

UNIVERSITY OF WISCONSIN  
CENTER FOR LIMNOLOGY  
680 North Park Street, Madison, WI 53706-1413

# **SCIENTIFIC DIVING SAFETY MANUAL**

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## Emergency Contacts

### **Center for Limnology - Madison**

Police / Emergency Medical Services	911
UW Health Services	(608) 263-6400
UW Lake Mendota Rescue Service	(608) 262-3505
CFL boat slip	(608) 262-0678

### **Trout Lake Station - Boulder Junction**

Police / Emergency Medical Services	911
Howard Young Medical Center	(715) 356-8000
Trout Lake Station	(608) 890-4967

### **Hyperbaric Chambers - Wisconsin**

St. Luke's Hospital (Milwaukee, WI) 24/7	(414) 649-6577
Marshfield Clinic (Weston, WI) M-F 9-5	(715) 221-7590

### **Divers Alert Network (DAN)**

Emergency Hotline (International)	+1-919-684-9111
Non-Emergency Information	+1-919-684-2948

### **Emergency Radio Frequencies**

Coast Guard	VHF Channel 16
Citizen Band (CB)	Channel 9

**DIVING CONTROL BOARD  
(A.K.A. CFL SCUBA COMMITTEE)**

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## SECTION 1.00

### SCOPE AND POLICY

This manual code applies to all University of Wisconsin Center for Limnology (CFL) employees, volunteers, and cooperating personnel who are engaged in, or who oversee CFL activities involving SCUBA diving. Furthermore, this manual code applies to any personnel diving under the auspices of the University of Wisconsin CFL where auspices are defined as:

All scientific diving operations in which the University of Wisconsin Center for Limnology is connected because of ownership of equipment, dive site, or facilities that are used in support of the diver's occupation, research, academic instruction/training, and certification.

The regulations herein shall be observed at all locations where scientific diving is conducted.

CFL employees are authorized to conduct scientific SCUBA diving pursuant to the policies, standards, regulations and procedures of this manual code. The procedures establishes regulations, standards, and policies for CFL SCUBA diving operations and promotes and improves the use of diving where underwater techniques will assist in meeting its scientific objectives. This manual code provides a framework to maximize protection from injury and/or illness for CFL divers, and to meet the exemption criteria set forth by the Wisconsin Department of Safety and Professional Services (DPS 332), which has adopted in full, the OSHA Regulation for Scientific diving (OSHA 1910 subpart T, App B). Diving activities conducted for the CFL under the procedures of this manual code shall be considered within the employee's scope of employment.

## SECTION 2.00

### BACKGROUND

Work related diving is regulated by the Occupational Safety and Health Administration (OSHA). Because diving is considered a high-risk occupation, there are very specific and stringent rules regulating diving activity under OSHA regulations, 29 CFR 1910. In addition, Wisconsin Department of Safety and Professional Services (DSPS) has adopted these OSHA regulations through DSPS 332, Wisconsin Administrative Code.

CFL diving activities are exempt from OSHA's commercial diving regulations, provided the CFL complies with the specific OSHA requirements for scientific diving. To be considered scientific diving, the diving program must contain at least the following elements:

- Diving safety manual, which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification (OSHA, 1910.401(a)(2)(iv)(A)).
- Diving control safety board, with the majority of its members being active divers, which shall at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices; and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving (OSHA, 1910.401(a)(2)(iv)(B)).
- The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations (OSHA, 1910 Subpart T App B).
- The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary (OSHA, 1910 Subpart T App B).
- The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving (OSHA, 1910 Subpart T App B).
- Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and, therefore, are scientists or scientists in training (OSHA, 1910 Subpart T App B).

Meeting the commercial diving standards require certifications beyond the resources of the CFL. In addition, failing to comply with the scientific diving regulations can subject the employee and/or the CFL to civil and criminal liabilities.

## SECTION 3.00

### PROCEDURES

#### 3.10 DIVING CONTROL BOARD

Requirements for the DCB are mandated by 29 CFR 1910 OSHA Subpart T Appendix B Guidelines for Scientific Diving/DSPS 332. Per these requirements, the DCB has autonomous and absolute authority over the department's diving program operations.

1. **Membership:** The DCB shall consist of a majority of active scientific CFL divers. The DCB Chair, in consultation with current DCB members shall appoint future DCB members. Other non-scientific diving administrative and research staff are welcome to join as fully participating members.
2. **DCB responsibilities:** The DCB shall meet at least once a year and have the following responsibilities:
  - a. Review and deny/approve applications to serve as an active diver for the CFL.  
<sup>[1]</sup><sub>SEP</sub>(Note: Applicants will also need the prior written approval of their immediate supervisor before being considered as a CFL diver by the DCB.)
  - b. Annually review active diver's qualifications, activities and status for continuation as an active diver.
  - c. Issue, reissue or revoke diving authorization (in consultation with the diver's supervisor).
  - d. Coordinate and assess diver training needs on an annual basis.
  - e. Review requests for variance from diving safety requirements contained in this manual code. The DCB shall determine that such variances are safe and essential to program operations.
  - f. Review and approve/deny all dive plans for CFL diving activities.
  - g. In whole or in part, review CFL diving operations on an annual basis.
  - h. Develop CFL protocols addressing the unique Aquatic Invasive Species (AIS) disinfection concerns with diving equipment.
  - i. Arrive at decisions by majority vote. In event of a tie, the Dive Safety Officer (DSO) will cast the tie-breaking vote.
  - j. Appoint local SCUBA locker managers for respective Hasler and TLS SCUBA equipment lockers.

- k. Appoint the Dive Safety Officer.
  - l. In the case of all reported incidents, BCD will review their severity and report conclusions on any suspensions or clearing of involved divers. In the event of a health related incident, a physical will be required by a licensed health care provider.
  - m. Develop, maintain and update this manual code as needed.
3. Dive Safety Officer: The DSO shall be a member on the on the DCB, and plays a key role in providing a unique perspective that enhances the safety and efficiency of department’s diving activities.
- n. The DSO shall be selected from the DCB by a majority vote. The DSO is required to be an active diver, and shall be knowledgeable and confident in safe diving procedures. The term of the DSO shall be two years and can be renewable.
  - o. The DSO shall coordinate the review of all dive plans with the DCB. The DSO has final say over approval or denial of a dive plan and all CFL diving activities.
  - p. The DSO has the authority to individually suspend any dive operation that he or she deems to be unsafe. The decision of the DSO is final on whether or not a dive may proceed.
  - q. The DSO shall receive the completed SCUBA Diving Application and Supervisory Authorization (Appendix A) and the Licensed Healthcare Professional (LHP) completed Medical Evaluation of Fitness for SCUBA Diving Report (Appendix D) from diving applicants. The DSO shall review the reports and advise the DCB whether or not the applicant has the approval of his or her immediate supervisor and has LHP “APPROVAL” or “RESTRICTED ACTIVITY APPROVAL” to participate in diving activities. After completing the review and report to the DCB, the DSO shall file the applicant’s SCUBA Diving Application and Supervisory Authorization and the LHP completed Medial Evaluation of Fitness for SCUBA Diving Report with the Assistant Director of the CFL.

### 3.20 SCUBA QUALIFICATIONS AND RESPONSIBILITIES FOR ACTIVE DIVERS

The CFL’s active divers are responsible for performing scientific diving operations for the CFL. Divers failing to meet qualifications or requirements of this manual code may have their authorization letter revised or revoked.

- 1. Qualifications: To qualify as an active diver and to continue as a CFL dive team member, the employee shall:
  - a. Diver certification: Possess a diver certification through a recognized training or certification program (e.g. PADI, NAUI, SDI) or program approved by the DCB.



A digital copy (front and back) of the certification must be provided in the divers application request to the DCB (Appendix 9).

