

2.4 Apprentice Cave Diver

Unless otherwise noted, all requirements listed under *2.1 Standards Applying to all NSS-CDS Training Programs* apply to the course.

2.4.1 Purpose

The NSS-CDS Apprentice Cave Diver course is the first step in a two-step process leading to full NSS-CDS Cave Diver certification. It takes the place of the old Cavern, Basic and Intro-to-Cave Diver courses.

- The Apprentice Cave Diver course focuses primarily on limited penetration along the main line. It is also where students learn and master critical emergency skills.
- The Apprentice course also provides students with the opportunity to gain limited experience and practice fundamental cave diving skills prior to completing the requirements for full Cave Diver certification.

2.4.2 Limits of Training

The Apprentice Cave Diver course prepares students to dive within the following limits:

- A. Penetration is limited to a gas volume of 1,400 L/50 ft³ or one-third the available starting volume, whichever is less.
- C. Minimum starting volume of 2,100 L/75 ft³ and a minimum penetration gas volume of 700 L/25 ft³. The minimum starting volume does not apply if, during training, the instructor is having students practice skills within the daylight zone.
- D. Penetration distance of no more than 300 m/1,000 ft from the surface.
- E. Depth of no more than 30 m/100 ft.
- F. Minimum starting visibility of at least 10 m/30 ft.
- H. Divers may navigate off the main line using a single reel or spool. However, no jumps or gaps to offshoot or continuation lines.
- I. No planned decompression.
- J. No use of stage bottles or DPVs.
- K. No original exploration.

2.4.3 Extending the Limits of Training

By spending additional time with their instructor, students may extend the limits of training for Apprentice Cave Diver. To do this, they must make at least one additional dive beyond the eight required for Apprentice Cave. This dive must include at least one jump to an offshoot line. Instructors who take advantage of this option must be authorized to teach to the full Cave Diver level.

If students perform to the instructor's satisfaction, the instructor may issue an NSS-CDS *Apprentice Cave Diver Statement of Understanding*. This form clearly outlines four areas in which students may or may not exceed the normal Apprentice Cave Diver limits. The instructor can use the form to specify which limits these are and by how much students may exceed them. These limits include:

- A. *Usable Gas*: Removes the 1,400 L/50 ft³ restriction and allows students to use a full third of their starting volume.
- B. *Distance*: Removes the 300 m/1,000 ft restriction. The instructor may list a specific number of meters or feet to which students may go.
- C. *Limited Decompression*: Allows students to make planned decompression dives using pure oxygen or oxygen-rich decompression mixture. Students must hold certification in the use of such deco mixtures and in decompression procedures by a widely recognized technical diver training organization. Decompression is limited by the fact students may not use stage bottles or dive below 30 m/100 ft.
- D. *Navigation*: Students may make limited jumps to offshoot lines. The number of jumps is not specified, but is limited by the total distance students may penetrate.

We encourage all instructors to use this form, even if students may not exceed the normal Apprentice Cave Diver limits. It clearly defines students' limits and secures their agreement, in writing, to follow them. Instructors are to give one signed copy to their students and keep a second copy for their records.

The *Statement of Understanding* form also carries an expiration date. This helps encourage students to complete their full Cave Diver training in a timely manner. Should the form expire before students do so, their Limits of Training revert to the minimums normally associated with Apprentice Cave Diver certification.

2.4.4 Course Duration and Location

- A. This course generally takes four days. Students must accrue at least 240 minutes of bottom time over at least eight dives.
- B. Training must take place at two or more different sites. Caves with two or more distinct entrances or which have two main lines leading from a single entrance may count as different sites.

- C. The requirements for multiple sites do not apply if there are no other sites available within 200 km/75 miles.

2.4.5 Student Prerequisites

In addition to the prerequisites outlined in *Standards Applying to all NSS-CDS Training Programs*, students must either:

- A. Provides proof of certification in Technical Sidemount or some form of Basics/Fundamentals/Essentials from a widely recognized technical diver training organization, or...
- B. Provide proof of equivalent experience in sidemount or backmounted doubles.

Additionally, instructors must screen and evaluate students to ensure they possess adequate buoyancy, trim and propulsion skills. If they do not, students may take part in the CDS Basics orientation to acquire the necessary skill levels.

