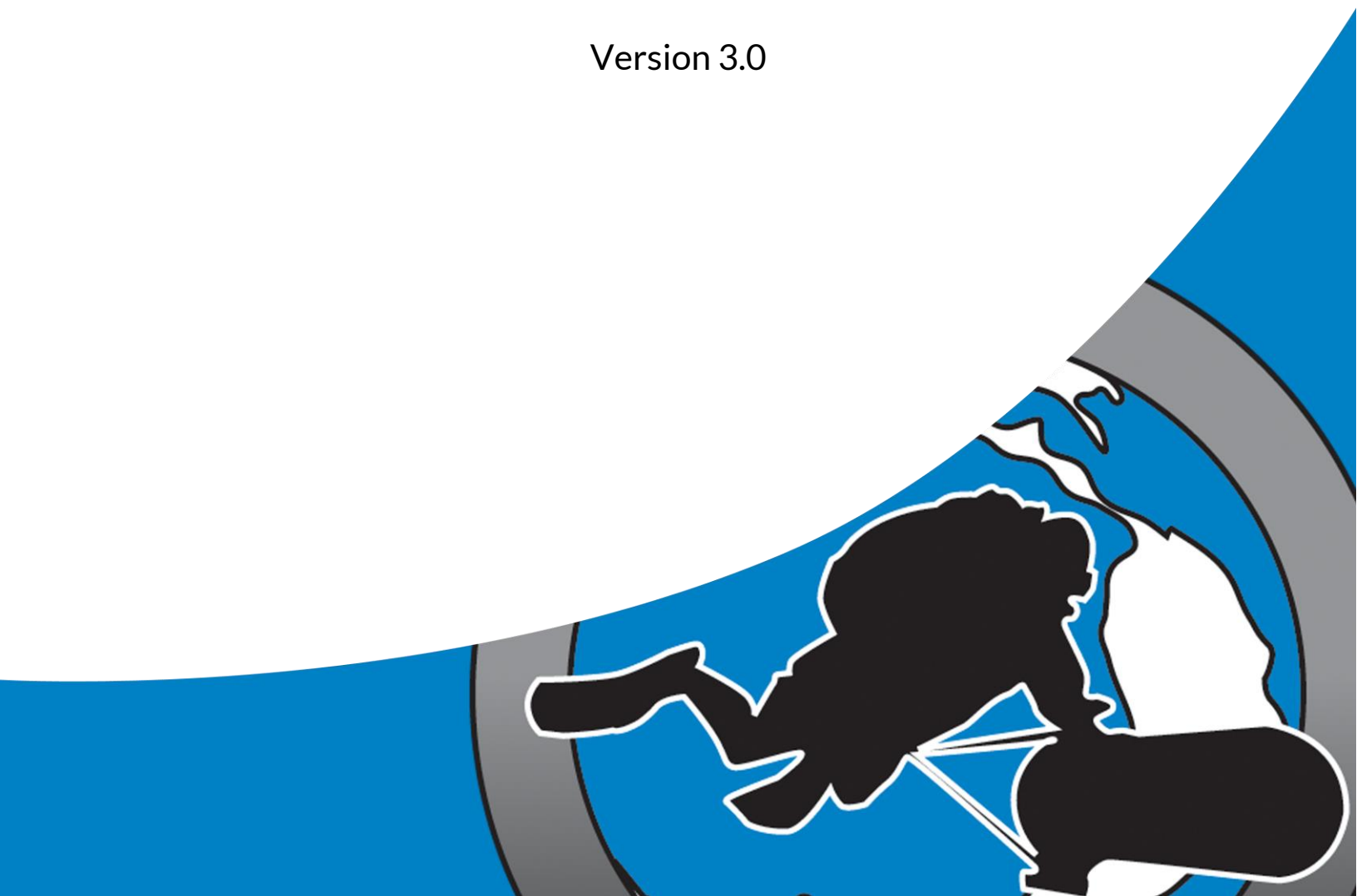
Standard Operating Procedures

Version 3.0



GUE Standard Operating Procedures

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Part 1: Routine Diving Operations

Ascent Rate Protocol

The following are guidelines for use in calculating various ascent rates and profiles. Divers should take caution that the on-site environment will ultimately determine the final shape of the profile. This is a team process, and **all** team members must participate. When feasible and practical, the last stop should be conducted at 6 m/20 ft, followed by a slow ascent of 1 m/3 ft per minute to the surface.

During recreational dives, the last stop should be conducted at 3 m/10 ft (if conditions permit), followed by a slow controlled ascent.

Recreational Diver 1 and 2, Fundamentals

The following procedures guide ascent strategy for dives that follow GUE minimum decompression limits.

1. Calculate 50% of the average depth of the dive. If the calculated stop is not in an increment of 3 m/10 ft, move the stop to the next shallower increment.
2. Ascend at 9 m/30 ft per minute to the calculated depth.
3. At 50% of average depth (or the calculated increment), reduce the ascent rate to 3 m/10 ft per minute.
4. For practical reasons, the 3 m/10 ft per minute ascent rate is executed as a 30-second stop and 30 seconds of movement to the next 3 m/10 ft interval.

