



Risk Management
Control and supervision of the quality of Hyperbaric Procedures

The recurrence of DCS despite the compliance with the diving procedures is indicative of a limit that has now been reached

- **Numerous DCS cases are reported every year**

These accidents can occur randomly, despite the compliance with the regulatory decompression procedures.

- **As it stands, there is virtually no prospect of improvement in the situation**

The large number of factors potentially contributing to DCS precludes any prospect of rapid progress. Even beyond decompression sickness, poorly adapted decompression procedures are also synonymous with increased arduousness, fatigue, and potential long-term effects for personnel.

O'Dive PRO¹: a connected risk management and decision support service

In such a context and for the first time in the world, O'Dive PRO offers the possibility to monitor and control the quality of decompression procedures in real working conditions.

Control the quality of procedures through desaturation monitoring

O'Dive PRO analyzes the quality of decompression procedures by considering two indicators for which a correlation to the DCS risk has been proven: the dive exposure parameters and the quantity of microbubbles detected in the operators' bloodflow.

O'Dive PRO includes a vascular microbubble sensor (ultrasonic Doppler technology) connected to an analysis server and an information reporting site.

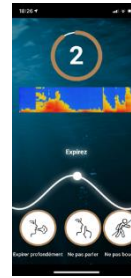


O'DIVE PRO connected system

¹ O'DIVE PRO connected service is one of the TOTAL Group's [Recommended Practices](#)

How are the measurements taken?

After surfacing, the intervenor places the sensor for 20 seconds under his left and then right clavicle. The signals are automatically recorded on the tablet. A visual feedback shows the operator the correct positioning of the sensor (red-orange signal on blue background). Exposure parameters are input manually or digitally imported.



The operation is done in just a few minutes, autonomously by the workers themselves. It does not require any additional human support.



Control & supervise the quality of hyperbaric procedures

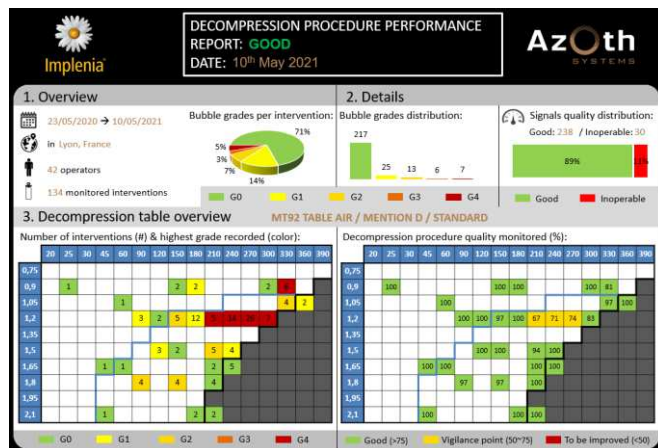
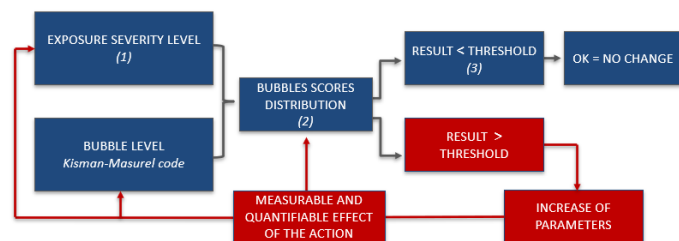


Illustration of an online report

A digital synthesis reporting on quantities of bubbles measured (Kisman-Masurel code) on each table point is updated periodically.

The statistical value of bubble levels is representative of a level of physiological stress specific to each table point.

A robust and controlled decision-support tool is made available to the EHS chain to optimize the safety of operators.



