

**073 – NORWEGIAN OIL AND GAS
RECOMMENDED GUIDELINES**

FOR

**MEDICAL SUPPLIES IN MANNED
UNDERWATER OPERATIONS
IN THE PETROLEUM
ACTIVITIES ON THE NORWEGIAN
CONTINENTAL SHELF**



Translated version

Table of content

| | |
|---|---|
| FOREWORD | 3 |
| 1 INTRODUCTION | 4 |
| 2 PURPOSE AND SCOPE | 5 |
| 3 REFERENCES | 6 |
| 4 ABBREVIATIONS AND DEFINITIONS | 7 |
| 4.1 ABBREVIATIONS | 7 |
| 5 SPECIFIC REQUIREMENTS REGARDING MEDICAL SUPPLIES | 8 |
| 5.1 OBJECTIVE..... | 8 |
| 5.2 REQUIREMENTS..... | 8 |
| 5.2.1 <i>Competence</i> | 8 |
| 5.2.2 <i>Responsible Person</i> | 8 |
| 5.2.3 <i>Planning</i> | 8 |
| 5.2.4 <i>Documentation</i> | 8 |
| 5.2.5 <i>Assessment, auditing and revisions</i> | 8 |
| 5.2.6 <i>Detailed specifications</i> | 9 |
| | |
| APPENDIX A | DMAC 15 “Medical equipment to be held at the site of an offshore diving operation” |
| APPENDIX B | DMAC 28 “The provision of emergency medical care for divers in saturation” |

Foreword

Version 1.

These guidelines have been developed as a joint industry project between operators, diving contractors, and relevant authorities.

Representatives from the Norwegian Board of Health (NGH) and Norwegian Petroleum Directorate (NPD) have participated in the project meetings and have continuously been informed about the process.

These guidelines and other Norwegian Oil and Gas guidelines are available on <http://www.norskoljeoggass.no>.

Version 2.

Minor changes in text based on changes in regulations and authority functions. References have been updated and latest revision of DMAC 15 and 28 have been incorporate.

The revision has been carried out by MD Jan Risberg, NUI, it has been for comments in the Norwegian Oil and Gas sub sea operations network during the periode 2 – 17 june 2009, and no comements have been received.

Contact person in case of questions is: Jan Risberg, StatoilHydro, JRI@nui.no, 90 61 21 74

Responsible Norwegian Oil and Gas manager can be contacted through Norwegian Oil and Gas Association's switchboard +47 51 84 65 00.

1 Introduction

The Norwegian Ministry of Social Affairs issued 1979 “Guidelines concerning first-aid equipment and medical life-saving kits for deep-sea diving in connection with exploration and drilling operations for submarine petroleum deposits on the Norwegian Continental Shelf”. These guidelines have not been revised, and are considered – from a professional point of view – out of date. Additionally, the guideline contributes to separate stores of medical equipment and drugs being required on North-Sea (Norwegian or UK) worksites.

Based on this fact, Norwegian Oil and Gas and the authorities agreed to issue a guideline based on current professional recommendations as well as a guideline harmonized with relevant industry and governmental regulations/recommendations.

These guidelines will be available in Norwegian, however, the English version will be the official one.

2 Purpose and scope

The purpose of this guideline is to give guidance regarding the supply of medical equipment and drugs *specifically applicable* for manned underwater operations on the Norwegian Continental Shelf. The guideline does not specify medical equipment and drugs generally applicable for ships, petroleum installations etc, as regulated by other authorities.

A main objective is harmonizing the medical supplies with the UK and international practice.

The relevant statutory requirements are the new Norwegian HSE regulations valid from 01.01.2002:

- Regulations Relating to Health, Environment and Safety in the Petroleum Activities (The Framework Regulations) 31 August 2001
- Regulations Relating to Management in the Petroleum Activities (The Management Regulations) 3 September 2001
- Regulations Relating to Conduct of Activities in the Petroleum Activities (The Activities Regulations) 3 September 2001
- Regulations Relating to Design and Outfitting of Facilities etc. in the Petroleum Activities (The Facilities Regulations) 3 September 2001
- Regulations Relating to Material and Information in the Petroleum Activities (The Information Duty Regulations) 3 September 2001

The regulations are available on <http://www.ptil.no>.

Within this guideline NORSOK Standard, U-100, "Manned Underwater Operations" is considered a normative standard.

3 References

Where references are given in the body of the document to a standard or a specific paragraph of a standard, these are regarded as normative references, unless explicitly noted.

