

# Hookah Diving Safety in Tasmania

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In figures derived from amalgamated data from the professional and recreational industries, serious incidents occur approximately 1:10,000 to 1:20,000 dives, and the death rates have been estimated at around 8.5 per 100,000 divers. Between 10 and 20 divers die each year in Australia, and this compares with a national annual death toll due to road trauma of over 1,200.

Diving is a very safe recreational activity, however there is still room for improvement. In Tasmania, there has been on average, one fatal diving accident each year of the last decade, and based on an estimated participation rate of 22,000 divers, demonstrates that our death rate from diving may be slightly lower than the national average. There are no reliable data for numbers of dives undertaken in Tasmania, and the best estimates of participation are derived from fisheries license statistics. Current statistics do not allow identification of divers by the type of breathing apparatus used; for example scuba vs hookah, nitrox or mixed gas (open circuit and rebreathers).

With regard to decompression accidents, the Royal Hobart Hospital Hyperbaric facility treats 25-30 divers with decompression illness (DCI) annually. These are split across the recreational and professional industries and are summarized in table 1.

**Table 1 Diver Groups treated at Royal Hobart Hospital**

<b>Recreational Scuba Divers</b>	<b>28%</b>
<b>Recreational Hookah Divers</b>	<b>30%</b>
<b>Aquaculture Industry</b>	<b>21%</b>
<b>Abalone Industry</b>	<b>13%</b>
<b>Other Professional Divers</b>	<b>7%</b>

## Hookah Diving Risks

Recreational Hookah divers are over represented in the decompression accident statistics. The figures in table 1 do not include cases of carbon monoxide poisoning, or other diving injuries such as ears, sinus or lung barotrauma.

There are many risks associated with hookah diving and recreational hookah use falls through many cracks of legislated and educational scrutiny:

- Recreational Hookah is not subject to State or Federal Occupational health and safety legislation

- Recreational Hookah equipment can be purchased and operated without any training. Data from RHH indicates that less than 30% of all hookah divers involved in accidents had *any* diving training, even less had specific hookah training.
- There is no requirement for regular maintenance or air quality testing for recreational hookah divers (this is compulsory for scuba filling stations under Australian Standard 2299.1). All hookah maintenance and air testing is at the discretion of the owner.
- There is no legislated requirement for hookah divers to wear an accessory air sources
- Courses on operating and diving with recreational hookah are virtually inaccessible
- Hookah divers have theoretically unlimited air supply, which allows them to exceed safe decompression limits

A typical Hookah apparatus is shown in figure 1.

**Figure 1 Hookah Pump**



Many owners and divers using Hookah are not aware of the risks they are exposing themselves to. The hookah apparatus is a type of surface supply breathing apparatus (SSBA). The majority operating in Tasmania consist of an internal combustion petrol engine driving a low pressure air pump that supplies air to the divers.

Of the many potential hazards of diving with the hookah apparatus, the most serious ones are carbon monoxide poisoning, failure of air supply and entanglement.

### **Carbon Monoxide (CO) poisoning**

Carbon monoxide is a colourless, odourless gas that is in the exhaust of all internal combustion engines. For hookah diving it is a constant hazard, because regardless of the care taken with setting up the air intake, weather conditions may lead to accumulation of exhaust fumes around the boat. which is then

pumped down to the unsuspecting divers. The danger is it renders the divers weak and confused, or at worst unconscious, and leads to death. The toxic effect of CO is amplified under pressure. I have treated divers who have sustained CO poisoning in very still conditions, where the exhaust fumes remained in the air around the boat. Others have received CO poisoning because of poor design of their air intake (pipes pointing downwards), or broken intakes, or even intakes that were accidentally bumped off the hookah. They were the lucky ones. Unfortunately others in Tasmania have not survived their CO poisoning episode. The best defense is prevention by design and regular hookah maintenance and careful vigilance by a boatman alert to the equipment and changes in weather. Incidentally, most air filters do not remove carbon monoxide.

