn seagoing traffic.
- In some cases, you will not be able to remove risks at source or take general precautionary measures. In such cases you must make personal protective equipment available to the employees and ensure that it is used by the employees.

This approach is known as the exposure assessment strategy.

Hiring divers

If you hire a diver and the diver uses his/her own diving equipment, you must ensure that this equipment provides adequate protection for the job at hand.

Visits from the DLI or the SSM

Two supervising bodies are charged with monitoring working conditions in relation to diving work: the DLI and inspectors from the SSM. The SSM is the supervising body for work directly or indirectly connected with the mining industry (opencast mining, underground mining industry and the mining industry involved in mining of minerals by drilling). In other situations, the DLI is the supervising body.

What does an inspection involve?

The inspector monitors your working conditions policy on the basis of the Working Conditions Act and regulations. At the beginning of the inspection, the inspector will usually ask if a member of the works council or a staff representative wishes to attend the inspection. This right to be present is laid down by law. Moreover, the works council has the right to meet with the inspector without you, the employer, being present. The inspection usually takes place at a dive location, where such a meeting is not always possible. Administrative inspections are also conducted. The inspector's job here is to check that you have a system for recording the process and/or whether you have any (policy) documentation for monitoring the working conditions.

The inspection is carried out as follows:

- At the place of work, the inspector monitors your compliance with the rules governing the main occupational risks.
- The inspector discusses his/her findings with you or your representative. It is possible that you comply with all your obligations, but if you fail to do so, in full or in part, you will need to make further compliancy arrangements with the inspector.
- The inspector will keep a written record of breaches which may be in the form of a warning or a demand. In the case of some breaches, the inspector may draw up a fine report and you will be fined on the spot.

This brochure deals with the main risks facing your sector. However, there may also be other specific rules or risks affecting your company or organisation, for example in the case of a diving assignment under extreme weather conditions. Such risks must also be recorded by you in the RA&E and the action plan and appropriate measures must be taken to reduce or remove such risks.





Your compliance with the obligations is poor or unsatisfactory

The approach that the inspector adopts will be 'tough where necessary, lenient where possible'. In practice, it works as follows. An inspector assesses the potential danger involved in the breach and the overall situation in a company. If the breach represents a great hazard to employees, the inspector's approach will be formal at all times, regardless of the situation in the company. If the breach does not represent a direct risk, the inspector will assess whether health and safety and the working conditions policy are generally well organised. If they are, you will be given the opportunity to remedy the breach(es) yourself. If not, you will receive a warning or a demand from the inspector. You receive a warning when it is immediately apparent how to deal with the breach. If this is not the case or if there are several measures or solutions for remedying the breach, you will receive a demand. In making the demand, the inspector will specify the exact action you need to take in order to comply with your obligations.

Following a warning or a demand, you will be given a period of time within which to remedy the breach. This is monitored at all times and failure to remedy the breach on time will result in a penalty. You will always be given the opportunity to respond to a demand or a penalty. You are also entitled to lodge an appeal.

In the event of a serious breach, the inspector may impose a penalty and suspend the work (temporarily) until such time as the breach has been remedied. In the case of diving work, for example, this may be due to the compression chamber being too far from the dive location. The inspector will stop the work if it is believed that people are in serious danger. Once the hazard is removed, the work can proceed.

The severity of the penalty depends on the seriousness of the breach and the size of your company or organisation. Small companies or organisations pay smaller fines than their larger counterparts. Fines due to an accident are higher than for 'ordinary' breaches. In the case of a criminal offence, the inspector will draw up an official report and you or your company may end up in court.

Employees may also be subject to a penalty if they consciously ignore or fail to comply with the safety measures. Examples include:

- failure to wear supplied personal protective equipment;
- use of personal protective equipment for reasons other than those intended;
- deliberate removal of safety measures for machinery or equipment.

What else do you need to know

Hiring self-employed persons without employees

Employers in the diving sector often hire self-employed people with no personnel. If self-employed persons without employees carry out work under your authority, such persons are regarded as your employees under the Working Conditions Act. This means that they are subject to all the regulations in the Working Conditions Act.

Information, instructions and supervision

As an employer, you are obliged to inform your employees about the risks associated with their work. You are also required to instruct them on the measures that can be taken to eliminate or reduce such risks. In short: you must give your employees good instructions on how to work as safely as possible and how to minimise health risks. This will help avoid and limit accidents, absenteeism and standstill in your sector.

As an employer you must also monitor compliance by your employees with the relevant instructions and regulations. Your employees also bear a responsibility in this regard. They must exercise due caution and care in carrying out the instructions. If your employee commits a serious breach in full knowledge (via information and training) that this constitutes a breach, the inspector may well fine your employee.

Prevention officer

Each company or organisation must appoint a prevention officer or designate someone within the company or organisation who will be responsible for the prevention tasks. This officer plays an important role in preparing the RA&E and the action plan. The prevention officer may also provide information on working conditions and assist in the investigation of any accidents that occur in your company or organisation. If you have a maximum of 25 employees, you as the employer may perform the task of the prevention officer.