The relevant NORSOK standard, which is a normative reference, is found on <http://www.nts.no/norsok/>

Table 3.1 Table of references

| Document id. | Document title |
|------------------------------------|--|
| Norsok U-100 Ed. 2 (Jul. 2008) | Manned underwater operations |
| DMAC 15 Rev. 2 (May 2009): | Medical equipment to be held at the site of an offshore diving operation |
| DMAC 28 (Dec 2003) | The provision of emergency medical care for divers in saturation |
| Norwegian Oil and Gas Guideline 6 | Veiledende medikamentliste for installasjoner på kontinentalsokkelen |
| Norwegian Oil and Gas Guideline 15 | Guidelines for medical equipment for fixed and mobile installations |

The latest revision of the documents should be used. Revision status as listed above, is applicable as of May 2009.

Other relevant Norwegian Oil and Gas guidelines concerning medical supplies in the petroleum activity should be evaluated when issued.

4 Abbreviations and definitions

4.1 Abbreviations

Below, a list of abbreviations used in this guideline is given.

DMAC Diving Medical Advisory Committee

HSE Health, Safety and Environment

MUO Manned Underwater Operations

NBHS Norwegian Board of Health Supervision

PSA Petroleum Safety Authority Norway

4.2 Definitions

In this document “Medical supplies” include medical equipment, medical consumables and drugs.

5 Specific requirements regarding medical supplies

5.1 Objective

The handling system and content of the medical supplies must be in compliance with relevant national, internal, contractual and professional requirements. In addition, the medical supplies must meet the specific needs of the MUO. The responsible competent diving doctor has the overall professional responsibility for this compliance.

5.2 Requirements

5.2.1 Competence

The diving contractor's responsible competent diving doctor must be properly qualified, i.e. relevant education and experience in compliance with current national and professional standards.

The personnel on the diving site handling the medical equipment and medicines must have the proper competence for dealing with such material (e.g. national, industry or internal requirements). The responsible competent diving doctor has the overall responsibility to see to that the relevant personnel are qualified.

5.2.2 Responsible Person

The responsible competent diving doctor of the diving contractor has the overall professional responsibility for the system and content of the medical supplies.

There shall be one dedicated competent person during the dive who has the responsibility for the medical equipment. The nurse shall have the onsite responsibility if he/she is dedicated to the site of the MUO. Tasks can be delegated to other personnel on site, e.g. first aid team and/or advanced first aider. This delegation should be described in the internal management system.

5.2.3 Planning

The health service of the company conducting the project should make proper planning before each MUO to secure compliance with relevant requirements regarding the medical supplies.

5.2.4 Documentation

Procedures shall be developed and implemented to ensure the expedition of recommendations relating to the system of medical supplies handling. All relevant activities shall be documented. The diving contractor should document (list) the medical supplies.

5.2.5 Assessment, auditing and revisions

In accordance with the PSA/NBHS regulations, a program shall be in place for regular audits, validation/verification, reviews and revisions of the medical supplies. On diving vessels with continuous operations, a pharmacist or medical doctor should audit the medical supply system

annually by measuring compliance with this guideline. For diving vessels (or similar) not being audited the last 12 months, the medical supply system should be audited prior to the MUO.

The responsible person on the dive site for the medical supplies shall, on a regular basis, review and document the supplies.

5.2.6 Detailed specifications

The diving contractor should, on a continuous basis, harmonize the medical supplies to conform with other relevant professional standards (e.g. other relevant DMAC Guidance Notes).

The management system for the medical supplies should conform to the standard applicable for installations (see table 3.1).

The volume and detailed content of the medical supplies required for a MUO will depend on vessel/installation, crew, other commitments, etc. The vessel/installation should be properly equipped with medical supplies, according to regulatory, contractual and professional requirements, to cover medical conditions including emergencies applicable for the vessel/installation. Additionally there are specific requirements for MUO with respect to medical equipment. To comply with these, a minimum content of medical supplies as published in DMAC 15 (“Medical equipment to be held at the site of an offshore diving operation” (see the enclosed Rev. 1) should be available. The volume of medical supplies listed in DMAC 15 is considered applicable for a maximum of six divers. Additional supplies may be called for due to additional requirements, particular operational or dive site conditions, number of divers or advances in the medical professional community.

The volume of medical supplies listed in DMAC 15 should be considered as an integrated part of the vessel/installation medical equipment. The detailed content of medical supplies for the diving operation and for the vessel/installation operation can be adjusted to avoid unnecessary duplication. Medical emergency supplies, intended for use in a hyperbaric chamber, should be stored and packed to allow immediate lock-in to the chamber complex.

