


AIR QUALITY



# Safety is in the Air

AVOIDING CARBON MONOXIDE POISONING  
WHILE SCUBA DIVING





# Carbon monoxide poisoning and its influence on diving safety

## INTRODUCTION

Carbon monoxide (CO) is an odourless, colourless and tasteless gas, usually produced by the incomplete combustion of carbon containing compounds.

It is absorbed 200 times more by haemoglobin than oxygen is. This reduces the oxygen carrying capacity and can eventually lead to hypoxia and even death.

The severity of CO poisoning depends on its concentration in the breathing gas and the exposure time. A long exposure to relatively low concentrations can therefore result in serious CO poisoning.

In diving, the partial pressure of CO will increase with depth, and even a low concentration of CO contamination, which at normal atmospheric pressure and after a prolonged exposure time would have no toxic effect, will become dangerous with increasing depth. When descending, the haemoglobin can get saturated with CO, impairing its ability to bind with oxygen, but the increased oxygen partial pressure may also result in enough oxygen in the blood keeping cells oxygenated. During the dive, the decreased oxygen transportation (through the haemoglobin) is also partially compensated by the amount of dissolved oxygen in the blood plasma. But during the ascent, when the partial oxygen pressure is reduced, and the amount of dissolved oxygen also reduces, this can lead to hypoxia. This might be the reason why the symptoms of poisoning may become worse during or after ascent.



## PREVENTION

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# Reducing the risk of CO intoxication during diving

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CO contamination usually arises from impurities in the air taken into the compressor or from contaminants generated by the compressor itself. Divers therefore need to be sure the air they use is uncontaminated.

Since compressors are used to fill many cylinders, CO contamination can be present in many cylinders filled using the same compressor.

What can the dive centre, club or dive shop do?

- Make sure the air inlet from compressors is not located nearby any source of contamination such as motor vehicles, diesel generators or other gas exhausts, or located downwind from the compressor's own internal combustion engine exhaust. Also make sure nobody is allowed to smoke or burn any materials nearby the air inlet.
- Make sure the correct compressor oil and filters are used, and regularly check that the air intake hose is not damaged and couplings are not loose (which is usually caused by vibrations).
- Ensure proper maintenance of the compressor, as excessive wear can lead to overheating and these high temperatures may decompose the lubricating oil into toxic products such as CO.
- Regular check the quality of the air. This can be done by using detector tubes and other non-reusable devices, or with electronic analysers. Alternatively, and required in some regions, air testing by accredited laboratories can be done.

What can the diver do?

- If using your own compressor, respect the recommendations as stated before.
- Only obtain air or breathing gas fills from a reputable dive centre, club or dive shop.
- Ask the air supplier how often they check the quality of their air and if they periodically perform compressor maintenance and have a compressor log.
- If possible, check the location of the air intake of the compressor when getting a cylinder filled at an unknown filling station, especially when on a dive holiday.
- Avoid smoking immediately prior to the dive as cigarette smoke also contains CO.
- Check your air cylinder for the presence of CO using a personal CO detector device, especially if you have concerns about the quality of the air supplier or when you can not determine how the dive cylinders were filled. While electronic CO detectors may be rather expensive for the single diver, products such as the CO - Pro™, which can detect the presence of CO in the breathing gas, are inexpensive, making them accessible to all divers.

Although diving accidents due to CO poisoning are relatively rare, the chances increase wherever safety standards are violated. Remote locations and informal compressor installations pose the highest likelihood for CO contamination.



**CO-PRO™**  
PERSONAL CARBON  
MONOXIDE PROTECTION

The Co-Pro™: A quick and effective way to detect CO in breathing air. If the air is contaminated by CO, the sensor within the balloon will change colour. You can discover this and many other safety materials in the online DAN-SA store at [www.dansastore.org](http://www.dansastore.org)

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## SIGNS & SYMPTOMS

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# Signs and symptoms of CO intoxication

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Typical signs and symptoms of carbon monoxide poisoning are:

- Headache and sensation of pressure inside the head
- Vertigo
- Nausea
- Breathlessness with exertion
- Confusion
- Vomiting
- Paralysis and/or
- Unconsciousness
- Cherry-red lips, cheeks and fingernails (specially at the early stage)





