

SAA Nitrox Diver

Course Notes

To the Reader.

Diving with Nitrox is easy and the benefits are plentiful. Enjoy your diving and take good care of yourself by taking the time to follow the simple safety checks.

Know what you're going to do before you do it!

Good Luck and Safe Diving.

Bob Cole

SAA Decompression Officer and CMAS Technical Director

ISBN 978-0-953290-48-4



9 780953 290482

Sub-Aqua Association
Space Solutions,
Business Centre,
Sefton Lane,
Maghull, Merseyside L31 8BX

Tel: 0151 287 1001
E-mail: admin@saa.org.uk
Web: www.saa.org.uk

SAA Nitrox Diver - Course Notes

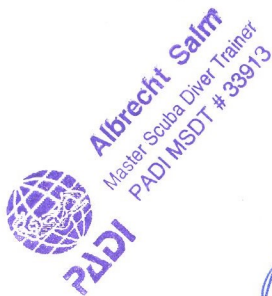
DeeP-Stop Edition



CONFÉDÉRATION MONDIALE
DES ACTIVITÉS SUBAQUATIQUES
WORLD UNDERWATER FEDERATION

DeeP-Stop Edition





Handwritten signature and date:
A
06/2010



The SAA DeeP-Stop Nitrox Diver Tool Box

by

Bob Cole

SAA Decompression Officer

CMAS Technical Director

This book forms part of the **SAA DeeP-Stop Nitrox Training Programme**, which is taught by SAA Diving Clubs.

Note: *The illustrations used in this book are taken from the SAA DeeP-Stop Nitrox PowerPoint Lecture CD. It is hoped that they will provide a link between the lecture and private study.*

Cover Picture

A diver analysing her Nitrox breathing mix before leaving the dive shop.

Published by: Sub-Aqua Association 2009

© Bob Cole

ISBN 10 : 0 9532904 8 4

ISBN 13 : 9780953290482

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means - electronic, mechanical, photocopying or otherwise - without the prior written permission of the author.

Printing history

Previously published by the Dive Information Company

First edition April 1996

Second (revised) edition May 1997

3rd (revised) edition August 2004

DeeP-Stop edition June 2009

Further copies of this book can be obtained from:

Sub-Aqua Association
Space Solutions, Business Centre
Sefton Lane
Maghull, Merseyside
L31 8BX

Tel: 0151 287 1001

E-mail: admin@saa.org.uk

British Library Cataloguing in Publication Data

Cole Bob

The SAA DeeP-Stop Nitrox Diver Tool Box - Course Notes

ISBN 10 : 0 9532904 8 4

ISBN 13 : 9780953290482

Printed by: AquaPress, 25 Farriers Way, Temple Farm Industrial Estate, Southend-on-Sea, SS2 5RY, England.

This book was designed and typeset by: The Dive Information Company, 25 Old Tye Avenue, Biggin Hill, Kent, TN16 3LY, England.

IMPORTANT

Because people vary in their susceptibility to decompression illness, oxygen toxicity, and carbon dioxide retention, no set of tables or personal decompression computer (PDC) can guarantee total avoidance of diving related illnesses; even if the limitations of the tables or PDC are complied with in full. Keep in mind that diving is a risk sport!

Special message

Because of the dangerous nature of diving, the user takes full responsibility for any accident and no warranty concerning the advice, tables or PDCs mentioned in this book is expressed or implied. Under no circumstances will the SAA, the estate of the late Professor A A Bühlmann, the author or the publisher be liable or responsible for any consequential loss and/or damages.

Caution

Diving cannot be learned by just reading books. It is a practical sport which requires skills and knowledge. This book provides notes for SAA Nitrox Diver Trainees and is only part of the SAA's Diver Training Package.

Never dive beyond the limit of your training and experience without a qualified instructor.

Know what you're going to do before you do it!

This SAA Deep-Stop Nitrox Diver Tool Box when read in conjunction with the SAA Bühlmann DeeP-Stop System and the new SAA EANx Gas Mix, Depth and EAD Tables constitutes the **SAA Bühlmann DeeP-Stop Nitrox System**.

The original SAA Nitrox Diver text was reviewed by Vic Bonfante.

Special thanks to Graeme Lawrie & Mike Harwood of the HSE for their encouragement and useful comments.

Finally my thanks to Dave Dresser for his constant help.

Preface

In the early 1990s the use of Nitrox was seen as Technical diving, although it had been around and used by the military since the early 20th century. To amateur divers, however, it was something new and in some quarters it was seen as a devil gas and because of this its growth in popularity was stunted. Nevertheless, a small band of enthusiasts kept plugging away and slowly but surely it started to be accepted. The SAA was the first sport diver training agency to adopt Nitrox diving as a policy and started to promote its use by running regional courses throughout the UK.

Subsequently, other sport diver training agencies began to join in and now all are committed to Nitrox as a sport gas. Eventually, a critical mass of Nitrox divers was created and nowadays Nitrox diving is seen as normal and many of the early restrictions that were imposed are now seen as a nervous reaction to the new gas.