Surface oriented diving

During surface-orientated diving the *Diving Bell Kit* as specified in DMAC 15 shall be available in the diving tender craft (eg. dinghy). Oxygen therapy sets, allowing supply for a minimum of 30 minutes treatment at surface pressure for each diver in water, shall be available in the diving tender craft.

Provision of emergency care for divers in saturation

Attention is drawn to guidance’s provided in DMAC 28 (The provision of emergency medical care for divers in saturation, see enclosed). As a minimum these requirements should be complied with:

- A risk analysis should identify a proper (living) chamber suitable for advanced medical care (medical treatment chamber)
- The medical treatment chamber should be properly equipped to allow advanced medical care of seriously injured or sick divers
- The medical treatment chamber should be prepared to allow use of ventilators, infusion pumps and emergency monitoring system (e.g. for ECG, blood pressure, invasive pressure) as required by the risk analysis and equipment availability

- Procurement and storage of advanced medical treatment and monitoring systems should be based on the risk analysis and equipment availability

Medical Equipment to be Held at the Site of an Offshore Diving Operation

DMAC 15 Rev. 2 – May 2009

NOTE: This replaces DMAC 15 rev 1 issued in February 1995 which is now withdrawn

Commercial diving operations include both surface supplied and saturation diving operations and cover a wide range of work activities. Appropriate medical equipment to be held at any particular site is best determined by an occupational health service with special knowledge of commercial diving operations. This list is designed to provide guidance on equipment to be held at the site where such advice is not available. It is recognised that in certain circumstances similar or greater facilities may be available from other sources which are sufficiently close and reliable.

The list covers equipment suitable for the treatment of diving related disorders on the surface or in a recompression chamber and for other potential problems eg. trauma which may occur during diving operations. The list takes account of situations where the diving operation may be remote from a vessel or installation sickbay and medical services. It includes equipment for use in an immediate first aid situation, equipment and drugs which may be used by personnel with advanced first aid training as well as equipment which would almost certainly only be used by medical staff. Medical staff who attend a casualty at a dive site may not necessarily be able to bring the appropriate equipment.

Some of the drugs mentioned in this note may not be available in some geographical areas and in such cases alternative drugs to those identified should be considered.

It is anticipated that except in emergency situations, equipment other than that in the bell or chamber first aid kits would be for use by or on the direction of medical staff.

There should be an appropriate system for the control and maintenance of the equipment and responsibility for the equipment should be vested in the Diving Superintendent or vessel medic. Equipment should be stored in a locked container and appropriately labelled. The diving supervisor must have access to the equipment at all times. Scheduled drugs should be held in a secure double locked container (with vessel medical supplies or installation sickbay). A logbook should be maintained with the equipment in which all use of equipment and drugs is recorded. The equipment should be inspected regularly (at least every three months) to ensure that all items are in working order (e.g. batteries) and to exchange drugs and other equipment which is nearing the end of its shelf life. These regular inspections should be recorded in the logbook.

Consideration should be given to the need for pressure testing mechanical or electrical equipment.

Equipment to be Held in a Diving Bell

| | |
|--|-----------------------------------|
| 1 Tourniquet | 3 Polythene bags |
| 1 Pocket resuscitator (eg.Laerdal pocket mask) | 1 Airway size 4 (eg. Guedel type) |
| 1 Tuf cut scissors | 1 Medium dressing |
| 1 Large dressing | 2 Triangular bandage |
| 1 Role of 1 inch adhesive tape | 2 Crepe bandage 3 in |
| 1 Hand operated suction pump (eg. Vitalograph) | 1 Water tight bag |
| 1 Suction catheters sizes 12 and 14 | |

[(20 Hyoscine dermal patches for Hyperbaric evacuation chamber (eg. Scopoderm plasters)]

The same equipment should be held in each living chamber of a saturation system, in air diving chambers and in hyperbaric lifeboats. In living chambers a foot or gas powered suction pump may be preferred.