Company emergency response planning

The inspector may also inspect your emergency response procedures. The emergency response provision forms part of your RA&E and action plan and you are required to have a minimum number of procedures in place at all times. For example, depending on the size of your company or organisation and the risks involved, one or more employees must be trained as the emergency response provision team (CERT). Each member of the team should be trained to deal with one or more of the emergency response tasks (first-aid in case of accidents, fire extinguishing and evacuation). The entire CERT organisation must be capable of dealing with these three emergency response tasks.

You can also organise the CERT jointly with other companies or organisations in the workplace.

System inspection

It is possible that your procedure for ensuring safe working conditions is inadequate. If the inspector feels that this is the case, he will carry out a system inspection. The inspector will conduct a number of interviews with you and with a number of employees and managers if necessary. The inspector may also wish to view or check company documentation. At the end, the inspector will discuss the results with you. If the inspector's presumption is correct, you will receive a demand and will be given the opportunity to modify your approach.

Complaints

Sometimes, the supervising body receives complaints with respect to the working conditions in a company or organisation. A complaint will be investigated only if received from an employee (or a relation/acquaintance or legal representative of the employee) or a trade union. Complaints or suggestions from other parties are not generally investigated by the supervising body, except where people are thought to be in serious danger.

Reporting accidents

Accidents occur on a regular basis in the diving sector, some serious or even fatal. You are required to report serious accidents to the supervising body immediately. These relate to fatal accidents or cases where the diver is hospitalised or suffers permanent injuries. Accidents in the mining industry must be reported to the SSM. All other accidents must be reported to the DLI. In the event of an accident, the SSM or the DLI will conduct an investigation.

The telephone numbers for your region are available on: www.sodm.nl and www.arbeidsinspectie.nl.

Diving work must be reported

Diving work is high-risk and you must report certain diving operations to the SSM or the DLI, for example diving work involving:

- depths of in excess of 9 metres;
- current speeds of in excess of 0.5 m/s;
- planned decompression;
- use of breathing gas other than air;
- dives for periods in excess of one week;
- dives for the underground mining industry or the mining industry where mining is by drilling.

You must report the work in writing and give at least five working days' notice. This is not always possible, for example where firefighting divers or other divers are called in to deal with emergencies. However, such matters must be reported as soon as possible.

For diving work related to the underground mining industry or the mining of minerals by means of drilling, information must be supplied at all times with respect to the safety and health risks at the dive location.

More information about notifications and notification forms is available on: www.sodm.nl and www.arbeidsinspectie.nl.

Composition of diving team

Besides the diver, a diving team must include a reserve diver, a diving supervisor and someone who is trained to advise the diver medically. Such people must be accredited by an approved institute. The function of the diving supervisor and the diver's medical adviser may be combined but the diving team must always consist of three persons.

There is one exception. The diving team may consist of two people if the work meets the following conditions:

- the liquid consists mostly of water; and
- the maximum accessible depth is nine metres; and
- the maximum current speed is 0.5 metres per second; and
- there is no foreseen risk of the divers experiencing difficulties in the liquid.

The diver is also expected to undergo a medical examination to assess his/her fitness for the job at hand. The medical examination must focus on the particular health risks involved in diving work of this kind.

Certification of diver

The members of the diving team (diver, reserve diver, diving supervisor and the diver's medical adviser) must be duly accredited for performing the work in question.

The doctor in charge of conducting the relevant medical examination must hold a diving doctor B cert for the initial medical examination and for repeated medical examinations, the doctor must hold a diving doctor A or B cert.





Approved certification institutes

The approved certification institutes for diving work in the Netherlands are:

- ▶ Nationaal Duikcentrum (NDC)
- ▶ On behalf of the Ministry of Defence: Defensie duikschool (DDS)
- ▶ On behalf of the Ministry of Interior Affairs and Kingdom Relations: Nederlands bureau brandweer examens (Nbbe – Dutch Fire Examinations Agency)

Occupational diseases

Any occupational diseases within your company or organisation must be reported by your company doctor to the Netherlands Centre for Occupational diseases (www.beroepsziekten.nl).

Your sector, the diving sector

Diving work is carried out for both the commercial and the public sector, as outlined below:

Diving work in the business sector

- offshore: incl. construction, maintenance and inspection work on drilling and production platforms;
- road and hydraulic engineering: incl. construction, maintenance and inspections of bridges and navigation locks;
- construction: incl. pouring of underwater concrete;
- salvage of (ship) wrecks (onshore and offshore);
- ship maintenance: inspections, maintenance, repairs and cleaning operations.

Public sector

- defence: diving activities for military purposes, detection, removal and decommissioning of explosives;
- fire service: assistance in protecting humans, animals and the environment;
- police: search and surveillance;
- customs: detection and control;
- science: archaeological and marine-biological research.