Recreational Diver 3, Technical Diver 1 and 2

The following procedures guide GUE diver decompression during GUE courses with mandatory decompression stops, and should also guide non-training dives. This procedure is not relevant for dives following Minimum Decompression Limits (MDLs).

1. Calculate profile using 20/85 GF in DecoPlanner (DP). Note the max stop depth reported in DP; estimate using 75% of the average depth (50% for Rec 3). No stops should be conducted below max stop depth.
2. Ascend at 9 m/30 ft per minute to the first DP stop (or gas switch, if relevant) and continue with DP profile. Adjust ascent speed as needed to maintain team control. Be aware that any delay in this zone adds to the total decompression obligation.

Adjustments to decompression profiles are permissible if considered within DecoPlanner. Examples of adjustments include adding time during a gas switch, reorganizing stops for strategic or convenience reasons, or slowing the ascent to maintain control or manage the needs of the team.

Bottle Rotation Protocol

1. Stabilize at chosen depth.
2. Clip light off and stow in temporary position.
3. Place the light cord under the long hose and the waist strap.
4. Unclip the tail of the bottle that is to be rotated back.
5. Unclip the leash and move it forward.
6. Unclip the nose of the bottle that is to be rotated back.
7. Clip to leash.
8. Choose the bottle to be moved from the leash to the left chest D-ring.
9. Clip it to the left chest D–ring.
10. Clip the leash onto the left hip D-ring and push other leashed bottles behind.
11. Clip the tail of the bottle that was moved up onto the left hip D–ring.
12. Move light back to primary position.

Cave Navigation and Marking Protocol

- Divers should always use the guideline to travel and reference their location.
- It is the team's responsibility to always ensure that it is following a continuous guideline.
- Ideally, divers should never be further than arm's reach from the guideline. Some scenarios where this would not be practical include high-flow caves and areas where the line is close to the floor and the distance to the ceiling is high (assuming good visibility exists).
- Jumps, permanent intersections, and initial change of direction markers are marked by all team members.
- Non-directional markers (cookies) should be placed on the exit side of the intersection.
- Directional (arrows) and non-directional markers do not need to be numbered, but should be labeled with the initials of the diver placing them.
- Visual jumps, blind circuits/traverses, and "trust me" dives must be avoided.

Decompression Computers

GUE has a long history of skepticism towards decompression computers. In most cases, these reservations have been justly deserved, as computers have historically produced ill-conceived and sometimes even potentially dangerous profiles. Reliability was also a common problem over many years. More recently, the technical capacity and reliability of dive computers has greatly improved, and today decompression computers can provide a very close approximation of current GUE diving protocols.

Despite the progress, decompression computers remain problematic in certain types of diving, with different computers sometimes producing vastly different outcomes. Some of these profiles are arguably as bad as those calculated by older computers, while others are quite similar to those being conducted daily in GUE diving activities.

Another potential negative aspect of computers is that divers may become dependent on them, and thus progressively more ignorant of the process of determining their decompression. New divers might also never become truly conversant in this process, given their lack of history with detailed planning. This would be unfortunate and potentially dangerous, eroding GUE training and protocols, which should produce divers that are empowered to operate safely and efficiently and with full knowledge of those operations.

Given the current landscape, GUE acknowledges that certain computers can be beneficial as secondary planning and assessment tools. GUE continues to assert the absolute necessity of maintaining robust knowledge of decompression planning as well as the ability to calculate profiles "on the fly," such as during emergency situations or as a means to efficiently manage their decompression profiles. These aspects must remain part of GUE educational programs and all instructors are required to assert that this important skill remains part of the GUE knowledge base. GUE divers are also required to use these procedures as the primary means of decompression planning. When used as a secondary source of information, any decompression computer selected should closely mirror DecoPlanner while using gradient 20/85, as is the case with all GUE decompression diving.

Flow Check (Modified Valve Drill)

Designed as a method of quickly confirming that all valves are in the correct position to conduct the dive, this procedure is a modified valve drill and is normally completed as part of the pre-dive sequence. When the diver is carrying stages, an argon bottle, and/or deco bottles the flow check is expanded to include these items as well. A comprehensive flow check is conducted as follows:

1. Rotate the right post valve to ensure it is fully open.

2. Rotate the isolator valve to ensure it is fully open.
3. Move the primary light to your right hand.
4. Rotate the left post valve to ensure it is fully open.
5. Keep working to the left and ensure any stages you have clipped off are pressurized and fully closed.
6. Return primary light to normal position.

Flying After Diving

- Follow the current DAN recommendations.
  - http://www.diversalertnetwork.org/
  - https://www.daneurope.org
  - http://www.danasiapacific.org
- Cross check with the computer, software, or tables used to plan the dive.

Gas Analysis

Double Tanks

A diver should personally analyze all their tanks on the day of the dive.