Equipment to be Held at the Dive Site

Diagnostic equipment

| | |
|--|--|
| Pencil torch | Thermometer (electronic) - inc low range |
| Stethoscope | Aneroid sphygmomanometer |
| Reflex hammer | Tape measure |
| Tuning fork (256 Hz) | Pins for testing sensation (eg. Neurotips) |
| Tongue depressors | Urine testing strips |
| Otoscope (with spare bulb and batteries) | |

Thoracocentesis

| |
|---|
| Intercostal drain/trocar and drainage kit (eg. Portex type) |
| Heimlich valve |
| 2 intravenous cannulae 14g |
| 1 wide bore needle |

Urinary catheterisation

| | |
|--|-------------------------|
| 2 Urinary catheters sizes 16 and 18 (eg. Foley type) | 2 Urine collection bags |
| 2 Catheter spigots | 2 20ml sterile water |
| 2 Urethral anaesthetic gel | |

Dressings

| | |
|---------------------------------|-----------------------|
| 10 pkts Gauze squares 10 x 10cm | 6 Triangular bandages |
|---------------------------------|-----------------------|

| | |
|------------------------------|----------------------|
| 10 pkts Cotton wool balls | 12 Safety pins |
| 2 Adhesive bandage 75mm x 3m | 40 Adhesive bandages |
| 2 Adhesive bandage 25mm x 3m | 2 Crepe bandages 3in |
| 2 Large dressing | 2 Crepe bandages 6in |
| 2 Medium dressings | 2 Dressing bowls |
| 2 Small dressings | 4 Eye pads |
| 2 Ambulance dressings | |

Sterile supplies general

| | | |
|---|---|------------------------------|
| 4 Universal containers solution) | 6 Sachets skin disinfectant (eg. Cetrimide) | |
| 10 Alcohol swabs | 2 Drapes | |
| 5 Gloves (selection of sizes) | | |
| 6 Sutures nylon (2/0 and 3/0), preferably with cutting needles attached | | |
| 2 resorbable sutures (2/0 and 3/0), preferably with needles attached | | |
| 5 x 20ml Syringes | 5 x 10ml Syringes | 5 x 2ml Syringes |
| 10 x 18g Cutting Needles 38mm | 10 x 21g Cutting Needles | 2 x 18g Cutting Needles 90mm |

Sterile instruments

| | |
|--------------------------------|-----------------------|
| 2 Spencer Wells forceps 5 inch | 1 Dressing forceps |
| 1 Spencer Wells forceps 7 inch | 2 Disposable scalpels |
| 1 Scissors fine pointed | 1 Dressing scissors |
| 1 Forceps fine toothed | |
| 1 pr Mosquito forceps | |

Intravenous access

| | |
|-------------------------------|---|
| 3 Giving sets | 4 iv cannulae 16g |
| 4 Butterfly infusion sets 19g | 4 iv cannulae 18g |
| 4 Infusion bottle holders | 2 long needles (for venting infusion bottles) |

Resuscitation

- Resuscitator to include reservoir and connection for BIBS gas. (eg. Laerdal type) *
- 3 resuscitation masks (varied sizes)
- Pocket resuscitator with with one way valve. (eg. Laerdal pocket mask)
- Laryngoscope and batteries and spare bulb

Endotracheal tubes (e.g. sizes 7, 8 and 9). Two Laryngeal masks or oesofago-laryngeal tubes (Larynxtube, Combitube) may replace endotracheal tubes.**

| | |
|----------------------------------|---------------------------------------|
| 1 ET tube coupling and mount | 2 Airways sizes 3+4 (eg. Guedel type) |
| Foot operated suction device | Torniquet |
| 2 endotracheal suction catheters | 2 wide bore suckers |
| semi-automatic defibrillator | |

* *Resuscitators may require modification to gas inlet to ensure adequate filling at pressure.*

** *Endotracheal tubes should be provided for use by doctors only*

Drugs

Anaesthesia/analgesia

5 x 10ml Lignocaine 10 mg/ml amps
25 x 500mg Paracetamol tabs
20 x 30mg Dihydrocodeine tabs
20 x 300mg Soluble aspirin tabs
5 x 10mg Morphine sulphate amps
(or 100mg pethidine amps)
2 x 1ml Naloxone 0.4mg/ml amps

Resuscitation

2 x 40mg Furosemide amps
10 x 1ml Adrenaline 1mg/ml amps
2 x 1.2mg Atropine amps
5 x 100mg Hydrocortisone amps
2 x 25mg Prochlorperazine amps
3 x 20ml Glucose 50mg/ml
6 x 150mg Amidarone amps

Various

| | |
|---------------------------------------|--------------------------------|
| 2 x 10mg Chlorpheniramine amps | 6 x 500ml Saline 9mg/ml |
| 2 x 50mg Chlorpromazine amps | 20 x 250mg Amoxicillin tabs |
| 5 x 10mg Diazepam amps | 20 x 250mg Erythromycin tabs |
| 10 x 5mg Diazepam tablets | 2 bottles antibiotic ear drops |
| 1 tube Silver Sulphadiazine cream 1 % | 2 x 10mg Diazepam (rectal) |

The Provision of Emergency Medical Care for Divers in Saturation

DMAC 28 Rev 1 – December 2008

1 Background

DMAC has published guidance over a number of years aimed at providing divers in saturation with a level of medical care which is as similar as possible to the level of medical care available to other personnel who work offshore.

