


The professional diver

1. Technical aspects
2. Procedures
3. Legal aspects
4. Aspects of risk analysis
5. Implications for medical decisions


Dr. Roland Vanden Eede



1

Elke reproductie, geheel of gedeeltelijk, van deze presentatie mag slechts gebeuren met voorafgaandelijk akkoord van de auteur.

Toute reproduction, partielle ou integrale, de cet exposé et de ces notes ne peut se faire qu'avec l'accord préalable de l'auteur.




2

1

Commercial diving :

Technical aspects



3

Out of scope : Saturation diving

Typical desat times : 5 to 7days

Earth to Moon travel time:

Apollo 12: 4 days 14 hours 32 minutes

Hygiène
Temperature
Evacuation
Medical emergencies
Psychological issues
HPN



4

Commercial diving



Offshore



Shipping



Inshore



Windfarm



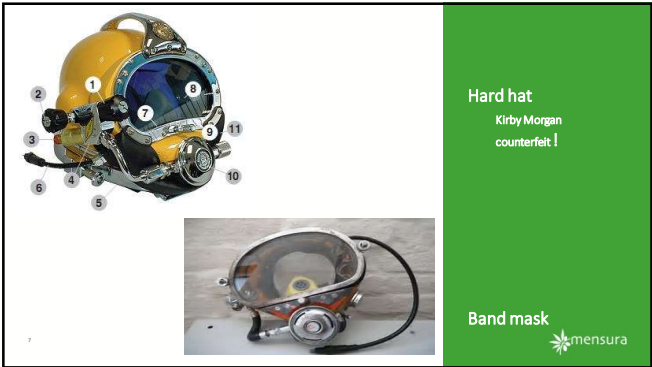
5



Dry suit
Full face mask
Umbilical
breathing gas
radio
video
Bail out
Gloves
Boots
Lead



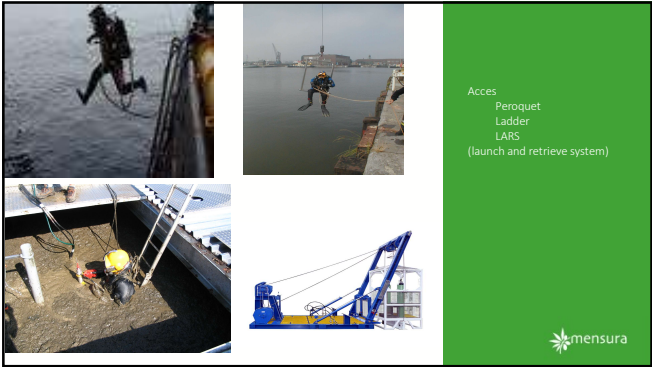
6



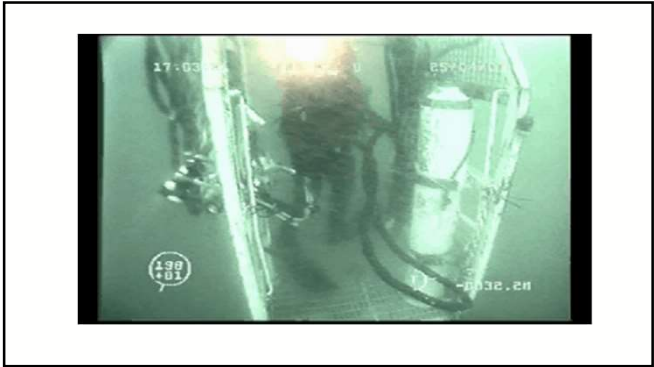
7



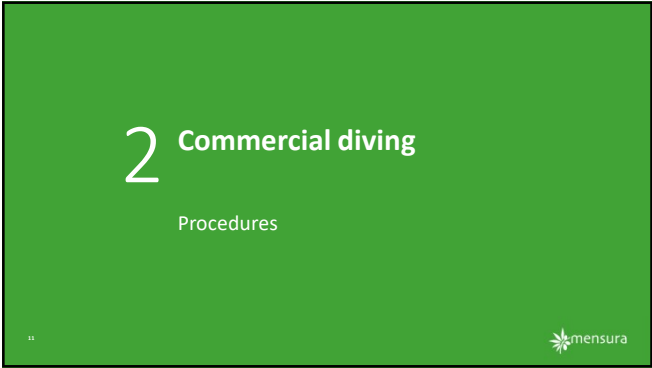
8



9



10



11




12

How to chose breathing gas ?