1. Verify that the isolator valve is fully open.
2. Slightly open the right valve to create a slow, steady flow of gas.
3. Use a properly calibrated analyzer and wait for the readings to stabilize.
4. Write the analysis results (to one decimal place) on a sticker and add your initials, the current date, and, if feasible, the tank pressure.
5. Place the sticker on the right tank between the valve orifice and the valve knob, so it can be seen clearly by your teammates.
6. If you have not already done so, verify the tanks are filled to the desired pressure.

Single Tank

A diver should personally analyze all their tanks on the day of the dive.

1. Slightly open the valve to create a slow, steady flow of gas.
2. Use a properly calibrated analyzer and wait for the readings to stabilize.

3. Write the analysis results (to one decimal place) on a sticker and add your initials, the current date, and, if feasible, the tank pressure.
4. Place the sticker on the tank between the valve orifice and the valve knob, so it can be seen clearly by your teammates.
5. In the case of stage and/or decompression bottles, the sticker should be placed so the user can read it while the tank is clipped.
6. If you have not already done so, verify the tank is filled to the desired pressure.

Gas Planning

Open Water

Any time a dive team is planning a dive in an open water environment, the team should reserve enough gas to safely manage an out-of-gas (OOG) scenario. This amount, known as minimum gas, is the amount of gas required for two divers to ascend from the bottom to the first available gas source.

Minimum gas is calculated using the CAT formula, where:

- C stands for consumption for 2 divers (except when planning rebreather dives).
- A stands for average depth (between maximum depth and the surface for minimum decompression dives, or maximum depth and the first gas switch depth for decompression dives)
- T stands for time (needed to travel between the maximum depth and the next available gas source at 3 m/min or 10 ft/min).

Further planning will depend on environmental conditions and the type of the dive. Depending on these factors, planning can be based on all usable, half usable, or one third usable gas rules.

Cave

Gas planning for cave diving presents some unique gas management issues. In general, experienced divers (such as Cave 2 level and above), employ the rule of thirds, which can be modified to be as conservative as the environmental conditions demand.

However, when planning Cave 1 dives more gas is needed to accommodate for divers who are still building their skills and awareness. While the rule of thirds is adequate for divers with more experience, this volume may not be sufficient for novice divers who encounter a problem requiring

additional gas. In order to ensure that adequate reserves are maintained, all Cave 1 dive gas volumes are calculated using the following formula:

1. Dives must start with a minimum volume of 2800 L/100 ft^3
2. The diver will reserve 1/3 of this total gas as reserve.
3. Then, subtract the reserve gas amount from the total available gas to get the amount of usable gas.
4. 1/3 of the usable gas volume from the preceding calculation may be used for the penetration phase of the dive.
5. Normal gas matching rules still apply for similar/dissimilar tank configurations.

Gas Switch Procedures

Back Gas

Switching Diver's Actions

1. Attract teammates' attention and signal that you are going to switch to back gas.
2. Clip light off and stow in temporary position. If the switch to back gas has been forced by a stage failure, clipping the light at this point might not be desirable and can be performed at a later stage of this sequence.
3. Locate, unclip, and purge the primary regulator with the right hand.
4. Grasp the deco or stage regulator with the left hand.
5. In one smooth movement, exchange regulators.
6. Take a few breaths from the primary regulator to ensure its proper operation.
7. Fully close the decompression or stage cylinder valve (this may be performed after stowing the hose).
8. Stow the decompression or stage regulator.
9. Deploy the primary light if needed (based on environment).
10. Check back gas pressure.

Teammates' Responsibilities

- Observe the diver who is switching to back gas.
- Maintain environmental awareness.

Decompression or Stage Cylinder

Switching Diver's Actions

1. Stabilize at switch depth.
2. Signal the team that you are going to perform a gas switch.
3. Clip light off and stow in temporary position.
4. Identify the correct bottle using the MOD label.
5. Keep your hand on the valve of the chosen bottle.
6. Pressurize regulator and return valve to the closed position.
7. Deploy second stage regulator.
8. Trace the second stage back to the first stage.
9. Press purge button on second stage and confirm dropping needle on SPG.
10. Open valve fully.
11. While keeping the stage regulator in front of you, present MOD markings and ask for confirmation from teammate.
12. After confirmation, verify depth and switch to deco gas.
13. Take a few breaths from the stage regulator to ensure its proper operation.
14. Clip off primary.
15. Replace light in normal position.

Teammates' Responsibilities

1. Observe the diver who is switching to back gas. When asked to confirm deco gas selection:
    a. Did the diver open the valve after the pressure interruption check?
    b. Trace second stage back to first stage.
    c. Check that depth matches MOD.
    d. Signal the diver to switch.
2. As soon as the last team member finishes his gas switch, communicate the decompression time and start the timer.

Hypoxic Protocol

This protocol refers to hypoxic mixes, which can cause a diver to lose consciousness when breathed on or near the surface with an excessively low pO_2.

