#### 9.4.5.4 SCC emergency panel

An emergency connector panel shall be provided, in accordance with IMO requirements, to allow for both diver and ROV operable connectors for the following items:

a) breathing gas;
b) hot water;
c) depth communications; and
d) emergency power.

### 9.4.6 SCC/Saturation breathing mixtures

Mixed gases (gas) shall be used as the breathing mixture for depths exceeding 50 m (165 ft). All mixed-gas diving operations shall be carried out in accordance with Clause 4.

Sufficient sources of gas, of breathing quality, shall be available and suitably arranged so that if the online supply to the diving bell/diver fails, an alternative supply can be immediately switched online from an alternative source.

**Note:** *See IMCA Guidance Note D 024 for breathing gas control and monitoring.*

### 9.4.7 SCC/Saturation breathing gas heating

For cold water (<5 °C) saturation diving using reclaim, active breathing gas heating shall be used, and active steps shall be taken to prevent freezing of any portion of the submerged breathing system. Loss of breathing gas heating should be recognized as an emergency situation requiring immediate removal of the diver from the water.

### 9.4.8 Reserve gas supplies

#### 9.4.8.1 Saturation chamber oxygen supplies

There shall be sufficient oxygen available at the dive site to allow for metabolic consumption by each diver, plus that required to maintain the appropriate partial pressure of oxygen during decompression.

#### 9.4.8.2 SCC and diver on-board gas backup

There shall be sufficient gas on-board the diving SCC to supply all lock-out divers and the SCC occupant with at least 20 min of breathing gas, not using a diver gas reclaim system.

**Note:** *The minimum capacity is normally 1250 usable litres of breathing gas for each diver, calculated to the ambient pressure (equal to 20 min at a breathing rate of 62.5 L/min).*

### 9.4.9 Emergency gas supplies

The following emergency gas supplies shall be provided:

a) SCC divers in the water—bailout cylinder(s) with sufficient endurance to allow the diver to return to the bell in an emergency;

   **Note:** *A calculation should be available showing that the capacity of the cylinder(s) at the depth of diving will allow breathing gas for 1 min for every 10 m of horizontal excursion.*

b) submersible compression chambers—gas supply for 24 h (lost bell);
c) saturation chamber and HEUs—gas supply for 72 h; and
d) habitats (welding)—gas supply for 48 h.

### 9.4.10 Diving team restrictions and working hours for saturation diving

#### 9.4.10.1 General

The following team restrictions and working hours shall be established:

a) two- and three-man SCC run—An SCC run should be planned not to exceed 8 h from initial lock-off time, regardless of any periods the SCC is locked onto the system prior to final lock-on. Only one dive number will be used regardless of the amount of times the SCC is locked back onto the system during the 8-h SCC run.

b) SCC lock-out time limits—A lock-out starts from the time of total submersion until the diver is back inside the SCC. During an SCC run, lock-out times are cumulative and should not exceed the following:
   i) 4 h per diver for a two-man SCC run;
   ii) 4 h per diver for a three-man SCC run where all three divers shall enter the water; and
   iii) Times from HSE Diving Information Sheet No. 7 (http://www.hse.gov.uk/pUbns/dvis7.pdf).

c) 30 min maximum additional time may be allowed for the times in Item b) only under exceptional circumstances, if the divers agree, and the agreement and reason for the extended period are recorded in the diving operations log.

d) 6 h per diver for a three-man SCC run where the standby diver does not enter the water.

   **Note:** *No additional lockout time may be allowed after a 6 h lockout, per HSE Diving Information Sheet No. 7.*

e) Divers shall return to the SCC and take off their helmets for a minimum 20 min break after approximately 3 to 4 h to ensure fluid balance. The break in the SCC shall be logged. This break may be waived by the diver where a company-approved hydration system has been fitted to the diver's helmet. Each diver shall be given a dry day as the SCC man every third day.