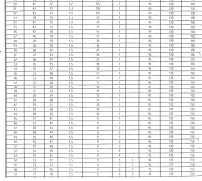
Safety – financial aspects

- Limits :
 - pP N2 : max 4,8 bar (50 m on air)
 - pP O2 : max 1,4 bar
- Equivalent air depth concept
$$\frac{(1-F O_2) (D+10)}{0,79} - 10 = \text{Equivalent air depth}$$
- Minimize decompression, maximize working time
- Count OTU's
- Add other inert gas when necessary

13




13



REPEX-TABEL

Aantal overstapelingen duikstapen	Maximaal aantal duikstapen per dag	Maximaal toegestaan aantal OTU's (overstapelen naar de tabel toevoegen)
1	800	800
2	800	1.600
3	800	2.400
4	800	3.200
5	800	4.000
6	800	4.800
7	800	5.600
8	800	6.400
9	800	7.200
10	800	8.000
11	800	8.800
12	800	9.600
13	800	10.400
14	800	11.200
15	800	12.000
16	800	12.800
17	800	13.600
18	800	14.400
19	800	15.200
20	800	16.000

14




14

How to chose tables ?

Legal – safety – financial aspects

- Has the country legislation concerning choice of tables ?
- Does the diving company provide tables in the diving manual ?
- Can you defend your choice of tables in case of incident/accident ?
- Make your choice and stick to it !

15



15


Types of tables

Bubble decompression models
Tables du Ministère du Travail 1992
BSAC'88
Varying Permeability Model (VPM)
Reduced Gradient Bubble Model (RGBM)

Probabilistic models
calculate the probability of DCS occurring on a given decompression profile
assumes a specified probability of DCS occurring

Goldman Interconnected Compartment Model
DCIEM 1983

16




16

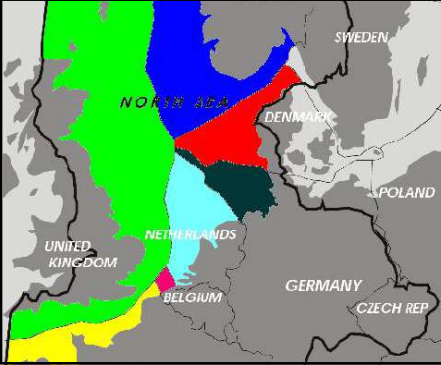
3 Commercial diving

Legal aspects

17



17




OSH is territorial legislation
National
Territorial waters
UK
1992 SAS UK AMED
Netherlands
Artes benelux overdrank
France
Journal Officiel 1992
Koninkrijks der Nederlanden

International guidelines
IMCA

Codes of good practice
EDTC

Belgium
Royal Decree 23/12/2003

18



18

European Framework Directive 89/391/EEC

application :situation as is 2018

demanding regulating systems in UK, Germany, France, Sweden, Norway, but sometimes very different.

Other European countries have very basic regulations or none at all

	Existing regulation	Only in general terms	Under development	Basic regulations	No regulations
Offshore/inshore	14 inshore 4 offshore			4	4
Safety, Quality, Risk mgmt	7	4	3		4
Organisation, duties, responsibilities	6	5		4	3
Health issues	9	2		4	3
Training, certification, competence	8	2	2	4	3
Operations, H&RA, IMRA	10	1		4	3
Diving Systems/Equipment	8	5	1	2 (no reference to PPE directive)	4

19

4 Commercial diving

Aspects of risk analysis

20

Risk analysis

Risk Consequence x Probability		Probability			
		Unlikely	Not very likely	Possible	Probable
Consequence	Very Serious	Hazardous	Hazardous	Very Hazardous	Very Hazardous
	Serious	Moderately Hazardous	Hazardous	Hazardous	Very Hazardous
	Mild	Moderately Hazardous	Hazardous	Hazardous	Hazardous
	Insignificant	Not Hazardous	Not Hazardous	Moderately Hazardous	Hazardous

