

## **Z275.2 Occupational Safety Code for Diving Operations**

### **CHANGES RE. DIVING IN A CONTAMINATED ENVIRONMENT**

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#### **3 DEFINITIONS**

Exclusion zone — the area at the surface of the dive site restricted to only authorized and protected personnel, from which divers are tended during a contaminated diving operation. May also be referred to as the hot zone.

Contaminant-reduction zone — the workplace used to transfer workers from the exclusion zone and for decontamination of personnel and equipment. May also be referred to as the warm zone.

Support area — the workplace used in support of the diving operations and where the cleaning and/or disposal of diving plant and equipment may take place. May also be referred to as the clean area.

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#### **7.1.4**

SCUBA shall not be used for diving operations that involve

- (a) welding;
  - (b) burning/cutting;
  - (c) high-pressure jetting;
  - (d) hoisting;
  - (e) dredging;
  - (f) the use of power tools;
  - (g) the use or handling of explosives (with the exception of the clearance/remediation of unexploded explosive ordnance (UXO) or police diving operations for render safe/disposal of explosives. For UXO operations, see CSA Z275.6
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### **10 Diving in contaminated environments**

#### **10.1 Application**

The criteria in Clause 10 applies only to diving operations in contaminated environments.

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

#### **10.2 Qualification**

No employer shall undertake to dive in a contaminated environment unless the employer's competence to engage in such work is acceptable.

#### **10.3 Identification and Planning**

##### **10.3.1**

Where the source of the contamination is known, the generator shall assume the responsibilities of the employer as outlined by the applicable federal and provincial regulations.

##### **10.3.2**

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.

##### **10.3.3**

Where identification of contaminants is not determined prior to any diving operation that must be performed, the minimum standards of protection for all personnel (as detailed in Table X) shall be as detailed for Category 2.

#### 10.3.4

The following additional criteria shall be used during the planning of a diving operation:

- (a) Level of personnel training and proficiency;
- (b) Equipment selection and compatibility with identified contaminant(s);  
*Note: If diving in hydrocarbons, natural rubber or latex is preferred over silicone.*
- (c) Protection measures to minimize the exposure of divers and surface support personnel;
- (d) Decontamination of divers, surface support personnel and equipment;
- (e) Decompression requirements (see below); and
- (f) Specific diving scenarios that increase the potential exposure to contamination such as run-off after heavy rainfall, working in sediment, working adjacent to points of discharge, and human remains recovery.

#### 10.4 SCUBA diving

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

#### 10.5 Surface-supply diving

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

#### 10.6 Contaminated water diving categories

Hazard categories for contaminated water diving are detailed in Table X.

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

#### 10.7 Minimum standards of protection for personnel

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

#### 10.8 Minimum crew

In addition to the minimum crew standards required by Clause 7 (SCUBA diving) and Clause 8 (surface-supplied diving) at least one extra crew member/tender shall be present at all times.

#### 10.9 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.*

#### 10.10 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 the use of surface decompression techniques is not recommended.

#### 10.11 Equipment

The equipment used in contaminated environments shall conform to the requirements of this Standard, including Table X, and the following additional requirements shall also be met:

- (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 is to 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 & 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.
- (i) The diaphragms of the first and second stage regulators and associated exhaust valves shall be inspected for any deterioration after each dive and cleaned or replaced as necessary.
- (j) Contaminated diving plant and equipment shall not be removed from the dive site unless authorized by a competent person.
- (k) Diving plant and equipment used in a contaminated environment shall not be used in any subsequent diving operation unless it is free of all contaminants.

- (l) Diving plant and equipment not suitable for reuse shall be destroyed and such action recorded.
- (m) Diving umbilicals used in a contaminated environment should be of twisted or spirally-wound construction (i.e. there should be smooth surfaces to facilitate decontamination). Umbilical bundles of parallel construction (e.g. using tape, cordage) are not recommended as contaminants may be captured and retained.