Other companies such as:

- zoos: cleaning and maintenance of aquariums;
- swimming pools: repair and maintenance;
- diving sport schools: diving instruction to sport divers.

The Working Conditions Act applies to all sectors.

Some 2,250 divers are employed in the diving sector in the Netherlands, mostly in the fire service. Of this figure, about 1,200 (mainly voluntary) firemen also work as fire service divers. Despite this high number, the diving work in which fire service divers are involved each year is rather limited, representing only a secondary task.

About 500 people work as professional divers for a private diving company or else are self-employed with no personnel. The Ministry of Defence has about 400 divers who work for the Royal Netherlands Navy and the Royal Netherlands Army. The other professional divers are employed by the Police, Customs, the Directorate-General for Public Works, Transport and Water Management, zoos, scientific institutions and underwater sport schools.

Diving work is usually carried out at locations that by definition do not represent a natural environment for humans. Working in a liquid or in a dry diving bell is only possible if the operator has a supply of breathing gas. Conditions such as poor visibility, cold temperatures and water current all add to the hazards, and it is for these reasons that diving work is regarded as high-risk. The obligatory reporting of accidents since 2000 underlines this fact: of the 19 accidents (10 in the commercial sector, 8 in the public sector and 1 in other companies) at least 8 resulted in fatalities. This is a very high figure for a group of 2,250 divers.

The following organisations are important in the diving sector in the Netherlands:

- ▶ Nationaal Duikcentrum (NDC), www.ndc.nl¹.
- ▶ Nederlandse Associatie van Duikondernemingen² (NADO), www.ndc.nl/nado
- ▶ Trade association for self-employed persons (with no employees) in the diving industry, www.nederlandseverenigingvanberoepsduikers.nl
- ▶ International Marine Contractors Association (IMCA), www.imca-int.com
- ▶ Kenniscentrum defensie duikschool³ (KC DDS), www.marine.nl

And for the fire service:

- ▶ Nederlandse vereniging voor brandweezorg en rampenbestrijding⁴, www.nvbr.nl
- ▶ Nederlands bureau voor brandweereexamens⁵ (Nbbe), www.nbbe.nl
- ▶ Nederlands instituut fysieke veiligheid⁶ Nibra, www.nifv.nl

¹ National Dive Centre, ² Dutch Association of Diving Companies, ³ Defence Diving School Knowledge Centre, ⁴ Netherlands Association of Fire and Disaster Control Services, ⁵ Netherlands Bureau for Firefighting exams, ⁶ Netherlands Institute for Physical Safety



More on the main occupational risks

This part of the brochure takes a closer look at the main occupational risks in the diving sector, with regard to the Working Conditions Act. The risks described relate to:

- working under overpressure;
- ensuring the dive location is safe and secure;
- safety of work equipment.

Other risks briefly considered are those associated with exposure to hazardous substances and biological agents, physical loads, working hours and rest periods.

We discuss what the occupational risks comprise, the potential consequences for the health and safety of your employees and the minimum action you need to take to prevent these consequences. This is an aspect that will be checked during inspections by the DLI and the SSM. Finally, we provide references to legislation and regulations that may help you comply with the provisions of the Working Conditions Act.

How are the main risks determined?

The DLI and the SSM define the main occupational risks on the basis of:

- the accident figures for your sector;
- figures for occupational diseases (occupational disorders);
- estimated figures for risks by the DLI and the SSM;
- inspection results.

The supervising bodies will also have consulted the employer and employee organisations in your sector.

Working under overpressure



For humans, diving is an unnatural occupation for which the human body is not designed. The higher pressure to which the diver is exposed underwater directly affects the functioning of the body and the breathing gas inhaled by the diver. The human body can only work with aids in such situations. To breathe alone, the diver is totally dependent on diving aids.

Diving work is defined by the Working Conditions Act as: “the performance of work in a liquid or in a dry diving bell including the period within which the diver remains in the liquid or in the dry diving bell, aided by a breathing apparatus which depends on the supply of a gas under higher pressure than the ambient pressure.”

What are the risks?

Diving diseases

Diving diseases are the principal occupational risk associated with diving work. A distinction is made between primary and secondary diving disease, decompression illness and other conditions

