Divemaster Course Presentation Notes

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Role and Characteristics of a PADI Divemaster

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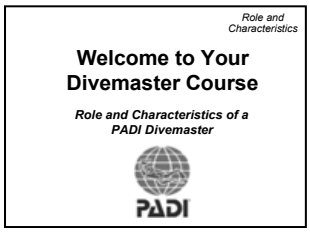
NOTES:

1. Conduct this presentation to begin the PADI Divemaster course, before any practical application components. You may combine it with a course orientation that overviews the requirements, schedule and logistics.
2. This presentation sets the tone for the course and lays the groundwork for developing professionalism and desired attitudes in candidates.
3. Encourage discussion and interaction, which not only assists in attitude development, but will help develop familiarity between candidates, you and your staff.
4. If possible, have candidates read the first chapter of the PADI *Divemaster Manual* and complete the Knowledge Review before this presentation.
5. Also have candidates watch the PADI *Divemaster Video* prior to this presentation, or immediately after it.



Overview

I. Welcome and Introductions

II. Your Role

A. What two broad characteristics may divers expect in a PADI Divemaster?

B. What characteristics does a good role model PADI Divemaster have?

C. How may role model behavior affect other divers?

D. Why do divers want the assistance of a PADI Divemaster?

III. Your Responsibilities

A. What are the benefits of being a PADI Divemaster and a PADI Member?

B. What are the responsibilities of a PADI Divemaster?

C. What is a "mentor relationship" between the instructor and you?

IV. Your Expertise

A. What characteristic allows experts to more easily solve problems than nonexperts?

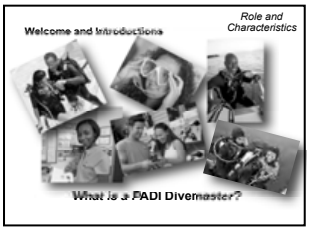
B. Why does it benefit you to have a dive reference library, and what might you include in such a library?

C. How does additional training help you gain expertise?

V. Course Schedule, Assignments, and Logistics

Outline

I. Welcome and Introductions



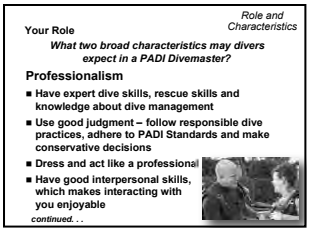
A. [Welcome candidates to the course and congratulate them on going pro.]

B. [Introduce yourself and have your staff and candidates introduce themselves. Encourage a relaxed and friendly atmosphere and get everyone interacting.]

C. [Complete any remaining administrative paperwork.]

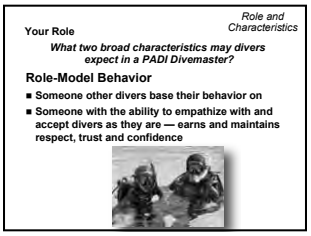
D. [Ask the question – **What is a PADI Divemaster?** – to start a class discussion. Write the answers and ideas on a board to refer to later for further discussion.]

II. Your Role



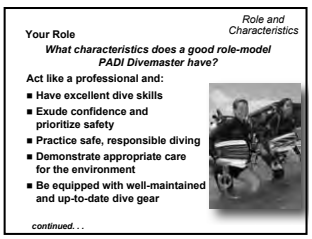
A. What two broad characteristics may divers expect in a PADI Divemaster?

1. Professionalism
   a. This includes having expert dive skills, rescue skills and knowledge about dive management and leading dives.
   b. It also means having good judgment that you display by following responsible dive practices, adhering to PADI Standards and making conservative decisions about dive conditions or other situations that may affect safety.
   c. Divers expect that you will dress and act like a professional.
   d. They also expect that you'll have good interpersonal skills, which makes interacting with you enjoyable and adds fun to the dive experience.

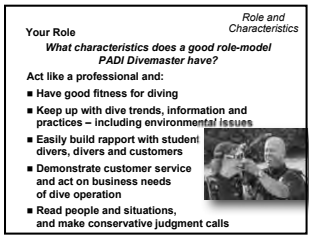


2. Role-model behavior
   a. This means that you're someone other divers base their behavior on because they respect how you conduct yourself.
   b. Divers expect that as a role model you have the ability to empathize with and accept them as they are in supervisory situations. This helps earn and maintain their respect, trust and confidence.

B. What characteristics does a good role model PADI Divemaster have?



1. Along with acting like a professional, as a good role model you:
   a. Have excellent dive skills.
   b. Exude confidence and prioritize personal safety and the safety of others.
   b. Practice safe, responsible diving.
   c. Demonstrate appropriate care for the environment.



d. Are equipped with well maintained and up-to-date dive gear.

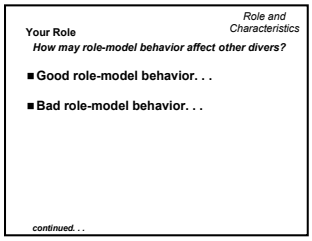
e. Have good fitness for diving.

f. Keep up with dive trends, information and practices, including environmental issues.

g. Can easily build rapport with student divers, divers and customers, which helps inspire them to pattern their dive habits after you.

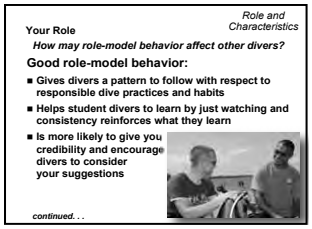
h. Demonstrate customer service and act on the business needs of the dive operation you're associated with.

i. Read people and situations, and make conservative judgment calls.

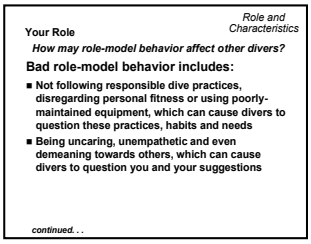


C. How may role-model behavior affect other divers?

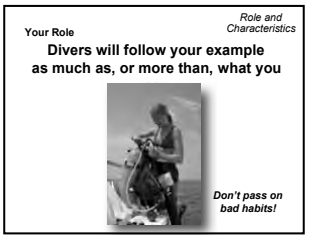
[NOTE: Ask candidates how good and bad role-model behavior affects other divers. Encourage a discussion — confirm and elaborate on candidate responses. Conclude with these key points:**]**



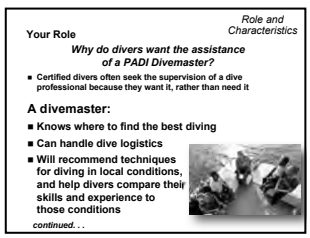
1. Good role-model behavior gives divers a behavior pattern to follow with respect to responsible dive practices and habits.
2. Good role-model behavior helps student divers learn a lot by just watching the instructor and assistants. Consistency between you and the instructor reinforces what student divers learn.
3. Good role-modeling is more likely to give you credibility and encourages divers to consider your suggestions.



4. Poor role-model behavior, such as not following responsible dive practices, disregarding personal fitness or using poorly-maintained equipment, can cause divers to question these practices, habits and needs. People follow your example as much as (sometimes more than) what you say — don't pass on bad habits.
5. Poor role-modeling, such as being uncaring, unempathetic and even demeaning towards others, can cause divers to question you and your suggestions. Divers will be less likely to act on your advice.



D. Why do divers want the assistance of a PADI Divemaster?



1. Certified divers can dive unsupervised within the limits of their training and experience, yet often seek the supervision of a dive professional because they want it, rather than need it.
2. Divers expect that a divemaster:
   a. Knows where to find the best diving.
   b. Can handle dive logistics.
   c. Will recommend techniques for diving in the local conditions and help divers compare their skills and experience to those conditions.
   d. Can handle difficulties – minor or major – that may arise.

e. Will provide information that helps improve safety and adds to the fun, which allows them to better enjoy the whole dive experience.

III. Your Responsibilities

A. What are the benefits of being a PADI Divemaster and PADI Member?

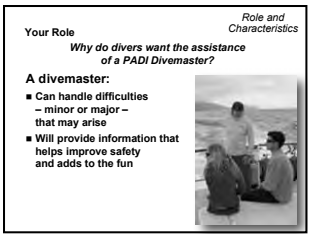
1. As a PADI Divemaster you are a PADI Member. This makes you part of the world's largest and most respected diver training organization.

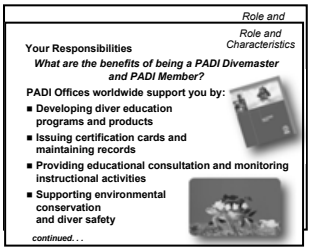
[Show *This is PADI* video, if available in a language candidates understand.**]**

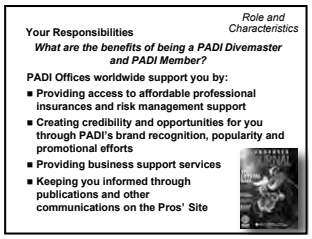
2. Supporting PADI Members and their diving activities is a large part of the PADI organization's focus. As a member, you can count on PADI Offices worldwide to do the following:
   a. Develop diver education programs and related educational products.
   b. Depending upon your membership level and qualifications, issue certification credentials and maintain certification records.
   c. Provide consultation regarding diver program implementation and educational product use, and monitor instructional activities.
   d. Support environmental conservation and diver safety through various means including partnership and/or contributions to nonprofit organizations such as the Project AWARE Foundation.
   e. Provide access to affordable professional insurance and risk management support.
   f. Create credibility and opportunities for you through PADI's brand recognition, popularity and promotional efforts.
   g. Provide business support services through educational materials, updates, seminars, insurance and other services.
   h. Keep you informed through publications including *The Undersea Journal*, *Training Bulletins*, newsletters, industry alerts, web-based articles and other communications on the Pros' Site at padi.com.
3. As a PADI Divemaster, you earn a credential that allows you to potentially work as a dive professional by assisting with PADI diver courses or conducting some PADI programs independently (more about these later).

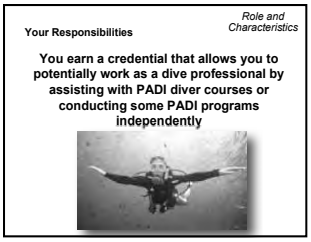
B. What are the responsibilities of a PADI Divemaster?

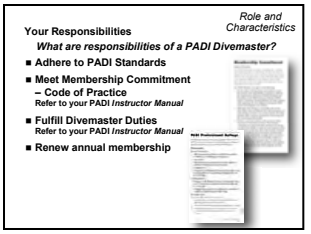
1. As a PADI Divemaster, you have the responsibility to adhere to PADI Standards when assisting with or conducting PADI programs as outlined in your PADI *Instructor Manual*. Much of what you learn in this course applies to this.











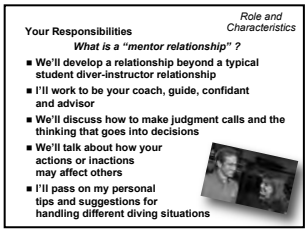
2. In your PADI *Instructor Manual*, you'll also find a Code of Practice that explains the professional and ethical behavior expected as part of your membership commitment. Let's review each item, so that you are clear about what is expected.

[Note: Have candidates refer to the PADI *Instructor Manual*, Professional Membership Guide, Membership Commitment, Code of Practice. Involve them in reading through each item and discuss as necessary for clarity.**]**

3. Also in the Professional Membership guide of your PADI *Instructor Manual*, you'll find a list of the tasks a divemaster can take on under Divemaster Duties. Let's review each item, so that you are clear about what you can do.

[Note: Have candidates refer to the PADI *Instructor Manual*, Professional Membership Guide, PADI Professional Ratings, Divemaster Duties. Involve them in reading through each item and discuss as necessary for clarity.**]**

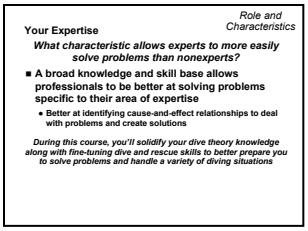
4. To continue functioning as a PADI Divemaster, you're also responsible for renewing your membership annually.
   a. If you allow your membership to lapse, you lose all the benefits listed, and you may not act in the capacity of a PADI Divemaster.
   b. Your PADI Office will send you a renewal notice each year. You may also sign up for automatic renewal, which authorizes your PADI Office to renew you by charging the renewal fee to your credit card.
   c. You need to keep your PADI Office informed of your current address so that you can receive information and important notices.



C. What is a "mentor relationship" between the instructor and you?

1. Because the PADI Divemaster course is an important step in becoming a dive professional, you'll find our relationship will develop beyond a typical student diver-instructor relationship.
2. It's more of a mentor-protégé relationship, which means I'll work to become your coach, guide, confidant and advisor as I help prepare you to be an assistant and peer.
3. We'll discuss how to make judgment calls and the thinking that goes into decisions during the instruction or supervision process.
4. We'll also talk about how your actions or inactions may affect others, and I'll pass on my personal tips and suggestions for handling different diving situations.
5. If you have the opportunity to work with other instructors during this course, plan to have a similar relationship and feel free to ask "why?" and "how?" about decisions that are made.

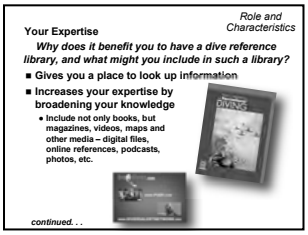
IV. Your Expertise



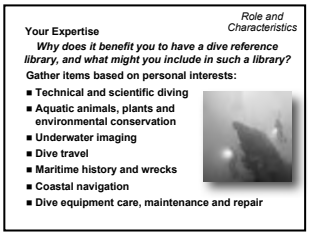
A. What characteristic allows experts to more easily solve problems than nonexperts?

1. As discussed earlier, professionals are people who have a high level of knowledge and skill in a particular area. This broad knowledge and skill base is what allows professionals to be better at solving problems specific to their area of expertise.
2. Research in cognitive psychology shows that experts have better problem solving abilities than nonexperts primarily because they have this knowledge base to draw upon — not because they're better problem solvers per se.
3. A large theoretical and experiential knowledge base makes it easier to identify cause-and-effect relationships when dealing with problems and creating solutions.
4. By reviewing and solidifying your dive theory knowledge along with fine-tuning your dive and rescue skills, you'll be better prepared to apply your expertise to solve problems during the practical application portion of this course.
5. Your knowledge and skill base will also better prepare you to handle the variety of diving situations that may arise when acting as a certified assistant or dive supervisor after the course.

B. Why does it benefit you to have a dive reference library, and what might you include in such a library?

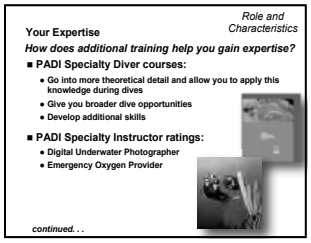


1. A dive reference library gives you a place to look up information and periodically review and refresh your knowledge.
2. Having reference materials beyond your PADI Diver manuals increases your expertise by broadening your knowledge beyond what you previously learned.
3. Keep in mind that your reference library may include not only books, but magazines, videos, maps and other media, such as digital files, online references, podcasts, photos, etc.
   a. You may bookmark appropriate websites and check them regularly for updated news, etc.
   b. Online forums are useful, but require caution because they may contain opinions or statements that are not factual, not accurate or highly biased.
4. Gather reference items based on your personal interests – including topics such as:
   a. Technical and scientific diving
   b. Aquatic animals, plants and environmental conservation
   c. Underwater imaging



d. Dive travel
e. Maritime history and wrecks
f. Coastal navigation
g. Dive equipment care, maintenance and repair

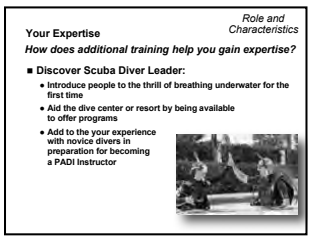
[Note: Ask candidates for other examples from their personal libraries.]



C. How does additional training help you gain expertise?

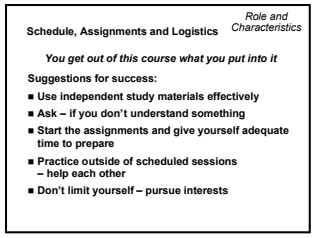
1. Being certified as a PADI Specialty Diver, helps broaden your expertise as a dive supervisor and instructional assistant. This training is important because:
   a. Specialties often go into more theoretical detail and give you a chance to apply this knowledge during specialty dives.
   b. Specialty training gives you broader dive opportunities, which contributes to your overall dive experience.
   c. Specialty training develops additional skills that you can apply in supervising certified divers and assisting student divers.
2. As a PADI Divemaster, you can qualify as a PADI Specialty Instructor to teach two popular specialty courses – PADI Digital Underwater Photographer course and PADI Emergency Oxygen Provider – before you become a PADI Open Water Scuba Instructor. You'll learn more about how to do this in the section – Divemaster Conducted Programs.

3. If technical diving interest you, PADI TecRec courses will greatly expand your knowledge and skills as a dive professional.
4. Other training that you pursue that is dive-related or dive business-related will not only add to your knowledge and skills, but help you reach your long-term and career goals. The following options and suggestions are covered during the topic – Business of Diving and Your Career – however, you may want to start planning for this training now:
   a. Boat handler or captain's license
   b. Sales and business training
   c. Manufacturer's equipment repair technician
   d. Compressor or diesel engine mechanic
   e. Research diving



5. Becoming a Discover Scuba Diving Leader authorized you to conduct Discover Scuba Diving in confined water. This allows you to:
   a. Introduce people to the thrill of breathing underwater for the first time and inspire them to go to certification.
   b. Aid the dive center or resort by being available to offer Discover Scuba Diving programs when the instructional staff is busy.
   c. Add to the your experience with novice divers in preparation for becoming a PADI Open Water Scuba Instructor.

V. Course Schedule, Assignments, and Logistics

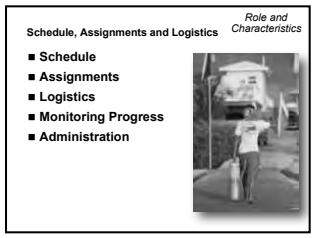


A. Success in this program comes through applying yourself to the assignments and exercises consistently. Like any learning process, you get out of this course what you put into it.

B. Here are a few suggestions to help you progress through the course:

1. If you are participating in Divemaster Online (and haven't already completed it) use the system fully – watch the videos, check out the additional information links, and review and repeat topics as necessary to fully understand each concept.
   a. Remember that you have access to the PADI *Divemaster Manual,* so refer to it during the course and use it as a reference after certification.
2. If you're reading the PADI *Divemaster Manual*, carefully focus on each chapter, watch the PADI *Divemaster Video* and then complete the Knowledge Reviews. Write in your books as you study – make notes, highlight important concepts to review, etc.
3. If you're having trouble mastering or understanding something, let me know as soon as possible.
4. Don't wait until the last minute to prepare for a session or to work on assignments. Start the assignments right away and give yourself adequate time to put together your best effort.
5. Practice outside scheduled sessions with other candidates. This will help you fine-tune your dive and rescue skills in a relaxed environment and at your own pace. Help your fellow candidates and let them help you. You learn by helping and being helped.
6. Don't limit yourself. If you're interested in something, find out all you can about it, even if it's beyond the course requirements.

C. Schedule



[NOTE: Give candidates the course schedule, including session times and locations, integrating assignment and due dates.**]**

D. Assignments

[NOTE: Assign the Emergency Assistance Plan including location, date due and the criteria for a complete plan. Discuss the Mapping Project.**]**

E. Logistics

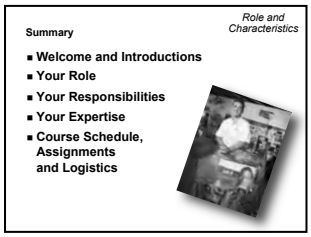
[NOTE: Provide a list of all equipment and materials candidates need to have. Discuss any other logistical requirements or issues.**]**

F. Monitoring Progress

[NOTE: Provide candidates with copies of score sheets and training records you'll use throughout the program and explain how you'll track their progress and critique their performances.**]**

G. Administration

[**NOTE:** Finish any paperwork, collect remaining fees, etc.]



Summary

I. Welcome and Introductions

II. Your Role

III. Your Responsibilities

IV. Your Expertise

V. Course Schedule, Assignments, and Logistics

Supervising Diving Activities

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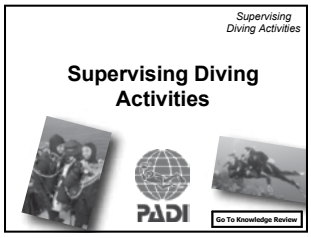
NOTES:

1. Use this presentation when divemaster candidates have not completed independent study through Divemaster Online or by reading Chapter 2 of the PADI *Divemaster Manual* and watching the *Divemaster Video*. You may also use this presentation for prescriptive remediation while reviewing the Chapter 2 Knowledge Review with candidates.
2. This presentation introduces problem solving skills and further develops the concept of using good judgment to make decisions about diving situations.



Overview

I. Dive Planning

- **What is the role of the divemaster in dive planning for a group of certified divers?**
- **How do you plan a dive by "thinking through the dive"?**
- **How do you evaluate general dive conditions, and how do conditions affect diving?**
- **What are three aspects of planning dives for remote areas?**
- **What is the primary purpose of diver accounting procedures?**

II. Diver Behavior

- **What individual differences in divers does a divemaster have to be prepared to accommodate?**
- **What are six characteristics of responsible diver behavior?**
- **What are four ways to encourage responsible diver behavior?**
- **How do you assess divers before a dive for experience level, possible stress and possible equipment problems?**
- **What are the characteristics of predive stress, and how do you help divers deal with it?**

III. Dive Supervision

- **What are four aspects of supervision in managing dives?**
- **What are the advantages and disadvantages of inwater versus out-of-water supervision, and advantages and disadvantages of out-of-water versus inwater supervision?**
- **What eight types of equipment can assist in supervising certified divers?**

IV. Dive Briefings

- **What 10 points does a dive briefing usually include?**
- **Why is it important to include an environmental orientation in every briefing?**
- **What predive suggestions can you give to help divers interact responsibly with the environment and aquatic life?**

V. Problem Management

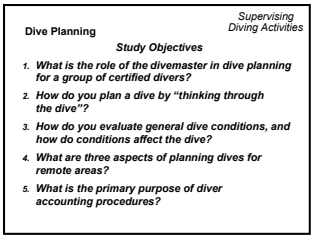
- **How do you prepare to handle problems that may occur at a dive site?**
- **When do dive supervision and problem management call for your judgment, and how do you develop good judgment?**
- **What are the general steps for handling a dive problem?**
- **What are the two likely roles of the divemaster in the event of a dive accident?**

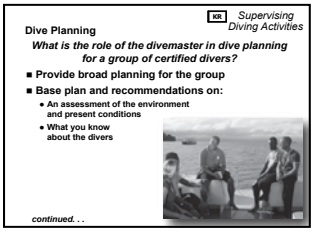
Outline

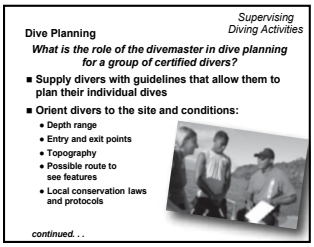
I. Dive Planning

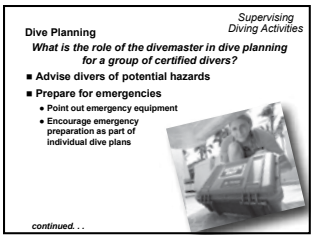
A. What is the role of the divemaster in dive planning for a group of certified divers?

