The Diving Medical Advisory Committee

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The Effect of Sonar Transmission on Commercial Diving Activities

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Supersedes DMAC 06 which is now withdrawn

1 The development of underwater technology commonly results in a noisy working environment for commercial divers. Also, the increasing use of active low-frequency sonar by submarines and ships raises the risk of accidental exposure to low frequency underwater sounds. While hearing conservation programmes based on recognised risks from measurable sound pressure levels exist to prevent occupational hearing loss for most normal working environments, there are no equivalent guidelines for noise exposure underwater.

2 Published data from humans under water in literature are scarce and sometimes use different terminology with regard to sound levels. For example sound pressure levels measured in air are normally reported with a reference pressure of 20uPa whereas levels measured in water are normally reported with a reference pressure of 1uPa. Therefore, in the diving environment it is recommended to use SPL (sound pressure level) threshold with reference pressure of one micropascal (1 µPa) for both water and air measurements in order to compare values from different sources (1, 2).

3 Divers exposed to high levels of underwater sound can suffer from dizziness, hearing damage or other injuries to other sensitive organs, depending on the frequency and intensity of the sound. This may include neurological symptoms such as blurred vision, lightheadedness, vibratory sensations in hands, arms and legs, and tremors in upper extremities (3, 4).

4 The single most important criterion related to diver safety resulting from low frequency sonar is that of disorientation due to vestibular stimulation. Whilst exposure to sonar transmissions below a level necessary to cause disorientation can give rise to temporary hearing threshold shifts, these are considered operationally acceptable for diving operations over limited periods.

5 The frequencies used in ultrasonic sonars (> 250 KHz) are above the human hearing threshold. Because the power of ultrasonic sonar rapidly falls off with distance, a safe operating distance is 10 metres or greater. Diving may be conducted around this type of sonar provided the diver does not stay within the sonar focus beam (5). None of the above avoids the need for positive safety measures to be adopted when divers are working on or very close to sonar sources which are inactivated. The possibility of accidental activation must be precluded.

6 Certain other considerations need to be taken into account before safe operating distances are calculated:

a) Helmeted divers are considered to have sufficient attenuation from the helmet itself to allow them to be safe from any known sonar in commercial use with frequencies above 500 Hz. In lower frequencies (<500 Hz) the minimal audible threshold is approximately 40 dB lower in humans in air than in water, and the estimated level of sound attenuation of divers helmets is between 25-30 dB over the same frequency. Therefore the divers helmets offers no advantage for hearing protection over the wet-suit hood for low frequencies (3).

b) Conversely, non-hooded and hooded divers may be at risk. The neoprene hoods normally worn by hooded divers do afford some attenuation. A 3mm neoprene wet-suit hood provides some hearing protection (10 dB) from sound frequencies between 400 and 500 Hz at shallow depth (<10 msw) (6).

7 It is not possible to set general safe distances with accuracy and appropriate figures must be calculated for each type of sonar or noise exposure.

8 None of the above avoids the need for positive safety measures to be adopted when divers are working on or very close to sonar sources which are inactivated. The possibility of accidental activation must be precluded.

References

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5 US Navy Diving Manual 2008, Vol 1, Revision 6, Appendix 1A: *Safe diving distances from transmitting sonar.*

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