2.4.6 Instructor Prerequisites

Any NSS-CDS Instructor previously authorized to teach at the Basic or Intro-to-Cave Diver level, as well as those currently authorized to teach to the Apprentice level, may teach this course. Only those instructors authorized to teach to the full Cave Diver level may take advantage of the option to extend the Limits of Training beyond those normally associated with Apprentice Cave Diver.

2.4.7 Knowledge Development

To be certified as NSS-CDS Apprentice Cave Divers, students must be able to answer the following questions:

- A. The cave environment
 - 1. How do cavern and cave diving differ?
 - 2. What safety factor inherent in open-water diving do divers potentially lose when diving in overhead environments?
- B. Accident Analysis
 - 1. What are three direct causes and two contributing causes of recreational diver deaths in caves?
 - 2. What are the five *Rules of Accident Analysis* derived from these direct and contributing causes?
 - 3. What are at least two ways accident analysis for certified cave divers differs from accident analysis for recreational divers?

4. What are the limits of depth, penetration, navigation and decompression for which the NSS-CDS Apprentice Cave Diver course prepares students?
 5. What are two activities for which NSS-CDS Apprentice Cave Diver training and certification *does not* prepare students?
- C. Landowner relations and conservation
1. Is there such a thing as unowned land?
 2. What is one of the most important things you can learn about and follow at the public and private dive sites you visit?
 3. What are several ways you can maintain and improve landowner relations?
 4. What must you match with each dive site you visit?
 5. How do you determine the best propulsion technique to use in any cave?
 6. What are three ways you can help protect the fragile cave environment?
- D. Cave formation and environmental hazards
1. What are the four basic types of naturally-occurring caves and which type is most frequently visited by cave divers?
 2. How does mine diving differ from cave diving and why may it be beyond the scope of this course?
 3. What is the process by which solution caves form?
 4. What is the difference between phreatic and vadose cave formation?
 5. Why can speleothems be found in some phreatic caves?
 6. What is a halocline and give how may it affect divers?
 7. What are four types of potentially fragile cave formations?
 8. What are the three primary types of underwater cave entrances and how can you identify each?
 9. What are several reasons we consider springs safer to dive than siphons?
 10. What is a *restriction*?
 11. What is a *line trap*?
 12. What are seven additional environmental hazards we associate with diving in caves?
- E. Guidelines
1. What are the two general categories of permanent cave guidelines?
 2. What are several ways main lines may differ from offshoot lines?
 3. What are several ways exploratory lines may differ from popular guidelines?

4. What conventions do we use to mark popular guidelines?

F. Equipment

1. What are two ways equipment used for cave diving differs from technical deep diving as regards lift bags/marker buoys and reels?
2. What are the primary goals for cave diving equipment configuration?
3. Why do many cave divers prefer masks with black skirts?
4. What is a technique which can help prevent mask loss and ensure better fit?
5. What popular styles of fins are not well suited for cave diving and why?
6. Why do cave divers generally need greater thermal protection than recreational divers do in water of the same temperature?
7. What are the preferred cylinder and valve configurations for cave diving?
8. What are the preferred regulator configurations and features for cave diving?
9. What is the minimum instrumentation required for cave diving?
10. What advantages do LED primary lights have over older quartz-halogen and HID designs?
11. What is the minimum number of primary and backup lights required for cave diving?
12. What are several desirable features for primary and backup lights?
13. What are desirable features, materials and styles for attachment hardware?
14. What are the differences between reels and spools?
15. What are the three basic guideline reel types and their purpose and function?
16. Why do cave divers carry cutting tools? What is the minimum number of cutting tools each cave diver should have?
17. What are common cutting tools in cave diving?
18. What type of snap do most cave divers choose?
19. What are the basic guideline marker types?

G. Dive planning

1. What do we consider the “Golden Rule” of cave diving?
2. What are the six basic components of a cave diving plan?
3. How does team sequence work on linear dives?
4. What is the underlying principle for gas management in caves?
5. What is the basic procedure for determining gas turnaround points?

6. How do you establish comparable usable gas volumes when team members use cylinders of different capacities?
7. What are seven situations in which you might want to use more conservative gas turnaround points than normal?
8. What is the role depth and time play in planning cave dives?
9. What is the role direction plays in planning cave dives?
10. What are several additional components which may be part of a cave diving plan?
11. What are three benefits of cave diving in teams?
12. What is the ideal and the acceptable number of members in a cave diving team, and why does more than this tend not to work?
13. Which team member establishes the limits for the entire team?