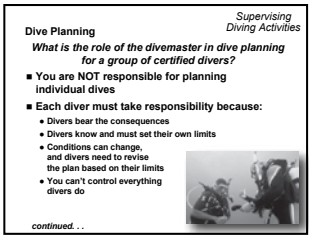
1. Your role as a divemaster is to provide broad planning for the group because you know the dive site and local environment. Generally, you make your broad plan and provide dive briefing recommendations based on:
   a. An assessment of the environment and the present conditions.
   b. What you know about the divers you're supervising. This may include what they tell you, previous experiences with them, observations of them, log books, certifications, etc.
2. By supplying divers with guidelines, you allow them to plan their individual dives. This may include:
   a. Orienting divers to the site and conditions. For example, giving them a depth range, suggesting entry and exit points based on water conditions, describing the site topography and possible routes to take to observe interesting features, explaining local conservation laws and protocols, etc.
   b. Advising divers of potential hazards such as currents, surge, abrupt thermoclines, etc.
   c. Being prepared for reasonably foreseeable emergencies. You can point out what emergency and first aid equipment is available, and encourage divers to discuss emergency preparation as part of their dive plans.



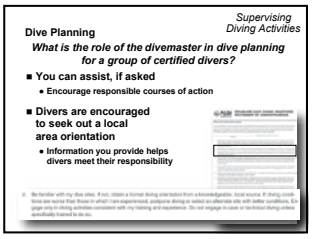




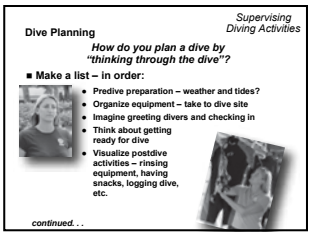




3. You are not normally responsible for planning the individual dives of certified divers. Each diver must be responsible for planning the dive within the limits you set and then implementing the plan. This is important because:
   a. Divers will bear the consequences of the dive plan, so they must accept responsibility for it.
   b. You can't know divers' comfort, training or experience levels as well as they do, thus they have to set their own limits.
   c. Conditions can change and divers may have to quickly revise the dive plan based on their personal limitations.
   d. You can't directly control everything divers do – they need to be responsible for their own actions.

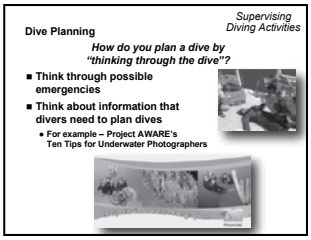


4. Although divers are responsible for their plans, you can assist them, if asked, by providing information and encouraging them to choose responsible courses of action. (We'll talk more about responsible diver behavior in the next topic.)
5. Keep in mind that the PADI Safe Diving Practices Statement of Understanding encourages divers to seek out a local area orientation when going to a new site or diving in new conditions. The information you provide about the conditions and environment is important to help divers meet their responsibility to receive an orientation. (We'll discuss more about how you can do this using the Discover Local Diving program later in the course.)



B. How do you plan a dive by "thinking through the dive"?

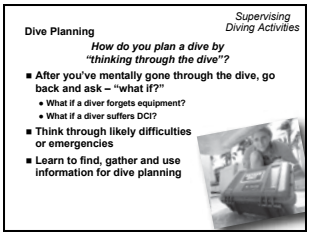
1. Thinking through the dive is an effective way to plan it. As you think of things, make a list what needs to be done and in which order.
   a. Start with predive preparation, such as checking the weather and tides.
   b. Continue with organizing equipment and loading everything you'll need on the boat or in the car to take to the dive site.
   c. Next, imagine greeting the divers and checking them in for the dive. This will remind you to have all necessary paperwork.
   d. Think about how activities on the boat or beach will occur as everyone gets ready for the dive.
   e. Also, visualize postdive activities such as rinsing and repacking equipment, or having snacks while talking about and logging the dive on the dive roster and in personal logbooks.



2. You also need to think through possible incidents or emergencies that you should prepare for and add them to the list.
3. Make sure you think through the information that individual divers need to plan their own dives, so you can provide as many details as reasonably possible for the divers.

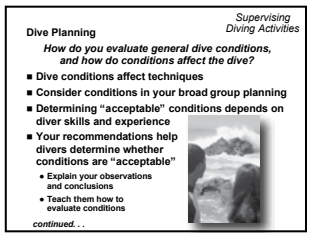
a. For example, if divers taking photos, make sure they are familiar with techniques to avoid harming the environment as listed in Project AWARE's Ten Tips for Underwater Photographers (available for download from projectaware.org).

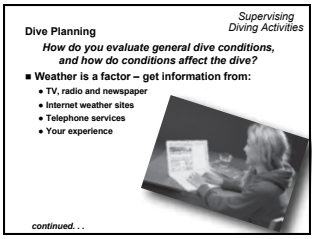
4. After you've mentally gone through the dive outing, go back through again asking yourself "what if?"
   a. What if a diver forgets a piece of equipment,
   b. What if a diver suffers DCI or an emergency?
5. Think about reasonably likely difficulties and emergencies, and include preparing for them in your dive plan.
6. Much of what you learn in this course teaches you how to find, gather and use information for dive planning.

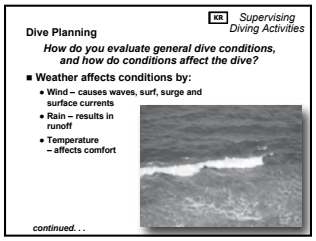


C. How do you evaluate general dive conditions, and how do conditions affect diving?

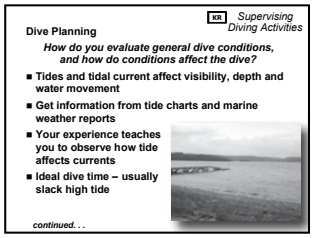
1. Your experience thus far has taught you that dive conditions greatly affect dive techniques or even whether diving is worthwhile. You normally consider dive conditions in your broad group planning and briefings so divers can consider them in their individual plans.
2. Being able to accurately evaluate conditions is an important part of dive planning.
   a. Determining "acceptable" conditions may depend partly on the skill and experience of the divers. For example, a beach entry through surf may be fine for some divers but beyond the capabilities and comfort of other divers.
   b. As a divemaster, your evaluation and recommendations help divers determine whether the conditions are acceptable for them.
   c. It helps divers plan their own dives when you explain your observations and conclusions. It also teaches them how to evaluate conditions for themselves.
3. Weather is a factor that always needs to be considered when evaluating conditions.
   a. You can get information about the weather expected for your planned dive from these sources:
      - TV, radio and newspaper
      - Internet weather sites
      - Telephone services – call in to listen to the forecast
      - Your experience with local weather behavior
   b. There are several aspects of weather that affects dive conditions:
      - The first is wind, which can cause waves, surf, surge and surface currents plus poor visibility. Offshore wind can calm surf and cause an upwelling and good visibility.



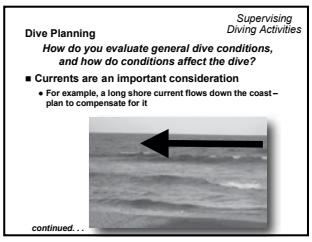




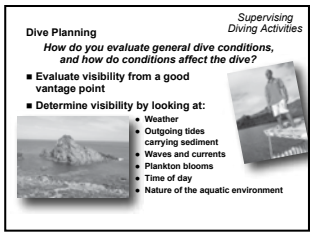
- Next is rain that results in runoff, which causes poor visibility or poor water quality.
- Finally, temperature – hot or cold – can cause discomfort before or after a dive. Air temperature can sometimes change water temperature in a couple of days.



4. Tides and tidal currents can affect visibility, depths and overall safety based on water movement during any dive.
   a. You can get information about the local tides from tide charts as well as from marine weather reports.
   b. Your experience with local conditions will teach you to observe how an incoming or outgoing tide affects currents at different dive sites. For example, the strength of the water flow in and out of a restricted bay varies depending on the tidal cycle.
   c. The ideal dive time is usually slack tide when high tide peaks. However, you need to learn how tides specifically affect the dive sites you frequent.
   d. You'll learn more about tides during the presentation — Awareness of the Dive Environment.

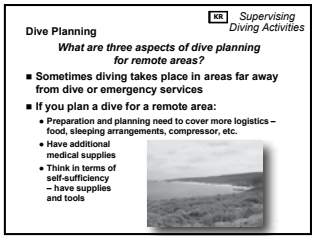


5. Whether currents are caused by tides, wind or the Earth's rotation, they are an important consideration for dive planning.
   a. For example, long shore currents caused by waves striking shore at an angle create water flow down the coast. You need to be able to recognize a long shore current in order to plan the dive to compensate for it.
   b. You'll learn more about currents and how to identify them during the presentation — Awareness of the Dive Environment.



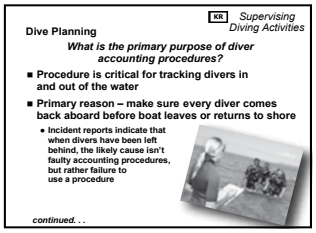
6. To evaluate visibility without getting into the water, you need to have a good vantage point that allows you to see into the water as much as possible. Even then it's difficult to determine exactly what the visibility will be; however, from experience you can determine whether it's better or worse than usual for the site.
   a. You can also determine what the visibility may be by looking at factors that affect it, including:
      - Weather
      - Outgoing tides carrying sediment
      - Waves and current that stir up sediment
      - Seasonal temperature changes which cause plankton blooms
      - Time of day and amount of light penetrating the water
      - Nature of the aquatic environment – for example, a silty lake versus clear spring water.

D. What are three aspects of planning dives for remote areas?

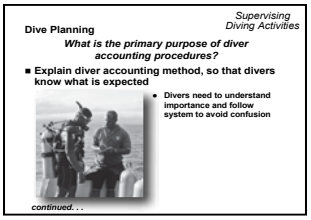


1. Sometimes diving takes place in areas that are hours away from dive services or emergency medical personnel. If you are planning a dive for a remote area, consider these three aspects:
   a. Your preparation and planning will need to cover more logistics depending on the location and type of diving. You may need to organize food, sleeping arrangements, compressors for filling tanks, etc.
   b. You also may need to have additional medical supplies on hand (for example, several hours worth of emergency oxygen) and need to have a plan for emergency evacuations.
   c. You should think in terms of self-sufficiency and try to have the supplies and tools you might need to take care of problems that arise, such as a boat engine breaking down.

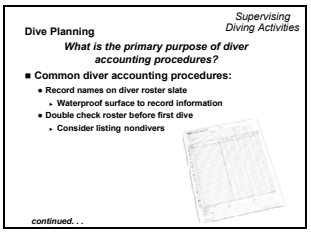
E. What is the primary purpose of diver accounting procedures?

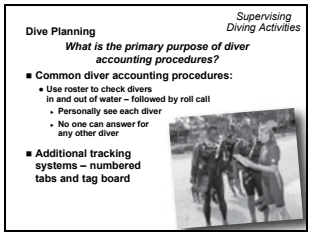


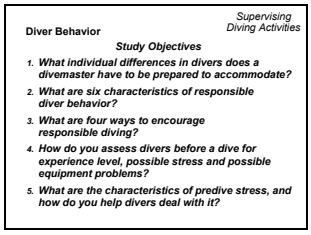
1. Having a formal accounting procedure is critical for tracking divers in and out of the water, whether you are supervising them from a boat or shoreline.
2. The primary reason for having and using accounting procedures is to make sure every diver comes back aboard before the boat leaves, or that every diver returns to shore after the dive.
   a. With only a handful of divers, it might not be difficult to note when each diver returns, but with a larger group it usually calls for a more formal procedure.
   b. Incident reports indicate that in the few cases where divers have been left behind, the likely cause isn't faulty accounting procedures, but rather failure to use a procedure.
3. Along with relevant dive site information for dive planning, you also should explain the diver accounting method you'll use so that all divers know what is expected. Divers need to understand the importance of adhering to the system, and that it is followed to avoid confusion and prevent you from losing track of a diver.

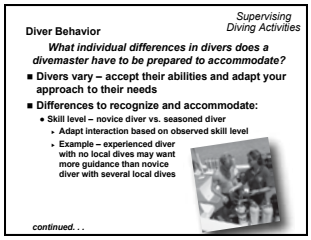


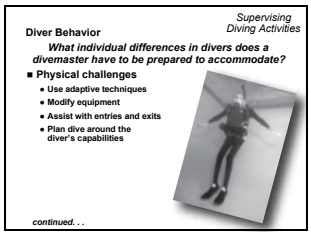
4. Common diver accounting procedures include:
   a. Have a dive roster listing all divers. Listing buddy teams together makes it easier to find and check off names as both divers enter and exit the water. The PADI Dive Roster slate provides a waterproof surface to write each diver's name as well as time in the water, time out of the water, and maximum depth.
   b. Double check that all divers are on the roster before the first dive.
   c. Use the dive roster to check divers in and out of the water.

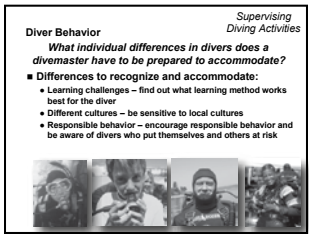


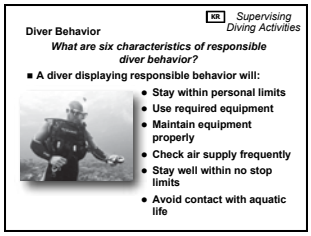












d. After each dive, perform a visual roll call. Make sure you personally see each diver. During your briefing, make it clear that each diver must be present during roll call and that no one can answer for any other diver. Some divers may want to answer for another to speed up the roll call; do not allow this to happen.

5. There are additional tracking systems to consider. One system uses numbered tags and a tag board. Divers each remove a tag and clip it to their BCDs. After the dive, the divers unclip their tags and return them to the board.

II. Diver Behavior

A. What individual differences in divers does a divemaster have to be prepared to accommodate?

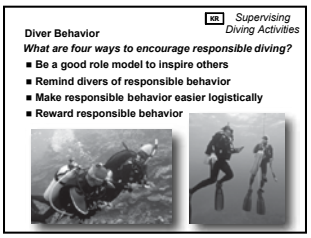
1. Because divers will vary in several ways, you need to accept their abilities and know how to adapt your approach to their needs.
2. Individual differences you need to recognize and accommodate include:
   a. Skill level — A novice diver may need and want more advice and assistance while preparing for a dive than a seasoned diver. Adapt your interaction based on general observed skill levels, not necessarily just on certification level (more on this later).
   b. Physical challenges — Individuals with physical challenges can use adaptive techniques to master dive skills and enjoy diving. Sometimes minor equipment modifications are necessary to compensate for physical impairments and assistance may be needed when entering and exiting the water. Adapt to what the diver can do and plan the dive around the diver's capabilities.
   c. Learning challenges — People with learning disabilities have difficulty receiving, processing, storing and responding to information, yet can do well academically if they know how to compensate for their learning difficulties. Find out what learning method works best for such a diver so you can adjust your approach to meet the diver's needs.
   d. Different cultures — Culture affects how people approach the social interaction side of diving. Be sensitive to the cultural needs of those you supervise and the local culture where you dive.
   e. Responsible behavior — Although you can encourage and role model responsible behavior, divers are responsible for their actions. Be aware of divers who may put themselves or others at risk.

B. What are six characteristics of responsible diver behavior?

1. A diver displaying responsible behavior will:
   a. Stay within personal limits and plan dives within limits of training, experience and buddy's abilities.

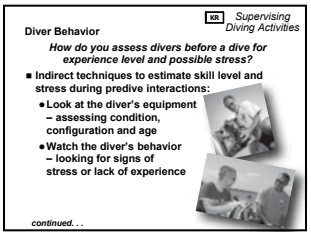
b. Use the equipment generally accepted as required for a dive.
c. Maintain equipment properly, and check it before diving.
d. Check air supply frequently, and end each dive with an appropriate reserve.
e. Stay well within no decompression limits, make safety stops and generally follow conservative dive practices.
f. Avoid contact with sensitive aquatic life, and dive in an environmentally sensitive manner.

C. What are four ways to encourage responsible diver behavior?

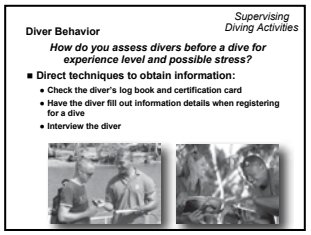


1. Be a good role model by making sure your dive habits reflect the characteristics of a responsible diver so that you inspire other divers to do the same.
2. During dive planning and dive briefings, suggest or remind divers of responsible behaviors.
3. When practical, make responsible behaviors easier logistically – for example, place a marker or hang bar at 5 metres/15 feet to assist divers make a safety stop.
4. Also, reward responsible behavior by acknowledging when divers follow safe diving practices and protect the dive environment.

D. How do you assess divers before a dive for experience level and possible stress?



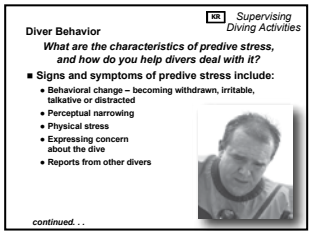
1. Use the following indirect techniques to estimate skill level and diver stress during normal predive interactions:
   a. Look at the diver's equipment, assessing condition, configuration and age. For example:
      - All rental gear may indicate a novice or infrequent diver.
      - Old gear may indicate a rusty diver returning to diving.
      - Dangling equipment may indicate inexperience or lack of familiarity with environmentally sensitive dive techniques.
      - Inappropriate or missing gear requires you to find out more about the diver's experience or attitude about responsible behavior.
   b. Watch the diver's behavior, looking for signs of stress or lack of experience. For example:
      - Withdrawal, excessive talking or excessive time preparing may indicate stress or concerns about the dive.
      - Withdrawal or looking pale may be signs of illness or injury.
      - Overdependence on a dive buddy for planning and gear setup may indicate inexperience.
2. Use the following techniques to obtain information directly from the diver about skill level, stress and equipment concerns:



a. Check the diver's log book and certification card.

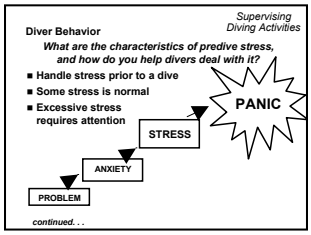
b. Have the diver fill out personal contact information, certification, experience and emergency contact details when registering for the dive.

c. Interview the diver, asking about concerns, experience, etc. — particularly if indirect assessment raises a question.

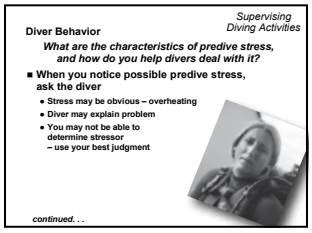


E. What are the characteristics of predive stress, and how do you help divers deal with it?

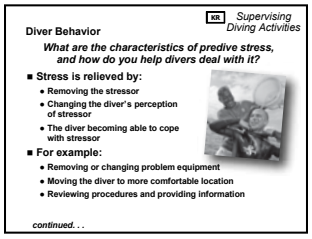
1. Whether observed indirectly or directly, the signs and symptoms of predive stress include:
   a. A behavioral change in which the diver becomes withdrawn, irritable, overtly talkative or distracted.
   b. Perceptual narrowing in which the diver focuses on an action or task to the exclusion of alternative actions or considerations.
   c. Physical stress displayed as sweating profusely, exhaustion, nausea or vomiting.
   d. A diver expressing concern about the dive to a buddy or to you.
   e. Reports from other divers that someone is exhibiting stress.



2. As you learned in your PADI Rescue Diver course, the stress response cycle starts with a build up of anxiety that produces psychological and physical stress and adds to the original stress. This begins an uncontrolled cycle of rising stress until it exceeds the diver's ability to self-control emotions and the diver panics.
   a. To avoid or stop the stress response cycle, it's best to handle stress, as much as possible, prior to a dive.
   b. Keep in mind that some stress is normal and helps a diver focus on important tasks such as equipment preparation and dive planning. Excessive stress, however, requires your attention.



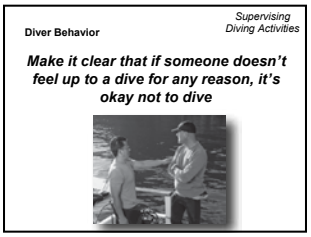
3. When you notice possible predive stress, confirm it by simply asking the diver about the signs observed.
   a. The cause of stress may be obvious, such as physical stress caused by overheating, or the diver may simply explain the problem.
   b. In some instances, you may not be able to determine the stressor and the diver may not tell you – use your best judgment as to what the stressor may be.



4. Stress is relieved by either removing the stressor, changing the diver's perception of the stressor so it's no longer threatening, or the diver simply becoming able to cope with it. For example:
   a. Physical stress is usually simply relieved by removing or changing the equipment causing the problem, or moving the diver to a more comfortable location.

b. Stress about the dive may be relieved by reviewing procedures, providing additional information and offering options. For example:
   - A diver concerned about strong currents may feel better if you review current diving procedures.
   - A diver concerned about the nurse sharks at the dive site may benefit from learning that nurse sharks are docile and not generally associated with attacks.
   - A diver concerned about successful navigation during a dive may appreciate the option to make a guided dive.

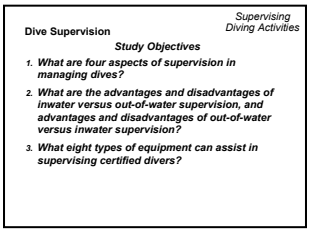
5. Make it clear that if someone doesn't feel up to a dive for any reason, it's okay not to dive.

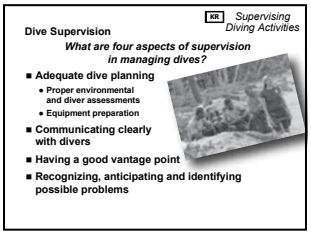


III. Dive Supervision

A. What are four aspects of supervision in managing dives?

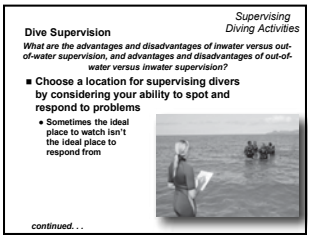
1. Adequate dive planning including proper environmental and diver assessments, as previously discussed, is the first aspect of supervision when managing a dive. This includes being prepared with appropriate equipment and being ready to respond to problems.
2. The next aspect is communicating clearly with divers while informing them about procedures, the dive plan and other key information.
3. Having a good vantage point is the third aspect. You need to put yourself in the most effective position to see and assist divers.
4. Finally, recognizing, anticipating and identifying possible problems so you can prevent, correct or respond to them is part of supervising and managing a dive.