- i. The specifics of the certification constrain the type of diving the individual is permitted to conduct. Additionally, the diver must have completed a minimum one dive to the certification level within the last two calendar years for the diver to be considered qualified at that certification level. For every lapsed year, the diver must complete a refresher dive consistent with the diver certification required for work before beginning dive work; eg. If three years have lapsed, diver would need to do three dives before starting work.
  - ii. Currently, the only mode of diving approved by the CFL DCB is “open circuit compressed air” with Open Water (max. depth 60 ft.) and Advanced Open Water certifications (max. depth 100 ft.). The DCB will consider other modes and certifications of SCUBA upon request.
  - iii. Current SCUBA training agencies and certifications recognized by the CFL DCB include: PADI, NAUI, and SDI. Application to the DCB for consideration of training agencies not here listed can be made through the DCB.
- b. Supervisory approval: Obtain written authorization from her or his immediate supervisor for participation on the CFL dive team.(Appendix A).
- c. Medical examination: Obtain a physical examination by a licensed healthcare physician (LHP) every 5 years, but every 3 years if over 40, and every 2 years if over 60:
- i. The employee shall complete the Diving Medical History Form (Appendix B) and give it to the LHP completing the medial exam.
  - ii. The LHP should review the Medical Exam Overview For the Licensed healthcare Physician (Appendix C).
  - iii. The LHP conducts the medical examination, completes the Medical Evaluation of Fitness for SCUBA Diving Report (Appendix D) and returns it to the diver applicant. The employee submits the completed Medical Evaluation of Fitness for SCUBA Diving Report and the SCUBA Diving Authorization (Appendix A) to the DSO for review.
- d. Must participate in at least one project related training dive before commencement of actual project work. This training dive must be logged and submitted to the CFL DCB (see Appendix 3).
2. Responsibilities: Each active diver for the department shall:

- a. Maintain a log of all dives (see Appendix 3).
- e. Maintain a current CPR and First Aid certification.
- f. Maintain a current personal information record, which will be submitted to the DCB (see Appendix 9). The record shall include your name, telephone number and a person to be notified in the event of an emergency.
- g. Report any diving-related incident, equipment failure, near miss or injury immediately to the supervisor and the DSO (Appendix 5). If the incident involves an injury or illness, it is suggested that the diver complete worker compensation form. The completed worker compensation form shall be forwarded to the diver's supervisor and the CFL Assistant Director.
- h. Immediately report malfunctioning shared use equipment to the local SCUBA locker manager (see Appendix 4).
- i. Ensure that non-CFL owned equipment is maintained in accordance with this manual code (see Section 3.30 (5) below) and inspection and servicing records are documented and electronically submitted to the DSO for approval prior to its use in CFL diving operations. For the inspection and servicing record form see Appendix 10).
- j. Determine whether a dive can be accomplished within his or her abilities and in a safe manner. If the diver believes that he or she cannot safely accomplish the dive for any reason, the diver shall inform the DCB and withdraw from the planned diving activity.

### 3.30 SCUBA DIVE PLANNING AND SAFETY REQUIREMENTS

The following sections outline requirements for diver safety, dive plans, dive procedures and logs, and equipment requirements and maintenance.

1. General dive safety considerations:
  - a. CFL divers are prohibited from exceeding the limits strictly defined in the certifications they have received by DCB recognized SCUBA training and certification programs (see Section 3.20 (1)(a)(i) and (ii)).
  - b. The open circuit compressed air open water dive is to a depth of no more than 60 ft.
  - c. The open circuit compressed air, advanced open water dive is to a depth of no more than 100 ft.
  - d. All CFL dives are to be made within the no-decompression limits of the U.S. Navy Dive Tables located in Appendix 2 of this manual code. Dive computers may be used

to track time and depth, but are not to be used as a substitute of the dive tables no-decompression limits.

- e. At the beginning of each diving season, a projects dive team must make at least one training dive in an environment and to a depth, similar to that in which the project's dive work will be conducted. This training dive must occur within 1 month of the commencement of the projects dive work.
- f. All CFL diving shall be planned and executed to ensure that every diver involved maintains constant, effective communication with at least one other comparably equipped CFL diver in the water. This buddy system is based upon mutual assistance, especially in the case of an emergency. Exceptions to this occur in certain situations when the buddy system is not appropriate (e.g., shallow water "stand-up" diving or restricted visibility (for Line-tended Diving procedures see Section 3.30 (6))).
- g. Dives shall be planned around the competency of the least experienced diver. Safety of operations shall be the prime consideration in all diving activities. Supervisors shall not promote, nor shall individual divers attempt, difficult or hazardous tasks that compromise diver safety.
- h. The primary responsibility for diver safety lies with the individual diver. Each diver shall exercise the responsibility and privilege to refuse to dive if, in the diver's judgment, conditions are unsafe or unfavorable and would violate the dictates of their training or this manual code. Accordingly, a diver shall not attempt to dive if they are not in the proper mental or physical condition for diving.

2. Annual training requirement for SCUBA divers:

- a. At a minimum, divers are required to complete one work related dive a year. A proficiency dive, in which a diver dives to the certification level that she/he has been trained, counts as a work related dive.
- b. Individual divers are responsible for forwarding logs of their training dives to the DCB (Appendix 3).
- c. Divers not maintaining their annual dive frequency will have their authorization for department SCUBA diving activities withdrawn by the DCB.

Exemptions: Exemptions for participating in the department's annual diving requirements can be reviewed by the DCB and granted on a case-by-case basis (e.g. pregnancy short-term injury, etc.).

- 3. Dive Plans: An annual dive plan must be completed by each project team and submitted to the DSO for approval prior to the start of the diving activity (Appendix 8).
- 4. Required dive precautions: Dive Procedures and Logs. All divers shall observe the following precautions and procedures:

a. Pre-dive:

- i. Each Scientific Diver shall conduct a functional check of her/his diving equipment in the presence of the diving buddy or tender, and review emergency hand signals and techniques.
- ii. It is the diver's responsibility and duty to refuse to dive if, in his/her judgment, conditions are unfavorable, or if he/she would be violating the precepts of their training or of this manual.
- iii. No dive team member shall be permitted to dive for the duration of any known condition, which is likely to adversely affect the safety and health of the diver or other dive members.
- iv. Each diver shall ensure that their equipment is in proper working order and that the equipment is suitable for the type of diving operation.
- v. Each diver shall have the capability of achieving and maintaining positive buoyancy.
- vi. Site Evaluation - Environmental conditions at the site will be evaluated.
- vii. Boat Tenders are required for divers in current areas where there is a chance for the divers or the dive boat to be swept away from the dive site.

b. During the dive:

- i. Boats or locations from which divers are operating shall be marked by a red flag with <sup>[1]</sup><sub>SEP</sub> a white diagonal stripe, in accordance with Section 30.70, Wis. Stats. When present, the boat tender shall be aware of any boat not maintaining the required 100 ft. distance from the dive flag. In addition, dives conducted in International Maritime waters and the Great Lakes, the International Code A dive flag shall also be displayed (i.e. rigid blue/white dove tail flag).
- ii. In areas of heavy boat traffic, the dive operation is to be accompanied by a boat tender who shall keep the diving area free of motor boats and assist the divers as necessary.
- iii. It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever they feel it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water.
- iv. The dive shall be terminated while there is still sufficient cylinder pressure to permit the diver to safely reach the surface safely with 500 PSI remaining.

- v. Any diver may deviate from the requirements of this manual to the extent necessary to prevent or minimize a situation that is likely to cause death, serious physical harm, or major environmental damage. A written report of such actions must be submitted to the DSO explaining the circumstances and justifications within 48 hours of the incident.
- c. Post-dive:
- i. Immediately report any diving-related incident, equipment failure, near miss or injury to the DSO (see Appendix 5). Any such incident will automatically suspend all associated personnel in the incident from further diving until cleared by the DCB.
  - ii. Log all CFL dives (see Appendix 3). Dive logs shall be submitted within 48 hours of a dive operation, except in reasonable circumstances that preclude this.
  - iii. Gear disinfection: For boats, trailers, and diving equipment that may be moved between waters, ensure that all equipment used during the dive(s) is properly disinfected to reduce the potential for the diving activities contributing to the spread of invasive organisms between waters (see Appendix 6).
5. Equipment: All SCUBA diving gear and accessory equipment shall be of high quality and maintained in a safe operating condition. Annual inspection and testing of CFL owned shared equipment follows protocol of Appendix 7. Inspection and servicing frequencies are noted below. Non-CFL owned equipment must be inspected and tested at the same frequencies of CFL owned equipment and records submitted (see Appendix 10) for approval before it is used in CFL related dives. At minimum each diver shall be equipped with and the equipment maintained as follows:
- a. Regulator equipped with submersible pressure gauge and alternate second stage. Inspected, tested and serviced annually.
  - b. Buoyancy compensator and power inflator, with a minimum amount of 20 pounds of buoyancy. Inspected and tested annually.
  - c. Quick release weight system.
  - d. Exposure/environmental suit or garment that provides adequate thermal and abrasion protection.
  - e. Depth gauge or dive computer.
  - f. Dive timing device (watch) or dive computer.