H. Site assessment and pre-dive checks

1. What are the seven questions you should answer as part of a site assessment?
2. What is the one thing divers wearing backmounted cylinders must do before heading to the water?
3. What are three locations where you can conduct pre-dive checks, and what are the steps you should follow at each?
4. What items should be part of your pre-dive equipment check?
5. What are two problems which can arise if open-circuit divers fail to test breathe their teammates' primary second stages before diving together?

I. Cave diving skills and procedures

1. What is the ideal state of buoyancy for cave diving?
2. How does making buoyancy adjustments in a cave while diving dry differ from recreational drysuit diving?
3. What is the ideal body position for cave diving and what are its benefits?
4. What are the three primary propulsion techniques used by cave divers and explain the circumstances under which each may be preferable?
5. What are the seven general principles which apply to guideline and reel use?
6. In what situations should you should run a primary reel?
7. What are the steps must you follow when running a primary reel?
8. What are the procedures for sharing primary reels and why may doing so be beneficial?
9. What are the procedures for dealing with high flow and little or no flow?
10. What steps can you take to maintain team cohesion and avoid separation?

11. What is *back referencing* and why it is important?
 12. Which team *generally* has the right of way when traveling in opposite directions?
 13. What are the three command signals and what is their significance?
 14. What are two additional light signals and what is their significance?
 15. What are ten additional hand signals and what is their significance?
 16. What are two additional methods of cave communication which do not involve light or hand signals?
 17. If divers must resort to using slates or wet notes to communicate with one another, what may this indicate?
 18. What are the sources and uses of cave maps? What are commonly used cave map symbols?
- J. Preventing and dealing with problems and emergencies
1. What is the most dangerous situation which can occur underwater and how can you prevent it?
 2. What does the term *panic* mean, what is its role in cave diving accidents and what is the only effective way of dealing with panic?
 3. What are five ways of helping prevent panic?
 4. What is *task loading*? What is *perceptual narrowing*? What are their implications for cave divers? How can we minimize the effects?
 5. What are seven sources of physiological stress in cave diving?
 6. What are six sources of psychological stress in cave diving?
 7. What are several common signs and symptoms of stress and how should you respond to them?
 8. Where in the sequence do distressed divers generally go and why?
 9. What is the correct response to jammed reels?
 10. What is the correct response to primary light failure?
 11. What is the correct response to loss of visibility?
 12. What is the correct response to valve roll-off?
 13. What is the correct response to regulator, valve or manifold failure?
 14. What is the correct response to total loss of breathing gas?
 15. What is the correct response to team separation along the same guideline?
 16. What is the correct response to a diver lost off guideline?
 17. What is the correct response to loss of guideline?

18. What is the correct response to entanglement in guideline?
19. What is the correct response to being stuck in a restriction?

2.4.8 Dry Land Exercises

Before entering the water, students are to practice these exercises on land:

- A. Deploy and retrieve a primary reel while maintaining tension and making primary, secondary and additional tie-offs and placements.
- B. Assist a teammate who is deploying and retrieving a primary reel.
- C. Follow a guideline with eyes closed.
- D. Follow a guideline with eyes closed while engaging in touch-contact with a teammate. Repeat as both leader and follower.
- E. Follow a guideline with eyes closed while engaging in bump-and-go with a teammate. Repeat as both leader and follower.
- F. Simulate searching for a lost teammate while using a safety reel or spool.
- G. Use a safety reel or spool to search for a lost guideline with eyes closed.

2.4.9 Overall Skill Performance Objectives

To be certified as NSS-CDS Apprentice Cave Divers, students must be able to:

- A. Develop and follow a dive plan which encompasses *Sequence, Air, Depth, Duration, Distance* and *Direction*, and any other activities unique to the dive.
- B. Correctly assemble, test and don a complete set of cave diving equipment.
- C. Enter and exit the water in a manner consistent with ease and safety.
- D. Perform a variety of common in-water, pre-dive checks, including:
 1. Checking for the presence of all necessary equipment.
 2. Ensuring all manifold and/or main gas valves are turned all the way on.
 3. Testing all regulators for function underwater.
 4. Checking pressure in all cylinders.
 5. If on open circuit, checking to ensure all long hoses are fully deployable.
 6. Checking to ensure no hoses, cords, straps, gauges, reels or attachment hardware are accidentally trapped under other equipment.
 7. If so equipped, testing fellow team members' primary (long hose) second stages for breathability and function.
 8. Inspecting fellow team members for signs of equipment problems.