The **hypoxic zone** is defined by GUE as the area between the surface and 6 m/20 ft when dived with any hypoxic gas from the GUE Standard Gases table. When such a mix is used for a dive, the team must address the risk by calculating the range of the hypoxic zone to manage the risk with appropriate measures for both the descent and the ascent portions of the dive.

For non-standard gas mixes, the hypoxic zone is calculated using a pO_2 threshold of 0.15. The calculation is based on the diver within the team that has the gas with the lowest oxygen content. For example, for a 10% oxygen mix, the hypoxic zone will be from 6 m/20 ft to the surface.

Divers must recognize that a pO_2 of 0.15 can produce hypoxic symptoms if breathed under exertion and/or for prolonged periods of time. During these conditions, a more conservative approach should be applied, including using a higher pO_2 mixture within the hypoxic zone. Such a mixture will usually be the deepest decompression gas carried for the dive. It is also important to ensure that the team accounts for additional gas reserves to ensure that any loss of decompression gas will not prevent a safe ascent with a proper gas mixture. This is usually accomplished by reserving additional gas (roughly 70 bar/1000 psi) in each member's decompression cylinder. During such dives it is advisable that support divers are used in order to manage the possibility of unconsciousness.

The complete hypoxic protocol is as follows:

1. Descend through the hypoxic zone using deepest decompression gas available.
2. Stabilize the team at 9 m/30 ft (depth may be adjusted based on environment).
3. Stow the primary light in the temporary position.
4. Switch to back gas and stow travel gas.
5. Perform checks (situation dependent) including:
    a. Modified valve drill (flow check)
    b. Modified S-drill
    c. Bubble check, including hip D-ring check for any potential cross linking of stage clips
6. Switch to bottom stage (or back gas, if relevant).
7. Move the light back to primary position.
8. When ascending, the team will travel through the hypoxic zone using oxygen.

Light Head Management

There are four typical positions for the light head.

1. Normal position: the light head is held in the left hand.
2. Temporary hold: the light head is momentarily held in the right hand.
3. Temporary position: the light head is clipped with a double ender attached to loop at the rear of the light head. The light cord is stowed behind the long hose and under the waistband.
4. Permanently clipped: the light head is switched off and clipped to the right chest D-ring using a permanent bolt snap. The light cord is stowed behind the long hose and under the waistband. This has the ramification that during open water ascents, the normal position (left hand) should be preferred rather than the temporary position.

The light should be in the temporary position during bottle rotations, gas switches, SMB deployments, etc., but the diver should redeploy the light to the normal position once the drill has been completed so that its value as a communication tool is not diminished. Remember that when a light has been clipped off or deployed, the diver must make an integrity check.

1. When light is clipped off: long hose integrity (hand following long hose down under light canister).
2. When light is deployed: light cord integrity (hand following the light cord down to the light canister lid).

Modified Safety Drill (Modified S-Drill)

While this drill is also incorporated into the GUE pre-dive sequence, it is a stand-alone exercise that should also be conducted any time a diver has adjusted their main equipment configuration. Ideally, it is conducted on the surface, but may, depending on the environment, be done at a shallow depth or on land. It is used to ensure that the donor's long hose is readily deployable in the event of an OOG situation.

Each diver will:

1. Deploy the long hose.
2. Switch to the alternate/backup regulator.
3. Grasp the primary regulator with the left hand.
4. Move the long hose from under the light canister (or free of the waistband if no light is being used).

5. Clear the long hose and verify that it is positioned over the right shoulder and has an unobstructed path to the primary regulator.
6. Once a partner has confirmed that the long hose is indeed free and unobstructed, return the long hose to the stowed position.

Situational Awareness Check

The purpose of a situational awareness check, or "sit check," is to create a real-time snapshot of the current state of the dive. It is encouraged that a sit check is conducted at the start of the dive and approximately every fifteen minutes thereafter, or when reasonable. The sit check should only take about 15 to 20 seconds and can be conducted "on the fly." A sit check should be conducted as follows:

1. Initiate the check with a flow check.
2. Track exposure by determining bottom time and average depth.
3. Track gas consumption by checking the relevant SPG and noting the pressure.
4. Make a quick situational awareness scan, monitoring any changes to the team, environment, or equipment.

This procedure is one of the most valuable tools in a diver's toolbox during the in-water portion of a dive. Frequent use of the sit check in the manner described above allows the diver to quickly gauge and update consumption, comfort, planning, and dive execution accuracy, as well as generally improving their awareness of all aspects of the dive.

Note: If using an RB80, the diver should also check the switch block to ensure that all valves are in the correct position and the proper gas is plugged in.

SMB Deployment

A surface marker buoy (SMB) is primarily used as a signaling device so the surface support personnel can locate and recover a dive team or to warn surface vessels that divers are ascending from below. It can also be used as a communication tool to indicate simply "we are OK" if team recovery is not the primary goal. The nature of the dive will determine when and how the SMB is deployed. It is conducted as follows:

1. The team aligns in whatever formation the environment dictates.
2. The diver responsible for the deployment of the SMB will indicate this by signaling "SMB deployment" to the team.