#### **10.12 Work and support areas**

The following requirements shall apply to work and support areas:

- (a) The work area shall be divided into two separate zones: exclusion (hot) zone and contaminant-reduction (warm) zone. See Figure Y.
- (b) The exclusion (hot) zone is the zone immediately surrounding the diving station/point of water entry/exit (i.e. highest risk of contamination).
- (c) The contaminant-reduction (warm) zone is the transition zone between the exclusion (hot) zone and support (clean) area.
- (d) The support (clean) area shall be positioned upwind from the exclusion (hot) and contaminant-reduction (warm) zones wherever possible. See Figure Y.
- (e) The support (clean) area shall contain all personnel and equipment that are not adequately protected for exposure to contaminants.
- (f) The dividing line between each zone shall be clearly identifiable (i.e. signage and barriers).
- (g) Access to/from the exclusion (hot) and contaminant-reduction (warm) zones shall be controlled.
- (h) Workers entering the exclusion (hot) and contaminant-reduction (warm) zones shall wear the personal protective equipment appropriate to the circumstances.
- (i) Workers shall leave the exclusion (hot) zone through the contaminant-reduction (warm) zone only.
- (j) No food, drink, or tobacco shall be taken into, left in, or consumed in either the exclusion (hot) zone or the contaminant-reduction (warm) zone.
- (k) Initial decontamination of the diver and dive equipment shall take place in the exclusion (hot) zone.
- (l) The standby diver should be located in the cleanest zone possible.
- (m) All personnel should practice the procedures applicable to the work and support areas prior to commencement of the diving operation.

#### **10.13 Medical requirements and emergency procedures**

##### **10.13.1 General**

Diving in contaminated environments may expose divers to either predetermined or unknown health hazards. When predetermined health hazards exist, appropriate preventive measures shall be taken and suitable medical screening and follow-up shall be arranged. When unknown health hazards exist, appropriate and comprehensive measures to prevent, monitor, and treat health effects shall be instituted.

##### **10.13.2 Preventive measures**

A diver's medical examination for diving shall be reviewed and updated by a physician prior to diving in contaminated water. Previous exposure to other or similar contaminants shall be recorded on the medical record. Appropriate tests for baseline values shall be conducted to serve as a pre-exposure record for long-term medical surveillance, if needed. Vaccinations for preventable diseases such as polio, tetanus, and hepatitis B shall be updated. Pre-existing conditions that may be aggravated or exacerbated by contaminant exposure shall be noted and the diver shall acknowledge, in writing, that this risk is understood.

Divers with pre-existing, unhealed wounds should be prevented from diving in contaminated water.

##### **10.13.3 Emergencies**

A contingency plan for emergencies shall be made and be available at the dive site. This shall include

- (a) Measures to decontaminate the diver rapidly, at least partially, and to institute resuscitation and treatment;
- (b) Measures to prevent contamination of surface support personnel;
- (c) Measures to minimize contamination of surface equipment and the recompression chamber;
- (d) Notification to the physician of an emergency involving contamination;
- (e) Notification to the backup hyperbaric facility or hospital emergency facility that a diver who is injured and has been contaminated with specific and/or non-specific contaminants is being sent to the facility; and,
- (f) Notification to the ambulance or emergency transport service that the diver/victim is contaminated.

##### **10.13.4 Treatment and surveillance**

###### **10.13.4.1**

When diving personnel or support personnel have been exposed to known or unknown contaminants, they shall be examined by a physician. Appropriate treatment, testing, and long-term medical surveillance shall be instituted by the physician according to accepted occupational medical practice.

###### **10.13.4.2**

Information on the specifics of sampling for a variety of substances is available from the federal and provincial health or labour departments.

Note: Sources of contaminant information include, but are not limited to,

- (a) Emergency Measures Organizations;

- (b) Provincial environment ministries;
- (c) Transport Canada; and
- (d) Spills Action Centres.

**10.13.4.3**

A contaminated diver shall not be allowed to return to work in the contaminated environment without a medical certificate, from the physician, stating that the diver may safely do so.