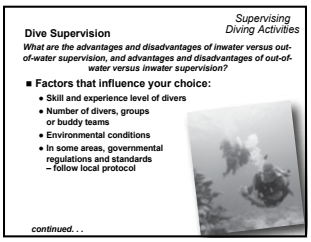


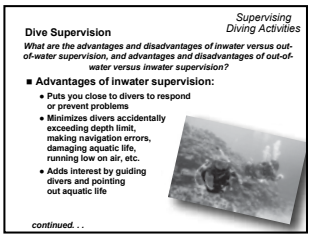


B. What are the advantages and disadvantages of inwater versus out-of-water supervision, and advantages and disadvantages of out-of-water versus inwater supervision?

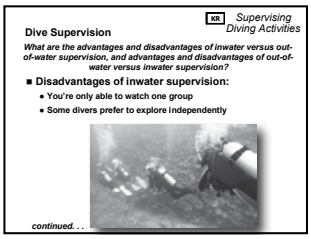
1. Choose your location for supervising certified divers by considering your ability to spot and respond to a problem. Keep in mind that sometimes the ideal place to watch isn't always the ideal place to respond from – you may need to compromise.
2. Other factors that influence your supervision choices include:
   a. The skill and experience level of divers.
   b. The number of divers and diver groups or buddy teams.
   c. Environmental conditions.
   d. Note that in some areas, governmental regulations and standards require both inwater and out of water supervision. Follow local protocol as appropriate.



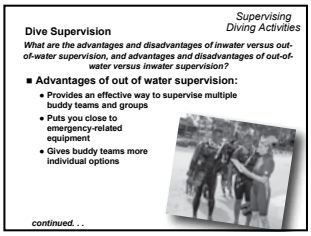




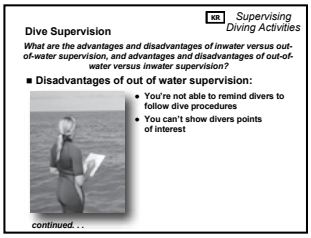
3. The advantages of inwater supervision include:
   a. Putting you close to divers to respond to or prevent problems.
   b. Minimizing problems such as divers accidentally exceeding their maximum depth, making navigation errors, damaging aquatic life or running low on air, because you're there to guide and remind them.
   c. Adding to the dive by guiding divers to interesting areas and pointing out local aquatic life.



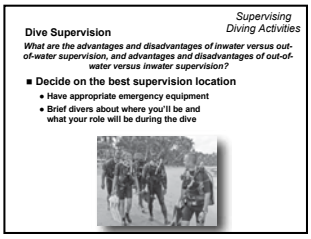
4. The disadvantages of inwater supervision include:
   a. Only being able to watch one group of divers, so it may not be appropriate with multiple groups or buddy teams.
   b. Some divers don't like diving in a group and prefer to explore independently.



5. The advantages of supervising divers while out of water, such as from a boat or the shore, include:
   a. It's the most effective way to supervise multiple buddy teams and groups at once.
   b. It usually puts you close to emergency-related equipment for rapid deployment.
   c. It often gives buddy teams more individual options in where they go during the dive.

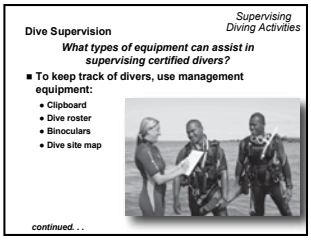


6. The disadvantages of out of water supervision include:
   a. You're not on hand to remind divers of their responsibilities to follow appropriate dive procedures.
   b. You can't show divers around the points of interest on the site.

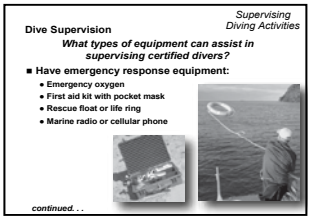


7. When you decide on the best supervision location for a particular dive, make sure you:
   a. Have appropriate emergency response equipment at hand.
   b. Brief divers about where you'll be and what your role is during the dive.

C. What types of equipment can assist in supervising certified divers?

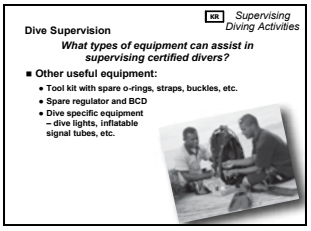


1. To assist you in keeping track of divers while supervising a dive, you may find management equipment helpful, such as a clipboard or dive roster, binoculars and a dive site map.



2. It's also prudent to have emergency response equipment prepared and easily accessible including:
   a. Emergency oxygen.
   b. A first aid kit with a pocket mask and barriers.
   c. A rescue float or life ring with line.
   d. A marine radio or cellular telephone.

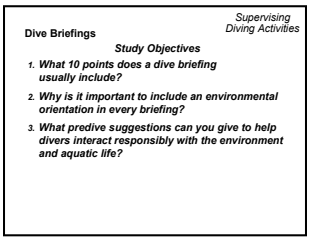
3. Other equipment that you'll find useful in managing a dive and helping divers get the most out of the experience include:
   a. A tool kit with spare o-rings, fin straps, weight belt buckles, etc.
   b. A spare regulator, BCD and other equipment specific to the dive and location, such as dive lights, inflatable signal tubes, etc.

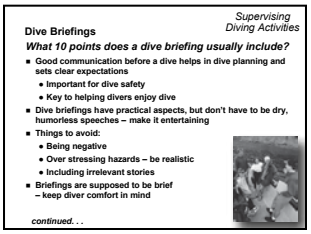


IV. Dive Briefings

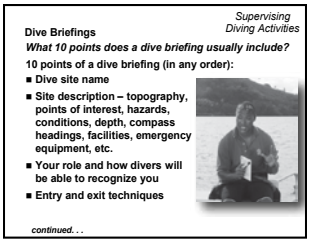
A. What 10 points does a dive briefing usually include?

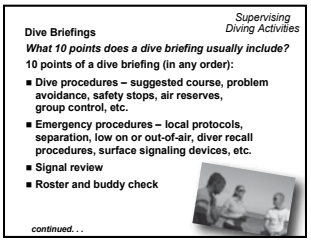
1. As mentioned, good communication with divers before a dive aids in dive planning and sets clear expectations for the dive. The effectiveness of your dive briefing is important to dive safety and success. It's also key to helping divers enjoy the dive.
   a. Dive briefings have their practical aspects, but that doesn't mean they have to be dry, humorless speeches. Do what you can to make the briefing entertaining. Divers pay attention, remember and respond better when the briefing is enjoyable.
   b. There are a few things you'll want to be cautious to avoid during your briefing.
      - The first is being negative in a way that takes the fun out of the dive.
      - The second thing to avoid is over stressing hazards. Give realistic appraisals of possible hazards so divers can plan accordingly and avoid them.
      - Third, don't include irrelevant stories. Say what needs to be said, be entertaining, but remember that a long-winded, self indulgent briefing can take the fun out of a dive before it starts.
   c. Briefings are supposed to be brief. Keep diver comfort in mind, such as by giving the briefing before divers climb into exposure suits in hot weather.





2. Here are the 10 points you'll generally include in a dive briefing: (in any order)
   a. Dive site name
   b. Site description: topography, points of interest, hazards to avoid, water conditions, depth range, compass headings, facilities (a map helps, when available), where to locate emergency equipment, etc.
   c. Your role and how divers will be able to recognize you underwater, if appropriate.
   d. Entry and exit techniques
   e. Dive procedures – suggested course to follow, problem avoidance in local conditions, safety stops, air reserves, group control, etc.





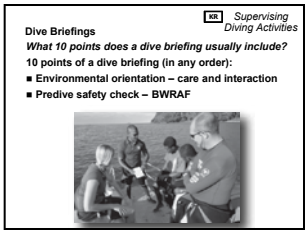
f. Emergency procedures – local protocols, buddy or group separation procedures, low-on-air/out-of-air procedures, diver recall procedures, use of surface signaling devices, etc.

g. Signal review specific to the dive. You may also remind buddy teams to review their own signals.

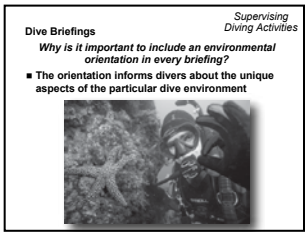
h. Roster and buddy check – check that everyone is listed on the dive roster and that everyone has a buddy.

i. Environmental orientation — how to properly care for and interact with the environment. (more on this next).

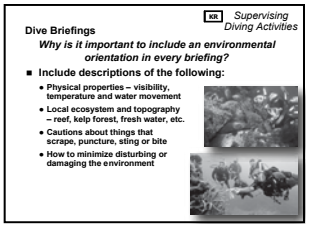
j. Predive safety check – remind divers of their responsibility to perform a predive safety check (BWRAF).



B. Why is it important to include an environmental orientation in every briefing?



1. For certified divers who have little or no experience in the local area, an environmental orientation informs them about the unique aspects of the particular dive environment. However, even divers who dive regularly in the area will benefit from being reminded about the interesting features of the dive site.



2. In every briefing, you should include descriptions of the following points, as appropriate:

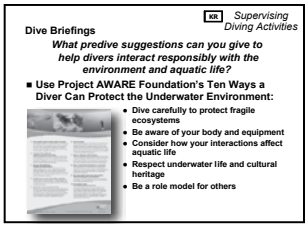
   a. Physical properties – visibility, temperature and water movement,

   b. Local ecosystem and topography – coral reef, kelp forest, fresh water spring, shipwreck, steep wall, submarine canyon, pinnacles, rocky bottom, etc.

   c. Cautions about avoiding things that can scrape, puncture, sting or bite – sharp rocks, coral, metal structures or wrecks, sea urchins, jellyfish, fire coral, snapping turtles, etc.

   d. How to minimize disturbing or damaging the environment, such as good buoyancy control, anti-silting techniques, etc.

C. What predive suggestions can you give to help divers interact responsibly with the environment and aquatic life?



1. An easy way to cover responsible interaction with the environment is to use Project AWARE Foundation's Ten Ways a Diver Can Protect the Underwater Environment (go to projectaware.org)

2 Key points include:

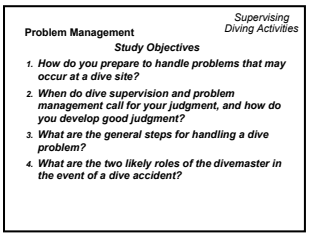
   a. Dive carefully to protect fragile aquatic ecosystems – avoid bumping, kicking or touching organisms.

   b. Be aware of your body and equipment placement – maintain buoyancy control and keep your gauges and alternate air source secured so they don't drag.

c. Consider how your interactions affect aquatic life – avoid handling, feeding or riding on aquatic life. Also, be aware of how your presence can disturb natural behaviors – for example, avoid scaring creatures who are protecting nests or their young.

d. Respect underwater life and the underwater cultural heritage – be aware of local protected species, avoid disrupting the local ecosystem and leave the environment as you find it.

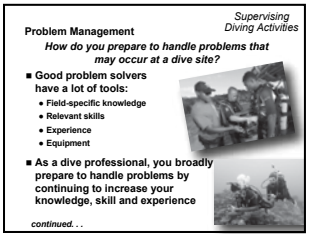
e. Be a role model for other divers when interacting with the environment.



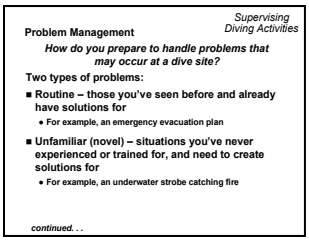
V. Problem Management

A. How do you prepare to handle problems that may occur at a dive site?

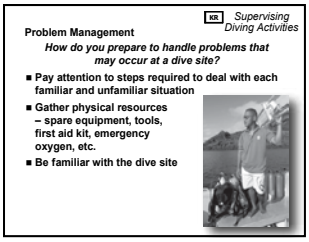
1. Good problem solvers generally have a lot of tools to use, including field-specific knowledge, relevant skills, experience and equipment.
   a. As a dive professional, you broadly prepare to handle problems by continuing to increase your knowledge, skill and experience.
   b. This may mean taking additional continuing education courses or seeking out specific training such as boat handling or equipment repair.

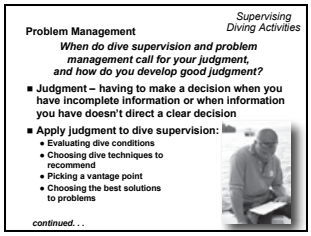


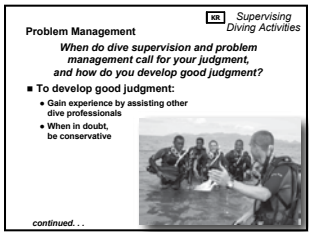
2. Psychologists see problems as two types:
   a. Routine problems – those you've seen before and already have solutions for. For example, an emergency evacuation plan provides a preplanned solution to the problem of who to contact and how to evacuate an injured diver.
   b. Unfamiliar problems – situations that you've never experience or trained for, and need to create a solution for. These problems are unusual and not reasonably foreseeable. For example, someone's underwater strobe catching on fire.

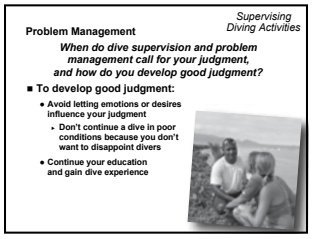


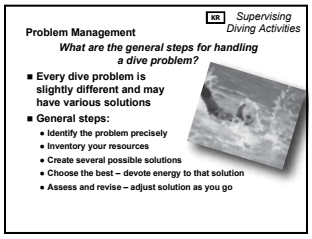
3. You prepare for all problems by paying attention to the steps required to deal with each familiar and unfamiliar situation. This helps you to apply the same or similar steps the next time you face the same or a similar problem.
4. You also can prepare by gathering the physical resources to handle problems, such as spare equipment, tools, first aid kit, emergency oxygen, etc.
5. Being familiar with a dive site, before you take other divers there, gives you lots of insight into preventing and then handling problems that may occur.











B. When do dive supervision and problem management call for your judgment, and how do you develop good judgment?

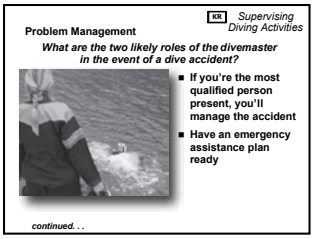
1. Dive supervision and problem management call for your judgment, which can be defined as having to make a decision when you have incomplete information, or when the information doesn't direct a clear decision.
2. You apply your judgment to many elements of dive supervision, such as:
   a. Evaluating whether dive conditions are acceptable.
   b. Choosing which dive techniques to recommend.
   c. Picking a vantage point for supervising dive activities.
   d. Choosing the best of several possible solutions to problems.
3. To develop good judgment:
   a. Gain experience by assisting other dive professionals who can explain their judgments to you.
   b. When in doubt or making decisions that you have less experience with, be conservative. Being unnecessarily cautious is generally better than being insufficiently cautious.
   c. Be cautious to avoid letting emotions or desires inappropriately influence your judgment. For example, you wouldn't want to continue a dive in poor conditions just because you don't want the divers to be disappointed.
   d. As with problem solving, dive experience and continuing your education provide you with knowledge that helps you make good judgments.

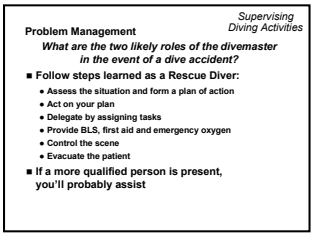
C. What are the general steps for handling a dive problem?

1. Because every dive problem is slightly different and may have various solutions, follow these general steps each time you handle a problem:
   a. Identify the problem precisely. The more specific the problem, the more specifically you can apply a solution.
   b. Inventory your resources. Think about what resources you can apply to the problem, including tools, your skills and knowledge and those of other people who may help.
   c. Create several possible solutions. Try to make these as different as possible.
   d. Choose the best. Pick one that seems the most feasible and likely to succeed, and devote your energy to that solution.
   e. Assess and revise. As you handle the problem, assess your progress, and adjust the solution as you go, building on the ideas and experience you gain by applying the solution.

D. What are the two likely roles of the divemaster in the event of a dive accident?

1. If a dive accident occurs and you're the most qualified person present, you'll probably manage the accident. This would be the expected situation when supervising certified divers.
   a. You'll want to have an emergency assistance plan ready to deal with emergencies.
   b. Be prepared to follow the steps you learned in your PADI Rescue Diver course including:
      - Assess the situation and form a plan of action.
      - Act on your plan.
      - Delegate by assigning tasks to suitably qualified individuals.
      - Provide basic life support (BLS), first aid and emergency oxygen as necessary for the patient.
      - Control the scene.
      - Evacuate the patient to the closest appropriate medical facility.
2. If a more qualified person is present, you will probably assist under that person's management. This would be the expected situation when assisting an instructor with student divers.





Summary

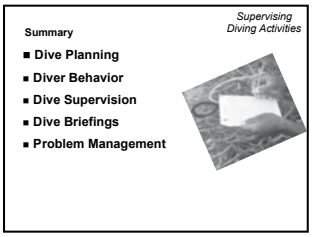
I. Dive Planning

II. Diver Behavior

III. Dive Supervision

IV. Dive Briefings

V. Problem Management



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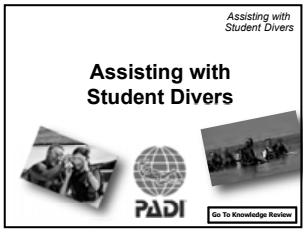
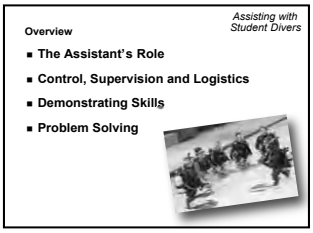


NOTES:

1. Use this presentation when divemaster candidates have not completed independent study through Divemaster Online, or by reading Chapter 3 of the PADI *Divemaster Manual* and watching the *Divemaster Video*. You may also use this presentation for prescriptive remediation while reviewing the Chapter 3 Knowledge Review with candidates.
2. This presentation explains a divemaster's role as an instructional assistant and highlights aspects of control, supervision and logistics.



Overview

I. The Assistant's Role

- **What is the primary role of a PADI Divemaster compared to that of a PADI Instructor in an instructional setting?**
- **What seven functions may you be asked fulfill as an instructional assistant in confined and open water?**
- **What is your primary role in the relationship between you and student divers in training?**

II. Control, Supervision and Logistics

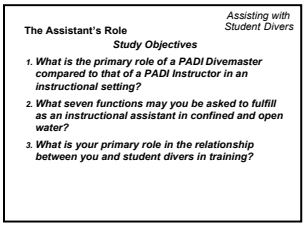
- **How does positioning affect your ability to assist with student diver control?**
- **For skills practice, what are the advantages and disadvantages of different student diver arrangements and assistant positioning?**
- **What are the methods and considerations for direct contact with a student diver?**
- **What logistical functions may you perform to assist with diver training at the surface?**
- **What are five examples of logistical functions you may perform to assist with student diver training underwater?**

III. Demonstrating Skills

- **When would you demonstrate a skill, and for what reasons?**
- **What are the characteristics of a demonstration-quality skill?**
- **How do you develop demonstration-quality skills?**
- **What are the 20 basic dive skills from the PADI Open Water Diver course?**
- **What are the skin dive skills specific to the PADI Skin Diver course?**

IV. Problem Solving

- **What common problems occur as student divers develop skills in confined and open water?**
- **What three steps do you take to help a student diver master a dive skill?**
- **How should you adapt your approach to create a comfortable learning environment for people with differing physical abilities?**

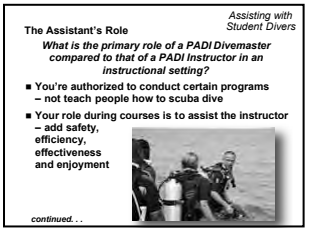


Outline

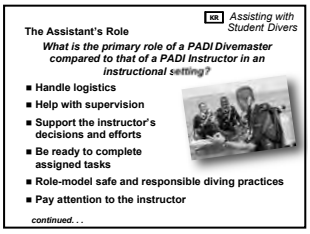
I. The Assistant's Role

A. What is the primary role of a PADI Divemaster compared to that of a PADI Instructor in an instructional setting?

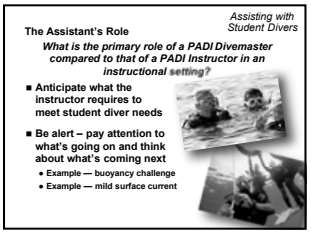
1. Although as a PADI Divemaster you are authorized to conduct a few PADI programs independently, you are not qualified to teach people how to scuba dive – that is the role of a PADI Instructor.

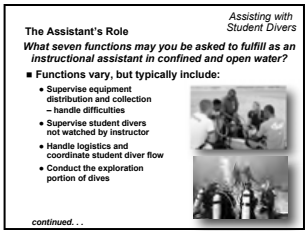


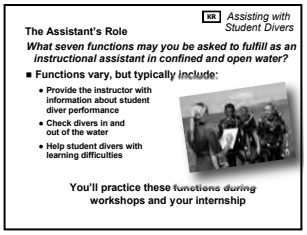
2. Your primary role during scuba diving courses is to assist the instructor, which adds to safety, efficiency, effectiveness and enjoyment of the learning experience.
3. In an instructional setting, under the instructor's direction, you handle logistics, help with student diver supervision and generally support the instructor's decisions and efforts.
   a. You are an important member of the instructional team and need to be ready to complete tasks as assigned by the instructor.
   b. Remember that as a role model, student divers will follow your example not only regarding safe and responsible diving practices, but also how you pay attention to and work with the instructor.

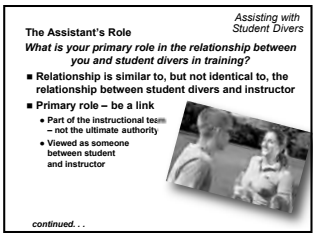


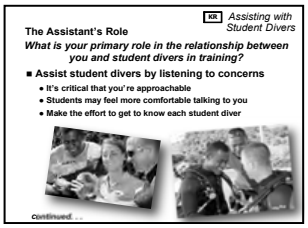
4. In your role as an instructional assistant, you should anticipate and provide what the instructor requires to meet the needs of student divers.
   a. You need to be alert while assisting with confined or open water dives. This means that you are not only paying attention to what is presently going on, but also thinking about what is coming next.
   b. For example, if the plan is to conduct a buoyancy challenge of swimming through hoops at the end of a confined water dive and you see that the last student diver is working on the final skill with the instructor, you can be ready to position the hoops – before the instructor asks you to get them.
   c. Another example is that you notice a mild surface current at the dive site, so you add an extra trail line to the float as you prepare it for the dive – anticipating that this will make keeping student divers near the float a lot easier.