- g. Mask with corrective lenses, if required.
  - h. Fins.
  - i. Dive knife or similar cutting device.
  - j. SCUBA cylinders. Cylinders shall not be filled beyond their rated pressures. Inspected annually. Annual visual inspection. 5 year hydrostatic testing.
6. Line-Tended Diving: In stand-up diving or diving in restricted visibility, Line Tended Diving may be used to satisfy the requirements of the buddy system. For purposes of definition shallow water “stand-up” diving is in water depths less than 4 ft., and “restricted visibility” is a perceived visibility of three feet or less. Line-tended diving consists of the following elements:
- a. SCUBA diver equipped with:
    - i. BCD with a metal D-ring securely integrated into the BCD unit.
    - ii. A dive knife or similar cutting device.
  - b. Line-Tender:
    - i. Adequately equipped to render immediate assistance and rescue to the in water diver.
    - ii. A dive knife or similar cutting device.
    - iii. A cell phone or radio, with adequate signal strength to call for help in case of emergency.
  - c. Line:
    - i. Maximum length of 100 ft.
    - ii. Securely fastened to the support platform from which the diver is conducting operations.
    - iii. Of a material that can be cut by the diver and dive tenders cutting tools and has a minimum breaking strength of 200 lbs.
    - iv. Line should be of floating material (e.g. polypropylene) so as to minimize chance of entanglement with submerged structures, to provide tracking of divers placement, and to facilitate effective line pull signals.

- v. Securely fastened to a metal link that securely fastens to the divers BCD D-ring. Additional securing measures (e.g. reinforce knot with electrical tape) may be necessary for polypropylene line that does not stay knotted well.
- d. Dive flag.
  - i. Must be present where boat traffic is of concern.
- e. Line Pull Signals:
  - i. Tender to Diver:
    - a. 1 Pull: "Are you alright?" / "OK, proceed."
    - b. 2 Pulls: "Surface for additional instruction."
    - c. 3 Pulls: "Return to me."
  - ii. Diver to Tender:
    - a. 1 Pull: "I am alright."
    - b. 2 Pulls: "I have found the target."
    - c. 4 Pulls: "Pull me in."
    - d. 5 or more Pulls: "I am in need of assistance. Come to my assistance right away."

## REFERENCES

Manual Codes: M.C 9182.5 – Water Safety M.C. 9183.1 - boat and Gear Disinfection Protocol M.C. 9187.91- Employees Working Alone

Wisconsin Statutes: s. 30.70, Wis. Stats – Wisconsin Statute flag marking requirements for diving and swimming. s. 230.36, Wis. Stats. - Hazardous employment, injuries, pay continued.

29 CFR 1910 – OSHA regulations applicable to diving  
DSPS 332, Wis. Adm. Code - Wisconsin Department of Safety and Professional Services rules applicable to diving activities  
General Incident Report Form DOA 6441 (<http://intranet.dnr.state.wi.us/itworks/forms/efoms/DOA-6441.doc>)  
Worker Compensation form DOA 6058  
Decontamination references:



## APPENDIX 1

### DEFINITION OF TERMINOLOGY

*Active diver* - CFL employees who qualify as divers and are approved under this manual code to conduct SCUBA diving for the CFL.

*AIS* - Aquatic Invasive Species

*CFL* - Center for Limnology (University of Wisconsin)

*DCB* - Dive Control Board

*DSO* - Dive Safety Officer

*LHP* - Licensed Healthcare Physician

*OSHA* - The federal Occupational Safety and Health Administration.

*Restricted visibility* - A perceived visibility of 3 feet or less.

*Scientific diving* - Diving strictly defined by OSHA standards 29 CFR 1910 Subpart T.

*SCUBA diving* - A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

*SCUBA locker manager* - The individual responsible for equipment use out of Hasler and TLS SCUBA lockers.

*Stand-up diving* - Diving utilizing SCUBA gear in waters of 4 feet or less in depth.

*Surface-supplied air diving* - A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.

*TLS* - Trout Lake Station

## APPENDIX 2

### PADI DIVE TABLES

The following tables are from the Recreational Dive Planner distributed by PADI. Video tutorials on how to use these dive tables are accessible on the web.

#### Rules during ascent:

1. Always ascend at a rate of 30 feet per minute (fpm) (20 seconds per 10 feet of seawater (fsw)). Minor variations between 20 and 40 fsw/min are acceptable.
2. If the rate of ascent is greater than 30 fpm, stop the ascent and allow the time to catch up to your depth and then continue.

START		RECREATIONAL DIVE PLANNER™																	TABELLE 2											
		DIVING SCIENCE & TECHNOLOGY CORP.																	OBERFLÄCHEN-PAUSE											
TIEFE (meter)	START	10*	12	14	16	18	20	22	25	30	35	40	42																	
A	10	9	8	7	6	6	5	4	3	3	↓	↓	▶ 0:00 0:48 3:00																	
B	20	17	15	13	11	10	9	8	6	5	5	4	▶ 0:00 0:08 0:48 3:48																	
C	26	23	19	17	15	13	12	10	8	7	6	↓	▶ 0:00 0:22 1:10 4:10																	
D	30	26	22	19	16	15	13	11	9	8	↓	6	▶ 0:00 0:08 0:31 1:19																	
E	34	29	24	21	18	16	15	13	10	↓	7	7	▶ 0:00 0:30 1:18 4:19																	
F	37	32	27	23	20	18	16	14	11	9	8	8	▶ 0:00 0:06 0:16 0:25 0:47 1:35																	
G	41	35	29	25	22	20	18	15	12	10	9		▶ 0:00 0:06 0:14 0:23 0:32 0:54 1:42																	
H	45	38	32	27	24	21	19	17	13	11			▶ 0:00 0:06 0:13 0:21 0:29 0:38 1:00 1:48																	
I	50	42	35	29	26	23	21	18	14	12			▶ 0:00 0:06 0:12 0:19 0:27 0:35 0:44 1:06 1:54																	
J	54	45	37	32	28	25	22	19	15	13			▶ 0:00 0:06 0:12 0:18 0:25 0:32 0:41 0:50 1:12 2:00																	
K	59	49	40	34	30	26	24	21	16	14			▶ 0:00 0:05 0:11 0:17 0:23 0:30 0:38 0:46 0:55 1:17 2:05																	
L	64	53	43	37	32	28	25	22	17				▶ 0:00 0:04 0:10 0:16 0:22 0:29 0:37 0:45 0:54 1:16 2:04 3:05																	
M	70	57	47	39	34	30	27	23	19				▶ 0:00 0:05 0:10 0:16 0:22 0:28 0:35 0:43 0:51 1:00 1:22 2:10																	
N	75	62	50	42	36	32	29	25	20				▶ 0:00 0:04 0:09 0:14 0:19 0:25 0:31 0:37 0:44 0:52 1:00 1:31 2:19																	
O	82	66	53	45	39	34	30	26					▶ 0:00 0:04 0:09 0:13 0:18 0:24 0:30 0:36 0:42 0:48 0:56 1:04 1:35 2:24																	
P	88	71	57	48	41	36	32	28					▶ 0:00 0:04 0:08 0:13 0:17 0:22 0:28 0:33 0:39 0:46 0:52 1:00 1:08 1:17 1:39 2:28																	
Q	95	76	61	50	43	38	34	29					▶ 0:00 0:04 0:07 0:11 0:16 0:20 0:25 0:30 0:36 0:42 0:48 0:55 1:03 1:11 1:20 1:42 2:30 3:31																	
R	104	82	64	53	46	40	36						▶ 0:00 0:04 0:08 0:12 0:16 0:20 0:25 0:30 0:35 0:41 0:47 0:53 1:00 1:08 1:16 1:25 1:47 2:35																	
S	112	88	68	56	48	42	37						▶ 0:00 0:03 0:06 0:10 0:14 0:18 0:23 0:27 0:32 0:38 0:43 0:49 0:56 1:03 1:10 1:18 1:27 1:49 2:38 3:39																	
T	122	94	73	60	51	44							▶ 0:00 0:02 0:06 0:10 0:13 0:17 0:22 0:26 0:31 0:36 0:41 0:47 0:53 0:59 1:06 1:13 1:22 1:31 1:53 2:41 3:42																	
U	133	101	77	63	53	45							▶ 0:00 0:03 0:07 0:10 0:14 0:18 0:22 0:26 0:30 0:35 0:40 0:45 0:51 0:57 1:03 1:10 1:18 1:26 1:36 1:57 2:45																	
V	145	108	82	67	55								▶ 0:00 0:03 0:06 0:10 0:13 0:17 0:21 0:25 0:29 0:34 0:38 0:43 0:48 0:54 1:00 1:06 1:13 1:21 1:29 1:38 2:00 2:48																	
W	160	116	87	70	56								▶ 0:00 0:02 0:05 0:08 0:12 0:15 0:19 0:23 0:27 0:31 0:36 0:40 0:45 0:50 0:56 1:02 1:08 1:15 1:23 1:31 1:40 2:02 2:50 3:51																	
X	178	125	92	72									▶ 0:00 0:03 0:06 0:09 0:12 0:16 0:19 0:23 0:27 0:31 0:35 0:40 0:44 0:49 0:54 1:00 1:06 1:12 1:19 1:27 1:35 1:44 2:06 2:54																	
Y	199	134	98										▶ 0:00 0:03 0:06 0:09 0:12 0:16 0:19 0:22 0:26 0:30 0:34 0:38 0:42 0:47 0:52 0:57 1:03 1:09 1:15 1:22 1:30 1:38 1:47 2:09 2:57																	
Z	219	147											▶ 0:00 0:03 0:06 0:09 0:12 0:15 0:18 0:21 0:25 0:29 0:32 0:36 0:41 0:45 0:50 0:55 1:00 1:06 1:12 1:18 1:25 1:32 1:41 1:28 1:50 3:00																	