- Primary diving disease (barotrauma) refers to pressure-related injury that may be sustained in body cavities (e.g. ear and nose) when a person is underwater. Under or overpressure occurs in body cavities relative to the ambient pressure. Such injuries are the result of pressure fluctuations and may occur when the diver descends or surfaces. An underpressure-barotrauma ('squeeze') can occur, while descending, in the natural body cavities (nasal sinuses, auditory organs and [rarely] lungs). The pressure in the body cavities then falls below the ambient pressure. Underpressure barotrauma may also occur in artificial cavities (dental fillings). When the diver surfaces, the opposite is the case and overpressure barotrauma may occur. The higher pressure in the body cavities can cause tearing in sensitive and soft body tissues, such as the lungs. This may be life-threatening.
- Secondary diving disease is caused by too high or too low partial pressure from a gas from the breathing gas mixture. The various gases in inhaled air each have a different effect on the functioning of the body. The symptoms linked to secondary diving disease are generally poisoning and narcosis. Examples of secondary diving disease include: nitrogen narcosis, oxygen poisoning or deficiency, carbon dioxide (O₂) poisoning or deficiency.
- The most prevalent diving disease is decompression illness. With decompression illness, nitrogen bubbles in the bloodstream cause the blood flowing through body parts to cease temporarily or completely. During a deep dive, the diver's body takes in inert gas(es) due to the influence of the prevailing high pressure. The inert gas particles are absorbed by the body. Under fixed pressure levels, the diver will experience no problems with the gas intake but on surfacing, the falling ambient pressure will cause the compressed inert gas absorbed by the body to expand, thus producing gas bubbles. Decelerated surfacing allows for the adequate exchange of gas from the body. If the diver surfaces too fast or if an inadequate exchange of inert gas from the body occurs, this may lead to decompression illness.
- Other conditions include: falling body temperature (hypothermia), increased body temperature (hyperthermia) and disorientation.

Every year, the Diving Medical Centre of the Royal Netherlands Navy deals with between 20 and 30 diving incidents. On average, six of the victims involved in these incidents suffer a serious form of decompression illness.



Incorrectly measured or contaminated breathing gas

Another risk facing divers relates to incorrectly measured or contaminated breathing gas. In normal circumstances, breathing gas comprises about 21% oxygen (O₂) and 79% nitrogen (N₂), plus negligible traces of other gases and substances. During diving work, the diver will breathe compressed breathing gas. This breathing gas is drawn from the ambient air by compressors and compressed in pressure cylinders or supplied directly to the diver via an umbilical hose. During the compression process, the breathing gas may become contaminated due to contaminated ambient air or defective compressor equipment, for example. The pressure cylinders or bottles may also be contaminated on the inside due to corrosion or other reasons.

In some situations, a gas mixture other than air is used. Reducing the nitrogen content in the breathing gas or increasing the oxygen content helps reduce the risk of decompression illness and allows for diving times to be increased. This may be useful for certain operations. Nitrox is also used. This is a gas mixture whereby the ratio of oxygen and inert gas is adapted so that the oxygen is always higher than with ordinary compressed air.

Neither air nor Nitrox is a suitable breathing gas for diving at greater depths. Due to the high partial nitrogen pressure, the diver becomes less productive and may suffer nitrogen narcosis. If the diver dives to depths below 50 metres, the gas mixture Heliox or Trimix may be used. These gases allow for the nitrogen to be wholly or partly replaced by Helium (He). The mix ratio of the breathing gas is adjusted, also to avoid oxygen poisoning. Use of Heliox causes the diver's voice to change, making communication more difficult. The diver also loses body temperature more quickly with the use of Helium in the breathing gas and may therefore require extra heat through a hot water suit.

What do you need to do?

As an employer, you are responsible for organising the work in a manner which eliminates or reduces the risks as far as possible when working under overpressure. A first step is the obligatory risk assessment and evaluation (RA&E). In the RA&E, you draw up a clear list of the occupational risks associated with the planned diving work. Based on the RA&E, you then prepare an action plan to eliminate or reduce the risks. Now you can prepare proper work instructions. In these work instructions, you must clearly describe the safety measures and emergency procedures which are in place or need to be put in place for personnel at the work location.

Work instructions

The work instructions must incorporate the safety measures and the emergency procedures, including:

- responsibilities and powers;
- equipment and maintenance;
- diving procedures;
- selection of reserve diver;
- measures and procedures to deal with varying conditions;
- guidelines for decompression;
- reporting accidents and medical assistance;
- composition and usage of first aid equipment.

Diving equipment

If you supply your employees with diving equipment, you must consider:

- the risk of the diver losing communication with the diving supervisor;
- problems that may arise when the diver enters and emerges from the liquid;
- problems that may arise when the depth and the exact location of the diver are unknown;
- the risks of hypothermia and hyperthermia for the diver;
- managing and monitoring the quality and quantity of the breathing gas;
- inspection and maintenance of all equipment, such as breathing apparatus, compressors, diving cylinders and air supply hoses.





Breathing gas

The breathing gas that you as the employer make available must be appropriate and of good quality for the work at hand. You must arrange for an adequate supply of breathing gas and reserve-breathing gas so that in an emergency, the diver can suspend diving work safely. Where divers use their own independent breathing gas supply (e.g. Scuba divers) and a breathing gas other than air, you will need to check the composition of the gas mixture just before a dive and adapt the diving limits accordingly.

Medical precautionary measures

You must ensure that the diver is physically and mentally capable of recognising the risks involved in the work and capable of preventing or limiting such hazards. Moreover divers must be checked to ensure that they are medically fit to take part in the diving work. This inspection must be repeated each year. Make sure that there is always someone on hand close to the work location who can provide adequate medical advice to the diver(s). For diving work at depths in excess of 15 metres or in another liquid under a pressure higher than 1.5.105 Pa above the ambient pressure, a compression chamber with a recompression and hyperbaric medicine lock is obligatory.