B. What seven functions may you be asked to fulfill as an instructional assistant in confined and open water?

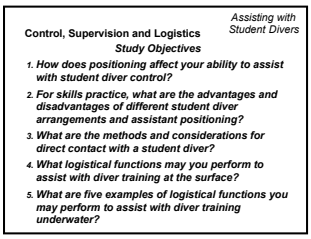
1. Your functions as an instructional assistant will vary with the needs of the moment, but will typically include many of the following:
   a. Supervise the predive equipment distribution to student divers, postdive equipment collection, and handling equipment difficulties.
   b. Supervise student divers not being immediately watched by the instructor.
   c. Handle logistics and coordinate student diver flow to keep things moving during training.
   d. Conduct the exploration portion of dives.
   e. Provide the instructor with additional information about student diver performance.
   f. Check divers in and out of the water at a training site.
   g. Help student divers with learning difficulties on an individual basis.
2. We'll discuss these functions in more detail next. Also note that as you progress through this course, you'll have an opportunity to practice all these functions either during role-playing workshops or while working with student divers during your internship.

C. What is your primary role in the relationship between you and student divers in training?

1. The relationship between you and student divers is similar to, but not identical to, the relationship between student divers and the instructor.
2. Your primary role is to be a link between the student divers and the instructor. Student divers see you as part of the instructional team having a level of authority, but you aren't the ultimate authority – that's the instructor's role. Thus, you are often viewed as someone of a level between the students and the instructor.
3. As this link, you have the ability to assist student divers by listening to their concerns and problems and then taking these concerns to the instructor, as appropriate.
   a. It's critical that student divers feel you are approachable so they will come to you with concerns or problems, because sometimes students feel more comfortable confiding in you than they do with the instructor.
   b. You need to make the effort to get to know each student diver individually to build this trust.
4. Your relationship with student divers also allows you to help keep training enjoyable, entertaining and relevant when the instructor is busy handling issues.

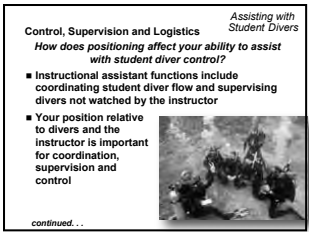
a. If a situation arises where student divers must wait for the instructor, they will look to you to keep them focused, involved and having fun.

b. For example, while waiting at the dive site, you can explain the aquatic life student divers may see on the dive.

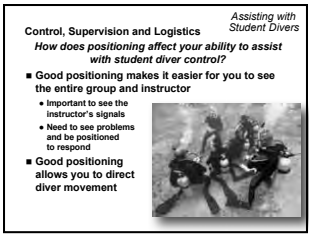


II. Control, Supervision and Logistics

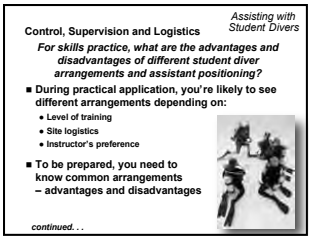
A. How does positioning affect your ability to assist with student diver control?



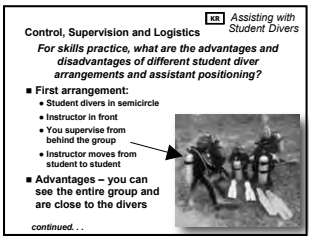
1. As mentioned, instructional assistant functions include coordinating student diver flow to keep things moving during training and supervising student divers not being immediately watched by the instructor.
2. Your position in the water relative to the student divers and the instructor is important to provide adequate coordination, supervision and control.
3. Good positioning makes it easier for you to see the entire group and the instructor.
   a. It's important that you can see the instructor's signals and respond if assistance is needed.
   b. You also need to be able to see if a student diver is having a problem and be positioned to quickly respond.
4. Good positioning also allows you to direct student diver movement to and from the instructor, as required. Entry-level divers sometimes have limited awareness of their surroundings and need guidance to find their place within the group.

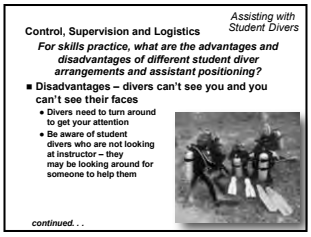


B. For skills practice, what are the advantages and disadvantages of different student diver arrangements and assistant positioning?

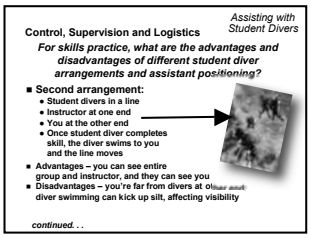


1. During the practical application portion of this course, you are likely to see different student diver arrangements depending on the level of training, site logistics and the instructor's preference. To be prepared to position yourself effectively, you need to know the common arrangements as well as their advantages and disadvantages.
2. The first arrangement is that the student divers form a semicircle or line with the instructor centered in front and you supervise from behind the group, directly opposite instructor. Typically in this arrangement, the instructor moves from student to student to conduct skills practice.
   a. The advantage of this arrangement is that you can see the entire group and the instructor, and you're close to all student divers.
   b. The disadvantage is that student divers can't see you and you can't see their faces.





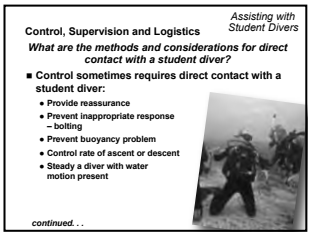
- The student divers will need to turn around to get your attention
- In this arrangement, be aware of student divers who are not looking at the instructor or watching the student diver who is performing the skill, because they may be experiencing stress or having a problem and are looking around for someone to help them.



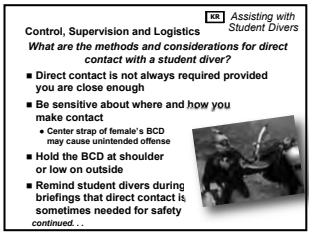
3. The second common arrangement is to have student divers in a line with the instructor at one end and you at the other. Once a student diver completes a skill, the instructor has the diver swim to you. You put the diver at the end of line, and the line moves down until all student divers complete the skill.
   a. The advantage of this arrangement is that you can see the entire group and the instructor, and they can see you.
   b. One disadvantage is that you are at one end far from student divers at the other end, although the instructor is there.
   c. Another disadvantage is that if you are on a silty bottom, the student divers are likely to kick up silt as they swim from one end to the other, thus affecting visibility.

4. You may learn variations of these common arrangements as you gain experience working with different instructors and student divers. However, the key is to position yourself to maintain communication with the instructor to reduce any delays in handling problems or coordinating activities.

C. What are the methods and considerations for direct contact with a student diver?



1. Control sometimes requires making direct contact with an individual student diver. You may do this to:
   a. Provide reassurance – appropriate contact can help a diver with a problem calm down by reminding the diver that you're there.
   b. Prevent an inappropriate response – for example, bolting to the surface.
   c. Prevent a buoyancy problem – too positively or negatively buoyant.
   d. Control the rate of an ascent or descent.
   e. Steady a diver while practicing a skill with some water motion present. For example, when a student diver is clearing a mask while on the bottom in mild surge.



2. Direct contact with a student diver is not always required provided you are close enough to make contact immediately should the situation call for it.
3. Be sensitive about where and how you make direct contact with

a diver because different cultures may have different perceptions regarding personal space and appropriate contact, especially between genders.

a. For example, a male divemaster holding the center strap of a female's BCD may cause unintended offense because it is so close to her chest.

b. Generally, holding the BCD at the shoulder or low on the outside, depending upon the circumstances, provides ample control with minimal likelihood of cultural sensitivities.

4. It helps if you or the instructor remind student divers during briefings that direct contact is sometimes needed for safety or control and explain how it will be made. For example, it's a normal part of the controlled emergency swimming ascent and this should be mentioned during the briefing.

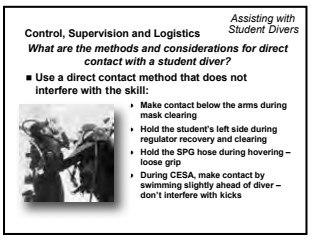
5. If direct contact is appropriate during additional skill practice under your supervision, use a method that does not interfere with the skill or provide unintended help. For example:

a. Make contact below the student diver's arms during mask clearing so you don't restrict movement.

b. Hold the student's left side during regulator recovery and clearing so you leave the right (recovering) arm unobstructed.

c. During hovering, a common technique is to hold the SPG hose to prevent an uncontrolled ascent. Use a loose grip that does not help the student diver hover – unless you need to stop an ascent.

d. During confined water practice of the controlled emergency swimming ascent, make contact by swimming slightly ahead of the diver so you can see exhalation bubbles, but enough to the side so you don't interfere with the diver's kicks. This is similar to the technique the instructor will use in open water.



D. What logistical functions may you perform to assist with diver training at the surface?

1. On the surface, you play an important role supervising and coordinating activities. The logistical functions you fulfill vary and are important for safety, control and effective course conduct.

2. Because diving is an equipment intensive activity, you help coordinate and monitor equipment so that all divers have what they need to dive. This includes:

a. Assisting with loading and unloading of vehicles or the boat.

b. Coordinating air fills between dives, if necessary.

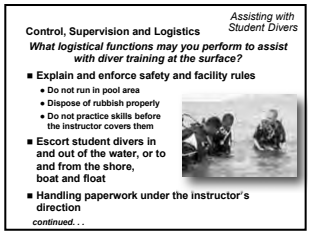
c. Taking charge of special equipment or safety equipment.

3. Another task typically handled by divemasters is to coordinate student divers at the training site.

a. This includes showing student divers where to go, where to place their equipment, and what to do, such as setting up their equipment.

b. If there are several groups of student divers at a training site, your role in directing student divers is even more important – especially if student divers are participating in different levels of training,

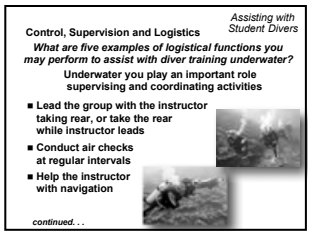
4. No matter what course you are assisting with, you also help student divers prepare for the dive.
   a. With entry-level divers, you need to provide more guidance as student divers gear up and perform equipment checks.
   b. With divers taking continuing education courses, you help them prepare specialty equipment.



5. You also provide logistical support by explaining and enforcing safety or facility rules. For example, reminding divers not to run in the pool area, making sure they dispose of rubbish properly, and asking them not to practice scuba skills before the instructor covers them, etc.

6. Depending on the number of student divers, the environmental conditions and the training level, your role could be to escort student divers in and out of the water or to and from the boat or shore to the float. This support adds efficiency to the flow of activities.

7. Another logistical function is handling paperwork under the instructor's direction, such as recording student diver scores, etc.



E. What are five examples of logistical functions you may perform to assist with student diver training underwater?

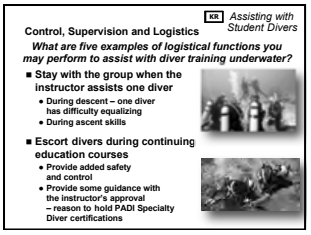
1. Underwater you also play an important role supervising and coordinating the activities of student divers. Besides positioning yourself for control during skills practice, you help the instructor by fulfilling several other functions.

2. The first function is to either lead the group with the instructor taking up the rear, or take up the rear when the instructor leads, as the group explores a dive site.

3. The second function is to conduct air checks with student divers at regular intervals. This reinforces good diving habits for student divers and allows you to keep the instructor informed about how much air student divers have.

4. Another important function is to help the instructor with navigation and keep track of the course to follow back to the exit. On dives where visibility is limited and the instructor needs to focus on student diver activities, you provide navigational assistance.

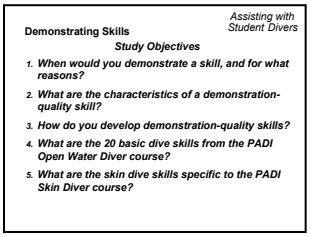
5. Another function is to stay with a group of student divers when the instructor has to assist one diver.
   a. This occurs, for example, during a descent when one diver has difficulty equalizing but the rest of class continues descending.
   b. Another example is while the instructor is conducting an ascent skill with one or two divers and you remain on the bottom with the rest.
6. A final function is to escort certified divers during continuing education courses.
   a. There are many activities, such as navigation exercises, that allow the instructor to indirectly monitor the dive.
   b. You provide added safety and control by escorting divers during these activities.
   c. If you're qualified in a specialty, you may also provide some guidance, with the instructor's approval. This is another reason to include PADI Specialty Diver certifications in your growth as a professional.

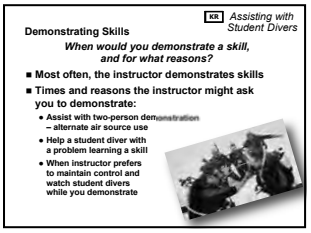


III. Demonstrating Skills

A. When would you demonstrate a skill, and for what reasons?

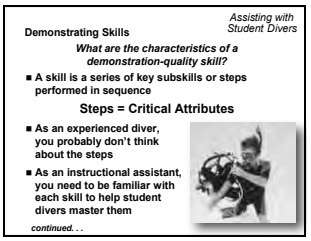
1. Most often, particularly in the PADI Open Water Diver course, the instructor will demonstrate skills for student divers. However, there are times and reasons when the instructor might ask you to demonstrate, including:
   a. To assist with a two-person demonstration for skills such as alternate air source use.
   b. When helping a student diver with a problem learning a skill. The student diver would have already seen the instructor's demonstration, but you may demonstrate additional times to help the student diver see the critical steps.
   c. When the instructor prefers to maintain control by personally watching the student divers while you demonstrate.

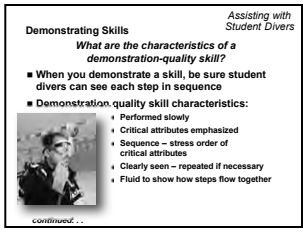




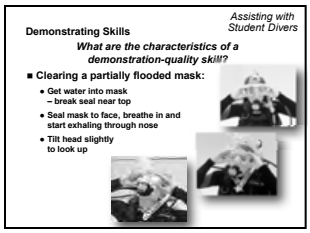
B. What are the characteristics of a demonstration-quality skill?

1. You realize that a skill is actually a series of key subskills or steps performed in sequence.
   a. These steps are called *critical attributes*, because without them, you can't perform the skill correctly.
   b. As an experienced diver, you probably don't think about the steps as you perform skills while diving. However, as an instructional assistant, you need to be familiar with the critical steps of each skill so that you can help student divers master them.

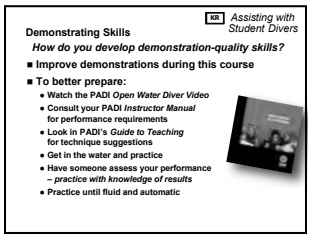




2. When you demonstrate a skill for student divers, you want to be sure they can see each step in sequence. A demonstration quality skill performance has these characteristics:
   a. The skill is performed slowly so that there is time to observe the details of the skill.
   b. The critical attributes are emphasized, especially those that may be easy to miss by someone who has never performed the skill.
   c. When the sequence of the steps are important to the skill, you also stress the order of the critical attributes.
   d. Student divers need to clearly see the demonstration, which means the demonstration is repeated, if necessary, to show more than one angle.
   e. The skill demonstration must also be fluid, so that student divers get an accurate and realistic view of how the steps flow together.
   f. Within reason, you can't over demonstrate a skill. Research shows that learners pick up nuances from further demonstrations after practicing, so don't hesitate to repeat a demonstration after student divers attempt the skill a few times.



3. For example, let's examine the simple skill of clearing a partially flooded mask.
   a. The first step is to get water into the mask. One technique is to break the mask seal near the top and slowly let water in. This shows control and avoids having water rush in, perhaps going up the nose.
   b. The next step is to seal the top of the mask to the face, breath in and then start exhaling through the nose.
   c. For a mask without a purge, tilting the head slightly to look up makes clearing more efficient.

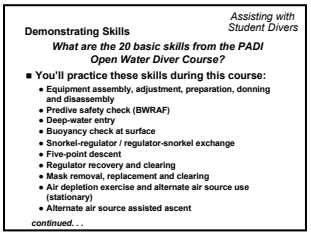


C. How do you develop demonstration-quality skills?

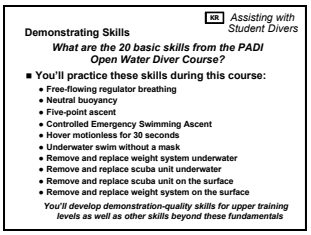
1. You'll work on improving the quality of your skill demonstrations during various water sessions in this course. You can better prepare to develop demonstration quality skills by doing the following:
   a. Start by watching skill demonstrations in the PADI *Open Water Diver Video* and note the critical attributes.
   b. Consult the PADI *Instructor Manual* for the performance requirements of each skill and look in PADI's *Guide to Teaching* for the technique suggestions for accomplishing each skill.
2. The best way to continue improving is to get in the water and practice skills. The only way to master a motor skill is through repeated practice.
   a. You also need to know how well you perform the skill, so it's important to have someone assess your performance.

b. Practice until each skill is fluid and automatic.

D. What are the 20 basic dive skills from the PADI Open Water Diver course?

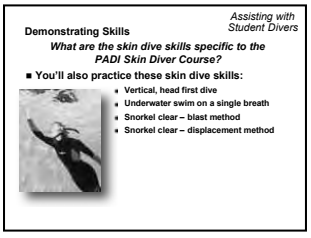


1. There are 20 basic skills you will practice during the Dive Skill Evaluation portion of this course. These skills are what new divers learn and skills you might be asked to demonstrate when assisting with an Open Water Diver course. They include:
   a. Equipment assembly, adjustment, preparation, donning and disassembly
   b. Predive safety check (BWRAF)
   c. Deep-water entry
   d. Buoyancy check at surface
   e. Snorkel-regulator/regulator-snorkel exchange
   f. Five-point descent
   g. Regulator recovery and clearing
   h. Mask removal, replacement and clearing
   i. Air depletion exercise and alternate air source use (stationary)
   j. Alternate air source-assisted ascent
   k. Free-flowing regulator breathing
   l. Neutral buoyancy
   m. Five-point ascent
   n. Controlled Emergency Swimming Ascent
   o. Hover motionless for 30 seconds
   p. Underwater swim without a mask
   q. Remove and replace weight system underwater
   r. Remove and replace scuba unit underwater
   s. Remove and replace scuba unit on the surface
   t. Remove and replace weight system on the surface



2. You'll eventually develop demonstration quality skills for upper training levels as well as other skills beyond these fundamental skills that an Open Water Diver student masters.

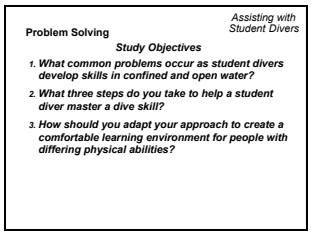
E. What are the skin dive skills specific to the PADI Skin Diver course?



1. In addition to scuba skills, there several skin diving skills that you will practice during the Dive Skill Evaluation portion of this course. These skills are part of the PADI Skin Diver course, which you can teach as a PADI Divemaster and thus, need to be comfortable demonstrating. They include:
   a. Make a vertical, head first dive from the surface in water too deep in which to stand.
   b. Swim at least 15 metres/50 feet underwater on a single breath.

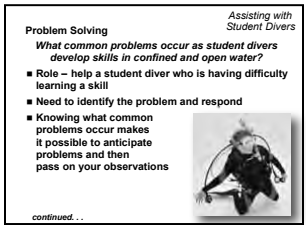
c. Ascend from a surface dive, clear a snorkel using the blast method and resume breathing through the snorkel without lifting the face from the water.

d. Ascend from a surface dive, clear a snorkel using the displacement method and resume breathing through the snorkel without lifting the face from the water.

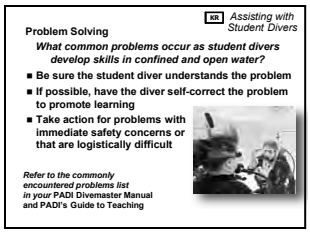


IV. Problem Solving

A. What common problems occur as student divers develop skills in confined and open water?

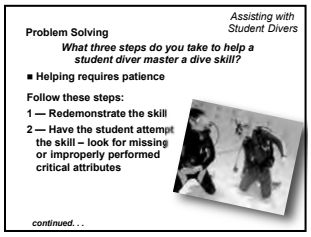


1. As mentioned, one of your roles is to help a student diver who is having difficulty learning a skill. To better assist the diver, you need to identify what problem the diver is having and respond to help solve it.
2. Also, knowing what common problems occur during skill development makes it possible for you to anticipate problems and then pass on your observations to the instructor.

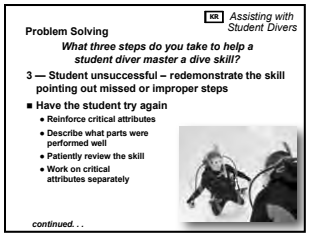


3. When assisting, be sure the student diver understands the problem and if possible, have the diver self-correct the problem to promote learning.
   a. Of course, you do need to take action for problems with immediate safety concerns or that are logistically difficult for a student diver to correct, such as a cylinder slipping out of the BCD's strap.
4. Please refer to the commonly encountered problems list in your PADI *Divemaster Manual* or PADI's *Guide to Teaching.*

B. What three steps do you take to help a student diver master a dive skill?

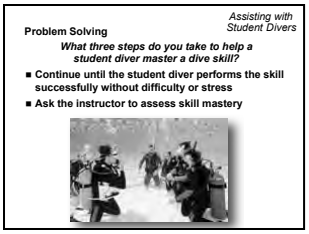


1. Helping student divers who have difficulty with a skill requires patience, but it also gives you experience for when you become an instructor.
2. If the instructor asks you to assist a student diver who has a difficulty, follow these three steps:
   a. First, redemonstrate the skill so the student diver can watch for missing critical attributes.
   b. Second, have the student diver attempt the skill and carefully look for missing or improperly performed critical attributes.
      - If the diver's actions create a safety concern, stop the exercise immediately.
   c. Third, if the student diver wasn't successful, redemonstrate the skill, making sure to point out the missed or improper steps.



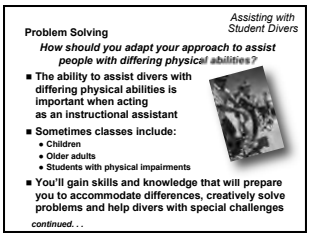
d. Follow up by having the student diver try the skill again.
   - If successful, reinforce how well the student diver performed all the critical attributes.
   - If not successful, keep the student diver motivated by describing what parts of the skill the diver performed well. This encourages the diver to continue trying. Then, patiently review the skill again.
   - If possible, work on critical attributes separately so that the diver enjoys success as the skill develops.

3. Continue until the student diver performs the skill successfully without difficulty or stress.
4. When you observe the student diver is performing the skill adequately, ask the instructor to assess skill mastery.

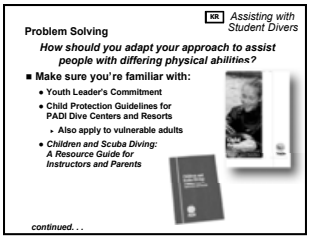


C. How should you adapt your approach to assist people with differing physical abilities?

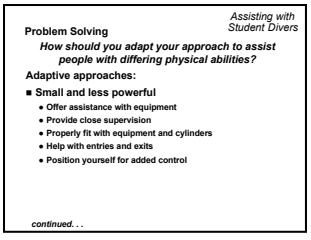
1. During the presentation – Supervising Diving Activities – the need for a divemaster to be able to accommodate certified divers with differing physical abilities is discussed. The ability to assist such divers is also important when acting as an instructional assistant.