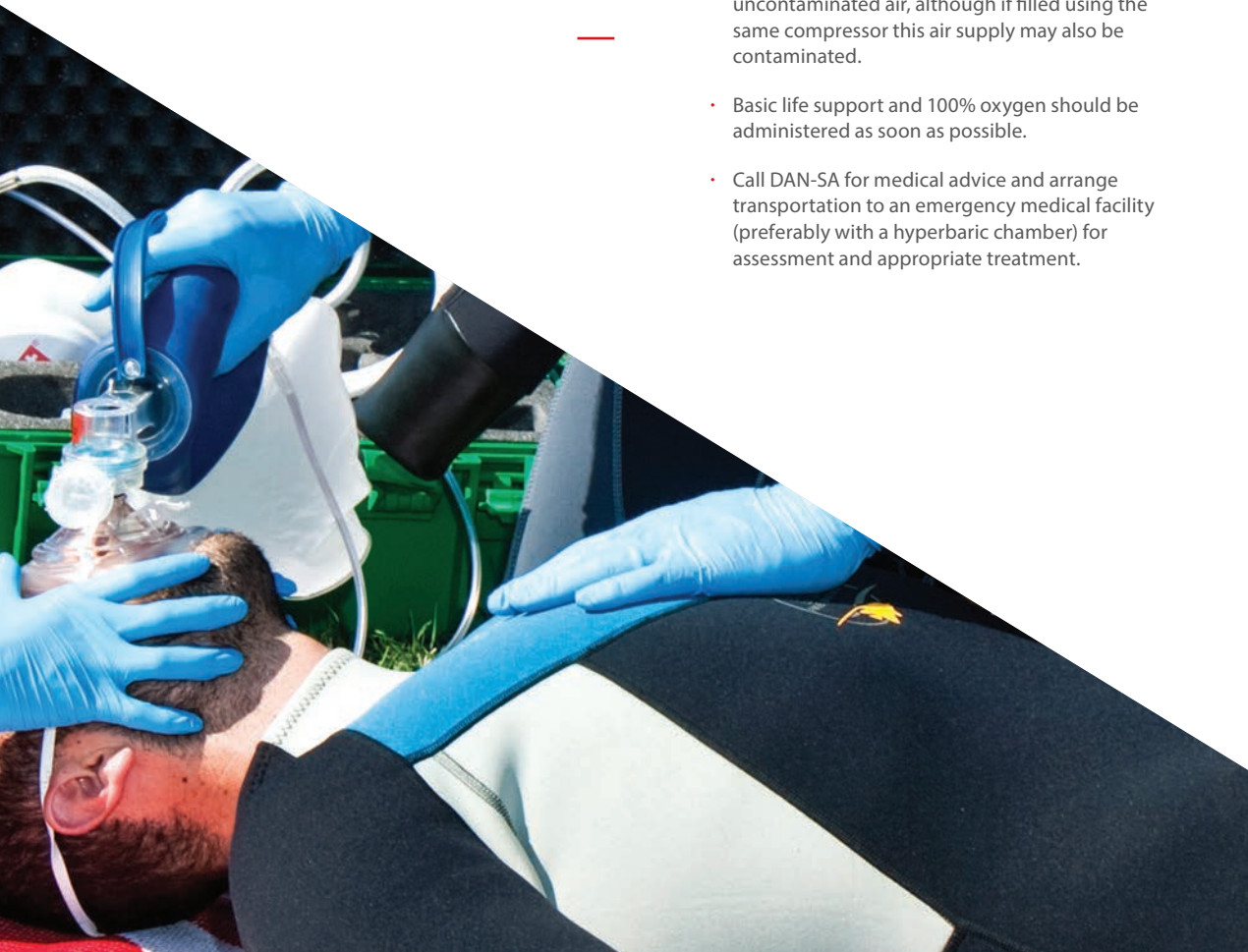




## TREATMENT

# First aid and treatment

- The diver should stop breathing from the contaminated cylinder and end the dive. The dive buddy can provide his alternative air source to provide the diver with uncontaminated air, although if filled using the same compressor this air supply may also be contaminated.
- Basic life support and 100% oxygen should be administered as soon as possible.
- Call DAN-SA for medical advice and arrange transportation to an emergency medical facility (preferably with a hyperbaric chamber) for assessment and appropriate treatment.





SAFETY IS IN THE AIR

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## A DAN-SA safety campaign

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CO is not the only potential contaminant in breathing gas, but it is potentially the most dangerous.

Carbon dioxide (CO<sub>2</sub>) in excessive quantities, especially for deeper diving, is a health concern. Oil mist is both a health and a fire hazard. Too much moisture will cause equipment and cylinder corrosion issues. Dust is hazardous to both our lungs, as well as to fine regulator parts. And then one might even encounter less frequent but certainly reported contamination from vapour released by cleaning compounds in the environment, methane (CH<sub>4</sub>) or other compounds presenting health, equipment or fire concerns. This all implies some awareness by the diver, diligence by the dive station and knowledge by all.

Discover more about this and other  
DAN-SA safety campaigns on  
[www.dansa.org](http://www.dansa.org)



Follow our campaign on Facebook and Twitter:  
[#breathinggasquality](#) [#DiveSafety](#)

Safety campaigns are financed by  
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