3. Then, this diver will:
    a. Stow their primary light in the temporary position, with the light cord placed under the long hose and the waist strap.
    b. Locate the SMB and a spool of appropriate size (Note: If the spool and SMB have not been pre-attached, then the diver will do so now using whatever method they choose, as per training).
    c. Unclip the double ender from the spool and clip it to the right chest D–ring.
    d. Ensure that there is no line hanging out from the spool and that they are holding the SMB and spool in a firm grip.
    e. Undo any elastic loop or Velcro closures that may constrain the SMB.
    f. Look up for any obstruction.
    g. With the left hand, gather the spool and valve. With the right hand, remove the primary regulator from the mouth and inflate the SMB with about 1/2 the capacity of their lungs.
    h. Replace the primary regulator, taking care not to breathe yet.
    i. Move the spool and SMB to an arm's length away from the body, then release the SMB and breathe, taking care that the spool runs smoothly between the thumb and forefinger of their left hand, which should be held over the center hole of the spool. When the SMB reaches the surface, re-spool any slack line and either use the clip previously attached to the D-ring or the hand to put tension on the line.
4. As the team rises through the water column, the diver in charge of the SMB will take in line on the ascent to match the rate of ascent as appropriate. The spool line must not be allowed to go slack during the ascent. During prolonged stops, the diver in charge of the SMB may clip the double ender to the spool in such a manner that it captures the up-line in a hole in the spool.

The above procedure describes the use of a closed-circuit SMB. If the team is using an open circuit SMB, then the procedure is identical except for the method used to inflate the SMB. In this case, air is introduced into the SMB from the exhaust bubbles of the primary regulator. The utmost care must be taken in order to control the line so that no entanglement occurs.

Stage Diving Procedures (Cave)

Stage Drop

1. Signal team.

2. Clip light head to chest D-ring in a temporary position. Place the light cord under the long hose and the waist strap.
3. Switch to long hose regulator while monitoring team members.
4. Turn off the valve and stow stage regulator.
5. Unclip the stage bottle, starting from the bottom clip.
6. Adjust buoyancy.
7. Drop and clip the stage cylinder on the guideline; the drop point must avoid fragile, restricted, and sediment-prone areas.
8. Unclip light head and check back gas pressure.
9. Continue the dive.

Stage Pick Up

1. Signal team.
2. Clip light head to chest D-ring in a temporary position. Place the light cord under the long hose and the waist strap.
3. Unclip and pick up stage cylinder from the guideline.
4. Adjust buoyancy.
5. Clip off the stage bottle, starting from the upper clip.
6. Switch to stage cylinder regulator while following the standard gas switch procedure.
7. Unclip light head.
8. Continue to exit or dive.

Survey

- Surveys are typically conducted during the penetration portion of the dive.
- The primary light can be temporarily clipped while taking measurements and the team can assist with lighting.
- Basic measurements include:
  - Depth
  - Distance
  - Azimuth
- Maintain a good pace and control.
- The survey site should reflect the capabilities of the dive team.

Team Positioning

The environment in which a particular dive is being conducted will largely dictate dive characteristics such as team formation in either single file (cave environment) or wing position (open water environment). However, distance between divers and distance from a point of reference when failures or emergencies arise can use these predetermined team configurations to greatly reduce confusion, thus reducing overall team stress. Here are some examples.

- When experiencing failures in a cave environment, reorder the team in the manner that best supports the diver with the problem.
- Where the team members have lights of variable intensity, the team can adjust to keep the brightest light in back. This diver would be placed in the third position on the way in and will also take this position on the way back out.
- It is very rare for a team to experience more than one major failure. It is usually simple to reorganize the team in a manner that provides the maximum support for the stressed diver. The following guidelines should be considered when a situation forces a team to reorganize:
  - The diver in the greatest difficulty is generally placed in the middle position
  - Gas problems are assigned the highest priority
  - Equipment issues can usually be readily dealt with; however, they must not be treated lightly, no matter how trivial. The team should reorganize in a manner that both accommodates the affected diver and keeps the problem in the team's focus.
  - No matter what the issue, the stressed diver is placed in a protected position until the dive is over or a higher priority situation arises.

Given the clearly impossible task of attempting to document and articulate all possible emergency scenarios, both single and multiple failure, it is of paramount importance that a great degree of flexibility be exercised by all team members as situations deteriorate. It is with this in mind that teams may be forced into using significant creative thought based on the principles listed above to ensure that all team members safely complete the dive.

Valve Drill

Double Tanks

This procedure is used to ensure the correct positioning of all valves, the diver's capacity to operate the valves, and the proper operation of the primary and secondary regulators. To master

the valve drill, a diver must first develop solid situational awareness and robust fundamental diving skills, including buoyancy control, trim, and maneuvering techniques.

Before starting the valve drill, the team assumes a formation as dictated by the environment. The diver who is conducting the drill will signal to one of their teammates to watch them while they execute the drill. The teammate will assume a ready state (be prepared to donate) and indicate OK.