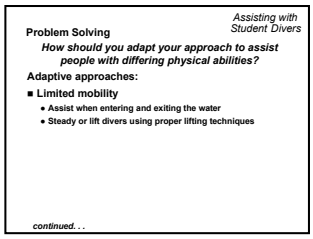


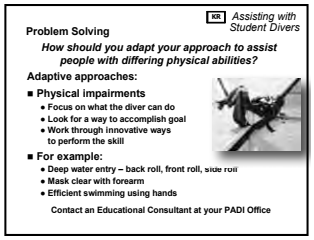
2. You will sometimes work with classes that include children or older adults, or encounter student divers that have physical impairments. The skills and knowledge you gain during this course will help prepare you to accommodate differences, creatively solve problems and help student divers with special challenges.
   a. Make sure you are familiar with the Youth Leader's Commitment, found in the Professional Membership Guide of your PADI *Instructor Manual*. It outlines the additional requirements and obligations you have when working with children.
   b. You can also refer to the Child Protection Guidelines for PADI Dive Centers and Resorts found on the PADI Pros' Site at padi.com and in PADI's *Guide to Teaching*. These guidelines also apply to protection of vulnerable adults.
   c. For more information, refer to the book – *Children and Scuba Diving: A Resource Guide for Instructors and Parents.*



3. Here are a few adaptive approaches to keep in mind when acting as an instructional assistant:
   a. When student divers are small and less powerful, such as a child or older adult, be ready to offer assistance with equipment and provide close supervision.
      - Work with the instructor to make sure that student divers have properly fitted equipment and smaller cylinders if possible.







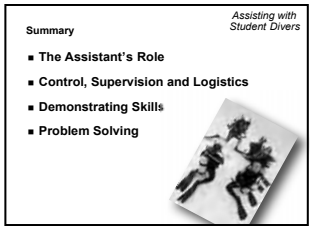
- Be available to help with water entries and exits.
- Position yourself in the water to offer assistance and added control, particularly if water movement is a factor.

b. Student divers with limited mobility sometimes need assistance when entering and exiting the water. Work with the instructor to help steady or lift divers making sure you use proper lifting techniques. However, don't lift or handle more than you can easily manage.

c. When working with a student diver with a physical impairment who is having difficulty mastering a skill, start by focusing on what the diver can do and what the skill is trying to accomplish.

- Don't get stuck on a particular technique; instead, look for a way to accomplish the goal using the diver's abilities.
- Put yourself in the diver's position and work through innovative ways to perform the skill.
- For example, deep water entries can be back rolls, front rolls or even side rolls.
- Also, mask clearing can be accomplished by pushing on the mask with a forearm instead of a hand.
- Another example is that efficient swimming is possible with hands instead of fins.

4. If questions come up about adaptive approaches during a program you in which you are assisting, contact an Educational Consultant at your PADI Office. Consultants have experience and training specific to working with divers with disabilities. Also, there are organizations, throughout the world, that specialize in training dive professionals to work with divers with disabilities, if this interests you.



Summary

I. The Assistant's Role

II. Control, Supervision and Logistics

III. Demonstrating Skills

IV. Problem Solving

Diver Safety and Risk Management

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NOTES:

1. Use this presentation when divemaster candidates have not completed independent study through Divemaster Online, or read Chapter 4 of the PADI *Divemaster Manual*. You may also use this presentation for prescriptive remediation while reviewing the Chapter 4 Knowledge Review with candidates.
2. This presentation focuses on diver safety and explains risk management techniques and tools that divemasters will use as certified assistants and dive supervisors.

Overview

I. Defining Risk Management

- **What is meant by *risk management?***
- **Why is risk management so important?**
- **What are meant by *duty of care* and *negligence* in most legal systems?**
- **Why are your health, personal safety and diving proficiency important to managing risk?**

II. Risk Management Techniques

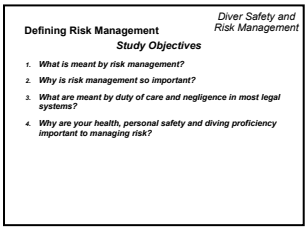
- **Why do you need to be familiar with the General Standards and Procedures Guide in your PADI *Instructor Manual*?**
- **How does adhering to standards help you reduce risk?**
- **Why is your judgment important when applying standards?**
- **What is the PADI Member Code of Practice and how does it apply to risk management?**
- **What is the Youth Leader's Commitment and how does it apply to risk management?**
- **What suggestions can help you manage your own risk?**

III. Risk Management Tools

- **What is the role of proper paperwork and administration in reducing risk?**
- **What steps should you take in the event of an accident?**
- **Why is it recommended that you carry professional liability insurance, even when it is not required and you plan to function exclusively as an assistant working under a PADI Instructor?**

IV. Quality Management

- **How does the PADI Quality Management process help you reduce risk?**
- **What are the steps in the Quality Management process?**

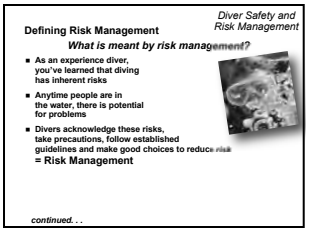


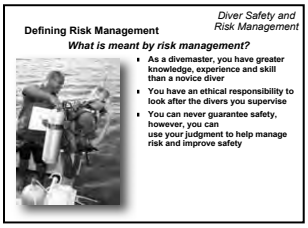
Outline

I. Defining Risk Management

A. What is meant by risk management?

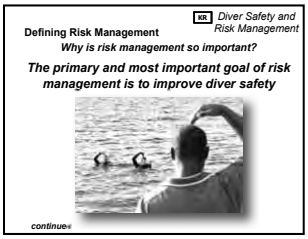
1. As an experienced diver who has taken many scuba courses, you've learned that diving has inherent risks that could result in serious injury. Anytime people are in the water – out of their normal element – there is potential for problems.
2. Active divers and dive professionals acknowledge these risks and take precautions, follow established guidelines and make good choices in order to reduce risk — this is risk management.
3. As a divemaster, you have greater knowledge, experience and skills than a novice diver to help prevent, avoid or minimize problems. You also have an ethical responsibility to look after the divers you supervise.
4. You can never guarantee that divers will be completely safe, however, you can use your judgment to help manage risk and improve safety for the divers under your care and influence.

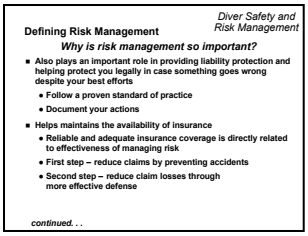




B. Why is risk management so important?

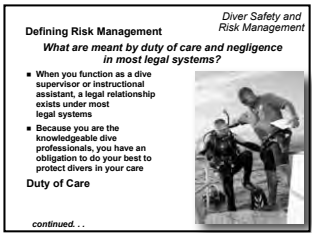
1. Striving to keep divers safe is the primary and most important goal of risk management. Preventing problems and avoiding situations where divers could be hurt or injured is a key responsibility of dive professionals (more on this when going over the PADI Member Code of Practice).
2. Risk management also plays the important role in providing liability protection and helping to protect you legally in case something goes wrong, despite your best efforts. By following a proven standard of practice and by documenting your actions, you maintain an improved level of liability protection.
3. Helping to maintain the availability of insurance is another reason. Dive professionals need the protection of reliable insurance coverage and continued availability of adequate insurance is directly related to the effectiveness of managing diving's risks. The first, most important step, is to reduce claims by preventing accidents. The second is to reduce claim losses through successful defense when litigation does occur.





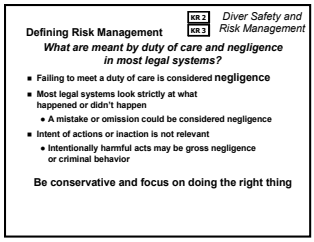
4. Diving's continued viability as an industry also depends on maintaining good public relations and its image as a responsible, professionally practiced activity with a reasonable safety record.

C. What are meant by duty of care and negligence in most legal systems?



1. When you function as a dive supervisor, instructional assistant or provide other dive-related services to someone, a legal relationship exists under most legal systems.
2. Because you are a knowledgeable dive professional in this relationship, you have a an obligation to do your best to protect the divers in your care. This means that you are expected to act as a reasonably prudent divemaster would act under the same or similar circumstances to protect less knowledgeable divers from harm. This is what is meant by duty of care. You can't ever guarantee diver safety, but you have a duty to generally use your best efforts to avoid reasonably foreseeable accidents.

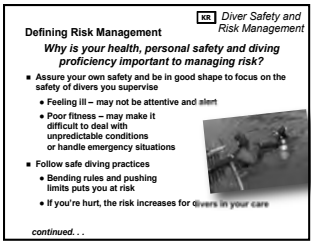
3. You fulfill this duty by taking steps to prevent problems and by also preparing for emergency situations including:
   a. Following PADI Standards, adhering to the PADI Member Code of Practice, following safe and responsible diving practices and adhering to local practices that are in place to reduce risk.
   b. Evaluating and reevaluating environmental conditions before and during a dive.
   c. Being aware of factors that put divers at risk, including diver behavior.
   d. Exercising sound judgment based on your experience and training.
   e. Having appropriate safety equipment available and being prepared to respond in an emergency.

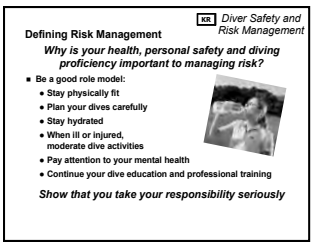


4. Failing to meet a duty of care is considered negligence under most legal systems.
   a. Most legal systems will look strictly at what happened or didn't happen to determine negligence. A mistake or unintentional omission that results in a problem could be considered negligence.
   b. The intent of a dive professional's actions or inactions is not relevant, because it's unlikely that a dive professional would purposely try to harm a diver. Intentional acts may be considered gross negligence or criminal behavior.
5. It's important to be conservative and focus on doing the right thing, which is to put diver safety as your first priority.

D. Why are your health, personal safety and diving proficiency important to managing risk?

1. You must assure your own safety and be in good shape – mentally and physically – to be able to focus on the safety of the divers you supervise.
   a. If you're feeling ill, you may not be attentive and alert.
   b. Poor physical fitness may make it difficult to deal with unpredictable dive conditions. You need to have the strength and stamina to handle an emergency situation.
2. Even though you may be better trained than the average diver, you still need to follow safe diving practices because bending the rules and pushing the limits puts you at risk. If you get hurt, the risk increases for the divers in your care.
3. To be a good role model and better manage risks through your personal health and diving proficiency, follow these recommendations:
   a. Stay physically fit by exercising regularly, getting adequate rest and eating properly.
   b. Plan your dives carefully and stay well within the no decompression limits. Make a safety stop at the end of all dives. Take a day off from diving every few days.
   c. Stay hydrated, especially in hot weather.
   d. When ill or injured, moderate your dive activities accordingly.
   e. Pay attention to your mental health – dive for fun, not just for work, so you avoid burnout and engage in other pastimes.
   f. Continue your dive education and professional training. This not only broadens your skills and knowledge, but also shows that you take your responsibilities seriously.



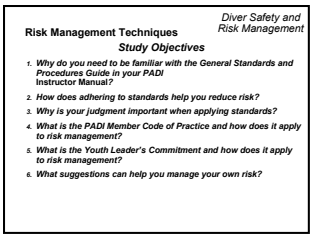


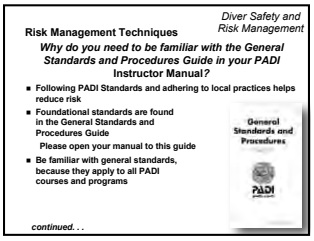
II. Risk Management Techniques

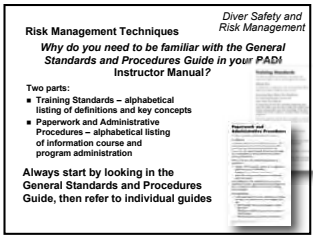
A. Why do you need to be familiar with the General Standards and Procedures Guide in your PADI *Instructor Manual?*

1. As mentioned, following PADI Standards and adhering to local practices helps reduce risks.
2. The foundational or "general" standards that you and all other PADI Members need to follow are contained in the General Standards and Procedures Guide of your PADI *Instructor Manual*.
3. You need to be familiar with this guide because standards outlined here apply to all PADI courses and programs and are not repeated in the individual course guides.

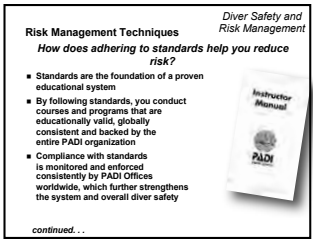
[NOTE: Have candidates refer to the PADI *Instructor Manual.*]





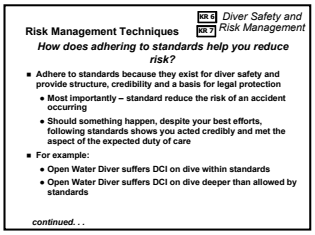


4. There are two parts to the General Standards and Procedures Guide.
   a. The first is Training Standards, which is an alphabetical listing of definitions and key concepts.
   b. The second is Paperwork and Administrative Procedures, which is an alphabetical listing of information about the administration of PADI courses and programs.
5. When preparing to conduct a PADI program or to assist an instructor with a course, always start by looking in the General Standards and Procedures Guide, then refer to the individual guide for requirements specific to that course or program.



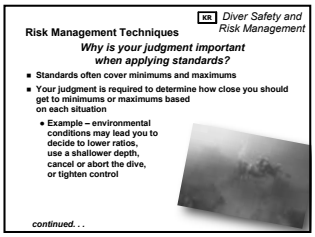
B. How does adhering to standards help you reduce risk?

1. PADI Standards are the foundation of a proven educational system. By following standards, you conduct PADI courses and programs that are educationally valid, globally consistent and backed by the entire PADI organization.
2. Compliance with PADI Standards is monitored and enforced consistently by all PADI Offices worldwide through quality management procedures. This adds further strength to the system and overall diver safety. (We'll discuss quality management in more detail in a few minutes.)



3. You need to adhere to standards because they exist for diver safety and provide structure, credibility and a basis for legal protection.
   a. First, and most importantly, standards reduce the risk of an accident occurring
   b. Secondly, should something unfortunate happen despite your best efforts, following PADI Standards can reduce legal risk by showing that you acted credibly as a professional, and that you met the expected duty of care.

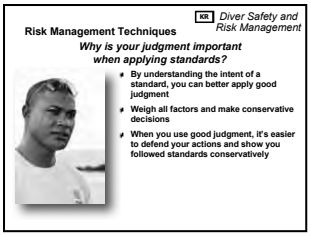
4. Note that local dive community and industry practices and regulations aren't typically part of PADI Standards, but you should follow them conservatively as well, because they generally are based on what experience has shown to be the best practices in the local environment.



C. Why is your judgment important when applying standards?

1. As you use your PADI *Instructor Manual*, it's important to understand that PADI Standards often cover minimums and maximums.
2. Your judgment is required to determine how close you should get the minimums or maximums based on each situation.
   a. For example, environmental conditions may lead you to decide to lower ratios, use a shallower depth, cancel or abort the dive, or tighten control in order to reduce risk.

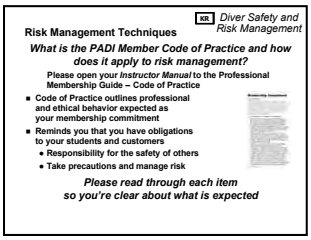
3. By understanding the intent of a standard, you can better apply your good judgment when adapting it to specific diving situations. You need to weigh all factors and make conservative decisions.
4. When you use good judgment to avoid problems, it's much easier to defend your actions if you can show that you not only followed standards, but that you followed them conservatively.



D. What is the PADI Member Code of Practice and how does it apply to risk management?

[NOTE: Have candidates refer to the PADI *Instructor Manual* – Professional Membership Guide, Membership Commitment, Code of Practice. Involve candidates in reading through each item and discuss as necessary for clarity.**]**

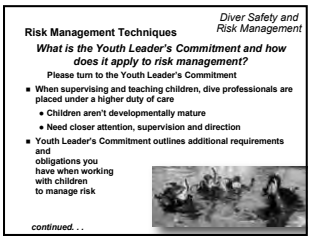
1. The PADI Member Code of Practice in your PADI *Instructor Manual* outlines the professional and ethical behavior expected as part of your membership commitment.
2. It specifically reminds you that you have obligations to your students and dive customers and that you are responsible for the safety of others. You need to take precautions and manage risk to fulfill this responsibility.
3. Read through each item, so that you are clear about what is expected.

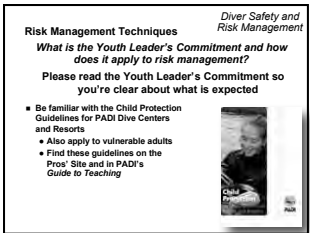


E. What is the Youth Leader's Commitment and how does it apply to risk management?

[NOTE: Have candidates refer to the Youth Leader's Commitment in the PADI *Instructor Manual*. Involve candidates in reading through each item and discuss as necessary for clarity.**]**

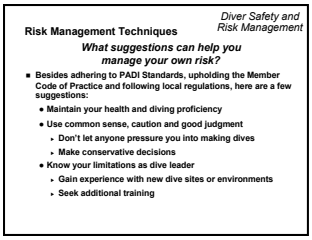
1. When supervising and teaching children, dive professionals are placed under a very high duty of care. Children aren't developmentally mature and thus need closer attention, supervision and more direction than adults.
2. The Youth Leader's Commitment outlines the additional requirements and obligations you have when working with children to thoroughly manage risks.
   a. You should also be familiar with the Child Protection Guidelines for PADI Dive Centers and Resorts. These guidelines also apply to protection of vulnerable adults. You can find these guidelines on the Pros' Site at padi.com and in PADI's *Guide to Teaching*.
3. Read the Youth Leader's Commitment, so that you are clear about what is expected.





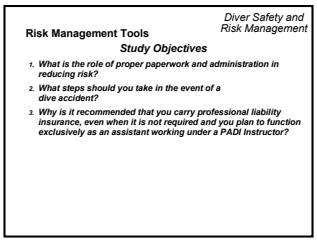
F. What suggestions can help you manage your own risk?

1. Besides adhering to PADI Standards and upholding the PADI Member Code of Practice, you need to follow established local regulations, environmental laws and industry guidelines to reduce



personal risk. Regulations, laws and guidelines generally exist to protect people and the local area – so it's prudent to follow them.

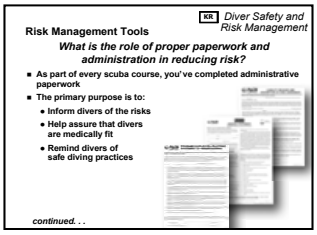
2. As mentioned, maintaining your personal health and diving proficiency helps manage risk. Don't dive when you're not prepared, mentally or physically to do so and dive conservatively, well within your personal limits.
3. Use common sense, caution and good judgment.
   a. Do not let student divers, employers or personal demands pressure you into making dives when conditions are not conducive to a positive experience.
   b. Make conservative decisions by reducing ratios, going to an alternate site or canceling the dive.
4. Know your limitations as a dive leader.
   a. Gain experience at new dive sites or in new dive environments before taking on a supervisory role.
   b. Seek out additional training before supervising divers with different equipment configurations, such as rebreathers, etc.

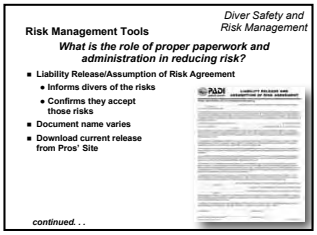


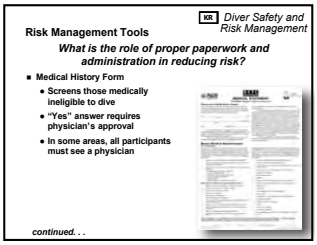
III. Risk Management Tools

- **What is the role of proper paperwork and administration in reducing risk?**

1. As part of every scuba diving course you've taken thus far, you've completed administrative paperwork. This is required to make sure you know about the risks and requirements of the particular dive course.
2. The primary purpose of the administrative paperwork is to inform divers of the risks of diving, help assure that divers are medically fit to participate in diving and to remind them of the importance of following safe diving practices. Administrative paperwork includes:
   a. A liability release/assumption of risk agreement that informs participants of risks and confirms that they accept those risks. (go to the Pros' Site at padi.com)
   b. A medical history form that helps prevent accidents by screening those medically ineligible to dive.
      - A "yes" answer to any condition requires that the diver receive a physician's approval before participating in any inwater activities.
      - In some areas, all participants must see a physician prior to enrolling in scuba activities.
      - It's important for divers to actually write "no" or "yes" next to each question as the instructions state, because this verifies that they've read the form and considered their answers to each question.







c. A safe diving practices statement of understanding that ensures divers are aware of their responsibilities.

3. Administrative paperwork also serves as evidence that you were diligent about informing divers of the risks involved and that they agreed to assume responsibility during and after training. PADI's forms have regularly been used in court to strengthen defenses. Law suits have been dismissed based on proper paperwork. Even if a suit isn't dismissed, properly completed paperwork adds to your credibility and helps document your professionalism and adherence to standards

4. Other paperwork, such as Knowledge Reviews completed by student divers, quiz and exam answer sheets, and log books, also provide the documentation needed in many legal systems to show that the dive professional followed standards and acted appropriately.

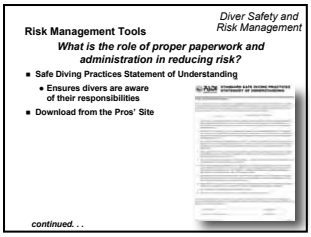
5. When conducting a program or supervising a dive, make sure you review participant paperwork closely to be certain that all blanks are filled, that it is signed, dated and legible.

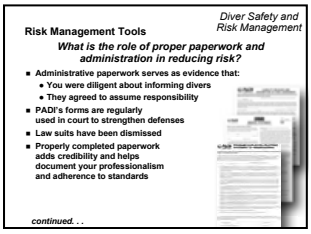
   a. Don't allow someone to alter or strike through the language on the forms.

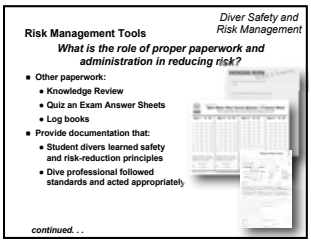
   b. If an individual doesn't wish to accept the risks and responsibilities for participating in a dive program, you don't want that person in the program.

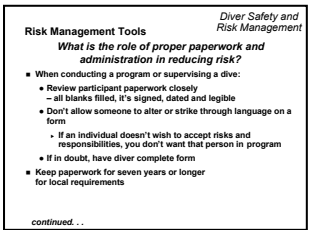
   c. If in doubt about whether a form is required, it's better to have someone complete it. It's more of an issue when a required form is missing than when a form that's not required is present.