In other situations, you must have a compression chamber at the dive location if the travel time between the dive location and the closest treatment facility with a compression chamber is more than two hours. The compression chamber must be geared to the number of persons involved in the relevant diving operation and to the type of work being performed. It must be suitable for at least two people.

How do the DLI and the SSM conduct inspections?

During an inspection, the DLI and the SSM will check to ensure whether:

- proper work instructions and risk assessment are available at the dive location and that the employees are aware of these instructions;
- the diving team are fully trained and qualified (demonstrably) for the job;
- the divers are physically and mentally fit;
- medical facilities are available for the diver;
- the breathing gas quality and quantity are guaranteed;
- a compression chamber is required and if so, is available at the work location;
- the diver keeps a log of the diving work in the logbook;
- the supervising body has been notified of the diving work, if required;
- a proper record is kept of working hours;
- the standards provided for in the Working Hours Act are being complied with;
- the diving equipment is approved and well maintained.

In the event of one or more breaches, the inspector will issue a warning, depending on the severity of the situation, or make a demand or draw up a fine report. In the event of immediate danger, the inspector will order operations to be suspended and draw up a fine report.

References to the Working Conditions Act and regulations

- ▶ Recording and evaluation of risks: Working Conditions Act, Article 5
- ▶ Information and training: Working Conditions Act, Article 8
- ▶ Working Conditions Decree: Part 6, section 5

Ensuring the dive location is safe and secure

In the Netherlands, most of the dive locations are cold or very cold and dark underwater; visibility is very poor and divers must work in flowing and/or polluted water. Besides the pressure-related risks associated with working underwater, each dive location has its own general high-risk situation, both below and above water. Invariably, construction work will be ongoing at the dive location. Cranes and forklift trucks are busy moving construction materials about. The fire service and training and practice dives often involve lifting and hoisting various (training) objects out of the water. Divers also have to contend with shipping traffic.

What are the risks?

Besides the specific dangers of overpressure to which divers are exposed, there are other prevailing risks to be taken into account. For example, at construction sites, at unknown dive locations with unexpected obstacles underwater, civil engineering works having suction and discharge openings, shipping traffic and passing traffic streams or in aquariums with dangerous marine animals. This makes diving work all the more difficult.

Divers often have to contend with other high-risk work over which they often have no control. All these activities and operations entail the constant risk of the diving systems becoming damaged or disrupted or the danger that divers become trapped, crushed or involved in a collision.

Accidents and defects which look innocent at first glance may well lead to serious consequences underwater. When a scuba diver gets into difficulties underwater, the lack of breathing gas soon becomes a problem. Likewise, the decompression procedure may not work as planned in an emergency situation. Immediate medical assistance may not always be possible. With saturation diving and surface decompression, there will be some delay before the doctor or nurse reaches the required pressure level or is able to provide medical assistance or treatment.

What do you need to do?

As an employer you are responsible for ensuring that the work location is structurally safe in terms of the dive location proper and the direct environment. You should have adequate facilities and measures in place to ensure that the work location is well laid out and where required, the diving work should be adapted to other ongoing activities. This helps reduce the risk of accidents.

You must ensure that:

- no diving work takes place below a moving load and that no loads are moved over the dive location;
- the dive location is safely separated from other traffic;
- the proper facilities are in place to provide access to the dive location. Likewise, compression chambers must be immediately accessible and the chamber, where installed, must be away from the (other) traffic flows;



Safety of work equipment in the diving sector

- the emergency procedures are sufficiently known and practised and these form part of the basic skills of the diver(s);
- the reserve diver is available at a moment's notice.

How are inspections conducted by the supervising body?

With respect to the obligatory work instruction, the supervising body will also check to ensure that:

- the dive location is laid out safely;
- the diving work and the requisite ancillary works by other employees adjacent to the dive location are organised safely;
- third parties have been properly informed and have had special zones allocated to them;
- the hoisting and transport system required for the diving work is in good condition and are being used safely;
- the diving systems required for the diving work are in good condition and are being used safely;
- the emergency systems required for the diving work are available, in good condition and are being used safely;

In the event of serious danger, the inspector will order operations to be suspended and impose a fine. The work may only be resumed when the (potential) hazard has been removed.

References to legislation and regulations

- ▶ Working Conditions Decree, section 3

Much of the work undertaken by divers is also performed above water. The work they do for field of hydraulic engineering, in the offshore industry or in ship maintenance, has many parallels performed by workers in the building or construction industry. They need to know how to use various equipment, such as:

- hand tools (hammers, saws, shears etc.);
- mechanical tools (jack hammers, bolt guns, drills, saws, grinding discs etc.);
- suction and (high pressure) spraying equipment;
- flame cutters and welding equipment;
- hoisting gear.