Z Y X W V U T S R Q P O N M L K J I H G F E D C B A

FORTSETZUNG AUF RÜCKSEITE

PRESSURE GROUP AT END OF SURFACE INTERVAL

DEPTH (feet)	Z	Y	X	W	V	U	T	S	R	Q	P	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
35	205	188	168	152	139	127	117	108	100	92	85	79	73	67	62	57	52	48	44	40	36	32	29	25	19	10
40	17	37	53	68	78	88	97	105	113	120	126	132	138	143	148	153	157	161	165	169	173	178	180	186	195	
50	11	20	29	36	43	49	55	61	66	71	76	80	85	89	92	96	100	103	106	109	113	115	118	124	131	
60		80	75	71	67	63	60	57	53	50	47	44	41	38	36	33	31	28	26	24	21	19	17	13	7	
70			5	9	13	17	20	23	27	30	33	36	39	42	44	47	49	52	54	56	59	61	63	67	73	
80				55	54	52	49	47	44	42	39	37	35	33	31	29	27	25	23	21	19	17	16	14	11	6
90					1	3	6	8	11	13	16	18	20	22	24	26	28	30	32	34	36	38	39	41	44	49
100							40	38	36	34	33	31	29	27	26	24	22	21	19	18	16	15	13	12	9	5
110								2	4	6	7	9	11	13	14	16	18	19	21	22	24	25	27	28	31	35
120									30	29	28	26	25	23	22	21	19	18	17	15	14	13	11	10	8	4
130										2	4	5	7	8	9	11	12	13	15	16	17	19	20	22	26	
										25	24	23	22	21	19	18	17	16	15	13	12	11	10	9	7	4
											2	3	4	6	7	8	9	10	12	13	14	15	16	18	21	
											20	19	18	17	16	15	14	13	12	11	10	9	8	6	3	
												2	3	4	5	6	7	8	9	10	11	12	14	17		
													16	15	14	14	13	12	11	10	9	8	7	5	3	
														2	2	3	4	5	6	7	8	9	10	13		
															13	12	12	11	10	9	8	7	6	5	3	
																2	3	4	5	6	7	8	10	13		
																	10	9	8	8	7	6	5	3		
																						3	4	5	7	

TABLE 3 • REPETITIVE DIVE TIMETABLE

The Recreational Dive Planner is designed specifically for planning recreational (no decompression) dives on air only. Do not attempt to use it for planning decompression dives.

**Safety Stops** — A safety stop for 3 minutes at 15ft is required any time the diver comes up to or within 3 pressure groups of a no decompression limit and for any dive to a depth of 100ft or deeper.

**Emergency Decompression** — If a no decompression limit is exceeded by no more than 5 minutes, an 8 minute decompression stop at 15ft is mandatory. Upon surfacing, the diver must remain out of the water for at least 6 hours prior to making another dive. If a no decompression limit is exceeded by more than 5 minutes, a 15ft decompression stop of no less than 15 minutes is urged (air supply permitting). Upon surfacing, the diver must remain out of the water for at least 24 hours prior to making another dive.

**Flying After Diving Recommendations**

**For Dives Within the No Decompression Limits**

- Single Dives: A minimum pre-flight surface interval of 12 hours is suggested.
- Repetitive Dives and/or Multi-day Dives: A minimum pre-flight surface interval of 18 hours is suggested.

**For Dives Requiring Decompression Stops**

- A minimum pre-flight surface interval greater than 18 hours is suggested.

**Diving at Altitude** — Diving at altitude (1000ft or higher) requires the use of special procedures.

**Special Rules for Multiple Dives**

If you are planning 3 or more dives in a day: Beginning with the first dive, if your ending pressure group after any dive is W or X, the minimum surface interval between all subsequent dives is 1 hour. If your ending pressure group after any dive is Y or Z, the minimum surface interval between all subsequent dives is 3 hours.

**Note:** Since little is presently known about the physiological effects of multiple dives over multiple days, divers are wise to make fewer dives and limit their exposure toward the end of a multi-day dive series.

**General Rules**

- Ascend from all dives at a rate not to exceed 60ft per minute.
- When planning a dive in cold water or under conditions that might be strenuous, plan the dive assuming the depth is 10ft deeper than actual.
- Plan repetitive dives so each successive dive is to a shallower depth. Limit repetitive dives to 100ft or shallower.
- Never exceed the limits of this planner and, whenever possible, avoid diving to the limits of the planner. 140ft is for emergency purposes only, do not dive to this depth.

White area indicates Residual Nitrogen Time (RNT) in minutes and is to be added to Actual Bottom Time (ABT).

Blue area indicates adjusted no decompression limits. Actual Bottom Time (ABT) should not exceed this number.

Residual Nitrogen Time (RNT)  
+ Actual Bottom Time (ABT)  
= Total Bottom Time (TBT)

**CAUTION:** This product for use only by certified divers or individuals under the supervision of a certified scuba instructor. Misuse of this product may result in serious injury or death. If you are unsure as to how to properly use this product, consult a certified scuba instructor.

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**Emergency Decompression Stops** - The following stops shall be made in the event the no-decompression limits are accidentally exceeded. All stops are to be made at 10 feet for the time prescribed.

Depth (fsw)	Bottom Time (min)	Decompression Time at 10fsw (min)/Group		Depth (fsw)	Bottom Time (min)	Decompression Time at 10 fsw (min)/Group
40	210	2 / N		100	30	3 / I
	230	7 / N			40	15 / K
	250	11 / O				
50	110	3 / L		110	25	3 / H
	120	5 / M			30	7 / J
	140	10 / M				
60	70	2 / K		120	20	2 / H
	80	7 / L			25	6 / I
	100	14 / M				
70	60	8 / K		130	15	1 / F
	70	14 / L			20	4 / H
	80	18 / M				
80	50	10 / K		140	15	2 / G
	60	17 / L			20	6 / I
	70	23 / M				
90	40	7 / J				
	50	18 / L				
	60	25 / M				

## **APPENDIX 3**

### **LOGGING DIVES**

All dives are to be logged online (<http://limnology.wisc.edu/scuba/index.php>).

When logging proficiency dives, be sure to note it is a proficiency dive in the field titled “Brief description of dive”.

All diving and logging of dives are to be in accordance with the PADI Dive Table (Appendix 2) or Dive Computer. Failure to do so may result in suspension of your diving privileges.

## **APPENDIX 4**

### **REPORTING MALFUNCTIONING SHARED EQUIPMENT**

SCUBA equipment at the CFL resides in a large pool from which multiple research projects and users borrow. Unlike any pool of shared equipment the failure to report malfunctioning gear in an accurate and timely manner exposes subsequent users to at worst to death and at least a waste of time. It is therefore extremely important to treat this pool of shared equipment with respect and care, and to report malfunctioning equipment immediately to DSO. Under no circumstances should the equipment user attempt to fix the malfunctioning equipment.