#### 9.4.10.2 Time limits for saturation dives and rest period following saturation dives

Under DMAC 21 (rev 1) of October 1992, "Guidance on the Duration of Saturation Exposures and Surface Intervals Following Saturation", the following recommendations have been made:

a) Under normal circumstances, saturation duration should not exceed 28 days.

b) Each period spent in saturation should be followed by a surface period of equal duration, except as detailed below. The exceptions for recommitting a diver to saturation prior to completing an equal surface interval time are as follows:
   i) for any saturation dives that are less than 20 days, the surface interval shall be at least half of the duration of the saturation; and
   ii) for any saturation dives that are greater than 20 days, the surface interval shall be at least 10 full days.

   **Note:** *If either of these exceptions is used, a diver may not be committed to saturation again until a surface interval which is equal to the duration of the longer of the previous two saturation dives is completed.*

c) A diver's cumulative saturation time should not exceed 182 days in any consecutive 12 calendar months.

d) Until the recommended surface interval has been satisfied, a diver should not undertake any diving or be exposed to a pressure greater than atmospheric unless cleared by the company's medical advisor.

e) Dives exceeding 200 m (660 ft) should be followed by an equal time on the surface. Dependent on the depth of dive and the work to be performed, an increased surface interval may, after consultation with medical advisors, be required.

### 9.4.11 Crew

#### 9.4.11.1 General

For all SCC/saturation diving operations there shall be a sufficient number of competent persons to

a) operate the diving plant and equipment and other facilities while any diver is under, entering, or leaving the water; and
b) operate any hyperbaric chamber required and its associated equipment.

#### 9.4.11.2 Minimum crew for saturation diving operations

The total number of diving personnel forming the 'diving team' will vary depending on factors such as the nature of the work to be performed, whether it requires two- or three-man SCC runs, and the number of SCC runs per 24 h.

#### 9.4.11.3 Single SCC run (two- or three-man)

The following list of personnel represents a minimum requirement for single SCC operations where two or three divers are used for a single SCC run in a 24 h period, for a total of 14 crew members:

a) one offshore construction manager [OCM (diving safety specialist or equivalent)];
b) two diving supervisors;
c) two or three divers (two- or three-man SCC run);
d) one surface standby diver;
e) two life support supervisors;
f) two life support technicians (LSTs);
g) two tenders (assistants to the LSTs); and
h) one mechanical or electrical technician.

#### 9.4.11.4 Multiple SCC runs (two- or three-man)

The following list of personnel represents a minimum requirement for single SCC operations where two or three divers are used for multiple SCC runs to take place over a 24 h period, for a total of 24 crew members:

a) one OCM;
b) four diving supervisors;
c) two surface standby divers (may function as trainee supervisors);
d) six to nine divers (two- or three-man SCC runs);
e) two LSSs;
f) two LSTs (suitably qualified and experienced to be appointed in writing to act as relief LSSs);
g) two tenders; and
h) one mechanical and one electrical technician.

**Note:** *Numbers of personnel will be adjusted for twin SCC operations.*

#### 9.4.11.5 Diving supervisor manning levels

#### 9.4.11.5.1 Single SCC saturation diving operation

For all continuous diving operations, there shall be a minimum of two diving supervisors per shift, one of whom is in direct control of the operation and is identified by virtue of having signed on in the diving operational record. The other supervisor is identified as the relief supervisor, who is normally located in dive control.

#### 9.4.11.5.2 Twin SCC saturation diving operations (combined dive control)

For continuous single SCC operations, two supervisors shall be present, with each in control of an SCC during any in-water turnaround. In the event that both diving SCCs are to be used simultaneously, three supervisors shall be on-shift at all times—one supervisor in control of each operation and the third acting as relief supervisor for both.

### 9.4.11.6 Saturation standby diver

One member of the on-shift dive team shall be designated as the surface standby diver. He/she cannot be the dive supervisor.