Divers also need to know how to operate TV cameras and photographic equipment and must be familiar with a range of measuring and testing techniques. In certain situations, they also need to have expert knowledge about the use of explosives under water

What are the risks?

Where tools and machinery are used, both the user and people in the general area are at risk (machinery or environment-related risks). Such risks are associated with the technical composition, state of maintenance, installation and use of the tools and machinery, among others. The operators' expertise also plays a role, as does the lack or disregard of work instructions. When using such equipment, divers regularly suffer cuts, crushed or broken fingers and hands, or other injuries. Other accidents occur because of exposure to electrical current or high-pressure water blasting.

As an employer, you are responsible for ensuring that the equipment is suitable for the work at hand and that it is well maintained. You can help prevent the breakdown of diving systems by ensuring that they are maintained in accordance with the Assessment Guideline governing the Maintenance of Systems for Diving and Caisson Equipment (*Beoordelingsrichtlijn voor het Onderhoudsysteem duik- en Caissonmaterieel - BRL*), issued by the relevant Board of Experts (in the Netherlands: *College van Deskundigen Duik- en Caissonmaterieel*). In following these guidelines, you must also keep a record with regard to the use and maintenance of the equipment. You should keep a record of:

- the minimum maintenance and inspection requirements concerning the diving and caisson equipment;
- the technical requirements concerning the diving and caisson equipment;
- the skills of the personnel involved in maintaining, testing and assembling the diving and caisson equipment.





In the future, diving work under overpressure may only be approved providing the employer holds the relevant maintenance system for diving and caisson equipment certificate (*Onderhoudssysteem duik- en caissonmaterieel*). Self-employed persons and assisting employers are also required to hold this certificate. To obtain the certificate, you must meet the requirements of the Assessment Guideline governing the Maintenance of Systems for Diving and Caisson Equipment (*Beoordelingsrichtlijn voor de Onderhoudssysteem duik- en Caissonmaterieel: BRL – D&C*), due to come into effect at the end of 2008 or early in 2009. When this brochure was in preparation, the Assessment Guideline had not yet come into effect nor was the effective date known.

What do you need to do?

When your employees are at work, you must always take into account the obligations arising from the Working Conditions Act and regulations. For example, you must make sure:

- that instructions are provided to employees with respect to the safe use of the equipment and machinery and you must ensure that they follow these instructions;
- that equipment and machinery are in proper order, i.e. by ensuring they are periodically inspected, maintained, cleaned and repaired;
- that mobile parts of machinery are screened or made safe;
- that systems and machinery are operated safely;
- that hoisting equipment or engines do not pose any danger to humans. They must not come into contact with loads and they should not be deployed beneath hanging loads;
- that mobile work equipment poses no threat to humans. Risks associated with mobile machinery involve overturning, excessive speeds or persons in the vicinity of mobile machinery.

In addition to the Working Conditions Act, you must comply with the provisions of:

- the Commodities Act (product safety);
- the Machinery (Commodities Act) Decree (Machinery guideline);
- the Pressure Equipment (Commodities Act) Decree (Pressure Equipment guideline).

Under the Working Conditions Decree you must ensure that work equipment meets the provisions of the relevant (Commodities Act) Decree. Manufacturers must ensure that their machinery and pressure equipment meet the provisions of the Machinery (Commodities Act) Decree and the Pressure Equipment (Commodities Act) Decree.

If you are involved in developing or materially altering machinery or in developing or adapting pressure equipment, then you are regarded as a manufacturer as well as an employer. You are therefore also required to meet the certification obligations of the Machinery (Commodities Act) Decree and the Pressure Equipment Decree.

Machinery predating and post 1995

Machinery predating 1995 is generally required to meet the current professional standards, unless the existing residual risk level is regarded as acceptable.

With respect to machinery and equipment brought onto the market either in or after 1995, the manufacturer (where applicable) is obliged to:

- hold an EC declaration of conformity;
- have instructions for use in Dutch;
- have CE marking on the machinery or equipment.

How are inspections conducted by the supervising body?

During the course of an inspection, the inspector will check whether equipment and usage thereof comply with the statutory provisions of the Working Conditions Decree and the Machinery (Commodities Act) Decree. Any work representing a serious hazard will be suspended for preventive reasons by the inspector, who will also impose a fine. The work may only be resumed when the (potential) hazard has been removed.

Depending on the findings, the inspector will then proceed to inspect a number of documents relating to machinery from 1995 and later in order to check availability of:

- instructions for use;
- an EC declaration of conformity for machinery with CE marking;

Other risks

- a maintenance logbook;
- (work) instructions and procedures;
- the risk assessment and evaluation and the ancillary action plan.