21

Often medical/hyperbaric aspects are least of my worries

22

Keep your eyes open when visiting

23

Divers are dying

Statistics UK government HSE

- All workers 0,5 / 100,000/y

- Service sector 0,3

- Construction 2

- Extractive Industries 4

- Agriculture 8

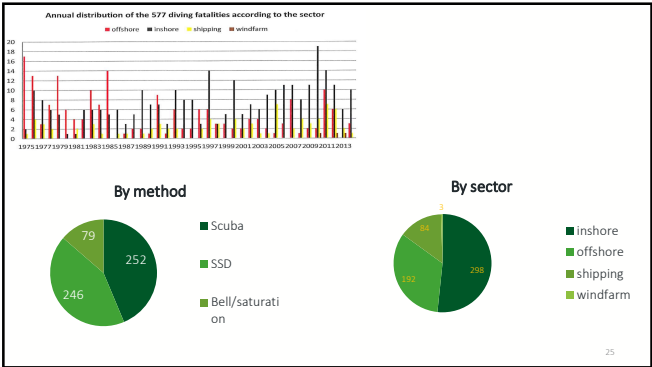
- Offshore diving 20-30

- Inshore diving 30-60

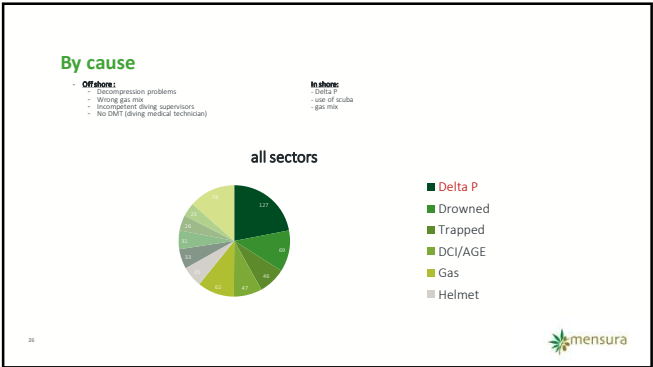
Independent source, collected by volunteers :

2000	39
2001	25
2002	26
2003	20
2004	35
2005	36
2006	29
2007	43
2008	50
2009	47
2010	70
2011	77
2012	65
2013	42
2014	44
2015	6

24



25



26



27

5 Commercial diving

Implications for medical decisions

28

Mental challenge :

- Level I diving physician
 - Impact of health on hyperbaric exposure
- DMA (diving medical advisor)
 - Impact of work on kind of work (heavy, long hours, cold, heat, remote locations...)
 - Impact of work on health (physical, chemical, biological, postural and psychological constraints)
 - Impact of fit/unfit decision on social situation (on payroll, self-employed, alternative jobs...)
 - Legal responsibility of employer vs medical secret
 - Legal responsibility of physician : does it stand in court ?

29

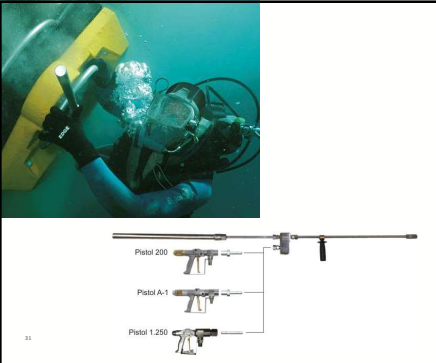
How to react ?

vascular disease ?
rheumatic disease ?
sigarettes ?
medication ?

Working environment ?


cold ?
vibration ?

30

A composite image. The top left shows a diver underwater with a yellow steering mechanism. The bottom left shows a diagram of three pistols (200, A-1, 1.250) connected to a steering mechanism. The right side is a green panel with text.

Adaptation of steering mechanism

Under investigation




31


My experience

300+ commercial divers each year since 1985
Most are fit when coming to medical : healthy worker effect

- Unfit : very seldom
 - Epilepsy after accident, diabetes by start diving, atrium fibrilation resistant to treatment...
 - Spontaneous pneumothorax, asma resistant to treatment
- Fit with exceptions
 - Diabetes for inshore diving with hard hat : blood glucose > 150 mg/dl at 60', 30' and pre-dive
 - Amputation foot after accident : no saturation diving
 - Accidental pneumothorax : no diving for 6 months
 - Asma responding well : treatment, and only in shore with LARS
- Question : wich degree of fitness ?
 - Diving is mostly not strenuous, but peaks can happen
 - Norway : sat diver 45 ml/kg/min VO2 max
 - Practical approach :
 - when starting : 12 MET (40 ml/kg/min VO2 max)
 - When experienced : off shore 10 MET, in shore 7 MET with coaching to train and lose weight
- Most important : what about his working conditions ?



32


A diver is shown on a stationary bike in a laboratory setting, wearing a heart rate monitor and connected to a computer system.

No binary fit-unfit for hyperbaric work

Keep in mind for what kind of job you see him


Medical is part of sensibilisation and prevention


Trust of diver is essential




33

Questions ?

 0478/223404

 Roland.vandeneede@mensura.be



34