### **Failure of air supply or entanglement**

In most cases, the hookah apparatus is subject to the vagaries of a petrol-driven internal combustion engines. Unfortunately these fail from time to time – either by stalling or running out of petrol. The first the diver knows is a breath is taken and there is extreme resistance. There may be a few breaths where breathing becomes stiffer, but Murphy’s law says the engine failure will occur when the diver is at their deepest and having just exhaled. The diver then bolts for the surface, perhaps taking some partial breaths from the air hose as ambient pressure falls, and if they are lucky they reach the surface. There is great risk of lung rupture during this ascent (pulmonary barotrauma), that can lead to gas in the circulation and unconsciousness. The shallowest depth that I have observed a gas embolism from a rapid ascent was 2 metres – that accident caused the diver to be paralysed down one side of their body. There is also risk of decompression illness or the bends, due to the “cork coming off the champagne bottle”. Our facility has treated many divers over the last 20 years who have been injured from rapid ascents after hookah air supply failure. One such episode also led to casualties in the boat who were trying to fill an empty Hookah engine petrol tank and received burns from the ensuing fire. Air supply failure has also occurred on many occasions due to severing of the hookah hose by outboard propellers. For recreational divers using Hookah, live boating is not recommended.

One other cause of air supply failure occurs when two divers are operating from a single hose with a “Y” piece in the hose. If one of the divers travels to the surface and their regular “free-flows”, air preferentially travels to the lowest pressure, leaving the other diver in effect, without air supply. The deeper diver will then be forced to make a rapid ascent with potential hazardous consequences.

The solution to preventing injury from failed air supply is simple but it costs money – carry an accessory air source and regulator. The \$500 or so spent on this life saver may well be your best investment ever! It converts a panic ascent into a leisurely trip to the surface. Compared to the overall cost of diving, boat and other equipment, the cost is relatively small. Please ensure your accessory air source has a cylinder around 400 litres (a C sized cylinder). This permits around 15 minutes of air and a deco stop if necessary. Smaller all-in-one air regulators generally do not contain enough gas for a controlled ascent, although they are definitely far better than no spare air at all. An example of such a cylinder is shown in figure 2.

Entanglement falls under the same heading as failure of air supply. Tasmania has heaps of kelp and irregular reefs that can tangle the hookah hose. This may prevent return to the boat or ascent. An accessory air source allows disconnection from the hookah hose, and again a safe, slow swim to the surface

**Figure 2 Accessory Air Supply**



### **Hookah Diver training**

Hopefully the percentage of trained divers using hookah apparatus, is higher than the 30% for the individuals we have treated at RHH. Hookah is actually more advanced diving than scuba, and in my opinion requires both basic open water training and speciality hookah training. Hookah divers need to be very familiar with diving table calculations because, due to continuous air supply, they are very capable of exceeding table limits. In addition, whoever is supervising the hookah in the boat needs to know its operation in detail, including how to prevent carbon monoxide poisoning. If you are diving with another hookah diver, it is not unreasonable to ask them how they were trained, and indeed inform them of your training.

### **Hookah Maintenance and performance**

For some of the reasons outlined above, the failure rate of hookah is higher than modern scuba regulators. Hookah divers are also personally responsible for something scuba divers take for granted – their own air supply. Dive shops around Tasmania all test their air and maintain their filling station equipment to ensure air quality meets Australian Standards. The owner of the hookah apparatus is responsible for the purity of the air they breathe. It has been my observation that very few hookah owners would be able to quote the results of their last air test. If you are invited to dive with a friend

who owns a hookah, ask them: when was it last serviced, what air filters are in the apparatus and when were they last changed, and how often do they test their air? If a hookah is placed on your boat by others, similar questions should be asked, because you may be carrying a death trap on your boat, that you will now become partially responsible for.