More information

- Brochure: *Veilig en gezond werken met machines (B265)* [Safe and Secure working with machinery]. See: www.arbeidsinspectie.nl under Brochures.
- *Arbo-informatieblad AI-1 I: Machineveiligheid: afschermingen en beveiligingen* [Working Conditions information sheet AI-1 I: Machinery safety: screening and safety precautions]; third revised edition; SDU (ISBN 90 12 08905 0). Order by e-mail: Sdu@sdu.nl.
- *Beoordelingsrichtlijn voor de Onderhoudssysteem duik- en Caissonmaterieel* [Assessment Guidelines governing maintenance of Systems for Diving and Caisson Equipment]. Issued by: NDC. Order by e-mail: post@ndc.nl

References to legislation and regulations

- ▶ Working Conditions Decree, sections 3, 6 and 7
- ▶ Machinery (Commodities Act) Decree
- ▶ Pressure Equipment (Commodities Act) Decree

Exposure to hazardous substances and biological agents

Divers run a particular risk of being exposed to hazardous substances and biological agents (microorganisms) if they fail to use the proper diving gear and equipment and do not remove their gear according to protocol. In closed ditches and canals where fire service divers perform many of their tasks, there is a risk of exposure to biological agents due to discharges and decaying animal remains. When diving in pits and pools in order to bury tanks containing chemical waste, the water often tends to be extremely contaminated by the same chemical substance. Very high concentrations may occur locally. Hazardous substances may affect the diving equipment and therefore pose a danger to the diver. Oil products constitute a risk because oil floats on top of the water requiring the diver to pass through it in order to work underwater. The greatest risk, however, arises due to insufficient knowledge of the degree of contamination.

To ensure that the diver can work safely, as an employer you must have a good understanding of the dangers of exposure to hazardous substances and biological agents. The risk assessment and evaluation (RA&E) is the approach to take here. This process will help pinpoint whether or not the diving equipment offers the diver maximum protection against the specific substances to which the diver is exposed.

References to legislation and regulations

- ▶ Working Conditions Decree, Articles 4.2, 4.13, 4.85, 4.87a, 6.14a, 6.15, 8.2, 8.3.

Physical effort

Physical effort does not constitute a health risk as such, but physical stress does. Physical stress may lead to problems with the locomotor apparatus and even to failure. Lifting, pushing and pulling, repeating the same movements over and over again, or poor work posture can all lead to physical stress. At the dive location, objects are generally carried and pulled above water when shifting heavy equipment. The risk of physical stress is further exacerbated in such aggravating circumstances.

When working under water, moving specific equipment (such as welding equipment, high pressure cleaning equipment and pneumatic drills) and drowned corpses is difficult. The work can be even more arduous when working in the dark and in confined spaces (with tools).

As an employer, you are obliged to organise the work in a manner that reduces or minimises physical stress. Here too, the RA&E forms the first step, so you start by listing the risks involved in the work area. Next, on the basis of the RA&E, you draw up an action plan in order to reduce or limit these risks.

References to the Working Conditions Act and regulations

- ▶ Physical effort, general: Working Conditions Decree, Articles 5.2, 5.3, 5.4 and 5.5



Working hours and rest periods

Diving work is sometimes subject to extreme time pressure. Due to the shortage of divers in the labour market, they tend to be assigned rather quickly to the next task. It is therefore important to take into account not only the surface intervals for decompression times, but also the rules governing working hours and rest periods.

References to legislation and regulations

- ▶ Working Hours Act and Working Hours Decree (ATB)
- ▶ Additional, different rules apply to diving work in mining installations and with regard to saturation diving. These are outlined in the Working Hours Decree.

For more information on International standards and regulations, see:

- ▶ EDTC: Harmonised Diving Standards of Europe
- ▶ HSE: Diving Information Sheets
- ▶ IMCA: International Code of Practice
- ▶ Lloyds Register: Rules and Regulations

More reading on exposure:

- ▶ *Schatting van de blootstelling van beroepsduikers aan micro-organismen in water*⁷ (RIVM report 330000006/2005;
- ▶ A Survey of diving behaviour and accidental water ingestion among Dutch occupational and sport divers to assess the risk of infection with waterborne pathogenic microorganisms (Jack Schijven et al., Environmental Health Perspectives, May 2006)
- ▶ Contaminated water diving: the risks divers don't want to acknowledge (Steven M. Barsky, H2Ops Magazine, May 2005)
- ▶ Arbo-Informatieblad AI 9: *Biologische agentia*⁸