In the early days of the offshore diving industry it was considered desirable to transport (under pressure) an ill or injured diver in saturation from an offshore location to an onshore facility which would provide specialised medical care. As experience was gained however it became clear that it was much better to retain the casualty at the offshore work site and transport medical equipment and personnel to the casualty. This has now become the accepted method of operation.

In many cases the most practical concept is to stabilise the patient until suitable decompression allows definitive care under atmospheric pressure.

DMAC published Guidance Note 25 in October 1993 and raised this to Revision 1 in March 1996. Guidance Note 27 was published in April 1996. This Guidance Note, No. 28, supersedes all three previous notes, and aimed to combine the advice which they contained in to one succinct source which can be applied anywhere in the world. This revision of DMAC 28 updates that advice to reflect current practice and equipment.

Whilst this document gives general guidance, detailed arrangements should exist for each work site, agreed and documented between the diving company and its specialist medical adviser.

2 Geographic Limitations

It is recognised that the location of the diving operation will determine the facilities which are readily available to provide expert medical care. For example, in the North Sea such skilled care will often be available within an hour or two while in other parts of the world specialised doctors may be thousands of miles away from the diving site.

Prior to the commencement of any diving operation the diving company should consult with its medical adviser (possibly also with the clients medical department) and agree what facilities and equipment should be available in relation to the specific location. In remote locations there may be more benefit from ensuring that good communications are available than from the provision of specialised medical equipment on site.

Whilst the advice given in this document is intended to apply anywhere in the world, it is recognised that there will be differences in the ability to implement its recommendations dependent on the exact location and circumstances.

3 Contingency Planning

The equipment that each of the various personnel with a role in providing medical care in an emergency (e.g. diver, diver medic, members of the medical support team) is capable of using should be agreed by the diving company and their medical adviser, and this should be taken into account when developing the contingency plan. Anyone expected to use a certain piece of equipment should be familiar with and trained in use of that equipment.

4 On Site Medical Arrangements

The equipment available at site and the ability of those present to provide adequate first aid and resuscitation within the first few minutes and hours of an incident will ultimately determine the outcome for the patient.

DMAC has published guidance on the equipment which should be held at an offshore worksite (DMAC 015 Rev.1)

The use of properly trained diver medics is now widespread but the selection and training of suitable personnel from among the divers to provide advanced first aid is crucial to the success of any medical treatment.

The diving company should prepare, in conjunction with its medical adviser, a well documented plan to provide initial first aid to an injured diver while at the same time contacting specialist medical personnel for advice. This plan is intended to stabilise a casualty until such time as a decision is taken as to what further treatment may be needed.

5 Suitability of Medical Teams

The highest level of medical care will be provided by a medical team which is trained and experienced in handling casualties under saturation conditions. This level of specialist knowledge is not widespread throughout the world and is often concentrated in specific locations which may be a significant distance away from the work site.

Effective monitoring of the patient by the onsite diver medic using simple monitoring equipment, coupled with direct communications (e.g. audio, video, photographic links and email) between the specialist doctor ashore will form the basis of care given to the casualty in the first instance.

Since local medical personnel might not possess specialised knowledge to provide the necessary medical support consideration should be given to utilising a specialist medical team from one of the world's recognised centres of diving who could be flown to the site of an incident.

6 The Saturation System

Since the diving system may vary from a single chamber on the simplest transportable system to a multi-chamber complex on a large DSV, it is not appropriate to give specific technical specifications. The basic requirement however is to provide a facility where an injured diver can be given medical treatment while still under pressure.