Knowledge of Hookah performance is particularly important if more than one diver uses the equipment. Hookah provides low pressure air at a line pressure of around 6-8 atmospheres (some are as low as 4 atmospheres). Line pressures are often not stated and should be measured and reported at the time of servicing. Usually a differential of 5 atmospheres is required for comfortable breathing. Quoted hookah performance may be in volume only, eg cubic feet per minute (CFM, 28.3 Litres = 1.0 cubic foot). The product of pressure and volume is essential for evaluating true performance. In general, because of their low pressure output, hookah use should be restricted to less than 18 metres depth. If two divers are working from the hookah, there is added complexity due to extra hose connections, and the depth reduced accordingly. Don't assume that the output to each diver will be exactly half of that for one diver. Turbulence and narrow connectors will reduce performance. Beware using "Y" connectors (see comment above). It is far better to operate two divers' hoses directly off the hookah pump reservoir, as this will cause less reduction in flow and pressure. I ask the question: how many hookah owners know the line pressure of their own hookah, and how many have measured the output in litres. Exercising divers may use up to 50 litres per minute, that then must be multiplied by the depth in atmospheres to calculate their air requirements when diving.

## **Emergency Procedures**

Hookah is ideal for diving in remote locations. Just pull the cord and there is continuous air! This is much easier than carrying heavy scuba cylinders and then requiring air fills after each dive. However with this flexibility comes responsibility. Greater distance compounds accidents. If you are on Tasmania's west coast, you may be a number of hours from even ambulance assistance. Prior planning and practice of Emergency procedures is a must. Have you ever tried to lift a disabled diver into your boat? If not then try it – boat owners will find it is extremely difficult. It is even worse with the boat in a choppy sea breeze. You will need to work out a way to do this. Do you carry oxygen – enough to treat an injured diver all the way to nearest help and 50% extra? If not then consider investing in oxygen first aid equipment, and some training. For injured divers, a recent study by Diver Alert Network showed that first aid oxygen makes a great difference to final outcomes. For more information on oxygen equipment, courses and safety, see: <http://www.danasiapacific.org/>

In Tasmania, emergency procedures are summarised in figures 2 and 3. The first number to call is "000", and Tasmanian Ambulance Service has procedures to involve the RHH Diving Medicine Specialist at the outset, to facilitate timely appropriate retrieval and treatment. The Hyperbaric facility can be contacted during office hours 8AM – 5PM Monday to Friday on 6222 8322 for non-emergency advice, and a specialist is always available for medical advice via the RHH switchboard 6222 8308.

Hopefully this introduction will serve as a reminder to boat owners and owners of hookah apparatus to ensure their equipment is serviced and maintained, that everyone using the equipment is fully trained in diving and familiar with the equipment and that the air they breathe is of sufficient quantity and quality for safe diving. Some important questions are posed in figure 4. I encourage all hookah divers to invest in an emergency air supply (maintained and full), and have your emergency procedures and equipment up to date. RHH Hyperbaric Facility staff can be contacted during office hours for routine diving safety and health issues.

Safe diving and may all your bubbles be silent ones.....

Figure 2 Initial Management of Diving Emergencies

## Initial Management of Diving Emergencies

- Ensure safety of rescuers
- Retrieve injured diver from water
- Attend to Airway, Breathing, Circulation – EAR or CPR if indicated
- POSITION: Lie the Diver Down – supine if conscious and cooperative, left lateral if unconscious, vomiting, or not maintaining airway when supine
- Give 100% oxygen, or the highest concentration possible
- Call 000 for to request an ambulance for an injured diver
- Avoid ascent to altitude, DO NOT administer Entonox for pain