9. Performing a bubble check on fellow team members.

2.4.10 Open-Water Exercises

Before entering the overhead, students are to practice these exercises in open water:

- A. Follow a guideline with eyes closed.
- B. Follow a guideline with eyes closed while engaging in touch-contact with a teammate. Repeat as both leader and follower.
- C. Follow a guideline with eyes closed while engaging in bump-and-go with a teammate. Repeat as both leader and follower.
- D. Follow a guideline with eyes closed while simulating sharing gas with a teammate. Repeat as both donor and receiver.
- E. Follow a guideline for a distance of at least 15 m/50 ft without a mask.
- F. Deploy a safety reel or spool.
- G. Maneuver through the water using:
 1. Modified flutter kick.
 2. Frog kick.
 3. Pulling.
 4. Helicopter turn.

2.4.11 Overhead Environment Exercises

Students must initiate and demonstrate mastery of the following skills beyond sight of daylight.

General skills

- A. Move efficiently using appropriate propulsion techniques, including modified flutter and frog kicks and pulling.
- B. Effortlessly maintain neutral buoyancy and horizontal body position while swimming, resting, deploying reels/spools and guidelines, and other common cave-diving-related tasks.
- C. Initiate and correctly respond to a variety of common cave diving hand and light signals.
- D. Maintain team sequence and cohesion while communicating effectively with fellow team members.
- E. Work effectively with fellow team members to accomplish a variety of common cave-diving-related tasks.

Guideline and reel use

- F. Install and retrieve both reels and spools while:

1. Orienting and holding the reel/spool correctly.
 2. Maintaining guideline tension.
 3. Correctly making tie offs and placements as needed.
 4. Avoiding situations which would inconvenience other dive teams or put them at risk.
 5. Avoiding damage to the cave environment.
- G. On at least two occasions, install and retrieve a primary reel while:
1. Making primary and secondary tie offs.
 2. Making placements or additional tie offs as needed.
 3. Correctly tying into a permanent guideline.
- H. Effectively assist a teammate who is deploying and retrieving a primary reel, providing light and removing tie-offs and placements when doing so is helpful.
- I. Correctly install and remove directional and nondirectional line markers.

Loss of visibility/loss of teammate/loss of light

- J. Follow a guideline with a teammate for a distance of at least 30 m/100 ft while simulating loss of visibility, using a combination of touch-contact and bump-and-go. If using touch-contact, complete line crossings within five seconds. Repeat as both leader and follower.
- K. Simulate searching for a lost teammate while using a safety reel or spool over a distance of at least 20 m/65 ft.
- L. Use a safety reel or spool to search for a lost guideline with eyes closed over a distance of at least 10 m/30 ft.
- M. Simulate primary light failure by deploying a backup light and swimming for a distance of at least 20 m/65 ft with all team members on backup lights.

Loss of breathing gas

- N. Respond within ten seconds to a diver signaling *Out of Air!* by passing the primary (long hose) second stage and deploying the full length of its hose.
- O. Assume the proper position for sharing gas with another diver, both as donor and receiver.
- P. Simulate sharing gas with a teammate for a distance of at least 30 m/100 ft in good visibility with eyes open. Repeat as both donor and receiver.
- Q. While simulating total loss of visibility, follow a guideline for a distance of at least 30 m/100 ft while simulating sharing air. If using touch-contact, complete line crossings within five seconds. Repeat as both donor and receiver.
- R. Shut down and re-open both outboard regulator valves, one at a time, taking no more than a total of 90 seconds. Include the isolation valve, if so equipped.

2.5 Cave Diver

Unless otherwise noted, all requirements listed under *2.1 Standards Applying to all NSS-CDS Training Programs* apply to the course.

2.5.1 Purpose

This course is the second step leading to full NSS-CDS Cave Diver certification. It builds on the knowledge, skills and experience students gain during the Apprentice Cave Diver course.

In addition to ensuring students have maintained knowledge and skill proficiency from the Apprentice course, the Cave Diver course focuses on:

- A. Cave navigation involving jumps and gaps and, at a minimum, the theory behind complex circuits and traverses (those requiring establishment of a halfway or “point of no return”).
- B. If applicable, how students can apply their open-water decompression training to caves.