The diver executing the drill will:

1. Purge the backup regulator to ensure a viable gas source.
2. Reach up with their right hand and close the primary valve while signaling for attention with primary light.
3. Breathe the long hose dry.
4. Remove the primary regulator from their mouth with right hand.
5. Place the backup regulator in their mouth with the left hand.
6. Clip off the primary to the right chest D-ring.
7. Pause.
8. Reach back with their right hand and rotate the primary valve to the fully open position.
9. Locate the primary regulator. Unclip, purge, remove the backup regulator using their left hand, and replace it with the primary regulator.
10. Pause.
11. Reach back with their right or left hand and rotate the isolator to the fully closed position while signaling with the primary light, then rotate it to the fully open position.
12. Pause.
13. Move primary light to a temporary hold in the right hand.
14. Reach up with their left hand and fully rotate the left valve to the closed position while signaling with the primary light.
15. Fully purge the backup regulator.
16. Rotate the left post to the fully open position.
17. Purge the backup regulator to ensure that it is functioning.
18. Move primary light back to normal position.
19. Conduct a final flow check, including any additional tanks such as stage, deco, or drysuit bottles.

Single Tank

This drill is used to confirm the valve position and that the single tank diver has the dexterity and ability to accurately locate and manipulate the on/off valve in the situation of inadvertent closure. Since the single tank diver only has one possible air source, it is absolutely critical that at no time does the diver close the valve.

The drill is conducted as follows:

1. The team assumes a formation as dictated by the environment.
2. The diver who is conducting the drill will signal to one of their teammates to watch them while they execute the drill.
3. The teammate will assume a ready state (be prepared to donate) and indicate OK.
4. The working diver will:
    a. Reach up with their right hand and locate the valve.
    b. Demonstrate their ability to manipulate the valve (flow check the valve, do not close).

Part 2: Emergency Procedures

Broken Guideline

1. Stop and stabilize your position.
2. Signal the team.
3. Establish a line-to-line connection between the loose end of the broken line and the safety line.
4. Search for the other side of the line with the help of the team. The guideline is likely to be near the bottom.
5. Fix the line permanently if time and conditions permit; if not, secure both ends of the line and warn others entering the cave/wreck.

Donation to an Out-of-Gas Diver: Safety or S-Drill

Both divers will face each other (or triangle up in a team of three) and establish a neutral base (may be not possible in a real OOG scenario). It is important that all team members be included in any team decisions and team reformations. If there is a third team member involved in this drill, then it is their responsibility to monitor the situation, including depth/time and environmental conditions, as well as be prepared to render appropriate assistance during an OOG scenario.

Initiating the Drill

OOG Diver Action

1. Signal distress with light, with left hand if no primary light available, or gain team member attention via touch contact.
2. Indicate OOG by slashing the right hand across the throat.
3. Identify and move towards the donor.
4. Do not remove the primary regulator from the mouth until donor's regulator is available for exchange.

Donor Action

1. With the right hand, locate and grasp the primary regulator hose, taking care not to cover the faceplate (purge button) of the regulator.

2. With smooth yet decisive action, remove the primary regulator from the mouth, duck the head and deploy the long hose over the head. Present the mouthpiece to the OOG diver.
3. With the left hand, locate the backup regulator, taking care not to capture the long hose with the left arm, and place in mouth.
4. Maintain situational and environmental awareness.

OOG Diver Action

1. Grasp the donated regulator (ideally with the left hand).
2. Replace your own primary regulator with the donor's regulator.
3. Clip off the evacuated primary.
4. Secure the donated regulator by holding on to the hose.

At this point, both divers should pause and stabilize while the donor ensures the OOG diver is OK via exchange of an OK signal from the OOG diver.

Donor Action

1. Clear the light cord from the long hose in a counter-clockwise manner.
2. Fully deploy the long hose over the right shoulder.

All Divers in the Team

1. Make a team decision on the action to be taken or direction to travel.
2. Assume an appropriate team formation.
3. Position the OOG diver slightly in front of the donating diver and initiate touch contact (in case of a third team member, this diver should be positioned slightly in front or to the side of the OOG diver thus "boxing in" the OOG diver during travel.
4. Route the hose for easy travel. Both the OOG diver and donor are responsible for controlling the hose at all times:
    - With the donor to the right of the OOG diver, the long hose will feed straight from the regulator. Both the OOG diver and donor control the hose by holding it in their right hand.
    - With the donor to the left, the hose will go behind the OOG diver's neck and the OOG diver will control the hose with his left hand.
    - For OOG scenarios that include following a guideline, the procedure above is exactly the same, except that the divers must control both the long hose and the guideline, with a locked "OK" signal around the hose and the guideline.

For open water ascents, the OOG diver and donor may choose to discontinue touch contact and (if conditions allow) position themselves so that all team members face each other. In all circumstances, the OOG diver must hold on to the donated hose (ideally with the right hand while having arms relaxed in front for a clear view of the bottom timer while ascending and still having the left hand free for controlling buoyancy).