Procedures for reporting malfunctioning shared equipment:

1. Immediately place the damaged or malfunctioning equipment in bin labeled “malfunctioning equipment” (located in Hasler and TLS SCUBA lockers).
2. Immediately notify the DSO and equipment managers through the online interface (<http://limnology.wisc.edu/scuba/index.php>).

## **APPENDIX 5**

### **INCIDENT REPORTING**

Report all diving incidents to the DSO within 48 hours of the incident. Use the online interface (<http://limnology.wisc.edu/scuba/index.php>) to report the incident.

## APPENDIX 6

### AIS DISINFECTION PROTOCOL

#### Overview:

To minimize the possibility of dispersing Aquatic Invasive Species (AIS) via SCUBA equipment, a sterilization protocol has been enacted for the CFL Hasler laboratory and TLS research station. Compliance with this protocol is mandatory for any user of CFL owned SCUBA equipment or for any dive operation undertaken under the auspices of the CFL.

Sterilization techniques include, steam cleaning, chemical cleaning, and desiccation. Techniques are applied selectively to different classifications of equipment so as to minimize the amount of damage to it. Classifications of equipment and sterilization techniques are:

1. Exposure Protection (e.g. wet suits) - Steam clean, bleach or abrasion/desiccate.
2. Mask/Snorkel/Fins/Ballast/Accessories - Bleach or desiccate.
3. Buoyancy Control Device (BCD) & Regulators – Bleach and abrasion/desiccate.

Equipment that is desiccated must remain completely dry for 36 hrs. To communicate what equipment is available and when it is available, a google calendar (contact DSO for access) is maintained by all equipment users. On the calendar the user of equipment lists the items used, when it was last used and when the desiccation period will be complete.

It is possible to check out a set of equipment ahead of time. The future user simply marks the intended period of use (including desiccation interval) with their initials and ID of equipment to be used. It is therefore the responsibility of any user to look ahead to ensure the equipment they intend to use doesn't conflict with reservations.

#### Exposure Protection:

Exposure protection (i.e. wetsuits, gloves, boots) can be steam cleaned, bleached or desiccated. Steam cleaning and bleach degrades neoprene more than desiccation but it is not often feasible to wait the desiccation period.

#### Procedure:

##### Steam Cleaning

1. Thoroughly rinse all debris from equipment with fresh water.
2. Steam clean inside and outside surfaces of equipment. Contact the SCUBA locker manager to receive instruction on steamer use.

##### Bleach Cleaning



1. Thoroughly rinse all debris from equipment with fresh water.
2. Evenly coat inside and outside surfaces of equipment with bleach solution (2 tablespoons bleach per gallon of water). Bleach solution must be less than 24 hours old.
3. Let stand for 10 minutes.
4. Thoroughly rinse bleach solution from equipment with fresh water.

#### Desiccation

1. Thoroughly scrub and rinse all debris from equipment with fresh water.
2. Hang equipment for drying.
3. Enter your initials and equipment ID into SCUBA locker calendar and delineate period of desiccation.

#### **Mask/Fin/Snorkel/Ballast/Accessories:**

Mask, Snorkel, Fin, Ballast, and Accessories can be bleached or desiccated. Steam cleaning is not used on this class of equipment because the heat degrades the silicone, plastic and rubber components and additionally the non-porous surfaces of these items can be sufficiently cleaned of AIS propagules.

#### Procedure:

##### Bleach Cleaning

1. Thoroughly rinse all debris from equipment with fresh water.
2. Evenly coat inside and outside surfaces of equipment with bleach solution (2 tablespoons bleach per gallon of water). Bleach solution must be less than 24 hours old.
3. Let stand for 10 minutes.
4. Thoroughly rinse bleach solution from equipment with fresh water.

##### Desiccation

1. Thoroughly scrub and rinse all debris from equipment with fresh water.
2. Hang equipment to air dry.
3. Enter your initials and equipment ID into SCUBA locker calendar and delineate period of desiccation.

#### **BCD and Regulators:**

BCD and Regulators are only desiccated, except for the internal BCD air-bladder which is bleach cleaned. These most fundamental components of the SCUBA life support system are not steam cleaned or exposed to large amounts of chemical solution so as to preserve their integrity.

Procedure:

BCD

1. Thoroughly scrub and rinse all debris from equipment with fresh water.
2. Remove air-bladder dump valve.
3. Fill air-bladder with bleach solution (2 tablespoons bleach per gallon of water). Bleach solution must be less than 24 hours old.
4. Let stand for 10 minutes.
5. Insert hose and flush air-bladder with fresh water for 3 min.
6. Re-attach air-bladder dump valve.
7. Hang BCD to air dry.
8. Enter your initials and equipment ID into SCUBA locker calendar and delineate period of desiccation.

Regulator

1. Thoroughly rinse all debris from equipment with fresh water.
2. Hang regulator to air dry.
3. Enter your initials and equipment ID into SCUBA locker calendar and delineate period of desiccation.

## APPENDIX 7

### SHARED EQUIPMENT INSPECTION AND TESTING PROTOCOL

#### Overview:

To facilitate the identification of malfunctioning SCUBA equipment a set of inspections and tests, with recommendations for associated outcomes, have been outlined below. Currently, only regulator sets, BCDs, and cylinders are required to be inspected/tested and serviced annually. Procedures for testing and servicing other equipment is detailed below, though not required. The CFL SCUBA Equipment Inspection Protocol is divided in two sections:

1. Equipment that can be fixed by the dive locker manager (i.e. non-primary life supporting equipment (e.g. wet suits, fin straps, etc.)).
2. Equipment that cannot be fixed by the dive locker manager and must be fixed by a certified professional (e.g. regulators, cylinders, BCDs).

Whenever malfunctioning equipment is identified and or fixed by the dive locker manager, or by certified professional, details of the work must be logged to the CFL SCUBA Equipment Inspection and Servicing Log Book.

#### **Section 1. Equipment that can be fixed by the dive locker manager**

#### Accessories:

##### 1. Flashlight

- a. Open the watertight housing and inspect for indications of water intrusion (i.e. corrosion, mineral deposits, etc.). If water intrusion seems likely, identify the location of intrusion.
  - Check housing for cracks. If present then dispose of unit.
  - Check O-ring seals for lint, dirt or scratches. If O-ring surfaces are dirty, remove O-ring, clean surfaces, lightly lubricate O-ring with material compatible grease and reseal. If O-ring is damaged then dispose of unit.
  - Clean inside of housing with > 90% ethanol and kimwipes, clean electrical contacts with fine grit sand paper and let dry.
- b. Replace batteries and test. If flashlight doesn't work ...
  - Check light bulb. Is it burnt out? If a spare can be deployed then do so, otherwise dispose of unit.

##### 2. Knife or Cutting Tool

- a. Inspect the sheathe.
  - Are there cracks or tears in the sheathe that could even remotely affect the holding ability of the knife or cutting tool? If so it may be possible to purchase an identical sheathe from the manufacturer. Otherwise dispose of unit.
- b. Inspect the sheathe securing straps.

- Are there cracks or tears in the securing straps of the sheathe? If so it may be possible to purchase identical or equivalently effective straps from the manufacturer. Otherwise dispose of unit.
- c. Inspect the cutting tool.
- Are the cutting surfaces sharp? If not then sharpen or have professionally sharpened.
  - Is the cutting tool corroded or seized? If so then attempt to remove corrosion with light abrasion and or lubricant. If unsuccessful then dispose of unit.
  - Is the hilt or handles of the cutting tool damaged? If so then dispose of unit.
- 3. Lanyard (retractable)**
- a. Inspect functionality of retractable lanyard.
- Does the retractable lanyard unspool and spool with out any hang-ups? If not then dispose of unit.
- 4. Line and Spool**
- a. Inspect function of spools mechanical components.
- Are there broken or missing pieces? If so then dispose of unit.
- b. Inspect condition of line.
- Is the line fouled? If so then untangle or cut out fouled section and re-terminate end of line.
- c. Inspect 'slide-bolt spring snap' of spool and bitter end of line (if present).
- Do the units open and close properly and with out hang up? If not then replace the snap links.
- 5. Position Marker (inflatable)**
- a. Test volume-holding ability of inflatable unit.
- Inflate unit and let stand for 24 hrs. After 24 hrs, has the unit lost significant volume? If so then dispose of unit.
- b. Inspect straps and buckles of position marker.
- Are securing straps, bands or other components torn or damaged to an extent that failure may reasonably be expected? If so then replace damaged components or dispose of entire unit.
- 6. Writing Slate**
- a. Inspect surface of slate.
- Is surface cracked? If so then dispose of unit.
- b. Inspect straps and other components of slate.
- Are securing straps, bands or other components of slate torn or damaged to an extent that failure may reasonably be expected? If so then dispose of unit.