2.5.2 Limits of Training

The Cave Diver course prepares students to dive within the following limits:

- A. Penetration is limited to one-third the available starting gas volume.
- B. Minimum starting volume of 2,100 L/75 ft³ and a minimum penetration gas volume of 700 L/25 ft³. The minimum starting volume does not apply if, during training, the instructor is having students practice skills within the daylight zone.
- C. Depth of no more than 40 m/130 ft.
- D. Minimum starting visibility of at least 6 m/20 ft.
- E. No use of stage bottles or DPVs.

2.5.3 Course Duration and Location

- A. This course generally takes four days. Students must accrue at least 360 minutes of bottom time over at least eight dives.
- B. Training must take place at two or more different sites. Caves with two or more distinct entrances or which have two main lines leading from a single entrance may count as different sites.
- C. At least two of the sites used during training must be different from those used during the Apprentice Cave Diver course.
- D. The requirements listed under *B* and *C* do not apply if there are no other sites available within 120 km/75 miles.

2.5.4 Student Prerequisites

NSS-CDS Apprentice Cave Diver or equivalent.

2.5.5 Instructor Prerequisites

Instructors must be authorized to teach at the full Cave Diver level.

2.5.6 Knowledge Development

- A. Unless students are entering this course in combination with the NSS-CDS Apprentice Cave Diver course, instructors must ensure students are still able to meet the academic performance objectives listed in the Apprentice Cave Diver course standards.
- B. Additionally, students must demonstrate the ability to correctly answer the following questions:
 - 1 What are three ways decompression diving in caves may differ from decompression diving in open water?
 - 2 What does the term *linear dive* mean and what are four potential benefits such dives may offer over more complex cave navigation?
 - 3 What is the difference between jumps and gaps?
 - 4 What common conventions do we follow when marking jumps on permanent guidelines?
 - 5 What is the procedure for making a gap?
 - 6 What is the procedure for making a jump?
 - 7 What is the procedure for negotiating tees?
 - 8 What do the terms *complex navigation*, *circuit* and *traverse* mean?
 - 9 What are several potential drawbacks associated with complex navigation?
 - 10 What do the terms *set-up dive* and *point of no return* mean?
 - 11 What are the procedures for making circuits and traverses, including set-up dives, completion dives and clean-up dives?
 - 12 What are the risks and hazards associated with “visual” jumps/gaps and “trust me” dives, and what factors would have to be present to at least somewhat mitigate these risks?
 - 13 What are the sources and uses of cave maps? What are commonly used cave map symbols?

2.5.7 Dry Land Exercises

If necessary, instructors may demonstrate and have students practice the procedures for making jumps to offshoot lines.

2.5.8 Overhead Environment Exercises

- A. Unless students are taking this course in combination with the NSS-CDS Apprentice Cave Diver course, instructors must ensure students are still able to meet the skill performance objectives listed in the Apprentice Cave Diver course standards.
- B. Regardless of the recency of students' Apprentice Cave Diver training, instructors are to have students repeat these exercises from the Apprentice course:
1. Follow a guideline with a teammate for a distance of at least 30 m/100 ft while simulating loss of visibility, using a combination of touch-contact and bump-and-go. If using touch-contact, complete line crossings within five seconds. Repeat as both leader and follower.
 2. Simulate searching for a lost teammate while using a safety reel or spool over a distance of at least 20 m/65 ft.
 3. Use a safety reel or spool to search for a lost guideline with eyes closed over a distance of at least 10 m/30 ft.
 4. Simulate primary light failure by deploying a backup light and swimming for a distance of at least 20 m/65 ft with all team members on backup lights.
 5. Respond within ten seconds to a diver signaling Out of Air! by passing the primary (long hose) second stage and deploying the full length of its hose.
 6. Assume the proper position for sharing gas with another diver, both as donor and receiver.
 7. Simulate sharing gas with a teammate for a distance of at least 30 m/100 ft in good visibility with eyes open. Repeat as both donor and receiver.
 8. While simulating total loss of visibility, follow a guideline for a distance of at least 30 m/100 ft while simulating sharing air. If using touch-contact, complete line crossings within five seconds. Repeat as both donor and receiver.
- C. Additionally, students must demonstrate the ability to:
1. Correctly install and retrieve a jump reel or spool.
 2. If typical of the local cave environment, plan for and execute decompression using either back (main) gas or one or more decompression cylinders; follow correct procedure when doing so.