Terminating the Drill

Once the drill has been terminated (or, in real OOG scenario, divers reach the next available gas source), both divers will face each other (or triangle up in a team of three) and establish a neutral base.

OOG Diver Action

1. Locate, unclip and purge the evacuated primary with the right hand (or go through the gas switch steps and prepare the stage/deco bottle regulator).
2. Remove the donated regulator with the left hand and replace with own.
3. Retain possession of the donated regulator until donor cleans up (re-stowing the hose and routing the light cord).

Donor Action

1. Stow the long hose.
2. Reroute the light cord around the long hose using a clockwise motion.
3. Obtain the primary regulator from the OOG diver.
4. Purge and replace.
5. Check that the light cord is routed over the long hose.

Excessive Buoyancy due to Equipment Failure

1. Signal the team.
2. Detect the source of the auto-inflation.
3. If the power inflator is stuck on, dump gas from the corrugated hose while disconnecting the low pressure (LP) inflator hose (single tank). In case of icing, switch to a teammate's long hose and close the valve.
4. If using doubles, shut the right valve down while dumping gas from the rear dump valve and then switch to the backup regulator.
5. If your dry suit is self-inflating, disconnect the LP inflator hose while venting excess gas.

6. If using a separate drysuit inflation bottle, shut down the bottle and/or disconnect the LP inflator.
7. Reestablish position and control.
8. Fix the problem or call the dive.

Line Entanglement

1. Stop and stabilize position.
2. Signal team members.
3. Make one attempt to free yourself.
4. Signal team members for assistance.
5. If guideline needs to be cut:
    - Position team on exit side of cut
    - Secure the line
    - Cut line and the free the diver
6. Repair line if possible.
7. If it is not possible to properly repair the line, notify other divers entering cave/wreck.

Loss of Decompression Gas

In the event that a decompression gas is unavailable due to equipment malfunction or an exhausted gas supply, a diver can share gas from their teammates. The procedure depends on the lost gas, as follows.

Nitrox 50

1. Failed diver should use Nitrox 50 from teammates at alternating stop depths.
2. Teammates should donate their regulator. Do not hand off the decompression cylinder.
3. Breathe back gas at other stops.
4. Maintain scheduled decompression stop times.
5. At 6 m/20 ft, either:
    a. Double stop time and alternate to teammate's nitrox every 5 minutes,
    b. Switch to oxygen and increase stop time by 1.5.

Oxygen

1. Share oxygen with teammates, 5 minutes each. Use Nitrox 50 when not breathing oxygen.
2. Extend 6 m/20 ft decompression stop by 1.5.

Lost Line Drill (Cave)

Normal Visibility

1. Stop and stabilize position near a reference point.
2. Search for team teammates' light, silt, bubbles, etc.
3. Use a primary tie-off to securely attach the safety line to a fixed point.
4. Whenever possible, look for a secondary tie-off.
5. Conduct search in the area of the cave that looks to be the most promising.
    - Use cave profile, configuration, flow pattern, compass heading, landmarks, sediment, etc. to regain orientation and locate the guideline.
    - Search patterns include: shotgun, wall-to-wall, and circular.
6. After the guideline is found, secure the safety spool to it, and place a non-directional marker on the exit side of the line.

Reduced or Zero Visibility

1. Stop, stabilize position, and feel for a reference point
2. Use a primary tie-off to securely attach the safety line to a fixed point.
3. Whenever possible, look for a secondary tie-off.
4. The primary light can be stowed in a permanent position but kept on.
5. Use cave profile, configuration, flow pattern, landmarks, and sediment to regain some orientation.
    - Search patterns include: shotgun, wall-to-wall, and circular.
    - Typically, the search should be conducted near the bottom of the cave with the safety spool in one hand and the other arm actively looking for the guideline.
6. After the guideline is found, secure the safety spool to it, feel both sides of the guideline for clues, and place a non-directional marker on what you believe to be the exit side.

If exiting the cave without all team members, leave a note (wetnotes open to note page and clipped to the line) stating that you have exited.

Loss of Visibility (Cave)

1. Stop, stabilize, and reference the guideline.
2. With one hand, secure the guideline with a locked OK.
3. All team members must have the same hand securing the line (all must use their right hands or all must use their left hand on the line) while the other hand is holding a team mate's arm or leg in touch contact communication.
4. Maintain good control (buoyancy and trim) so as not to make a bad situation worse.
5. Teammates need to be aware of one another's positions on the guideline at all times.
6. Divers must create space on the guideline to facilitate touch contact and exit procedures.
7. Exit the cave in an expeditious manner.

