

## Return to Diving after COVID-19

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### 1 Introduction and scope

This guidance covers the return to commercial offshore surface supplied and saturation diving after confirmed or suspected COVID-19. It also contains recommendations for the assessment of fitness for diving duties of asymptomatic offshore commercial divers during the ongoing COVID-19 pandemic. The assessment of asymptomatic divers is necessary to identify potential pulmonary changes in those who contracted the disease but were symptom free. It is recognised that the guidance may be of interest to other diving sectors (e.g. inland/inshore, military etc.). The advice in this document is based on ‘expert opinion’ (Oxford CEBM Level 5) i.e. on very limited scientific foundations as only a limited number of case series have been available for review as of June 2020. We expect the advice in this document to be adjusted as knowledge is increased on the prevalence, infectivity and persistent health effects of COVID-19.

### 2 Short-term and Long-term Health Effects of COVID-19

The severity of COVID-19 disease is highly variable – from asymptomatic infection to death. Although pulmonary infection (pneumonia) with ground-glass opacities visible in chest CT scans is well recognised(1), recent reports suggest that, particularly in severe cases, the central nervous system and the cardiovascular system may be involved as well (2, 3). Preliminary data suggest a high incidence of pulmonary embolism in patients hospitalized for COVID-19 (4). DMAC has not identified studies characterising the progression and recovery of pulmonary CT changes in non-hospitalised patients, but there were remaining pulmonary CT changes in a small cohort of 112 hospitalised Chinese COVID-19 patients examined >28 days after initial symptoms (5). Pulmonary changes [were reported](#) in a group of asymptomatic, passengers on the cruise ship ‘Diamond Princess’ (6). In this group of 104 patients with COVID-19 (confirmed by PCR tests), 54% of the 76 asymptomatic patients demonstrated CT findings. Overall, the findings suggest that there may be structural pulmonary changes in the absence of symptoms and these findings may persist for a long time.

### 3 Effects of COVID-19 on Fitness for Diving

In the acute phase of disease, symptoms like fatigue, malaise, dyspnea and coughing will preclude diving and will not be further discussed. The question arises as to the consequence for diving safety and infectivity once the diver is asymptomatic. Advice on these questions will be based on extrapolation of data and expectations based on the effects of similar infectious diseases. An example of such an assessment is the one published by the Belgian Hyperbaric Medicine Society (7). This statement discusses the potential consequences for fitness for diving after COVID-19 based on infectivity to other divers, pulmonary barotrauma, cardiac events, pulmonary oxygen toxicity and decompression sickness. The statement does not specify whether it is applicable to diving in general or whether it specifically addresses recreational or occupational diving.

Dr Frank Hartig, a senior physician at the Innsbruck University hospital, has reported that six divers having suffered COVID-19, but not being hospitalised, demonstrated ‘severely damaged lungs’ five to six weeks after recovery (8). However, the international hyperbaric diving society UHMS calls for caution when interpreting statements in the lay-press without peer review (9).

It is the opinion of DMAC that the data on cardiac events, pulmonary oxygen toxicity and decompression sickness after COVID-19 currently is too scarce to support any guidance. If the chest CT is normal, the likelihood of contracting pulmonary barotrauma is probably very low in the occupational diving industry. The most significant effects of COVID-19 on divers' fitness is probably fatigue, impaired exercise capacity and infectivity. Our recommendations in section 5 below reflect this opinion.

#### **4 Existing Guidelines on Fitness for Diving after COVID-19**

Prior to the Hartig report, the Belgian Hyperbaric Medicine Society called for a minimum of two, preferably three months, of abstinence from diving after Covid-19 (7). The society recommends extensive pulmonary function testing, high resolution CT scans and cardiac evaluation before diving is resumed for divers who have been hospitalised for COVID-19. The University of California, San Diego, has issued [guidelines](#) for examination of recreational, scientific and commercial divers after COVID-19 (10). The guidelines detail requirements for clinical examination, exercise testing (with and without oximetry), chest X-ray, ECG, and echocardiogram.