(1) : Ratio between gas charge and total decompression time
 (2) : Function of (1) and circulating bubble level (KM code)
 (3) : Maximum bubble grade distribution threshold (convention)

Example of a decision support flowchart

Rewards

SUHMS prize: Best poster at the 2nd International Scientific Congress of Francophone Hyperbaric Medicine



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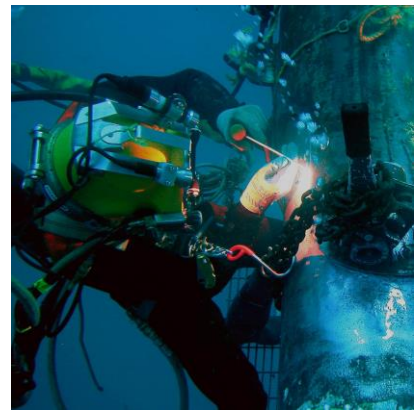
Risk Management Bend Watch Service – Professional divers

Context and use cases

This brochure concerns professional divers.

Initial framework

After their decompression period and the surfacing, depending on the dive duration and the nature of the work, professional divers are required to remain at the work site for a fixed observation period (typically 2 hours) in order to have at disposal - in the event of the occurrence of a decompression sickness (type I hyperbaric accident) - the means provided for by the site's emergency procedure.



Bend Watch Option

The purpose is to systematically use the O'Dive PRO microbubble detection system on professional divers after their surfacing, to **check the performance of the followed decompression procedure. Depending on the amplitude of the observed bubble load** (Kisman-Masurel grade, from 0 to 4) it may be recommended, in addition to the already-imposed mandatory period on site:



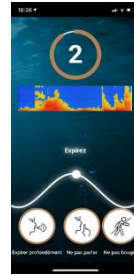
- (a) A prolonged stay at the work site beyond the set time;
 - (b) Breathing oxygen, or an oxygen-enriched gas mixture, to help reduce the dissolved gas load in the responder's body;
 - (c) If necessary, to induce a preventive recompression in a hyperbaric chamber, this recompression not being considered as a recompression for therapeutic purposes, but as an addition to the procedure which *de facto* is potentially (weak signals) insufficient.
- (b) and (c) validated after call / advice of the hyperbaric physician.

How are the measurements taken?

After surfacing, the intervenor places the sensor for 20 seconds under his left and then right clavicle. The signals are automatically recorded on the tablet. A visual feedback shows the operator the correct positioning of the sensor (red-orange signal on blue background).

The operation is done in just a few minutes, autonomously by the workers themselves.

The signals are then sent to the Azoth Systems servers for immediate human control.



Operation

The Bend Watch option requires a rigorous training of the operators and the recording of preliminary reference signals.

A contact is made with Azoth Systems (service available 24 hours a day when activated) to notify the measurement periods and to ensure an immediate human control of the collected signals.

Feedback is guaranteed within 5 minutes after the signals' upload.

Data processing and communication

All data exchanged and all information collected within the framework of the O'Dive PRO services are treated as completely confidential.

Depending on the company's policy, it is also possible to process all data anonymously.

In such a case, the use of an anonymous code corresponding to the users is recommended (example: operator 1; operator 2; etc...).

As far as communication is concerned, only communications that have been mutually validated by the contracting company and Azoth Systems are authorized.

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Risk Management Bubble Watch Service – Hyperbaric workers

Context and use cases

This brochure concerns hyperbaric workers in dry environments.

Initial framework

After their decompression period and return to the atmospheric pressure, depending on the duration of the intervention and the nature of the work, hyperbaric workers are required to remain at the work site for a fixed period of observation (typically 2 hours) in order to be able to have at their disposal - in the event of the occurrence of a decompression sickness (type I hyperbaric accident) - the means provided for by the site's emergency procedure.



Bend Watch Option

The purpose is to systematically use the O'Dive PRO microbubble detection system on hyperbaric workers after their intervention, to **check the performance of the followed decompression procedure. Depending on the amplitude of the observed bubble load** (Kisman-Masurel grade, from 0 to 4) it may be recommended, in addition to the already-imposed mandatory period on site:



- A prolonged stay at the work site beyond the set time;
- Breathing oxygen, or an oxygen-enriched gas mixture, to help reduce the dissolved gas load in the responder's body;
- If necessary, to induce a preventive recompression in a hyperbaric chamber, this recompression not being considered as a recompression for therapeutic purposes, but as an addition to the procedure which *de facto* is potentially (weak signals) insufficient.

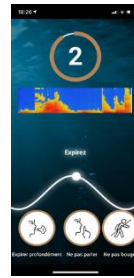
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