### 9.4.11.7 Life support personnel manning levels

There shall be a minimum of one LSS and at least one LST per shift. At least one of the aforementioned personnel shall be present at the saturation control, and the other shall be in the vicinity of the control at all times.

**Note:** *Divers in saturation always require 24 h monitoring, so by default the minimum life support crew is four, consisting of two LSSs and two LSTs for 24 h coverage. Generally, a life support tender is also required per shift to assist the LSTs and LSSs, bringing the total number to six. Larger saturation systems may require more tenders, depending on the number of divers in saturation at the time.*

## 9.5 Hyperbaric evacuation unit (HEU) and life support package (LSP)

### 9.5.1 Availability of an HEU and an LSP

An HEU and an LSP shall be available on all saturation diving operations. Refer to CSA Z275.1 for detailed specifications and testing procedures for HEUs and LSPs.

### 9.5.2 Hyperbaric evacuation

#### 9.5.2.1

In the event of an emergency, saturation divers under pressure shall be quickly and efficiently evacuated under pressure to an HEU and transported to a suitable place for decompression as quickly as possible.

#### 9.5.2.2

The contingency plan for an emergency evacuation shall include a description of the procedure for hyperbaric evacuation, transport of HEUs, and decompression to surface pressure at a designated HRF.

#### 9.5.2.3

The employer’s plan for hyperbaric evacuation shall be based on risk analyses covering the launch, stabilization, recovery, and normalization phases of a transportation to an HRF for decompression.

#### 9.5.2.4

The following phases shall be described in the contingency plan:

a) the transfer of divers to the HEU and launching of the unit;
b) the handling of the HEU in the water, including a description of how the life support functions are to be maintained; and

c) where and how the rescue unit is to be transported and, if applicable, taken out of the water and mated to the HRF for decompression of the divers.

**Note:** *If there might be more than* 1800 kPa *(18 bar) difference in pressure between persons who are to be evacuated, it should be possible to maintain a difference in pressure during evacuation. The time from the moment the last diver enters the evacuation unit until the unit is* 100 m *(328 ft) away from the diving work site should not exceed* 15 min*. The total period between notification of an evacuation, with divers in the chamber complex, and the time when the evacuation unit is* 100 m *away from the diving platform, should not exceed* 30 min*. This includes the time required to bring the system to a pressure enabling transfer of all divers into the evacuation unit using emergency procedures such as NORSOK U100, Ref. Annex A 38, "Time margins during hyperbaric evacuation", or equivalent. This recommendation should be viewed with reference to the time required to bring the divers to the same pressure using emergency procedures.*

### 9.5.2.5

The selection of the HRF shall be based on an evaluation of the time it will take, under the prevailing weather conditions, to transport the HEU to the centre from the operational location, and the centre's proven capability to receive the HEU. Documentation of a successful HEU integration tests for the type of HEU in question shall be available.

### 9.5.2.6

In addition to the requirement in Clause 9.5.2.5, diving operators shall have a suitable transportation plan in place to ensure that the HEU can reach a safe haven within the time period dictated by its life-support capacity. A suitable LSP or HRF shall be available and compatible to receive the HEU in use.

### 9.5.2.7

Each operator shall provide a comprehensive plan that includes

a) connect ability audit (confirm connect ability of HEU to HRF, flanges, clamps, and LSP connections);
b) emergency response team (ERT) integrated with the ship's and operator's ERT;
c) vessel to recover the HEU, identifying suitable lifting equipment, lift plans, cradles, breathing gas, life-support team, and mechanical team;
d) HRF capability including lift plans, crane operations, lifting beams, and cradle;
e) training and familiarity with the system for the emergency team; and
f) trained medical team with equipment known to be suitable and compatible with the HEU and HRF.