It is recommended that one chamber be identified as the chamber in which any medical treatment will be carried out. This chamber should have the following:

-
- A minimum internal diameter of 1.8 metres (6 feet) but preferably 2.15 metres (7 feet) or more.
 - The ability to remove, or move out of the way, bunks and other equipment normally fitted to the chamber but not needed directly for a medical emergency.
 - A bunk for the patient which should:
 - be waist high
 - have access from at least one side and one end have a firm base (such as a permanent, or easily fitted metal base) be able to tilt the patient to 30° both at the foot and head ends
 - be provided with a mattress, or other means, to electrically insulate the patient from the bunk
 - A tray or working surface for medical instruments
 - A means for suspending IV drips overhead the patient (hooks or similar) A convenient medical lock of at least 300mm diameter
 - A good communications system with connections in a suitable location for personnel beside the casualty.
 - Suitable extra lighting for the area of the casualty. This may be the normal bunk lights fitted with long leads to reach the treatment area.
 - Sufficient additional gas and electrical hull penetrations (in order to ensure that in an emergency appropriate gas and electrical supplies can be rapidly connected) as agreed with the specialist medical adviser (See sections below)
 - Sink facilities (with foot or elbow operated taps) to be provided in the vicinity of the patient's bunk.

7 Communications

Good communications are extremely important. Ideally a doctor onshore should be able to talk directly to the person inside the chamber who is treating the diver. In practice however this may be difficult or impossible.

The normal arrangement is for the person inside the chamber to speak to someone outside the chamber (eg. supervisor I LST / diver medic) who is used to understanding helium distorted speech. This person then relays the message or information to the doctor onshore.

It is important that the audio link to the doctor from offshore (and vice versa) is as clear and reliable as possible. Electronic transfer of digital images should be considered as a valuable aid to assist the doctor in remote diagnosis and treatment of the patient.

8 Electrical Equipment

Electrical equipment should not be used inside a chamber unless it has been specifically manufactured for such use. However where equipment to be used in the chamber has not been specifically manufactured for such use, a risk analysis should be undertaken and its results documented. Where appropriate local testing of the equipment might be undertaken, and in such cases the results documented.

9 Equipment to be Held at Site

The exact list and detailed specifications of all medical equipment to be held offshore at a saturation site is a matter for assessment and agreement between the diving company and their medical adviser.

This will depend on a number of factors including: communications available, remoteness of location, the first aid competence of personnel on site, ability to maintain and keep secure the equipment etc. etc.

Included in the items which might be held at site are:

- Arrangements for supplying gas to power the ventilator, which is compatible with both the oxygen hood and ventilator
- Dump and suction systems
- A free flow transparent oxygen hood
- Suction Equipment
- Extra lighting
- Simple patient monitoring equipment for blood pressure, pulse, temperature and CO₂ monitoring
- Defibrillator
- DMAC 15 medical kit

10 Equipment to be Taken Offshore by a Medical Support Team

Again the detail of the equipment which will need to be taken offshore by the medical support team in an emergency will be a matter for agreement between the diving company and its specialist medical adviser. Detailed planning will be needed at this preliminary phase to ensure full compatibility of the medical equipment with the services available on site. Such equipment will need to be kept in a state of constant readiness and must be fully maintained and tested at regular intervals.

The medical support team must be fully familiar with all of the equipment and among the items which may be included in this list are:

- Specialised drugs to complement those currently held at the worksite, e.g. DMAC 15 Rev.1
- Surgical instruments consisting of a general surgical kit, a laparotomy kit and amputation kit
- Specialist monitoring equipment for ECG, % O₂ saturation of blood, blood pressure, respiration rate etc.
- Ventilator, suitable for use in a hyperbaric environment that has appropriate connections for interfacing with the chamber arrangements
- An exchange humidifier and heat exchanger for the gas circuit turbine flow meters
- Infusion pump/syringe driver (minimum 3 required) with a suitable power pack/external power supply for extended use
- X-ray equipment

11 Future Developments

Advances in technology provide new equipment which may assist in the treatment of an injured or sick diver in saturation and should always be considered by both the diving company and its specialist medical adviser on a regular basis.

Items of equipment which may be of use in the future include:

- Satellite linked television systems which can send a clear picture from an offshore site to a medical adviser onshore. Such equipment has been used for remote medical assistance and may be suitable for use offshore. It requires an infrastructure to exist and is a considerable investment in equipment both offshore and by the medical adviser.
- Better communications systems, particularly in remote locations, will allow easier transmission of data and information.

12 Conclusion

The ability to provide good quality medical treatment to an ill or injured diver in saturation is constantly being increased as new equipment and technology becomes available. The basic requirements however remain the training and abilities of those personnel offshore who will be required to care for a casualty during the early stages of an incident, coupled with the appropriate arrangements to obtain specialist medical advice or treatment quickly.