**Ballast:**

- 7. Belt and Buckle**
- a. Inspect belt.
- Is belt torn or frayed? If so then dispose of unit.
- b. Inspect buckle.
- Is buckle bent or damaged or open and closing ability impaired? If so then dispose of unit.
- 8. Weight**

- a. Inspect weight units.
  - Is belt slot malformed? If so it may be possible to reform the opening to allow the belt to pass through.
  - Is belt slot cracked or missing a section such that it may disconnect from the belt? If so then properly dispose of weight.
  - Is weight pouch (lead shot filled) torn such that loss of ballast is a possibility? If so then properly dispose of unit.

## **Exposure Protection:**

### **9. Boots**

- a. Inspect latching mechanism.
  - Is the zipper or velcro damaged such that it doesn't effectively close? If so then dispose of unit.
- b. Inspect general integrity of boot.
  - Are there significant holes or tears in the material? If so it may be possible to patch the breaches. Patches should only be affixed to outside of boot. If patching is unfeasible then dispose of unit.
  - Is the rubber sole separating from the boot? If so it may be possible to re-secure it with an adhesive. If sole can not be secured then dispose of unit.

### **10. Gloves**

- a. Inspect latching mechanism.
  - Is zipper or velcro damaged such that it doesn't effectively close? If so the unit may still be usable. If deemed not the case then dispose of unit.
- b. Inspect general integrity of glove.
  - Are there significant holes or tears in the material? If so it may be possible to patch the breaches. Patching should only be applied to outside of glove. If patching would negatively affect a users dexterity dispose of unit. If patching is unfeasible then dispose of unit.

### **11. Hood**

- a. Inspect general integrity of unit.
  - Are there significant holes or tears in the material? If so it may be possible to patch the breaches. If patching is necessary around the neck area then dispose of unit. Patching should only be applied to outside of hood.
  - Is a zipper or velcro latching mechanism present? If so does it open and close properly? If not then dispose of unit.

### **12. Vest**

- a. Inspect general integrity of unit.
  - Are there significant holes or tears in the material? If so it may be possible to patch the breaches. If patching is necessary around the neck area then dispose of unit. Patching should only be applied to outside of vest.

### **13. Wetsuit**

- a. Inspect latching mechanisms.
  - Is zipper or velcro damaged such that it doesn't effectively close? If so the unit may still be usable. If deemed not the case then dispose of unit.
- b. Inspect general integrity of unit.

- Are there significant holes or tears in the material? If so it may be possible to patch the breaches. If patching is necessary around the neck area then dispose of the unit. Patching should only be applied to outside of wetsuit.

## **Mask & Snorkel:**

### **14. Mask**

- Inspect lens.
  - Is lens significantly scratched or abraded? If so then dispose of unit.
  - Is lens cracked? If so then dispose of unit.
- Inspect skirt.
  - Is skirt torn or cracked? If so then dispose of unit.
- Inspect strapping.
  - Is mask strap cracked or torn? If so then replace mask strap.
- Inspect strap buckles.
  - Is buckle cracked or broken? If so then dispose of unit.

### **15. Snorkel**

- Inspect snorkel.
  - Are there cracks or tears in the ridged and flexible tubing? If so then dispose of unit.
  - Is the mouthpiece in good condition? If not then replace mouth piece if possible, otherwise dispose of unit.
- Inspect snorkel keeper.
  - Is the snorkel keeper cracked or broken? If so then dispose of snorkel keeper and replace with new.

## **Fins:**

### **16. Fins**

- Inspect fin blades for tears and cracking.
  - If tearing or cracking is significant along the structural components of the blade, or between the structural components then dispose of unit.
- Inspect heel of 'closed heel' units.
  - If tearing or cracking is significant around the heel or dorsum then dispose of unit.
- Inspect straps of 'open heeled' units.
  - If tearing or cracking is evident on the strapping, either at the heel or at the adjustable buckle then replace the strapping.

## **Section 2. Equipment that must be fixed by a certified professional (CP)**

### **Cylinder:**

## 1. Valve

- a. Inspect O-ring and groove.
  - Is the O-ring surface scratched or damaged? If so the O-ring can be swapped with a suitable replacement from a CP. When removing the O-ring use a tool that will not scratch the O-ring groove of the cylinder valve.
  - Does the O-ring groove appear malformed? If so bring to the attention of CP.
- b. Inspect valve, exhaust port and test functionality.
  - Is the valve tightly fastened to the tank? If not then have serviced by CP.
  - Is there oxidation around the exhaust port of the cylinder valve? If so have cylinder inspected by CP.
  - Open valve and close. Does valve open and close smoothly and start and stop airflow accordingly? If not then have serviced by CP.

## 2. Tank

- a. Inspect surface of tank.
  - Are there any significant dents in the surface of the tank? If so have inspected by CP.
- b. Identify date of last visual inspection.
  - Visual inspections are usually documented on a sticker on placed on the side of the tank. Visual inspection of the cylinder must occur annually. Coordinate visual inspection with CP.
- c. Identify date of last hydrostatic test.
  - The date of the last hydrostatic test should be stamped on the shoulder of the tank. Hydrostatic testing of the cylinder must occur every 5 years. Coordinate hydrostatic testing with CP.

## Regulators:

### 3. First Stage

- a. Inspect intake.
  - Is there significant oxidation around the intake? If so then have serviced by CP.
  - Is the O-ring mating surface of the intake scratched? If so bring to the attention of a CP.
- b. Inspect high-pressure hose.
  - Inspect entire length of hose. If strain relief sleeves are present, temporarily remove them. Are cracks or splits present? If so then have replaced by CP.
  - Is hose securely fastened at first stage? If not then have serviced by CP.
- c. Inspect submersible pressure gauge.
  - Are there cracks in the submersible pressure gauges housing? If so then dispose of unit.
  - Does the pressure indicating needle (if present) read zero when the unit is not pressurized? If not then have serviced by CP.
- d. Test submersible pressure gauge.
  - Obtain cylinders with two or three different internal pressures.

- Methodically connect each submersible pressure gauge to each cylinder of different pressure while noting the gauge readings. Compare values. If discrepancy is present then bring to the attention of CP.
- 4. Second Stage**
- a. Inspect low-pressure hoses.
    - Inspect entire length of hoses. If strain relief sleeves are present, temporarily remove them. Are cracks or splits in the hoses present? If so then have replaced by CP.
    - Are hoses securely fastened at first stage? If not then have serviced by CP.
  - b. Inspect primary and alternate second stage.
    - Are there cracks in the housing? If so bring to the attention of a CP.
    - Is the mouthpiece in good condition? If not then have replaced by CP.
  - c. Test primary and alternate second stage.
    - Pressurize regulator set.
    - Do purge functions of second stage regulators work properly? If not have serviced by CP.
    - Do breathing functions of the second stages seem normal? If not have serviced by CP.

**Buoyancy Control Device (BCD):**

**5. Quick-releases**

- a. Inspect quick-release buckles.
  - Check all quick-release buckles for cracks or damaged. If present then obtain replacement from CP and install.
  - Check all quick-release buckles for functionality. Any buckles not functioning or functioning poorly then obtain replacement from CP and install.

**6. Straps**

- a. Inspect BCD straps.
  - Inspect all BCD straps for significant wear or tearing. If present seek advice from CP.
  - Inspect tank latching strap and buckle. If torn or damaged then have replaced by CP.

**7. Weight-integrated Modules**

- a. Inspect attachment mechanisms.
  - Are attachment mechanisms broken, significantly worn or unreliable? If so the modules may need to be replaced. Seek advice of CP.
- b. Inspect pockets.
  - Are there holes or tears in the pockets? If so the modules may need to be replaced. Seek advice of CP.

**8. Inflator/Deflator**

- a. Inspect inflator deflator mechanism.
  - Is the mechanism cracked or visibly broken? If so have mechanism replaced by CP.
- b. Inspect inflator/deflator hose.