### 9.5.2.8

When diving in remote offshore locations or when specified by the site owner/operator, an LSP for HEU shall be provided. The LSP will normally mobilize with the vessel, and when in location, shall be transferred to a nominated HRF. Procedures and location of emergency LSP equipment and services shall be discussed and agreed upon with the site owner operator well in advance of commencement of diving operations. This LSP is an integral part of hyperbaric evacuation procedures in offshore locations.

**Note:** *Details of the HEU support requirements should be available immediately to emergency response organizations.*

## 10 One-atmosphere diving

**Note:** *The use of one-atmosphere diving techniques (manned submersible vehicle, atmospheric diving suit, etc.) avoids the need for decompression to atmospheric pressure at the end of each diving operation. These systems have worked in depths greater than* 300 msw (985 fsw)*. There are a wide variety of these systems available, with no one system being described as typical.*

## 10.1 Atmospheric diving suits (ADS)

### 10.1.1
All ADS shall be assessed and classified by a recognized marine classifying agency.

### 10.1.2
ADS diving operations and training shall be conducted in accordance with the ADS manufacturer's instructions and requirements.

## 10.2 Design requirements
In addition to the requirements detailed in Clause 10.1.2, atmospheric diving operations shall not be conducted unless the atmospheric diving suit is

a) provided with a secondary means whereby the ADS can be returned to the surface. Where such means involves the shedding of weights, the controls for such shedding are capable of operation from within, and a means is incorporated to prevent accidental shedding of these weights;
b) provided with a secondary lifting eye or similar device that is at least the same strength as the primary lifting eye;
c) provided with a certified secondary lifting cable that is readily available and that has at least the same strength as the certified primary lifting cable, and is compatible with the secondary lifting eye or similar device; and
d) provided with a means to cut all power cable attachments and jettison both thrusters, and to cut and jettison the surface tether/lift cable should it become entangled.

## 10.3 Required equipment
ADS operations shall not be conducted unless the ADS is equipped with

a) valves, gauges, and other fittings as required to control the internal pressure and to clearly indicate the internal and external pressures inside and outside the ADS;
b) a reserve supply of breathing oxygen. The reserve supply of oxygen shall be protected against inadvertent operation, be of a sufficient quantity to complete the mission plus emergency time for rescue, and be capable of being brought online from within, without outside assistance;
c) a two-way voice communication system including an emergency backup system to communicate with the diving supervisor and record communications of the entire dive;
d) lighting equipment, including emergency backup illumination;
e) thermal protection;
f) a strobe light that can be activated while the ADS is in the water;
g) an emergency locating device with a surface receiver operating at 37.5 kHz;
h) instruments to enable occupants to monitor the temperature, oxygen, and carbon dioxide levels within the ADSs;
i) a primary and an emergency means of scrubbing carbon dioxide;
j) an indicating light visible to the operator showing that the scrubber fan is functioning;
k) in case of an emergency, a device that allows the operator to disconnect or shear the primary lifting cable and the umbilical bundle; and
l) in addition to a primary lifting cable, a tag rope or secondary lifting method so designed that if the primary cable breaks during the air-water interface transfer, the tag rope or secondary method will permit the ADS to descend only to a calm area immediately below the turbulent wave zone.

## 10.4 Backup (standby) vehicles

Where an ADS is to be used, there shall be a backup ADS, manned submersible vehicle, or ROV standing by with sufficient depth and function capabilities to immediately affect a rescue.

## 10.5 Life-support system

An ADS shall not be used unless the on-board reserve life-support system will sustain life for a period of time that would enable the backup unit required by Clause 10.4 to conduct rescue operations.

## 10.6 ADS handling systems

### 10.6.1

The ADS handling system should be rated as specified for “manned submersible” operations (UNOLS, etc.).

A dedicated, ADS-specific LARS should be that which meets all applicable man-rated codes and standards as recommended for use or supplied by the ADS manufacturer.

### 10.6.2

During launch and recovery, the ADS shall be locked to a device, ensuring safe and quick transit through the surface of the water.