**10.13.4.4 First Aid Records**

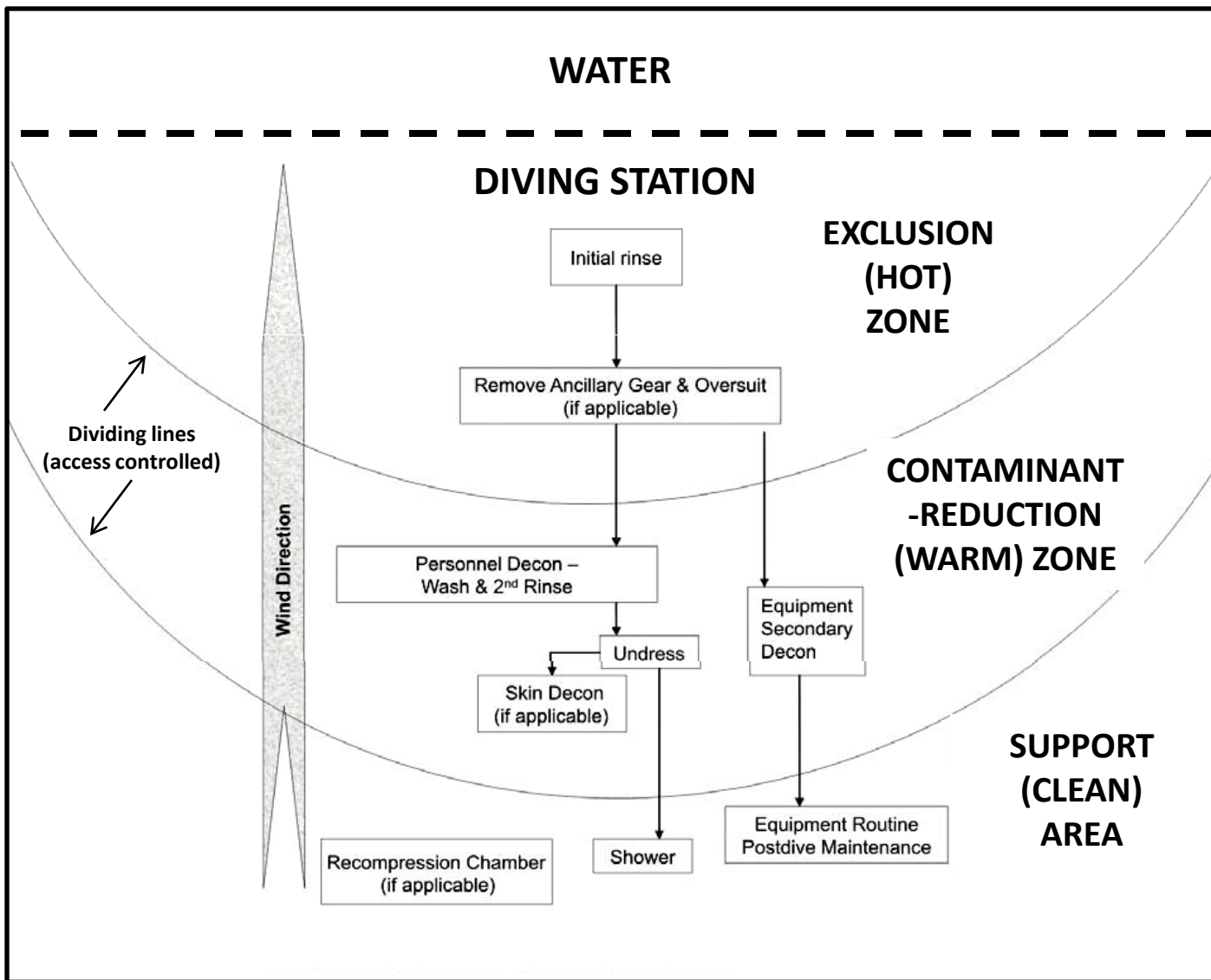
- (1) The employer must maintain a record of all injuries and exposures to contaminants.
- (2) First aid records must be kept for at least 3 years.
- (3) First aid records are to be kept confidential and may not be disclosed except as permitted by law.
- (4) Workers may request or authorize access to their first aid records for any treatment or report about themselves.