6. Keep all paperwork at least seven years, or longer if the local statute of limitations is longer.









B. What steps should you take in the event of an accident?

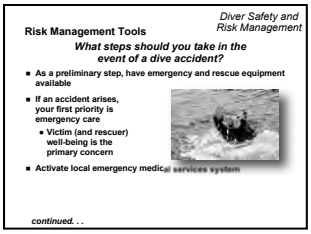
1. As a preliminary step, have appropriate emergency and rescue equipment available as required by standards, local regulations and practices.

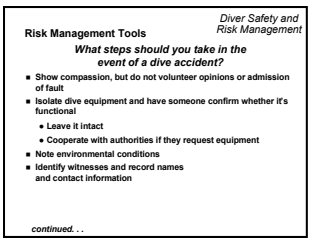
2. If an accident or emergency situation arises, your first priority is to render appropriate emergency care. Make the victim's (and rescuer's) well-being your primary concern.

3. Activate the local emergency medical service system as soon as possible, if necessary. As appropriate, contact the Divers Alert Network (DAN), The DES (Diving Emergency Service) Hotline or other emergency services that deal with diving-related accidents.

4. Show compassion, but do not volunteer an admission of fault. You may not be at fault, so don't assume you are.

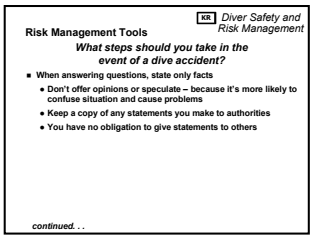
5. Isolate dive equipment and have someone else confirm whether it's functional – noting the equipment configuration and connections,



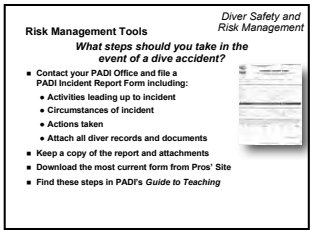


tank pressure, regulator and gauge function, etc. – however, leave it intact. Cooperate with authorities if they request the equipment.

6. Make note of environmental conditions, such as the time of day, conditions, water movement, temperature, visibility, etc.
7. Identify witnesses and record their names and contact information.
8. When answering questions about the accident to local authorities, state only the facts and refrain from offering opinions or speculation.
   a. Providing anything other than the facts is more likely to confuse the situation and cause problems than it is to be helpful.
   b. Keep a copy of any statements you make. You have no obligation to give statements to others – media, family, etc. – and it's not recommended.

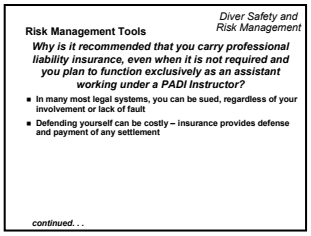


9. Contact your PADI Office and file a PADI Incident Report Form (go to padi.com Pros' Site, Training Essentials to download the most current form) that includes facts about:
   a. The activities leading to the incident.
   b. The circumstances of the incident.
   c. Any action taken by the people involved following the incident.
   d. If you are providing second hand information, be sure to identify that it is second hand information.
   e. Attach all diver records and other documents (releases, etc.) that may apply.
   f. Keep a copy of the report and attachments for your files.

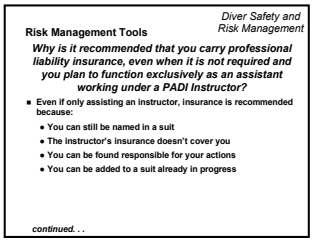


[NOTE: Explain to candidates that these steps are listed in PADI's *Guide to Teaching* along with more information about legal responsibility and risk management.**]**

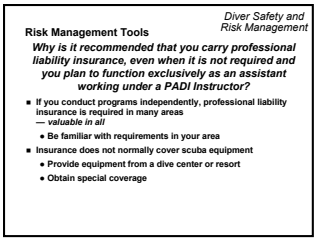
C. Why is it recommended that you carry professional liability insurance, even when it is not required and you plan to function exclusively as an assistant working under a PADI Instructor?



1. In many legal systems, you can be sued if there is an accident, regardless of your involvement or lack. Defending yourself can be costly and liability insurance provides coverage for your defense. If you are found liable, insurance provides payment of any settlement.
2. Even if you are only assisting an instructor, who does have most of the responsibility, insurance coverage is recommended because:
   a. You can still be named in the suit.
   b. The instructor's insurance does not cover you – the assistant.
   c. You can be found responsible for your own actions or for what part you may have played in an accident, even with an instructor present.
   d. You can be added to a suit already in progress.



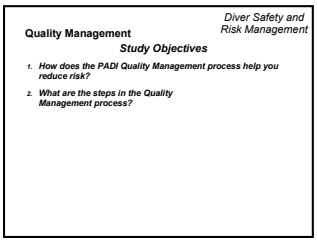
3. As a PADI Divemaster, if you plan to conduct allowed programs independently, professional liability insurance is required in many areas around the world – valuable in all. Be familiar with the requirements in your region and make certain you have the insurance you need. (Go to the Pros' Site for information or contact your PADI Office).
4. Note that professional liability insurance does not normally provide liability coverage for personally owned scuba equipment that you might provide a diver or student diver (such as when something malfunctions or is forgotten).
    a. Instead, provide equipment from a dive center or resort's normal rental or class scuba equipment, which will be covered under the operation's store insurance.
    b. If necessary, you can obtain special coverage as part of your professional liability insurance to provide liability coverage for personal equipment you might provide a certified diver or student diver.

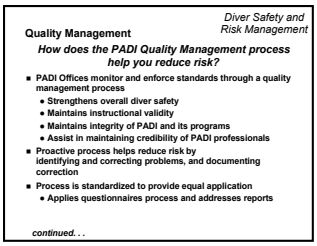


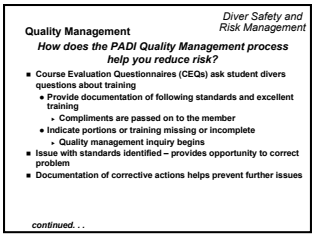
IV. Quality Management

A. How does the PADI Quality Management process help you reduce risk?

1. As discussed earlier, PADI Offices monitor and enforce PADI Standards through the PADI Quality Management process.
    a. The goals are to strengthen overall diver safety, to maintain the instructional validity of PADI programs, to maintain the integrity of PADI and its programs, and to assist in maintaining the credibility of the PADI professionals before the public.
    b. The process also helps reduce risk by identifying and correcting problems, and documenting the corrections.
2. PADI's Quality Management process is standardized to provide equal application. It applies both a proactive questionnaire process, as well as addresses problems reported by divers and PADI Members.
3. Monitoring occurs through the use of Course Evaluation Questionnaires (CEQs) that ask student divers specific questions about their training.
    a. Often, CEQs provide documentation that a PADI Member followed standards, and provided excellent training and customer service.
        - Compliments from student divers are passed on to the member along with recognition for a job well done.
    b. Occasionally, CEQs indicate that portions of training were improper, missing or incomplete. If this happens, a quality management inquiry begins. (More on this process next.)

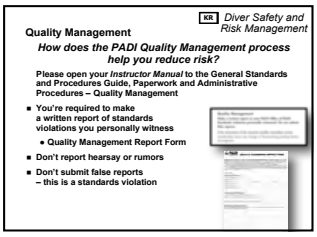




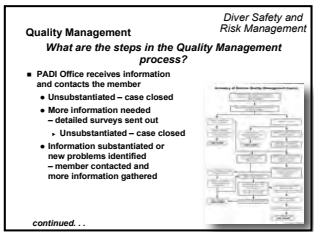


- The fact that an issue with standards is identified provides an opportunity to correct the problem with the PADI Member.
- Documentation of corrective action, helps prevent further issues and strengthens defense of the member in the future, if necessary.

[**NOTE:** Have candidates refer to the PADI *Instructor Manual* – General Standards and Procedures Guide, Paperwork and Administrative Procedures, Quality Management.]



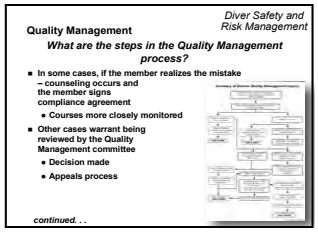
4. As noted in your PADI *Instructor Manual,* you are required to make a written report to your PADI Office of PADI Standards violations you personally witness. There is a Quality Management Report form for this purpose.
   a. Because the focus of the quality management process is diver safety and program integrity, it's necessary to let your PADI Office know if you see any violations.
   b. However, don't report hearsay and rumors – only what you personally witness. Do not submit false reports.



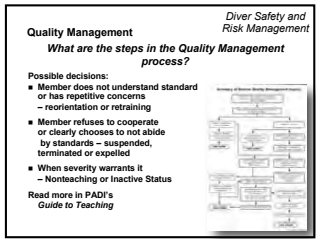
B. What are the steps in the Quality Management process?

[**NOTE:** Have candidates refer to the Summary of Routine Quality Management Inquiry]

1. The first step in the quality management process is that a PADI Office receives information about a standards violation and then shares this information with the PADI Member.
   a. If the information is unsubstantiated, the case is closed.
   b. If more information is needed, detailed surveys are sent to student divers. If the information is found to be unsubstantiated, the case is closed.
   c. If the information about a standards violation is substantiated or new problems are identified, the member is contacted and more information is gathered and exchanged.



2. In some cases, if the member realizes the mistake or standards misinterpretation, counseling occurs and the member signs a standards compliance agreement. The member's courses are more closely monitored for a prescribed period.
3. Other cases warrant being reviewed by the Quality Management committee, and a decision is made about how to handle or correct the member's situation.
   a. There is an appeals process that allows the member to present new information, and the committee again reviews everything to make a decision.



4 There are several possible decisions the Quality Management committee might make based on the circumstances:
   a. First, if the member does not understand the standard or has repetitive standards concerns, reorientation or retraining is required.

b. Next, if a member refuses to cooperate with quality management inquiries or clearly chooses not to abide by standards, the member is suspended, terminated or expelled from the PADI organization.

- These punitive measures result primarily from ethical problems, such as criminal acts, severely endangering divers, blatant disregard for safety, acts of malice against PADI Members or the PADI organization, or repeated and persistent failure to follow standards, even after correction.

d. When the severity of the situation warrants it, members are immediately placed in Nonteaching or Inactive Status pending the outcome of the investigation.

4. For more information, read about the Quality Management process in your PADI's *Guide to Teaching*.

Summary

I. Defining Risk Management

II. Risk Management Techniques

III. Risk Management Tools

IV. Quality Management

Divemaster-Conducted Programs

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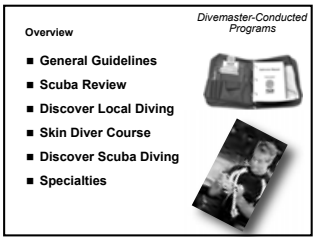
NOTES:

1. Use this presentation when divemaster candidates have not completed independent study through Divemaster Online or by reading Chapter 5 of the PADI *Divemaster Manual* and watching the *Divemaster Video*. You may also use this presentation for prescriptive remediation while reviewing the Chapter 5 Knowledge Review with candidates.
2. This presentation goes over the standards, structure and techniques for the PADI programs that divemasters are qualified to conduct independently.
3. It's best to conduct this presentation before the corresponding Divemaster-Conducted Programs Workshops.



Overview

I. General Guidelines

- **How do you use the PADI *Instructor Manual* to find standards related to the programs you are qualified to conduct?**
- **What other PADI instructional materials are available to guide your conduct of programs?**

II. Scuba Review

- **For the PADI Scuba Review program, who is the program intended for, and what are the program's approach and philosophy?**
- **For the PADI Scuba Review program, what are the diver prerequisites, forms, materials, ratio and performance requirements?**

III. Discover Local Diving

- **For the PADI Discover Local Diving program, who is the program intended for, and what are the program's approach and philosophy?**
- **For the PADI Discover Local Diving program, what are the diver prerequisites, material, ratio and general considerations?**

IV. Skin Diver Course

- **For the PADI Skin Diver course, who is the program intended for, and what are the program's approach and philosophy?**
- **For the PADI Skin Diver course, what are the diver prerequisites, material, ratio and performance requirements?**

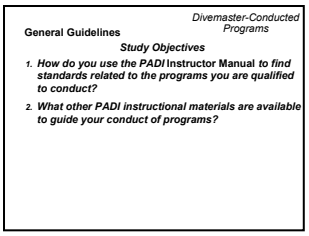
V. Discover Scuba Diving

- **For the PADI Discover Scuba Diving program, who is the program intended for, and what are the program's approach and philosophy?**

- **For the PADI Discover Scuba Diving program, what are ratio and supervision requirements when assisting with a program or taking participants on a subsequent dive?**
- **How can a PADI Divemaster become a Discover Scuba Diving Leader?**

VI. Specialties

- **What two PADI Specialty Diver courses can a PADI Divemaster qualify to teach?**
- **What are the benefits of qualifying to teach these two courses?**



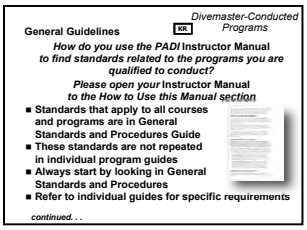
Outline

I. General Guidelines

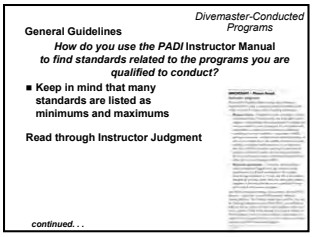
A. How do you use the PADI *Instructor Manual* to find standards related to the programs you are qualified to conduct?

[NOTE: Have candidates refer to the PADI *Instructor Manual*.**]**

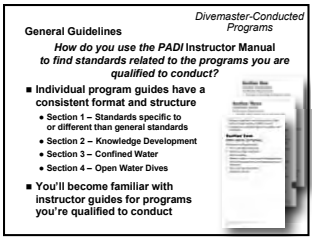
1. In the Diver Safety and Risk Management presentation, you learned that standards that apply to all PADI courses and programs are contained in the General Standards and Procedures Guide of your PADI *Instructor Manual*.
   a. Because these standards are not repeated in the individual program guides, you need to be familiar with the General Standard and Procedures Guide.
   b. Always start by looking in the General Standards and Procedures Guide when preparing to conduct a PADI program, then refer to the individual guide for requirements specific to the program.
2. Keep in mind that standards are listed as minimums and maximums. To clarify this, let's read through Instructor Judgment pages in the How to Use this Manual section of your PADI *Instructor Manual*.



[NOTE: Have candidates refer to the How to Use this Manual pages on Instructor Judgment. Read through the pages and answer questions as necessary.**]**

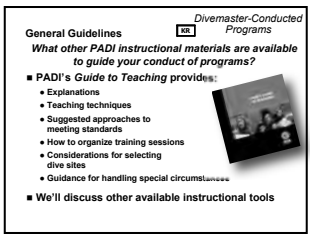


3. All individual program guides have a consistent format and structure, which makes it easy to find the information you need:
   a. The first section contains program standards – anything specific to the program and different from general standards.
   b. The second section explains knowledge development requirements, which may involve reviewing what divers learned through independent study or delivering a complete presentation or briefing.
   c. The third contains standards pertaining to confined water training, if required.



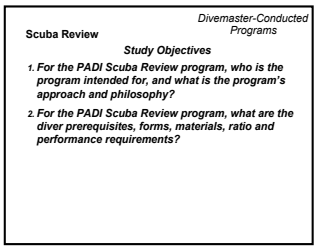
d. The final section has performance requirements for any open water dives that are part of the program.

4. During this presentation, you'll become familiar with the instructor guides and standards for the programs you are qualified to conduct. You'll refer to these guides each time you prepare to conduct a program.

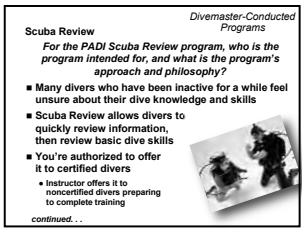


B. What other PADI instructional materials are available to guide your conduct of programs?

1. PADI's *Guide to Teaching* provides explanations, teaching techniques and suggested approaches to meeting standards for core courses and many PADI programs.
   a. You'll find reminders about how to organize training sessions, considerations for selecting confined and open water dive sites, guidance about handling special circumstances, etc.
2. As we look at each individual program you are qualified to conduct, we'll discuss other available instructional tools, such as the Skill Evaluation Slate for the Scuba Review program.
3. Remember that you'll also have an opportunity to practice conducting these programs during role-playing workshops.

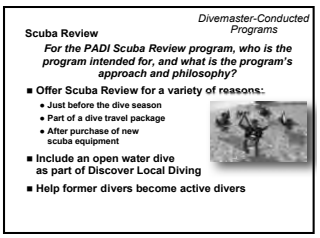


II. Scuba Review



A For the PADI Scuba Review program, who is the program intended for, and what is the program's approach and philosophy?

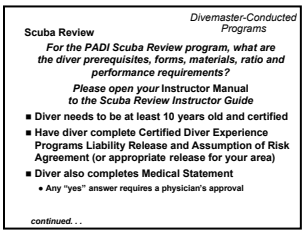
1. Many divers who have been inactive for a while feel unsure about their dive knowledge and skills. The Scuba Review program allows divers to quickly review safety-related dive information through independent study, then to review basic dive skills with your guidance.
2. As as PADI Divemaster, you are authorized to offer Scuba Review to certified divers who need a refresher. A PADI Instructor is qualified to offer it to noncertified divers who are preparing to complete training.
3. Because there is a lot of flexibility in the Scuba Review program, you can offer it to divers for a variety of reasons to meet individual diver needs. For example:
   a. Offer it just before the dive season begins (if applicable in your area.)
   b. Include it as part of a dive travel package to help tune-up divers before they go.
   c. Offer it to divers who have just purchased new scuba equipment to help them get comfortable with their new gear.
   d. By including an open water dive through the Discover Local Diving program (more on this in a few minutes), you allow divers to get the most from the dive.



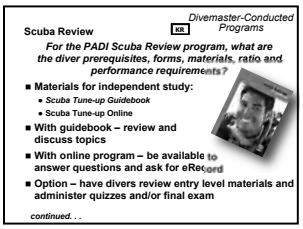
4. Scuba Review is a great tool to help former divers become active divers.

B. For the PADI Scuba Review program, what are the diver prerequisites, forms, materials, ratio and performance requirements?

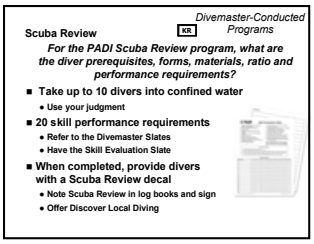
[NOTE: Have candidates refer to the PADI *Instructor Manual* – Scuba Review Instructor Guide and review the standards. Also, have them refer to their Divemaster Slates.**]**

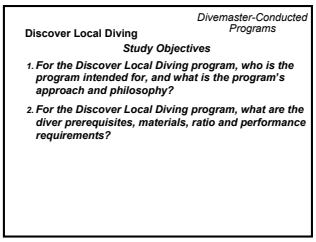


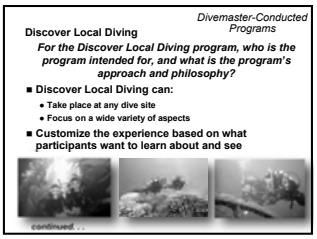
1. As listed in the Scuba Review Instructor Guide, a diver needs to be at least 10 years old and certified as an entry-level diver to participate in a program conducted by you.
2. You must have the certified diver complete a Certified Diver Experience Programs Liability Release and Assumption Of Risk Agreement (product number 10074) and a Medical Statement (product number 10063).
   a. Note that a "yes" answer on the medical history questionnaire requires that the diver receives a physician's approval before any inwater activities.
   b. You can download the most current forms from padi.com/Pros' Site.
3. The materials available for knowledge review independent study include the *Scuba Tune-up Guidebook* and Scuba Tune-up Online.
   a. When divers complete the guidebook, quickly review it with them and discuss any topics they have questions about.
   b. If divers complete the online program, be available to answer questions they have and verify completion by asking for their eRecord.

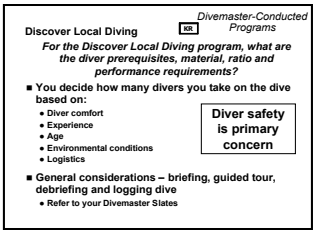


4. Another option is to ask divers to review entry-level materials, such as a current version of the PADI *Open Water Diver Manual*, and then administer the PADI Open Water Diver course quizzes and/or final exam. This verifies that divers have retained important dive knowledge and identifies any concepts you may need to clarify.
5. You may take up to 10 divers into confined water for skills practice and assessment. Remember that this is the maximum number and you should use your judgment which may mean choosing to take fewer divers for better control.
6. The 20 skill performance requirements are listed in Section Three of your Scuba Review Instructor Guide and on your Divemaster Slates. You'll practice demonstrating these skills during this course.
7. You can refer to your Divemaster Slates, but it's also a good idea to have the slate called the Skill Evaluation Slate to take into confined water. It lists the skill requirements and also has a place to easily record which skills divers complete.









8. When you've completed the knowledge and skills review with divers, provide them with a Scuba Review decal for their certification cards. It's common to note the Scuba Review in their log books and you sign it to verify completion. Also consider offering a Discover Local Diving experience.

III. Discover Local Diving

A. For the PADI Discover Local Diving program, who is the program intended for and what is the program's approach and philosophy?

1. Discover Local Diving is a supervised underwater tour designed to orient certified divers to different aquatic conditions and environments. Reasons divers might participate include:
   a. To learn about the local environment while on a dive holiday.
   b. Orientation to a new dive site they've never visited. Divers learn to seek out an orientation anytime they go to a new area or will dive in conditions that are new to them.
   c. Discovering new aspects of a dive site they have visited, but never fully explored.
   d. Combining Discover Local Diving with Scuba Review to get back in the water.
2. Discover Local Diving can take place at any dive site used by recreational divers, and can focus on a wide variety of different aspects of the dive site. You should customize the experience based on what participants want to learn about and see.

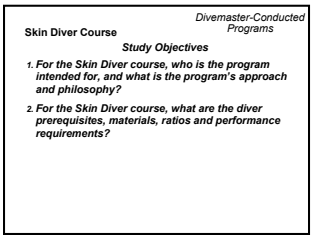
B. For the PADI Discover Local Diving program, what are the diver prerequisites, material, ratio and general considerations?

[**NOTE:** Have candidates refer to the PADI *Instructor Manual* – Discover Local Diving Instructor Guide and review the standards. Also, have them refer to their Divemaster Slates.]

1. As listed in the Discover Local Diving Instructor Guide, a diver needs to be at least 10 years old and a certified diver to participate.
   a. If you have young divers in the group, be sure to reference the Diver Age Restrictions – Key Standards in the General Standards and Procedures Guide for depth maximums and the need to dive with an adult.
2. You must have the diver complete a Certified Diver Experience Programs Liability Release and Assumption Of Risk Agreement (product number 10074). You can download the most current form from padi.com/Pros' Site.
3. Because there is no "training" involved, you decide how many divers you take on the dive based on factors including diver comfort, experience, age, environmental conditions and logistics.
   a. Remember that diver safety is the primary consideration.

b. Divers also need to have an enjoyable experience.