### 10.6.3

The device mentioned in Clause 10.6.2 shall comprise a tether management system (TMS) designed to enable the ADS to leave and re-enter the device in a safe manner. If required by the environmental conditions (e.g., the sea state), the TMS shall have a positive locking system and shall be operable independent of the ADS operator.

### 10.6.4

If required by the environmental conditions (e.g., the sea state) and operated from a vessel, the handling system shall be equipped with a heave compensation system. Static and dynamic calculations demonstrating the performance of the system shall be available.

### 10.6.5

A detailed mission-specific health and safety plan and an emergency rescue plan shall be provided.

## 10.7 Risk assessment and contingency plan

A risk assessment plan and a contingency plan shall be provided that include procedures for dealing with aborting a dive due to

a) deteriorating weather and/or ice conditions during a dive;
b) the inability of the surface craft to maintain station;
c) failure of any major component of diving plant and equipment;
d) the need to maintain life support;
e) critical maintenance of rescue capabilities; or
f) any other circumstances that can reasonably be anticipated.

**Note:** *An in-shore or offshore diving safety specialist (DSS) may be employed to conduct such risk assessments.*

### 10.8 Crew (minimum crew size)

The crew size shall be determined by formal job risk assessment. There shall be a sufficient number of personnel to operate all the diving plant and to provide support functions to the dive team. The minimum number of ADS personnel is five, as follows:

a) supervisor;
b) operator (pilot);
c) standby ADS pilot, manned submersible vehicle, or ROV operator;
d) technician; and
e) LARS operator.

**Note:** *This might require additional deck support personnel and other management or associated technical support personnel, e.g., engineers or vessel maintenance technicians. There needs to be a sufficient number of qualified personnel to operate the backup system in the event of the recovery of a disabled ADS system.*

## 11 Diving in contaminated environments

### 11.1 Application

The criteria in Clause 11 apply only to diving operations in contaminated environments.

**Note:** *This includes contaminated water diving (CWD) and diving conducted in a contaminated topside or surface environment.*

### 11.2 Qualification

No employer shall undertake to dive in a contaminated environment unless each dive crew member is competent to engage in such work (i.e., competent in their assigned roles).

### 11.3 Identification and planning

#### 11.3.1

Where the source of the contamination is known, the generator of the source contaminated water shall be considered to be the employer for the purpose of Clause 11.

**Note:** *Additional responsibilities for the "employer of record" are outlined in applicable federal and provincial OHS regulations.*

#### 11.3.2

Where a contaminated environment exists or is suspected, the dive supervisor shall ensure that identification of contaminants is made by a competent person. This may include conducting a full analysis of water samples using an accredited water-testing laboratory or seeking the advice of an industrial hygienist.

The employer shall, before the commencement of any dive, make documentation available at the dive site specifying

a) identification of the contaminants and their physical properties;
b) expected route(s) of exposure: ingestion, inhalation, absorption, and puncture/cut;
c) the specific health effects to humans;
d) pre- and post-dive medical precautions to be undertaken by divers and diving support personnel; and
e) any special clothing and/or equipment to be worn.

**Note:** *See also the example hazardous substance data sheet in Annex I.*

### 11.3.3

Where heavy contamination is evident or suspected (e.g., based on previous experience or knowledge) and identification of contaminants is not determined prior to any diving operation, the minimum standards of protection for all personnel shall be as detailed for Category 2 (CAT 2). For diving in CAT 2 conditions, divers shall be dressed in a surface-supplied diving system with full encapsulation of the diver in a suitable diving helmet and dry suit ensemble. In addition, appropriate protective measures shall be implemented for topside personnel. See details in Table 8.