**Table X**  
**Contaminated Water Diving (CWD) - Categories and Minimum Standards of Protection**

Category	Definition	Explanatory Information	Minimum Standards for Diver's Dress & Equipment	Topside Protection Measures
<b>CAT 1</b>	Grossly contaminated water including: Extreme risk of injury to unprotected divers; Potential long-term health effects	CAT 1 diving presents an extreme level of risk for which specialized equipment and procedures are required. Other techniques should always be considered before diving in a CAT 1 environment.  EXAMPLE: Diving in locations where potential for radioactive or lethal contamination exists.	Surface supplied diving system: a. Diving helmet configured with free flow or surface/return line exhaust b. Non-permeable synthetic rubber or composite dry suit. <i>See Notes 1 &amp; 2.</i> c. Dry suit to be fitted with double exhaust valve d. Helmet yoke/neck dam attached to suit e. Chemically-resistant waterproof (i.e. dry) gloves attached to suit with cuff rings  f. Two-way voice communication system g. All equipment checks, including leak tests, to be completed prior to diver entering the water	Diver decontamination: Yes Dive equipment: Decontamination and thorough post-dive inspection Tender protection: Yes. <i>See Note 3.</i> Tender decontamination: Probably Medical support on-site: Yes
<b>CAT 2</b>	Heavily contaminated water including: High risk of injury to unprotected divers; Potential long-term health effects	CAT 2 diving is commonly encountered during occupational diving in industrial environments or following incidents involving chemicals or oils.  EXAMPLE: Diving in sewage, industrial clarification plants, tanks or contained bodies of water with high concentrations of oil-based contaminants or corrosive materials, visible fuel slicks, aircraft recovery operations with copious jet fuel present.	Surface supplied diving system: a. Diving helmet with double exhaust (i.e. may exhaust to water). <i>See Note 4.</i> b. Non-permeable synthetic rubber or composite dry suit. <i>See Notes 1 &amp; 2.</i> c. Dry suit to be fitted with double exhaust valve d. Helmet yoke/neck dam attached to suit  e. Chemically-resistant waterproof (i.e. dry) gloves attached to suit with cuff rings f. Two-way voice communication system g. All equipment checks, including leak tests, to be completed prior to diver entering the water	Diver decontamination: Yes Dive equipment: Decontamination and thorough post-dive inspection Tender protection: Probably. <i>See Note 3.</i> Tender decontamination: Possibly
<b>CAT 3</b>	Moderately contaminated water including: Some risk of injury to diver, especially if ingested (i.e. biological risk); Potential short-term health effects	CAT 3 diving covers routine diving activity where there is some, mainly biological, risk and precautions must be taken to avoid water ingestion, and entry through skin cuts, abrasions or unhealed wounds.  EXAMPLE: Harbours, locations adjacent to points of contaminant discharge, and other locations where concern exists for contaminants (e.g. sewage treatment outfalls), especially biological, that may easily enter the body through the mouth.	SCUBA: a. Full Face Mask (FFM) with integrated 2nd stage regulator. <i>See Note 5.</i> b. 2nd stage regulator to have separate inhalation and exhalation channels c. Dry suit. <i>See Note 1.</i> d. Hood. <i>See Note 6.</i> e. Gloves  f. Two-way voice communication system	Diver decontamination: Possibly Dive equipment: Thorough post-dive cleaning and disinfecting Tender protection: Possibly Tender decontamination: Possibly
<b>CAT 4</b>	Baseline contaminated water Low/no unusual risk to diver from contamination over and above the risk from normal diving activities.	CAT 4 diving involves water that is known not to pose a specific risk and where there has been no recent environmental event likely to increase the level of contamination (e.g. "first flush" after significant rainfall).  EXAMPLES: Locations with no known or expected source of contamination, open water locations (at least 400 yards away from any river or pipeline outfall, harbour mouth, or other inland waterway), drinking water reservoirs, locations analyzed for water quality (such as swimming beaches).	a. The requirements of this Standard apply b. No special dive equipment or procedures required c. FFM with integrated 2nd stage regulator recommended	Diver decontamination: No Dive equipment: Routine post-dive cleaning and disinfecting Tender protection: No Tender decontamination: No

- Notes**
1. The diver's dry suit is to 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.
  2. Prior to CAT 1 and 2 diving, the dry suit and suit valves are to be tested for leaks (dry suit exhaust valves may be susceptible to degradation from petroleum products and solvents).
  3. Protection for surface support personnel may involve skin & eye protection (i.e. to guard against water/splash hazards) as well as appropriate respiratory protection.
  4. Exhaust valves, especially silicone ones, in diving helmets are generally highly susceptible to degradation from petroleum products and solvents.
  5. A Full Face Mask with natural rubber skirt is recommended when a high concentration of oil or hydrocarbon contamination is expected (silicone components degrade faster in this situation).
  6. The FFM must overlay and seal onto the hood without leakage. A latex sealing surface on the hood is recommended. All-neoprene hoods are generally unsuitable for CWD due to poor face sealing qualities.
  7. It is strongly recommended that an employer consults with an industrial hygienist to provide professional advice prior to diving in a contaminated environment.

**Table Y**  
**Contaminated Water Diving – Example of Work and Support Areas**



No food, drink, or tobacco shall be taken into, left in, or consumed in either the exclusion (hot) zone or the contaminant-reduction (warm) zone.