- Are there cracks or splitting in the hose? If so have replaced CP.
- Is the hose securely fastened to the airbladder? If not it can be tightened by hand until snug. Do not over tighten. If having difficulty or uncertain about how to secure, have it serviced by CP.
- c. Test inflator/deflator functionality.
  - Connect to regulator set and inflate air-bladder. Does the inflation valve stick in the open position? Does the inflation valve not open? In either case then have unit serviced by CP.
  - Deflate BCD. Does the deflator stick in the closed or open position? If yes then have serviced by CP.
  - Orally inflate BCD. Do the valves operate properly? If not then have serviced by CP.

### **9. Over-pressurization Valve**

- a. Test over-pressurization valve.
  - Inflate BCD airbladder until almost full. Carefully proceed until completely full. If over-pressurization valve doesn't trigger then add a little more air. If over-pressurization valve doesn't trigger then deflate airbladder and have serviced by CP.

### **10. Dump-valves**

- a. Inspect dump-valves.
  - Are all dump-valves securely fastened to the BCD airbladder? If not then tighten by hand until snug. Do not over tighten. If having difficulty or uncertain send to CP for servicing.
  - Are dump-valve pull chords frayed or damaged? Are any pull chords missing their handles? If so then have serviced by CP.
- b. Test functionality of dump-valves.
  - Inflate BCD airbladder. Test functionality of all dump-valves. If valve doesn't open or sticks in the open position, have serviced by CP.

### **11. Airbladder**

- a. Inspect exterior of airbladder.
  - Are there abraded or torn sections of the airbladder? If so have serviced by CP.
- b. Test volume-holding ability of airbladder.
  - Inflate BCD airbladder until over-pressurization valve triggers. Set BCD aside for 24 hrs.
  - Inspect airbladder for volume loss. Has the airbladder lost volume? If uncertain perform test again. If volume loss is certain then have serviced by CP.

## **Depth Gauge:**

### **12. Depth Gauge**

- a. Inspect depth gauge.
  - Are there cracks in the housing? If so then dispose of unit.
  - Is the depth gauge reading something other than zero when out of the water? If so then have serviced by CP.
  - Is the max depth indicator broken? If so have serviced by CP.
- b. Test depth gauge.

- When out diving, compare the depths read from multiple depth gauges at multiple depths. Are the depth outputs different between gauges? If so then bring details to attention of a CP.

### **Submersible Compass:**

#### **13. Compass**

- a. Inspect compass.
  - Are there cracks in the housing? If so then dispose of unit.
  - Is compass rotation impeded in horizontal position? If so then bring to the attention of CP.
  - Is there significant air intrusion in the compass? If so bring to the attention of a CP.
  - Is the bezel missing or damaged? If so then dispose of unit.

## **APPENDIX 8**

### **DIVE PLANNING**

Submit dive plans online (<http://limnology.wisc.edu/scuba/index.php>). Dive plans must be approved by the DCB before the requesting project is allowed to proceed with proposed diving operations.

## **APPENDIX 9**

### **NEW DIVER REQUEST FORM**

Complete the new diver request form online (<http://limnology.wisc.edu/scuba/index.php>).

**APPENDIX 10**

**NON-CFL OWNED EQUIPMENT SERVICING RECORD SUBMISSION**

Scan and email this form to the current DSO (see contact list at beginning of this manual).

ITEM (+ serial number)  
=====

INSPECTOR  
=====

DATE  
=====

**NOTES:**

**Equipment owner** \_\_\_\_\_

**Date of submission** \_\_\_\_\_

**APPENDIX A**

**SCUBA DIVING APPLICATION AND SUPERVISORY AUTHORIZATION**

**(To be completed by applicant-diver, approved by the supervisor and submitted to the Dive Safety Officer)**

DATE:

TO:

FROM:

SUBJECT: SCUBA Diving Authorization

Please consider this as my request to become/continue as an Active Diver for the Center for Limnology. I would like to continue to be available and dive for the CFL as needed under the scope of employment. I meet the SCUBA diving certification requirements of the CFL Scientific Diving Safety Manual, and I have continued to maintain proficiency with SCUBA diving techniques and practices since the last review and have attached a copy of my dive certification. I understand and accept the conditions that I need to maintain my physical condition and meet the diving medical requirements and participation in department training dives in order to become/continue as a CFL Active Diver.

Attached is the required report from the Licensed Healthcare Physician regarding the results of my Medial Evaluation of Fitness for SCUBA Diving as required by the CFL Scientific Diving Safety Manual. In addition, if you would like to review any of the training records or dive logs please let me know and I will forward them to you for review.  
Thank you in advance for your consideration.

Signature: \_\_\_\_\_ [L] [SEP] (Applicant)  
Date: \_\_\_\_\_

Approved: \_\_\_\_\_ [L] [SEP] (Supervisor)  
Date: \_\_\_\_\_

**APPENDIX B**

**SCUBA DIVING MEDICAL HISTORY FORM**

**(To be completed by the applicant-diver and given to the Licensed Healthcare Physician)**

Name \_\_\_\_\_ Sex \_\_\_\_\_ Age \_\_\_\_\_

Wt. \_\_\_\_\_ Ht. \_\_\_\_\_ (Print or type applicant-diver's name)

**To The Applicant:**

Scuba diving makes considerable demands on you, both physically and mentally. Diving with certain medical conditions may be asking for trouble, not only for yourself, but also for anyone coming to your aid if you get into difficulty in the water. Therefore, it is prudent to meet certain medical and physical requirements before beginning a diving or training program. Your answers to the questions are as important, in determining your fitness as your physical examination. As an applicant, you must provide accurate information to the Licensed Healthcare Physician completing your diving medical examination. This form shall be kept confidential. This SCUBA Diving Medical History Form shall be provided to the licensed healthcare physician. If your licensed healthcare physician concludes that diving would involve undue risk for you, remember that they are concerned only with your well-being and safety.

**Have you ever had, or do you presently have, any of the following?**

- \_\_\_\_ Yes \_\_\_\_ No Trouble with your ears, including ruptured eardrum, difficulty clearing your ears, or surgery.
- \_\_\_\_ Yes \_\_\_\_ No Trouble with dizziness.
- \_\_\_\_ Yes \_\_\_\_ No Eye surgery.
- \_\_\_\_ Yes \_\_\_\_ No Depression, anxiety, claustrophobia, etc.<sup>[L] [SEP]</sup>
- \_\_\_\_ Yes \_\_\_\_ No Substance abuse, including alcohol.<sup>[L] [SEP]</sup>
- \_\_\_\_ Yes \_\_\_\_ No Loss of consciousness.
- \_\_\_\_ Yes \_\_\_\_ No Epilepsy or other seizures, convulsions or fits.
- \_\_\_\_ Yes \_\_\_\_ No Stroke or a fixed neurological deficit.
- \_\_\_\_ Yes \_\_\_\_ No Recurring neurologic disorders, including transient ischemic attacks.
- \_\_\_\_ Yes \_\_\_\_ No Aneurysms or bleeding in the brain.
- \_\_\_\_ Yes \_\_\_\_ No Decompression sickness or embolism.
- \_\_\_\_ Yes \_\_\_\_ No Head injury.
- \_\_\_\_ Yes \_\_\_\_ No Disorders of the blood, or easy bleeding.
- \_\_\_\_ Yes \_\_\_\_ No Heart disease, diabetes, high cholesterol.<sup>[L] [SEP]</sup>
- \_\_\_\_ Yes \_\_\_\_ No Anatomical heart abnormalities including patent foramen ovale, valve problems, etc.
- \_\_\_\_ Yes \_\_\_\_ No Heart rhythm problems.
- \_\_\_\_ Yes \_\_\_\_ No Need for a pacemaker.
- \_\_\_\_ Yes \_\_\_\_ No Difficulty with exercise.
- \_\_\_\_ Yes \_\_\_\_ No High blood pressure.

Yes  No Collapsed lung. Asthma.  
 Yes  No Other lung disease. Diabetes mellitus.  
 Yes  No Pregnancy.  
 Yes  No Surgery If yes explain:  
 Yes  No Hospitalizations. If yes, please explain: \_\_\_\_\_

\_\_\_\_\_  
 Yes  No Do you take any medications? If yes, please list: \_\_\_\_\_

\_\_\_\_\_  
 Yes  No Do you have any allergies to medications, foods, environmentals? If Yes, please explain: \_\_\_\_\_

\_\_\_\_\_  
 Yes  No Do you smoke?  
 Yes  No Do you drink alcoholic beverages?  
 Yes  No Is there a family history of high cholesterol?  
 Yes  No Is there a family history of heart disease or stroke?  
 Yes  No Is there a family history of diabetes?  
 Yes  No Is there a family history of asthma?