Loss of Visibility while Sharing Gas (Cave)

1. Stop, stabilize position, and reference guideline.
2. With one hand, secure the guideline with a locked OK.
3. If the guideline is on the right, the hose will feed straight from the regulator to the right hand, through the locked OK on the line.
4. If the guideline is on the left, the procedure is reversed; however, the hose will go behind the OOG diver's neck and feed through the locked OK of the left hand.
5. In both cases, both divers are responsible for controlling the excess long hose.
6. The OOG diver will always secure the long hose.
7. Establish touch contact communication with the remainder of the team.
8. Maintain good control (buoyancy and trim) so as not to make a bad situation worse.
9. Exit the cave in an expeditious manner.

Missing Diver

Cave

1. Stop and stabilize position.
2. Locate the line and reference the exit.
3. Search for teammates' light, silt, and bubbles
4. Determine team member is truly missing by first returning to the last place they were seen.

5. Reserve twice the gas needed to exit from that point. The remaining gas is available for searching. If significant penetration into the cave is required, a maximum of 1/3 of this searching gas can be used.)
6. Conduct the search as follows:
    a. Search on the line.
    b. Search off line if given probable cause.
    c. Place an arrow on the line.
    d. Utilize a safety spool for searching.
7. If the teammate is not found, leave all spools and the primary reel in place. Also, attach a backup light (turned on) and a note to the line and place several line arrows as you are exiting.
8. After you have surfaced, notify other divers to assist with search.

Open Water

Team separation constitutes the end of the dive. It is considered a serious emergency and requires that all focus be directed to locating the missing teammate(s).

- Limit the time spent searching on the bottom.
- The ultimate limit for the search will be minimum gas (MG).
- After concluding the search, proceed to obvious meeting points, e.g., the up-line.
- If your teammate is missing, deploy an SMB (even if ascending on a primary up-line) to communicate the problem to the boat crew and surface support. This will also allow them to track separated team members.

Omitted Decompression

Omitting decompression (for example, due to an equipment failure) is potentially hazardous. In the event it becomes necessary, a number of steps should be taken.

Affected Diver Response

1. Remain calm; notify surface support when feasible.
2. If DCI symptoms are not present, descend with team (within 5 min of surfacing).
3. Resume decompression one stop deeper.
4. Follow original profile.

5. Extend the 6 m/20 ft stop for as long as gas/temperature/environment allow.
6. Monitor physical status and keep close to the team.

Surface Support Response

1. Prepare for DCI and possible evacuation.
2. Deploy safety divers to assist with decompression.
3. Prepare for in-water extraction of unconscious or injured diver.

Being prepared for DCI can radically alter the outcome! Surface oxygen is extremely useful as a first-aid measure. Very rapid onset of DCI (on ascent or immediately after) may indicate more sever conditions, such as:

- Arterial gas embolism (AGE) and/or cerebral arterial gas embolism (CAGE)
- Barotraumas and neurological DCI injuries.

Primary Light Failure

1. Locate and remove a backup light from the stowed position.
2. Leave the light clipped to the chest D-ring.
3. Rotate the bezel to the on position.
4. Signal the team.
5. Properly stow the primary light once team has stopped and regrouped.
6. Position the light cord under the long hose and the waist strap.
7. Unclip the backup.
8. The team will regroup with the failed diver in the middle (for a three-person team) or in the lead (for a two-person team).
9. At this point, the team will decide on and execute the appropriate course of action as dictated by the environment.

Change Log

Version 2.0.2 to 3.0, February 2017

1. The following new sections have been added:
    a. Routine Diving Operations
        i. Decompression Computers
        ii. Flying After Diving
        iii. Gas Analysis
        iv. Stage Diving Procedures (Cave)
    b. Emergency Procedures
        i. Excessive Buoyancy due to Equipment Failure
        ii. Loss of Decompression Gas
        iii. Omitted Decompression
2. Ascent Rate Protocol
    a. Ascent rate changed for dives requiring staged/mandatory decompression.
        i. Variable ascent speed approach simplified. Divers are to ascend at 9 m/min or 30 ft/min to the first stop required by DecoPlanner.
    b. Deep ascent profile is to be calculated using DecoPlanner, a more prudent and proven way of calculating a decompression profile that allows for adjustment with the use of gradient factors.
3. Cave Navigation and Marking Protocol
    a. Added section on visual jumps, gaps, and traverses.
4. Gas Planning
    a. Open Water section edited to include:
        i. The use of the CAT Formula, a simplified method of memorizing the gas planning steps.
        ii. That an ascent is to be calculated based on a linear ascent speed of 3 m/min or 10 ft/min. This rate should provide sufficient reserves for a team that is sharing gas and unable to maintain a normal ascent rate of 9 m/min or 30 ft/min.
    b. Cave section updated to be more detailed.

5. Survey section simplified; more detailed procedures will be provided in course-specific SOPs.
6. S-drill moved to emergency procedures section, as it is designed to prepare divers for a true out-of-gas emergency.
7. Lost Line Drill (Cave) expanded to include both normal and zero visibility conditions, as well as a more detailed description of procedures.
8. Missing Diver expanded to include both cave and open water environment.
9. Unconscious Diver Rescue removed; more detailed procedures will be provided in course-specific SOPs.