### ESSENTIAL PHONE NUMBERS:

TASMANIAN AMBULANCE SERVICE	000
ROYAL HOBART HOSPITAL SWITCHBOARD	6222 8308
DIVING AND HYPERBARIC FACILITY	6222 8322

**Figure 3 Tasmanian Diver Emergency Protocol**



## TASMANIAN DIVING EMERGENCY FLOWCHART

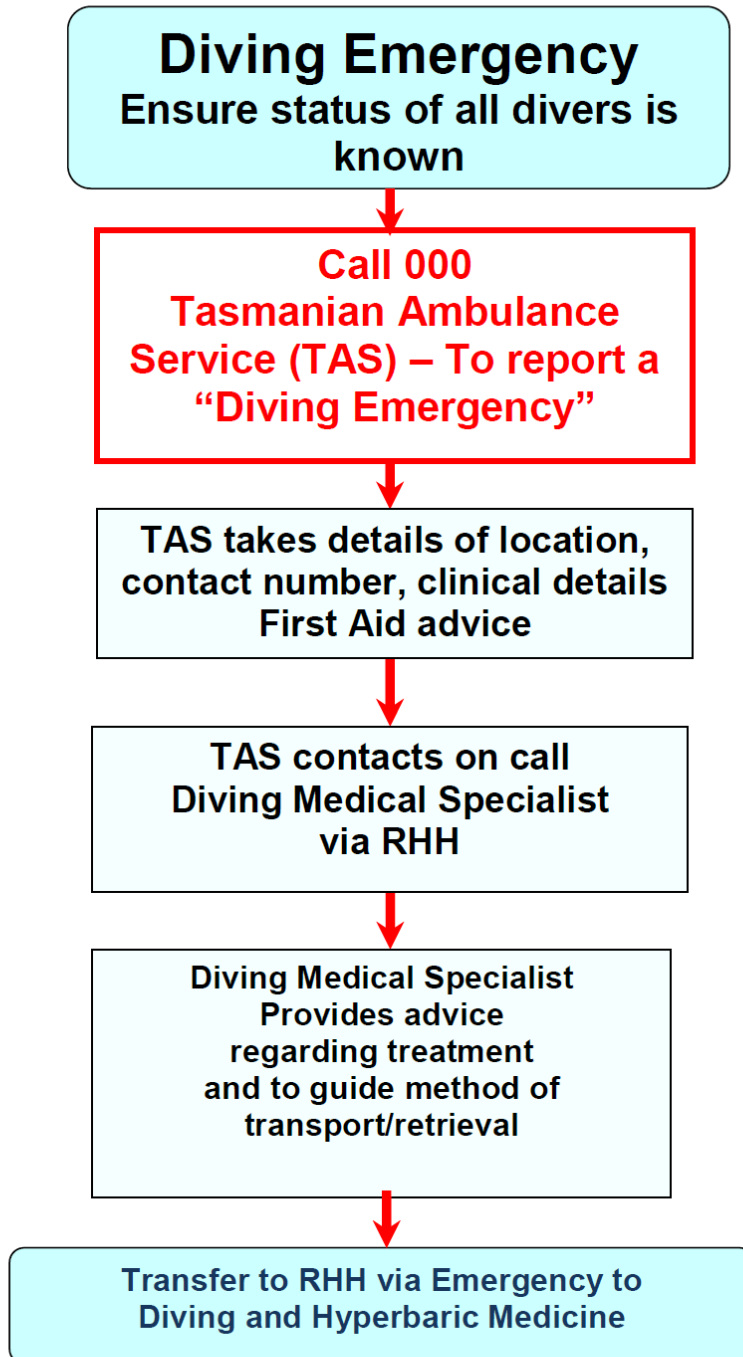


Figure 4 Important Questions for Hookah Divers

## **Questions for Hookah divers:**

**Do you have scuba diving training?**

**Do you have *specific* hookah diving training?**

**When did you last service your hookah apparatus?**

**Have you ever had your hookah air quality tested?**

**What is the air output of your hookah apparatus?**

**Do you have an accessory air supply?**

**What are your emergency procedures?**