I certify that the above answers and information represent an accurate and complete description of my medical history.

\_\_\_\_\_  
Name of Applicant (Print or Type)

\_\_\_\_\_  
Date (Mo/Day/Year)

\_\_\_\_\_  
Signature of Applicant



## APPENDIX C

### DIVING MEDICAL EXAMINATION OVERVIEW FOR THE LICENSED HEALTHCARE PHYSICIAN

#### To: The Licensed Healthcare Physician

This person, \_\_\_\_\_, requires a medical examination to assess their fitness for certification as a SCUBA diver for the University of Wisconsin Center for Limnology. Their answers on the Diving Medical History Form (attached), may indicate potential health or safety risks as noted. Your evaluation is requested on the SCUBA Diving Fitness Medical Evaluation Report. If you have questions about diving medicine, you may wish to consult one of the references listed below. Thank you for your assistance.

SCUBA and other modes of compressed-gas diving can be strenuous and hazardous. A special risk is present if the middle ear, sinuses or lung segments do not readily equalize air pressure changes. The most common cause of distress is eustachian insufficiency. Most fatalities involve deficiencies in prudence, judgment, emotional stability or physical fitness. Please consult the following list of conditions which usually restrict candidates from diving (Adapted from Bove, 1998: 61 -63, bracketed numbers are pages in Bove).

#### Conditions Which May Disqualify Candidates From Diving

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to auto inflate the middle ears. [5,7,8,9]
2. Vertigo including Meniere's Disease. [13]
3. Stapedectomy or middle ear reconstructive surgery. [11]
4. Recent ocular surgery. [15,18,19]
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states,
6. Untreated depression. [20 - 23]
7. Substance abuse, including alcohol. [24-25]
8. Episodic loss of consciousness. [1, 26,27]
9. History of seizure. [27, 28]
10. History of stroke or a fixed neurological deficit. [29,30]
11. Recurring neurologic disorders, including transient ischemic attacks. [29,30]
12. History of intracranial aneurysm, other vascular malformation or intracranial [SEP]hemorrhage. [31]
13. History of neurological decompression illness with residual deficit. [29,30]
14. Head injury with sequelae. [26, 27]
15. Hematologic disorders including coagulopathies. [41, 42]
16. Evidence of coronary artery disease or high risk for coronary artery [SEP]disease. [33 - 35]
17. Atrial septal defects. [39]
18. Significant valvular heart disease - isolated mitral valve prolapse is not [SEP]disqualifying. [38]
19. Significant cardiac rhythm or conduction abnormalities. [36 - 37]
20. Implanted cardiac pacemakers and cardiac defibrillators (ICD). [39, 40]

21. Inadequate exercise tolerance. [34]
22. Severe hypertension. [35]
23. History of spontaneous or traumatic pneumothorax. [45]
24. Asthma2. [42 - 44]
25. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.[45,46]
26. Diabetes mellitus. [46 - 47]
27. Pregnancy. [56]

### **Selected References in Diving Medicine**

Many of these are available from Best Publishing Company, P.O. Box 30100, Flagstaff, AZ 86003-0100, the Divers Alert Network (DAN) or the Undersea and Hyperbaric Medical Association (UHMS), Bethesda, MD.

1. ACC/AHA Guidelines for Exercise Testing. A report of the American College of Cardiology/American Heart.
2. Association Task Force on Practice Guidelines (Committee on Exercise Testing). Gibbons RJ, et al. 1997.
3. Journal of the American College of Cardiology. 30:260-311:  
<http://www.acc.org/clinical/guidelines/exercise/exercise.pdf>
4. Alert Diver Magazine; Articles on diving medicine:  
<http://www.diversalertnetwork.org/medical/articles/index.asp>.
5. "Are Asthmatics Fit to Dive? " Elliott DH, ed. 1996 Undersea and Hyperbaric Medical Society, Kensington,MD.
6. "Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations." Grundy et. al.1999. AHA/ACC Scientific Statement.  
<http://www.acc.org/clinical/consensus/risk/risk1999.pdf>.
7. DIVING MEDICINE, Third Edition, 1997. A. Bove and J. Davis. W.B. Saunders Company, Philadelphia.
8. DIVING AND SUBAQUATIC MEDICINE, Third Edition, 1994. C. Edmonds, C. Lowery and J. Pennefather. Butterworth-Heinemann Ltd. Oxford.
9. MEDICAL EXAMINATION OF SPORT SCUBA DIVERS, 1998. Alfred Bove, M.D.,Ph.D. (ed.). Medical Seminars, Inc. San Antonio, TX.
10. NOAA DIVING MANUAL, NOAA. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.
11. U.S. NAVY DIVING MANUAL. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

**APPENDIX D**

**LICENSED HEALTHCARE PHYSICIAN'S REPORT<sup>[SEP]</sup> "MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING"**

**(To be completed by the Healthcare physician and returned to the applicant-diver for submission to the Dive Safety Officer)**

\_\_\_\_\_  
Name of Applicant (Print or Type)

\_\_\_\_\_  
Date (Mo/Day/Year)

**To The Licensed Healthcare Physician:**

This person is an applicant for training or is presently certified to engage in diving with a self-contained underwater breathing apparatus (SCUBA). This is an activity which puts unusual stress on the individual in several ways. Your opinion on the applicant's medical fitness is requested. SCUBA diving requires heavy exertion. The diver must be free of cardiovascular and respiratory disease. An absolute requirement is the ability of the lungs, middle ear and sinuses to equalize pressure. Any condition that risks the loss of consciousness should disqualify the applicant.

**[ ] Initial Examination [ ] Re-examination (Every 3 years, every 2 years over age 60):**

Please initial that the following was completed.

\_\_\_\_\_ Medical History<sup>[SEP]</sup>

\_\_\_\_\_ Complete Physical Exam, with emphasis on neurological and otological components

The following procedures are to be completed at the physician's discretion.

\_\_\_\_\_ Chest X-Ray<sup>[SEP]</sup>

\_\_\_\_\_ Spirometry<sup>[SEP]</sup>

\_\_\_\_\_ Hematocrit or Hemoglobin<sup>[SEP]</sup>

\_\_\_\_\_ Urinalysis<sup>[SEP]</sup>

\_\_\_\_\_ Any further tests deemed necessary by the physician.

\_\_\_\_\_ Assessment of coronary artery disease using Multiple-Risk-Factor Assessment 1

Note: Exercise stress testing may be indicated based on Risk Factor Assessment 2

**RECOMMENDATION:**

**[ ] APPROVAL:** I find no medical condition(s) which I consider incompatible with diving.

**[ ] RESTRICTED ACTIVITY APPROVAL:** The applicant may dive in certain circumstances as described in remarks.

**[ ] FURTHER TESTING REQUIRED:** I have encountered a potential contraindication to diving. Additional medical tests must be performed before a final assessment can be made. See remarks.

**[ ] REJECT:** This applicant has medical condition(s) which, in my opinion, clearly would constitute unacceptable hazards to health and safety in diving.

**References:**

1. Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations.” Grundy et. al. 1999. AHA/ACC Scientific Statement. <http://www.acc.org/clinical/consensus/risk/risk1999.pdf>
2. Gibbons RJ, et al. ACC/AHA Guidelines for Exercise Testing. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Exercise Testing).
3. Journal of the American College of Cardiology. 30:260-311, 1997. <http://www.acc.org/clinical/guidelines/exercise/exercise.pdf>

**Remarks**

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My familiarity with applicant is:

With this exam only

Regular Physician for \_\_\_\_\_ years

Other (describe) \_\_\_\_\_

My familiarity with diving medicine is:

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I have discussed the patient's medical condition(s) which would not seriously interfere with diving but which may seriously compromise subsequent health. The patient understands the nature of the hazards and the risks involved in diving with these defects.

\_\_\_\_\_  
M.D.

\_\_\_\_\_  
Licensed Healthcare Physician Signature

\_\_\_\_\_  
Name (Print or Type)

\_\_\_\_\_  
Address

\_\_\_\_\_  
Telephone Number

**Applicant's Release of Medical Information Form**

I authorize the release of this information in association with my diving to the University of Wisconsin Center for Limnology Diving Control Board and CFL Administrative Staff.

(name) \_\_\_\_\_ or their designee at

(place) \_\_\_\_\_ on (date) \_\_\_\_\_.

Signature of Applicant \_\_\_\_\_