As with all forms of diving there are always associated risks, but time has shown us that Nitrox diving, within the current safety limitations, is relatively safe.

The final move in the SAA Nitrox story is that we have now developed a training programme so that it can be delivered by Club Instructors within their own Clubs. So the training bottleneck of arranging regional courses has been removed.

Diving with Nitrox is easy and the benefits are plentiful. Enjoy your diving and take good care of yourself by taking the time to follow the simple safety checks.

Know what you're going to do before you do it!

Good Luck

Bob Cole



Contents

Chapter 1

Introduction

Background	1-1
Why Use Air?	
What is Nitrox?	
Why Use Nitrox?	
Scuba Equipment	1-2
Extra Limitations	
Nitrox - The Ideal Sport Diving Gas	
Entry Qualifications	
SAA Nitrox Instructor Qualifications	
Operational Limits of the SAA Nitrox Diver	

Chapter 2

Decompression

Background	1-2
The Important Message	
Changing the Boundaries	
Ascents	2-2
Decompression Illness (DCI)	
First Aid Treatment for DCI	

Chapter 3

The Equivalent Air Depth Technique (EAD)

Background	3-1
SAA Nitrox EAD Tables	
EAD Calculations	3-2
Repetitive Dives	3-3
Mixing the Breathing Gases	
Finally	3-4

Chapter 4

The SAA Bühlmann DeeP-Stop Nitrox System

Introduction	4-1
The SAA Bühlmann DeeP-Stop Nitrox System	
Changing Gases During the Diving Day	4-3

Contents

Chapter 5

Personal Decompression Computers (PDCs)

Introduction	5-1
Which PDC to Buy?	
Deep-stop PDCs	5-2
Applying deep-stops to a non deep-stop PDC	
Limitations of Use	5-3
Diver Behaviour	

Chapter 6

Oxygen Physiology

New Limits	6-1
Central Nervous System (CNS) Oxygen Toxicity	
Symptoms and Signs of Acute Oxygen Toxicity	6-2
Convulsions	6-3
Avoidance	
Pulmonary Oxygen Toxicity	
The SAA Oxygen CNS% Exposure Tables	6-4
The Method of Use for the SAA CNS% Exposure/minute Table	
Repetitive Dives	6-5
Instructors Teaching Air Diving whilst Breathing Nitrox	6-6
DCI Oxygen First Aid and Therapeutic Treatment	
Carbon Dioxide Retention	
Medication	

Chapter 7

Gas Blending

Introduction	7-1
Gas Blending Methods	
1. Partial Pressure	
2. Weight	
3. Continuous Blending	7-2
4. Extraction Double Filtration Method	

Contents

Chapter 8

Oxygen Clean, Oxygen Compatible and Oxygen Service

Introduction	8-1
Combustion	
Oxygen Service	8-2
Oxygen Clean	
Oxygen Compatible	
Maintenance of Oxygen Service	

Chapter 9

Personal Diving Equipment for use with Nitrox

Introduction	9.1
Demand Valves	
Dive Cylinders	
Nitrox Cylinder Inspection and Testing	
Nitrox Cylinder Identification	

Chapter 10

Analysing Your EANx Mix

Introduction	10-1
Analysing Your EANx Mix	

Appendix 1

PFOs (shunt/by-pass) and the Diver

Introduction	A1-1
Antonio-Maria Valsalva (1666-1723)	A1-2
PFOs may be Dynamic	A1-3
Putting PFOs and Diving in Perspective	
How can you tell if you have a PFO?	
Modifying your Behaviour	A1-4
As a Minimum:	A1-5
PFO Closure	A1-6
(Transcatheter Closure of Atrial Septal defect)	
Pregnancy and PFOs	
Conclusion	

Further Reading and References

Title	Publisher	Author	ISBN
SAA Bühlmann DeeP-Stop System	SAA	Bob Cole	0 9532904 8 4
The Physiology and Medicine of Diving	Saunders	Bennett & Elliott	0 7020 1589 X
Oxygen and the Diver	SPA Ltd	Ken Donald	1 85421 176 5
The Decompression Matrix	Dive Info Co	Bob Cole	0 9520934 2 1
Royal Navy Diving Manual	MoD	BR 2806	
NOAA Diving Manual	Best Publishing	J Joiner (Ed)	0 941332 70 5

Decompression after Repeated Dives. A A Bühlmann. Undersea Biomedical Research 14, 59-66 1987

Decompression Sickness, Micro Gas Bubbles, Gas Emolism-Barotrauma (extract) A A Bühlmann. Zürich 1992

The IANTD (UK) Basic EANx Student Workbook 7th ed. Kevin Gurr and Rob Palmer from an original concept by Dick Rutkowski

Mixed Gas Diving. Tom Mount & Bret Gilliam. ISBN 0 922769

Men and Women in Diving. M St Leger Dowse, P Bryson, A Gunby and W Fife. DDRC - ISBN 0 9525152 0 2