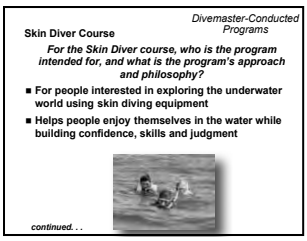
4. The general considerations as listed in your Discover Local Diving Instructor Guide include a briefing, guided tour, debriefing and logging the dive.
   a. Guidelines for conducting the program are listed on your Divemaster Slates for easy reference at the dive site.

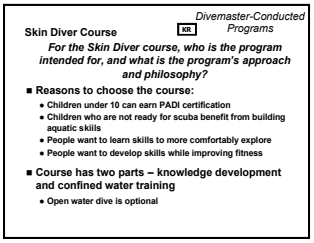


IV. Skin Diver Course

A. For the Skin Diver course, who is the program intended for and what is the program's approach and philosophy?

1. The PADI Skin Diver course is for people who are interested in exploring the underwater world using skin diving equipment – this includes both scuba divers and nondivers.
2. The course helps people enjoy themselves in the water while building confidence in skills and developing good judgment about the dive environment.
3. There are several reasons that individuals may choose this course, including:
   a. Children under 10 years old who don't meet the minimum age for a scuba course but want to earn a PADI certification.
   b. Children who are not ready to be scuba divers, yet could benefit from building their aquatic skills.
   c. People who want to learn basic skin diving skills to more comfortably explore the underwater world.
   d. People who want to better develop their skin diving skills while improving their stamina and physical fitness.
4. The PADI Skin Diver course consists of two parts — knowledge development and confined water training. An open water dive is optional.

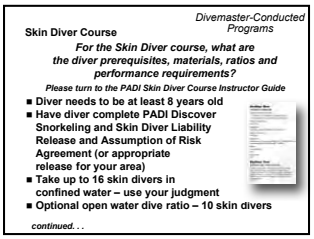




B. For the PADI Skin Diver course, what are the diver prerequisites, material, ratios and performance requirements?

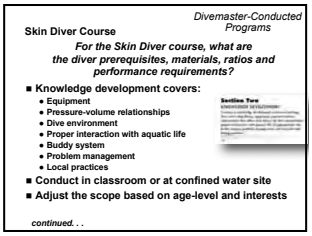
[**NOTE:** Have candidates refer to the PADI *Instructor Manual* – Skin Diver Course Instructor Guide and review the standards. Also, have them refer to their Divemaster Slates.]

1. As listed in the Skin Diver Course Instructor Guide, a diver needs to be at least 8 years old to participate.
2. You must have the diver complete a PADI Discover Snorkeling and Skin Diver Liability Release and Assumption of Risk Agreement (product number 10089). You can download the most current form from padi.com/Pros' Site.
3. You may take up to 16 skin divers into confined water for skills practice and assessment. Remember that this is the maximum



number and you should use your judgment which may mean choosing to take fewer divers for better control, especially if children are participating.

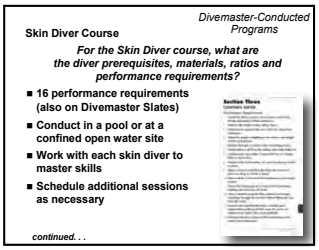
a. If you conduct the optional open water dive, the ratio is lowered to 10 skin divers or fewer.



4. In Section Two of the instructor guide, you see that knowledge development covers information on equipment, pressure-volume relationships that affect skin divers, the dive environment, proper interaction with aquatic life, the buddy system, problem management and local safe skin diving practices.

   a. You can conduct knowledge development in a classroom or choose to do a complete briefing at the confined water site.

   b. Adjust the scope of this information based on the age level and interests of the skin diving students.

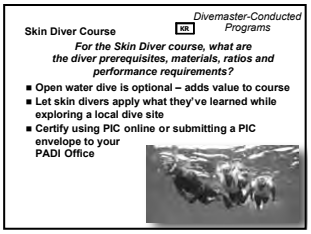


5. In Section Three of the instructor guide, the 16 confined water performance requirements are listed. The skills are also listed on your Divemaster Slates.

   a. This session may take place in a pool or confined open water site.

   b. Work with each skin diver to master skills and meet the performance requirements.

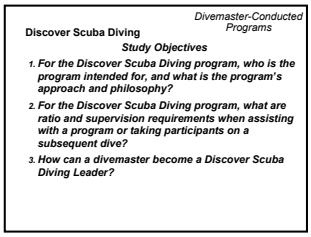
   c. Schedule additional sessions as necessary for diver mastery and to build confidence.



6. Although the open water dive is optional, it adds value to the course. Conduct it whenever possible to let student divers apply what they've learned while they explore a local dive site under your supervision.

7. You certify PADI Skin Divers who have met all performance requirements by using PIC online or submitting a PIC envelope to your PADI Office.

[NOTE: Show candidates an PIC envelope and discuss how to complete it. If possible, show candidates how PIC online works.]



V. Discover Scuba Diving

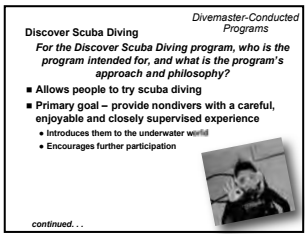
A. For the PADI Discover Scuba Diving program, who is the program intended for and what is the program's approach and philosophy?

1. Discover Scuba Diving allows people to try scuba diving in a pool or confined open water site, or go on an open water dive.

2. The primary goal is to provide nondivers with a careful, enjoyable and closely supervised experience that introduces them to the joys of diving and the underwater world, while encouraging further participation.

3. Discover Scuba Diving introduces scuba diving in a way that:

   a. Makes it convenient to try diving.



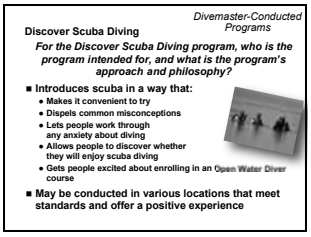
b. Dispels common misconceptions by letting people experience how easy diving can be.

c. Lets people work through any anxiety about diving in a controlled environment.

d. Allows people to discover whether they will really enjoy scuba diving.

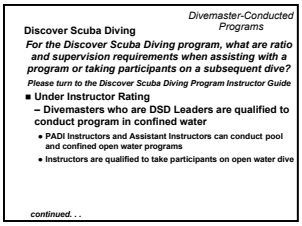
e. Gets people excited about enrolling in an Open Water Diver course.

4. Discover Scuba Diving may be conducted at various locations that meet PADI Standards and offer participants a positive and enjoyable diving experience.

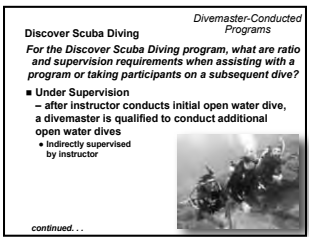


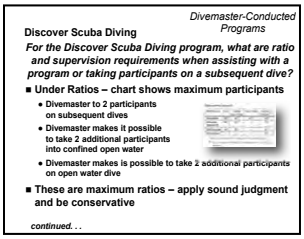
B. For the PADI Discover Scuba Diving program, what are ratio and supervision requirements when assisting with a program or taking participants on a subsequent dive?

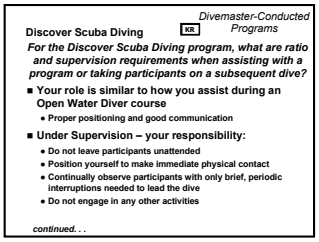
[NOTE: Have candidates refer to the PADI *Instructor Manual* – Discover Scuba Diving Program Instructor Guide and review the standards.**]**



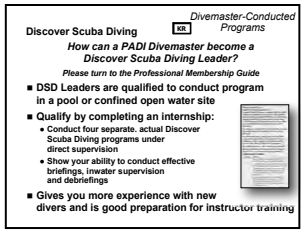
1. As listed under Instructor Rating in the Discover Scuba Diving Program Instructor Guide, PADI Divemasters who are qualified DSD Leaders may conduct the program in confined water – either a pool or confined open water site.
   a. This also means that PADI Instructors and Assistant Instructors can conduct pool or confined open water programs.
   b. PADI Instructors may take participants on an open water dive.
2. If you look under Supervision, it explains that after an instructor conducts an initial open water dive with participants, a divemaster may take them on additional open water dives. An instructors must indirectly supervise any additional dives conducted by a divemaster.
3. Under Ratios there is a Participant-to-Instructor chart that shows the maximum number of participants allowed in either a pool confined water or open water with various supervision.
   a. As a divemaster, you are authorized to take two participants on a subsequent dive (under an instructor's indirect supervision, as mentioned.)
   b. As a divemaster (acting as a certified assistant,) you make it possible for an instructor or assistant instructor to take two additional participants into confined open water.
   c. You also make it possible for an instructor to take two additional participants on an open water dive.
   d. Keep in mind that these are maximum ratios, and as noted in your manual, you must apply continuous and sound judgment before, during and after the dive, and make adjustments to reduce risk.







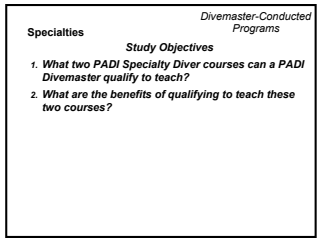
4. Your role during a Discover Scuba Diving program is very similar to how you assist an instructor during an Open Water Diver course. Proper positioning and good communication with the instructor are critical for control.
5. Note that under Supervision, standards clearly outline your responsibility to:
   a. Not leave participants unattended, either at the surface or underwater.
   b. Position yourself so that you can make immediate physical contact with, adjust buoyancy for, and render assistance to, participants.
   c. Continually observe participants with only the brief, periodic interruptions needed to lead the dive and to provide assistance to individual divers.
   d. Not engage in any other activities, such as taking photographs or video, while supervising participants.
6. You will participate in two Discover Scuba Diving program workshops to give you practice supervising novice divers and dealing with any problems that occur.



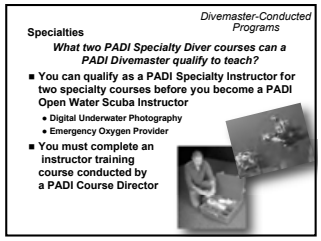
C. How can a PADI Divemaster become a Discover Scuba Diving Leader?

[NOTE: Have candidates refer to the PADI *Instructor Manual* – Professional Membership Guide, Discover Scuba Diving Leader Internship Requirements]

1. As mentioned, divemasters who are DSD Leaders are authorized to conduct the program in a pool or confined open water.
2. After certification as a PADI Divemaster, you qualify as a DSD Leader by completing an internship that includes:
   a. Conducting four separate real (not simulated) PADI Discover Scuba Diving programs in confined water under the direct supervision of a PADI Instructor.
   b. Showing your ability to conduct effective briefings, inwater supervision and debriefings.
3. Becoming a DSD Leader gives you more experience with new divers and is good preparation for instructor training.



VI. Specialties



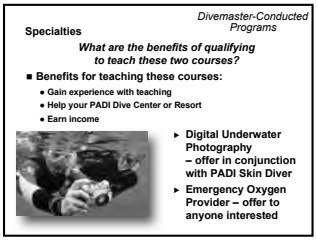
A. What two PADI Specialty Diver courses can a PADI Divemaster qualify to teach?

1. As a PADI Divemaster, you can qualify as a PADI Specialty Instructor to teach two popular specialty courses before you become a PADI Open Water Scuba Instructor.
   a. The first is the PADI Digital Underwater Photographer course.

b. The second is PADI Emergency Oxygen Provider course.

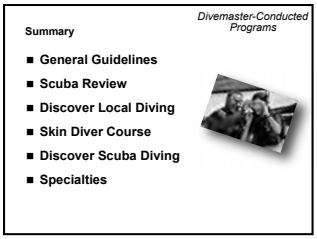
2. To qualify, you must complete the respective instructor training course conducted by a PADI Course Director. After you complete your PADI Divemaster course, look for an instructor training course for either or both of these programs.

B. What are the benefits of qualifying to teach these two courses?



1. There are several benefits to qualifying to teach these courses:
   a. Teaching these courses is a great way to begin gaining experience with teaching that will help you later as a PADI Open Water Instructor.
   b. The ability to teach these courses helps the PADI Dive Center or Resort through which you operate by allowing them to offer the programs without tying up the instructor schedules.
   c. Offering the programs earns you income.
2. Specific to digital underwater photography – you can offer this course in conjunction with a PADI Skin Diver course because skin divers and snorkelers can earn this certification.
3. Specific to emergency oxygen provider – since this is a nondiving course with no scuba certification prerequisite, you can offer this course to anyone interested in learning how to provide emergency oxygen.

Summary



I. General Guidelines

II. Scuba Review

III. Discover Local Diving

IV. Skin Diver Course

V. Discover Scuba Diving

VI. Specialties

Specialized Skills and Activities

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NOTES:

1. Use this presentation when divemaster candidates have not completed independent study through Divemaster Online, or by reading Chapter 6 of the PADI *Divemaster Manual*. You may also use this presentation for prescriptive remediation while reviewing the Chapter 6 Knowledge Review with candidates.

2. This presentation goes over equipment and procedures for specialized diving activities as well as a divemaster's role in supervising these activities and assisting with specialty diver courses.

Overview

I. Floats, Marker Buoys and Signaling Devices

- **How do you set a dive float?**
- **What is the purpose of surface marker buoys and how do you properly use the various types?**
- **As a divemaster, what signaling and safety devices should you carry and know how to use?**

II. Mapping

- **What are the general steps for mapping a dive site, and what elements do you include in a dive site map?**

III. Search and Recovery

- **What are five general steps in planning a search and recovery dive?**
- **What general considerations should you take into account when using search patterns?**
- **What is the procedure for lifting an object to the surface with a lift bag?**

IV. Deep Diving

- **What steps should you take to plan and prepare for a deep dive?**
- **What factors should you take into account when supervising a deep dive?**
- **What are the procedures for preventing or dealing with gas narcosis, low-on or out-of-air emergencies and decompression illness?**

V. Dive Activities

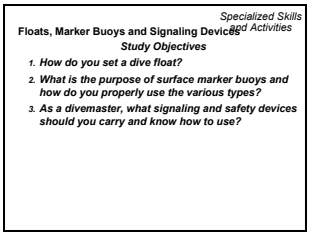
- **What general equipment, concerns and procedures apply when supervising each of the following activities — boat diving, altitude diving, drift diving, surf diving, night diving, cold water diving, enriched air diving and technical diving?**

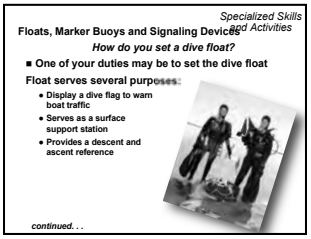
Outline

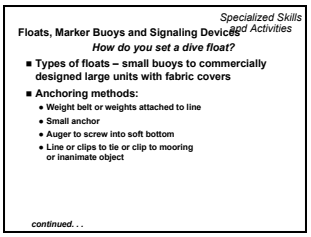
I. Floats, Marker Buoys and Signaling Devices

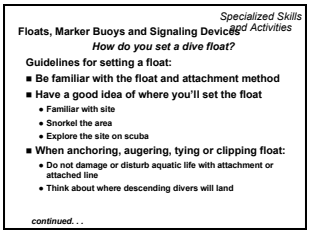
A. How do you set a dive float?

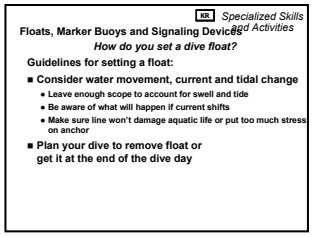
1. One of your duties as a dive supervisor or instructional assistant may be to set the dive float for the group. Setting the float serves several purposes:
   a. It allows you to attach and display a dive flag to warn boat traffic away from the area. In many places, the law requires you to display a dive flag when diving.
   b. It serves as a surface support station before descending and after surfacing.
   c. The float line provides a descent and ascent reference, which is often required in teaching situations.
2. There are many different types of floats ranging from small buoys to commercially designed large units with fabric covers. There are also different anchoring methods including:
   a. A weight belt or weights attached to the float line.
   b. A small anchor
   c. An auger designed to be screwed into a soft bottom, such as sand.
   d. Line or clips to be tied or clipped to a mooring or inanimate object.
3. No matter what type of float you need to set, here are a few guidelines to follow:
   a. First, be familiar with the float and attachment method before getting in the water.
   b. Have a good idea of where you will set the float before you get in the water.
      - If you're familiar with the dive site, you probably already know the ideal spot.
      - If the water is clear enough for you to see the bottom, you may find a good spot as you snorkel the area.
      - If you're not familiar with the site and can't easily pick a spot while snorkeling, one option is to explore the site on scuba to find an appropriate location.
   c. When anchoring, augering, tying or clipping the float to the bottom, do not damage or disturb any aquatic life – either with the attachment or with the attached line.
      - For example, you may find a small sand patch to place the anchor, but if the line is likely to brush up against the surrounding coral, then it is not a good spot.





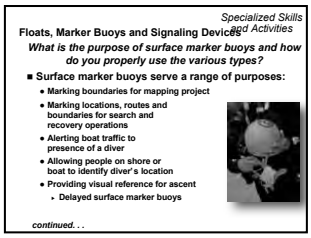






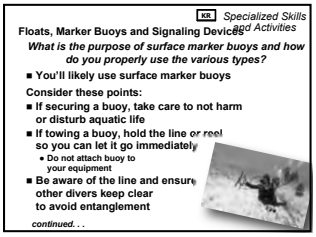
d. Consider how water movement, currents or tidal changes will affect the float.
   - Leave enough scope in the float line to account for the swell or rising tide.
   - Be aware of what will happen if the current shifts. Make sure the line won't damage aquatic life or put too much stress on the anchor point so that it dislodges.

e. Plan your dive so that you can remove the float at the end of the dive or be prepared to get it at the end of the dive day.



B. What is the purpose of surface marker buoys and how do you properly use the various types?

1. Surface marker buoys serve a range of purposes including:
   a. Marking boundaries for your mapping project, as previously discussed. They are also used for search and recovery operations to mark locations, routes or boundaries.
   b. Similar to a dive float alerting boat traffic to the presence of a diver. Surface marker buoys are important and often required in areas with heavy boat traffic, or where divers may be drifting in a current.
   c. Allowing people on shore or on a boat to identify the divers' location. For example, an instructor asks buddy teams to tow a surface marker buoy during the Underwater Navigation Specialty course to allow monitoring exercises from the surface.
   d. Providing a visual reference for ascending divers. In some areas, divers launch a marker buoy during the dive to use as an ascent line and to complete safety stops. These are referred to as delayed surface marker buoys.
2. As a divemaster, you'll likely use a surface marker buoy for most of the purposes just discussed. To properly use surface marker buoys, consider these points:
   a. If securing a buoy to mark a specific location, such as when mapping a dive site, take care to not harm or disturb bottom dwelling aquatic life, similar to the way you set a dive float.
   b. If towing a marker buoy during a dive, such as a drift dive, hold on to the line or reel so that you can let go immediately if necessary. Do not attach the buoy to your equipment.
   c. Anytime a surface marker buoy is used, be aware of the line and ensure that other divers keep clear to avoid line entanglement.
3. If using a delayed surface marker buoy, note that protocols vary and you need to be aware of any local practices. For example, the color of the buoy may have a specific meaning in a different area, such as one color for emergencies. In other areas, two buoys together signals a request for help. In general, follow these guidelines:



a. Prepare the buoy in advance making sure it is properly attached to the clip on the reel.

b. When launching, check for objects or divers above you, keep the line tight and away from your equipment and then inflate the buoy carefully, either orally, using a second stage or using an accessory inflator system as specified by the manufacturer.

c. Once the buoy is on the surface, keep the line taut, which keeps the buoy upright and increases its visibility.

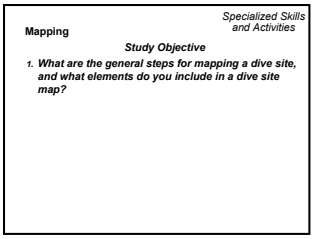
C. As a divemaster, what signaling and safety devices should you carry and know how to use?

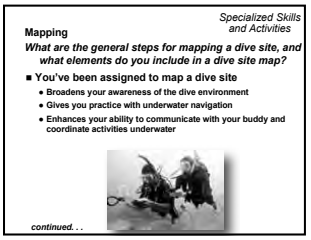
[**NOTE:** Have candidates refer to the PADI *Instructor Manual* – General Standards and Procedures Guide and review the equipment requirements.]

1. In your PADI *Instructor Manual* – General Standards and Procedures, under Equipment, Standard Instructor and Certified Assistant Equipment – you'll see that as a certified assistant, you need to carry two surface signaling devices – one audible and one visual.
   a. Audible devices like whistles or air horns can be easily heard to gain attention on the surface. You should make sure your audible device is easily accessible on your equipment should you ever need to use it.
   b. Visual signaling devices like signal mirrors, surface marker buoys, inflatable signal tubes and emergency strobes are important because they make you much more visible and easy to spot on the surface. Again, your device should be accessible and you should be proficient using it.
2. If you work on a dive boat, you should be familiar with the location and operation of safety equipment onboard, which may include personal flotation devices, fire extinguishers, signal devices (horns, lights, flares, EPIRBs), life rings, marine radio, emergency oxygen, first aid kit, etc.

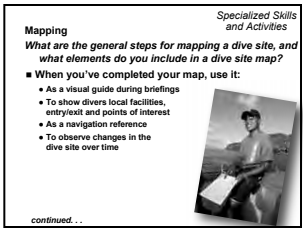
II. Mapping

A. What are the general steps for mapping a dive site, and what elements do you include in a dive site map?

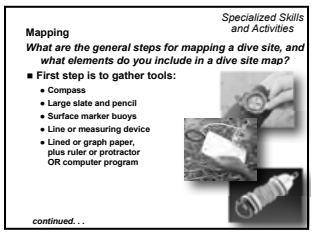




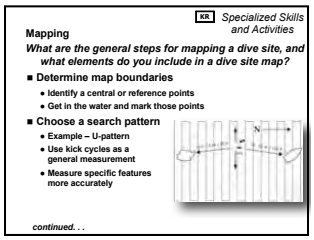
1. For this course, you've been assigned to map a dive site for several reasons. The process of mapping:
   a. Broadens your awareness of the dive environment by having you focus on details.
   b. Gives you practice with underwater navigation.
   c. Enhances your ability to communicate with your buddy and coordinate your activities underwater.



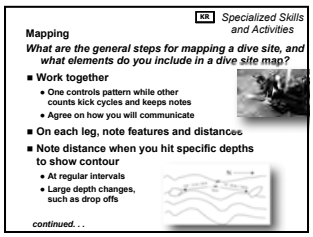
2. When you've completed your dive site map, you can use it:
   a. As a visual guide during briefings.
   b. To show divers local facilities, entry and exit points, and points of interest to aid their dive planning.
   c. As a navigation reference when leading dive tours.
   d. As a reference to observe changes in the dive site over time.



3. The first step in mapping a dive site is to gather the tools you'll use including:
   a. An underwater compass for navigation.
   b. A large slate (or several slates) and a pencil to record dive site features.
   c. Surface marker buoys with lines and weights to define the map area or mark specific reference points.
   d. A line or measuring device to check distances.
   e. Lined or graph paper and a ruler or protractor to accurately draw your final map, or a computer program that allows you to create and print out your map.