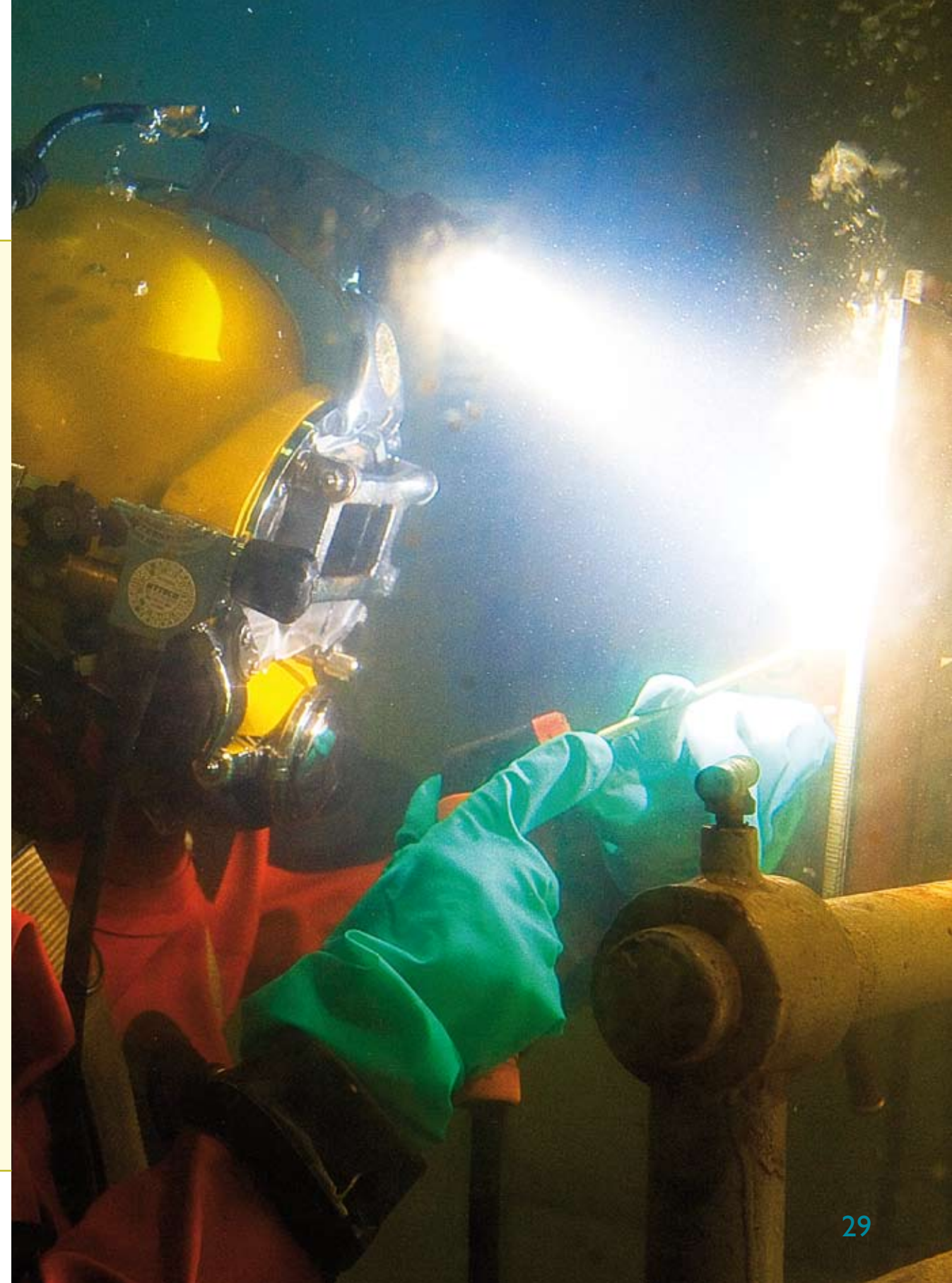
For more information on physical effort, see:

- ▶ Working Conditions Information Sheet AI-29 *Fysieke belasting bij het werk*⁹

⁷ Estimation of the exposure of professional divers to microorganisms in water

⁸ Working Conditions Information Sheet: Biological agents

⁹ Physical stress at work



For more information on working hours and rest periods, see:

- ▶ SZW - dossier arbeidstijden¹⁰. See: www.arbeidsinspectie.nl under Arbeidstijden (Specific regulations governing the mining sector)
- ▶ Detailed section on Mining in the Working Hours Decree. See: www.sodm.nl under Documentation (working hours in the mining sector; in Dutch)

¹⁰ Record of working hours by the Inspection Service of the Ministry of Social Affairs and Employment



Colophon

This brochure has been prepared on behalf of the DLI in cooperation with the SSM.

Disclaimer

This brochure outlines the main occupational risks arising in the diving sector. The brochure describes how the DLI and SSM conduct inspections in response to these risks. Not all of the risks outlined may concern your company or organisation, in which case you may disregard the inapplicable sections. If there are risks facing your company or organisation which have not been listed in this brochure, you must incorporate these risks both in the RA&E and the action plan. You are also required to take measures to remove or reduce these risks. The rules referred to in this brochure are existing rules. For more information, see: www.arbeidsinspectie.nl, www.sodm.nl and www.arbonieuwestijl.nl. The Ministry of Social Affairs and Employment is not responsible for information contained on the websites of the third parties cited in this brochure. No legal liability can be accepted in relation to the information provided in this brochure.

Further information

This brochure is available on: www.arbeidsinspectie.nl. On this website you will find more information on the references to legislation and regulations in this brochure. All the provisions of the Working Conditions Act and regulations can be viewed on: www.overheid.nl.

We are grateful to all the companies and organisations in the sector that assisted us in preparing this brochure.