### 11.3.4

When planning a diving operation to be carried out in a contaminated environment, it is important to first conduct a thorough risk assessment. The following shall be assessed during the planning stage:

a) level of personnel training and proficiency;
b) equipment selection, noting the limitations of SCUBA (where permitted) as compared with surface-supplied diving equipment;
c) compatibility with identified contaminant(s);
   **Note:** *If diving in hydrocarbons (e.g., petroleum), natural rubber or latex is preferred to silicone.*
d) protection measures to minimize the exposure of divers and surface support personnel;
e) decontamination of divers, surface support personnel, and equipment; and
f) decompression requirements (see Clause 11.10).

Certain scenarios might increase and/or introduce potential exposure to chemical/biological contamination. In these cases, extra protective measures should be considered (e.g., using a surface-supplied diving system that provides full encapsulation of the diver). Diving scenarios that could increase the potential exposure to contamination include run-off after heavy rainfall, working in sediment, working in active commercial ports areas, and working immediately beside points of discharge. See Clause 11.3.3.

**Note:** *An in-shore or offshore diving safety specialist (DSS) may be employed to conduct the risk assessment.*

## 11.4 SCUBA diving

The requirements of Clause 7 shall apply to diving operations in which a diver uses SCUBA.

## 11.5 Surface-supplied diving

The requirements of Clause 8 shall apply to diving operations in which a diver uses surface-supplied apparatus.

## 11.6 Contaminated water diving (CWD) categories

Hazard categories for CWD are detailed in Table 8.

**Note:** *The categories used in this Standard follow established U.S. Navy guidance and practices.*

## 11.7 Minimum standards of protection for personnel

### 11.7.1

The minimum standards of protection for divers and topside personnel (i.e., surface-support team) are detailed in Table 8.

### 11.7.2

A full face mask (FFM) shall be worn by each diver when using SCUBA for diving in a contaminated environment.

**Note:** *Minimum standards for FFMs are detailed in Table 8.*

## 11.8 Minimum crew

The minimum crew size for both surface-supplied diving and SCUBA diving in a contaminated environment shall be four. Each crew member shall be present at all times during the dive operation, and the following duties shall be allocated, each to a specific crew member:

a) diving supervisor;
b) diver(s);
c) standby diver; and
d) tender(s).

## 11.9 Thermal hazards

Suitable measures shall be taken to ensure that encapsulated divers or surface support crew do not overheat.

**Note:** *Best practice includes ensuring that all personnel remain well hydrated, using chemical cooling packs, and limiting the duration of the dive.*

## 11.10 Decompression

Diving in CAT 1 or CAT 2 contaminated water should be planned to require no decompression in order to limit the diver's exposure to waterborne hazards. If decompression is unavoidable, the choice of technique should be made with care. Surface decompression is complicated by the time constraints on decontamination, diver undressing, and the need to avoid contamination of the hyperbaric chamber. For these reasons, surface decompression techniques should not be used.

## 11.11 Equipment

The equipment used in contaminated environments shall conform to the requirements of this Standard, including those specified in Table 8, and the following additional requirements:

a) Breathing gases shall be supplied to a diver by a cascade or an equally contaminant-free system.
b) Air intakes for compressed breathing air systems shall be situated outside the work area (i.e., in a contaminant-free area).
c) The diver's dry suit shall be suitable for the anticipated category of contaminated water. Resistance to known chemical contaminants should be checked by reference to published permeation test results where available.
d) The standby diver shall be equipped with a level of protection at least equal to that of the diver.
e) Suitable apparel and equipment shall be worn to prevent exposure of surface-support personnel to any contaminant. Protection for surface-support personnel may involve skin and eye protection (i.e., to guard against water/splash hazards), as well as appropriate respiratory protection.
f) A proper means of safely decontaminating personnel shall be available in the work area, including provision of sufficient quantities of fresh water.
g) The work area shall be provided with the appropriate means and facilities for depositing contaminated clothing and equipment.
h) All diving plant and equipment exposed to the contaminant(s) shall be inspected for any deterioration after each dive and cleaned as necessary.