#### **5 Recommendations for Assessment of Fitness for Commercial Diving during the ongoing COVID-19 Pandemic**

DMAC advice is based upon the precautionary principle. We recommend caution and vigilance with respect to the as yet unknown consequences for diving health and safety that previous COVID-19 infection amongst divers may cause. The diving industry is international, and divers are recruited from areas where the proportions of people affected by COVID-19 in populations may be vastly different. In the Upper Tier Council Area of England, 26,8% of the population might have suffered the disease as per April 2020 according to a recent report (11). This may be an overestimate as [antibody testing in London](#) suggests that 17% of the population would be positive for antibodies, but the results clearly demonstrate the large infectivity in some areas. A diver living in such an area has thus a higher likelihood of presenting persistent pulmonary effects compared to divers living in areas with low prevalence. The screening procedures detailed below reflects the intention to identify divers at risk.

The diving contractor is advised to establish a screening procedure to identify divers potentially affected by COVID-19 health effects. The screening procedure suggested below would be in addition to any virus (PCR) or antibody testing, as discussed in [IMCA D 06/20](#) (12). The screening procedure should be applied to all divers – saturation as well as surface oriented – independently of whether they have experienced COVID-19 infection. The reason for this is the high proportion of asymptomatic cases of COVID-19 observed. The contractor's diving medical advisor should supervise the screening, assess the screening results and establish requirements for medical contingency related to the screening. It is advised that screening should take place during mobilisation before each diving project.

The screening should include exercise testing monitored by a trained medic, respiratory technician or nurse. The national regulatory requirements and acceptance criteria for such testing should be applied. [IMCA D 061](#) (13) provides details of such tests e.g. a Chester Step Test (CST). The same document also recommends a minimum VO<sub>2</sub> max of 40 ml/kg/min. Results of exercise tests should be compared to previous tests.

The further extent of screening and required medical examinations will depend on the likelihood of COVID-19 short term health effects. For this purpose, we have divided divers into two groups:

1. Asymptomatic commercial divers and divers who have had confirmed COVID-19 with mild symptoms only. Chest x-rays or CT scans in this group are normal or not taken.
2. Commercial divers with moderate or severe symptoms of COVID-19. This includes (but is not limited to) all divers who have been hospitalised with COVID-19, divers who have received supplemental oxygen treatment, divers who have shown signs or symptoms of hypoxemia, and divers with structural changes in chest x-rays or CT scans secondary to COVID-19.

**For divers in group 1** we recommend all of the following:

- ◆ Divers who have had confirmed COVID-19 with mild symptoms only should not be permitted to dive for a period of at least one month after cessation of symptoms.
- ◆ Physical fitness capacity should be tested before each mobilisation.
- ◆ National regulatory requirements and acceptance criteria for testing of physical capacity should be applied.
- ◆ The diver should be monitored for SpO<sub>2</sub> during the test, if possible. Exercise testing should not take place if resting SpO<sub>2</sub><95%. In this case medical guidance on further examination is required.
- ◆ The test should be supervised by a trained medic, respiratory technician or nurse and the results should be assessed by the diving contractor's medical adviser.
- ◆ The diving contractor's medical adviser should consider referral to a specialist in pulmonary medicine if a decrement of >4% in SpO<sub>2</sub> is observed(14), or if there is a significant decrease in physical capacity compared to previous tests.

**For divers in group 2** we recommend all of the following:

- ◆ All divers should be assessed by specialists in pulmonary medicine and cardiology. This should be done in close relationship with the diving medical examiner or the diving medical advisor.
- ◆ The diver's medical fitness for diving should be reassessed by a medical examiner of divers. The examination should comply with the appropriate standard for medical examination and assessment of working divers, and a new certificate of medical fitness should be issued.
- ◆ The examination should include a test for physical fitness and the results should meet national regulatory requirements.
  - Depending on equipment availability, the monitoring should include measurement of SpO<sub>2</sub>.
  - A maximal exercise test is expected to have a higher sensitivity for detection of symptoms and hypoxemia.
- ◆ A chest CT should be completed in all cases when previous imaging has identified structural changes secondary to the infection or when the diver has been hospitalised or the diver wants to return to diving earlier than 3 months after being asymptomatic.
- ◆ A pulmonary function test, as a minimum including conventional dynamic spirometry, should be completed. Any clinically relevant deterioration from previous measurements should be reviewed by a specialist in pulmonary medicine.

When a diver in group 2 has been examined as described above, and considered fit to dive, later screening should be done as per group 1 guidance.

## 6 References

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