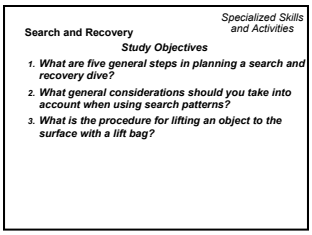
4. The next step is to determine the map boundaries and identify a central point or reference points that you'll use to gather data. Then, get in the water and mark those points with your surface marker buoys.
5. Next, choose a search pattern that allows you to cover the map area while using your reference points. For example, a U-pattern starting at a central or corner reference point.
   a. You may need to use several sets of patterns to cover the whole area.
   b. You can use kick cycles as a general measurement, but may want to measure specific features more accurately with a measuring device.



6. You and your buddy need to work together effectively as you swim the search pattern.
   a. One technique is to have one person control the pattern while the other person counts kick cycles and keep notes.
   b. Agree on how you will communicate and coordinate your activities.
7. On each leg of your pattern, note the features and distance when you find those features. Depending on your dive site, you may want to go back after your initial survey and determine the distance between key features.
8. On each leg, also note the distance when you hit specified depths to show contour, or record the depth at regular intervals – for example,

every 3 metres/10 feet along the leg. Be sure to note large depth changes, such as a sharp drop-off, as a feature on the map.

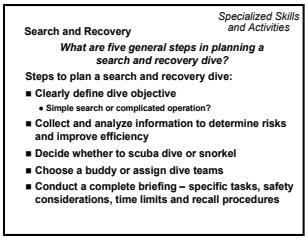
9. When you've gathered all the data you need from the dive site – keep in mind that this may take several dives – you are ready to create your map.
   a. If drawing the map, you may want to transfer your data to lined or graph paper first to keep heading angles, feature placement and depth contours accurate. Then finish the map by copying it to another sheet while you fine-tune the details.
   b. If using a computer program, use available tools such as background grids and layers to keep the data accurate as well as add details to create a useful map.
   c. Be sure to fill in the shoreline, facilities and topside features.
10. There are many other ways to map using technology and additional tools. Use the method and tools that best fit your environment and the time you have available to make your map.



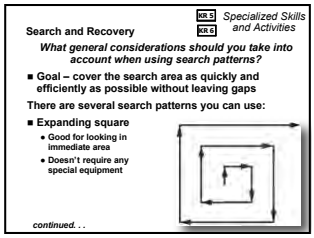
III. Search and Recovery

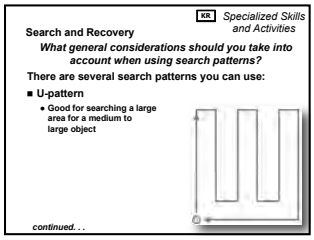
A. What are five general steps in planning a search and recovery dive?

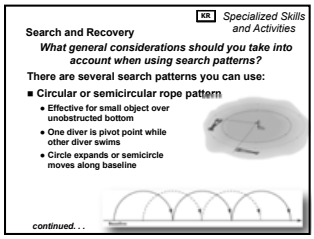
1. As a dive professional, you will occasionally be involved in search and recovery operations.
   a. Most often, you will be asked to help search for a dropped piece of dive equipment.
   b. If you're ever at a dive site when a diver is missing, you may be asked to be part of or lead the search effort.
2. To be prepared, you need to be know how to plan and execute a search and recovery dive. If you're already certified as a Search and Recovery Diver, this will be a review. If not, consider earning this certification.
3. Follow these steps to plan a search and recovery dive:
   a. Make sure the dive objective is clearly defined. This will help you figure out the scope of the search – whether it's a simple search or a complicated operation that may require several dives.
   b. Collect and analyze all available information to determine possible risks and improve search efficiency. Find out as much as possible about the object – its description and possible location, etc.
   c. Decide whether it's better to scuba dive or snorkel to search for the object.
   d. Choose a dive buddy or assign dive teams. It's best to use certified Search and Recover Divers, in all cases ensure that dive teams have a clear search strategy and work together.

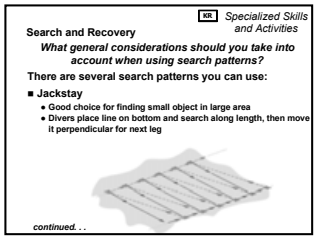


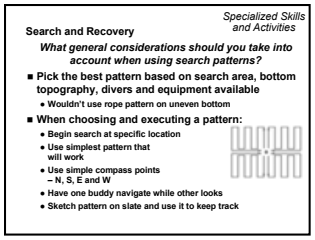
e. Conduct a complete briefing so that divers understand their specific tasks – include safety considerations and time limits after which everyone should surface. If possible, have a way to recall teams that are still out searching when someone finds the object, or in case of an emergency.





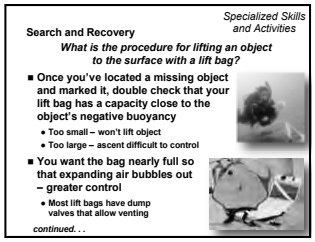






B. What general considerations should you take into account when using search patterns?

1. There are several search pattern you can use including the:
   a. Expanding square, which is good for looking for something lost in the immediate area because you start at the best guess of where the object is and continue expanding outward. It's quick to start and doesn't require any special equipment
   b. U-pattern, as discussed in the section on mapping, is good for searching a relatively large area for a medium to large object.
   c. Circular or semicircular rope pattern is effective for smaller objects over unobstructed bottom. By using a line, one diver acts as the center point while the other diver swims a circle or semicircle looking at the bottom. The circle expands after each pass or semicircle moves along a baseline.
   d. Jackstay is a good choice for finding a small object in a large area. Basically, divers place a line on the bottom and search along its length, then move it perpendicular a given distance for the next leg.
2. You need to pick the best patterns based on the search area, visibility and bottom topography as well as the divers and equipment you have available. For example, you wouldn't use a rope pattern if the bottom is very uneven or you don't have enough rope.
3. When choosing and then executing a search pattern, keep the following points in mind:
   a. Begin the search pattern at a specific location within the established search area.
   b. Use the simplest search pattern that will work.
   c. When using compass-based search patterns, use the compass points – N, S, E and W – to simplify search headings.
   d. It's often most effective if one buddy navigates the pattern while the other looks for the object.
   e. Sketch the pattern on a slate and use it to keep track of your position. Also note significant features while swimming.

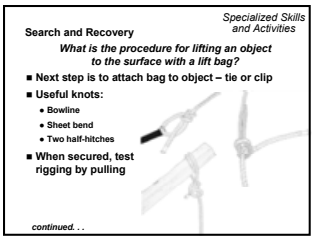


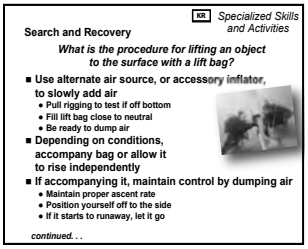
C. What is the procedure for lifting an object to the surface with a lift bag?

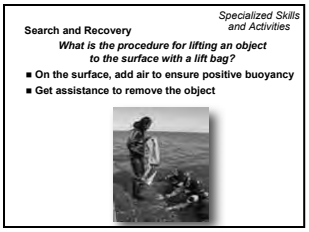
1. Once you've located a missing object and marked it, you want to double check that your lift bag has a lifting capacity as close to the object's negative buoyancy as possible.

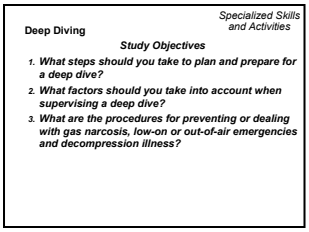
a. If the bag is too small, you won't get the object off the bottom.
b. If the bag is too large, the air inside will continue to expand on the way up, which makes the ascent difficult to control and could result in a runaway ascent.
c. You want the bag to be nearly full when it offsets the object's negative buoyancy, so that expanding air bubbles out during ascent – allowing greater control.
d. Many lift bags have dump valves that allow air to be vented during ascent.

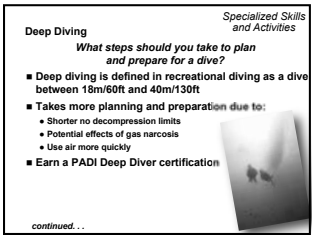
2. The next step is to attach the bag to the object. Depending on your lift bag, you may need to tie it to the object or use clips to secure it.
   a. A few useful knots you should be able to tie are the bowline, the sheet bend, and two half-hitches.
   b. When the bag is secured to the object by knots or clips, always test your rigging by tugging on it prior to attempting a lift.
3. Use your alternate air source, or accessory inflator, to slowly add air to the lift bag.
   a. Inflate the lift bag a little at a time while pulling on the rigging to test if the object is coming off the bottom.
   b. Fill the lift bag with enough air so that it's close to neutral at the bottom before beginning the ascent.
   c. Be ready to dump air if needed.
4. Depending on conditions and the situation, you may accompany the lift bag to the surface or allow it to rise independently.
   a. If accompanying it to the surface, maintain control of the lift bag by periodically dumping air from the bag, as necessary. Maintain a proper ascent rate.
   b. Position yourself off to the side – not under the object – just in case it comes loose during the ascent.
   c. If it starts to runaway from you, let it go.
5. On the surface, if necessary, add air to the lift bag to ensure positive buoyancy. Get assistance to remove the object from the water, if appropriate.









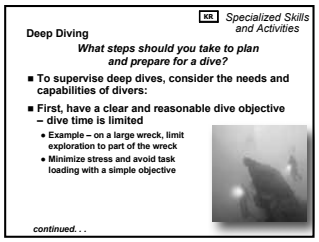


IV. Deep Diving

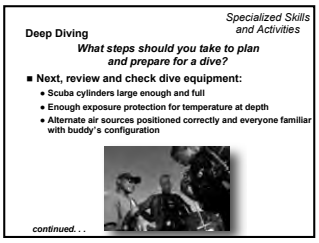
A. What steps should you take to plan and prepare for a deep dive?

1. From your training thus far, you know that a deep dive is defined in recreational diving as a dive between 18 metres/60 feet and 40 metres/130 feet.
   a. You also know that deep diving takes a little more planning and preparation due to shorter no decompression limits, potential affects of gas narcosis and the fact that you use air more quickly at depth.

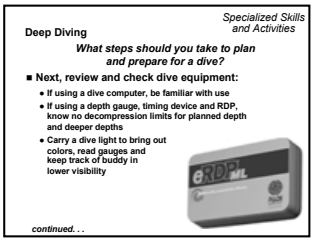
b. If you're already certified as a Deep Diver, you've already learned a lot about preparing for a deep dive. If not, consider earning this certification.



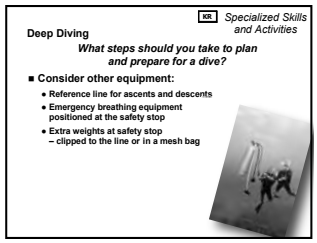
2. If you're going to supervise a deep dive, consider the needs and capabilities of other divers in your preparation and planning.
3. The first consideration is to have a clear and reasonable dive objective, because your dive time is limited.
   a. For example, if diving on a large wreck, you may want to limit exploration to just part of the wreck instead of rushing to try to see the whole thing on one dive.
   b. The goal is to minimize stress and avoid task loading by having a simple and often singular objective.



4. Next, you should review and check dive equipment to be sure it's appropriate for deep diving and in good condition. Specifically pay attention to:
   a. Scuba cylinders should be of large enough capacity for the planned dive and be full.
   b. Divers should have enough exposure protection for the cooler water temperature anticipated at depth.
   c. Check that divers have alternate air sources positioned correctly and that everyone is familiar with their buddy's alternate air source configuration.



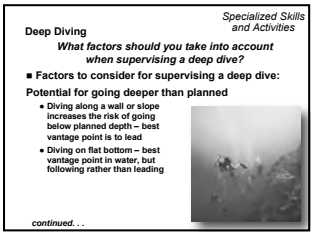
   d. If divers are using dive computers to plan and monitor the deep dive, make sure they are familiar with computer use.
   e. If divers are using a depth gauge and timing device along with an RDP (table or eRDPML), make sure they know the no decompression limit not only for the planned depth, but deeper depths should they accidentally go deeper than planned.
   f. Encourage each diver to carry a dive light to bring out colors at depth or to peer into cracks and holes. A light also helps with reading gauges and keeping track of your buddy in low visibility.



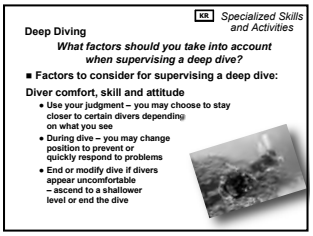
5. In preparing for a deep dive, you should also consider other equipment that will make the dive easier and add to safety, such as:
   a. A reference line for ascents and descents allows better control and makes it easier to keep the group together.
   b. If possible at your dive site, it's a good idea to have emergency breathing equipment positioned at a safety stop, just in case a diver is getting low on air. You can suspend a cylinder and regulator at 5 metres/15 feet next to the reference line.
   c. You may also want to have a few extra weights available at the safety stop to help divers who may be a little buoyant comfortably complete the stop. Leave extra weights clipped to a line or in a mesh bag secured at 5 metres/15 feet.

B. What factors should you take into account when supervising a deep dive?

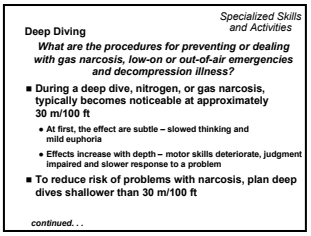
1. As you've learned, anytime you supervise a dive you want proper preparation (as just discussed,) clear communications, a good vantage point and the ability to identify, prevent, correct or respond to problems.
2. Factors you should consider when deciding how best to supervise a deep dive include:
   a. How experienced divers are with deep diving and what information and guidance they need.
      - For divers with less experience, your might provide more information about descent and ascent techniques, frequent monitoring of depth, time and air supply, watching for narcosis, safety stop procedures, etc.
      - For more experienced divers, you may only need to remind divers of key safety points.
      - No matter what the divers' experience levels, be sure to remind divers to have contingency plans for accidentally exceeding planned depth and time.



   b. Potential for going deeper than planned.
      - Diving along a wall or slope increases the risk of going below the planned depth. You may decide that your best vantage point is to lead the dive so that you can monitor depth and remind divers to watch their air supply.
      - If diving on a flat bottom, you may still decide that your best vantage point is in the water, but perhaps you follow rather than leading the dive. You are still close enough to remind divers to watch their air supply.

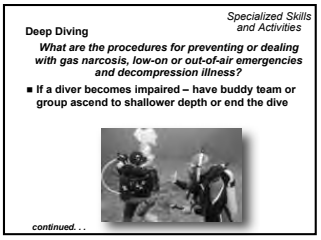


   c. Diver comfort, skill and attitude.
      - You need to use your judgment before the dive to determine how comfortable divers appear along with their attitude towards following safe diving practices. You may choose to stay closer to certain divers during the dive depending on what you see.
      - During the dive, you also need to determine how comfortable divers appear – if they are controlling their buoyancy and monitoring their gauges. You may choose to change your position underwater to be closer to certain divers to prevent or quickly respond to problems.
      - Use good judgment in ending or modifying the dive if divers appear uncomfortable. At many dive sites, you can ascend 10 metres/30 feet to a shallower level and continue the dive, which may turn a stressful dive into a fun one. If not, end the dive

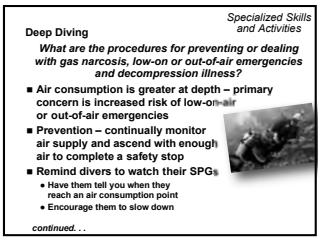


C. What are the procedures for preventing or dealing with gas narcosis, low-on or out-of-air emergencies and decompression illness?

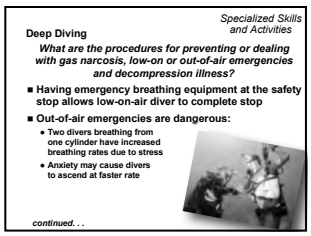
1. During a deep dive is when divers are most likely to encounter nitrogen, or more properly, gas narcosis. Although it differs between individuals, the effects typically become noticeable at approximately 30 metres/100 feet.
   a. At first, the effects are subtle – slowed thinking and for some, a mild sense of euphoria or well being.
   b. The effects increase with depth – motor skills deteriorate, judgment is impaired and slower thinking delays response to a problem.
2. To reduce problems with gas narcosis while diving, plan deep dives to be shallower than 30 metres/100 feet. If this is not possible based on the dive objective, plan multilevel dives with minimal time at or below 30 metres/100 feet.



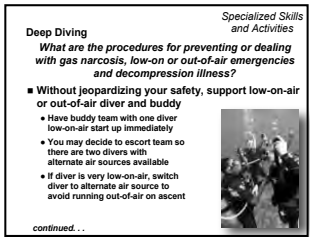
3. If it appears that a diver you are supervising is being impaired by gas narcosis, have the buddy team or group ascend to a shallower depth or if necessary, end the dive and ascend to the safety stop.
4. Because air consumption is greater at depth, there is a risk of low-on-air situations or worse, out-of-air emergencies.
   a. The obvious prevention is to continually monitor air supply and ascend with enough air to easily complete a safety stop.
   b. As a dive supervisor, remind divers to watch their submersible pressure gauges. If appropriate, have divers tell you when they reach an air consumption point, such as half way, so that you can help them get back to the ascent line in plenty of time.
   c. Also, encourage divers to slow down to avoid using even more air due to overexertion.



5. As discussed, having emergency breathing equipment positioned at a safety stop allows a low-on-air diver to complete the stop.
6. An out-of-air emergency is particularly concerning on a deep dive because:
   a. Two divers are breathing from one cylinder as they ascend from depth and likely have increased breathing rates due to stress.
   b. Anxiety may also cause the divers to ascend at a faster rate.



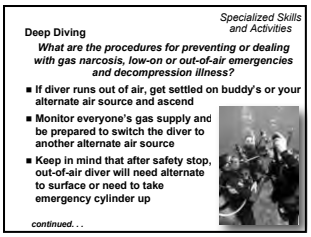
7. Without jeopardizing your safety, do your best to support a low-on-air or out-of-air diver and buddy as they ascend and encourage a normal ascent rate.
   a. It's best to have a buddy team where one diver is low-on-air start up immediately, even if not as close to the exit point as desired.
      • Depending upon the circumstances, you may decide to escort the team so there are two divers with alternate air sources available to share should the low-air diver need it.



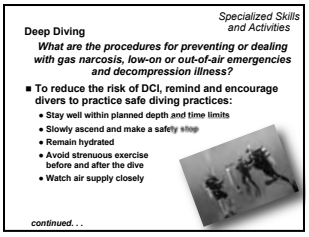
- If the diver is very low-on-air, a prudent measure may be to switch the diver to an alternate air source, which helps the diver avoid running out-of-air during the ascent.

b. If a diver runs out of air, get the diver settled on the buddy's or your alternate air source and start ascending without delay, encouraging a proper ascent rate.
   - Monitor gas supply on the way to the surface, and be prepared to switch the out-of-air diver to another alternate air source to avoid emptying the first cylinder – creating another out-of-air situation.

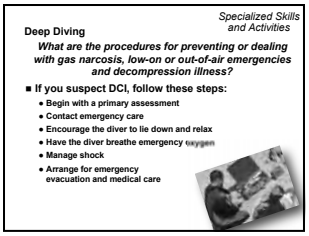
c. Keep in mind that after reaching the emergency cylinder at 5 metres/15 feet for a safety stop, the out-of-air diver will need an alternate to surface, or will need to take the emergency cylinder up.



8. To reduce the risk of decompression illness, remind and encourage divers to practice safe diving practices and conservative behavior, including:
   a. Stay well within their planned depth and time limits.
   b. Slowly ascend and make a safety stop for at least 3 minutes at 5 metres/15 feet.
   c. Remain hydrated.
   d. Avoid strenuous exercise before and immediately after a dive.
   e. Watch their air supply closely to avoid emergency ascent situations.

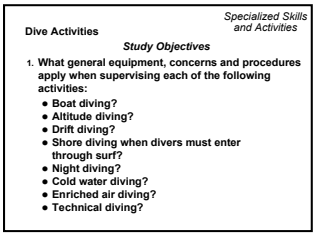


9. If you suspect that a diver has decompression illness following a deep dive, follow these steps:
   a. Begin with a primary assessment. Contact emergency care.
   b. Encourage the diver to lie down and relax.
   c. Have the diver breathe emergency oxygen.
   d. Manage shock.
   e. Arrange for emergency evacuation and medical care.

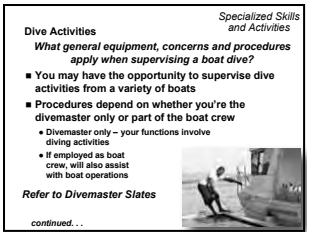


V. Dive Activities

A. What general equipment, concerns and procedures apply when supervising a boat dive?



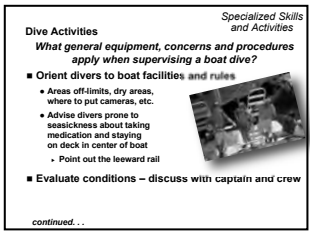
1. As a divemaster, you may have the opportunity to supervise dive activities from a variety of boats ranging from a small inflatable to a large liveaboard on a multiday dive trip.
   a. What procedures you'll handle may depend upon whether you're the divemaster only, or whether you're also part of the boat crew.
   b. If leading a group as a divemaster only, your function involves the diving activities.



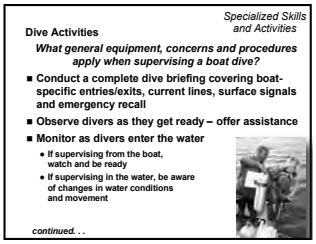
c. If you're employed by the dive boat, you're usually considered crew and will assist with boat operations, you're usually considered crew as well as a divemaster.

2. Regardless of the boat, you should be familiar with the location of this equipment:
   a. Lines used to guide divers in the water and those used to moor or anchor the boat.
   b. The boat safety equipment including personal flotation devices, fire extinguishers, life rings, signal devices and communication devices, etc.
   c. Dive safety equipment including dive flags, emergency oxygen and first aid kit, etc.

3. When divers arrive for the boat dive, make sure to take care of administrative paperwork as the first step.
   a. Have divers sign a liability release and write their name on a roster along with listing certification information.
   b. Having a dive roster makes it possible to check that everyone is onboard before departing and is important for calling roll, or for small groups, visually confirming that each diver is back aboard, after each dive.
4. Help divers stow or set up equipment depending on procedures for the boat.
   a. Space is usually limited on boats, so it's important to remind divers to keep their equipment organized during the trip.
   b. Remind them to work in and out of gear bags to reduce deck clutter.



5. Orient divers to boat facilities and rules.
   a. For example which areas are off-limits; dry areas; where they can put cameras; time to the dive destination, etc.
   b. Also advise divers prone to seasickness to take seasickness medication prior to departure according to instructions/doctor recommendations. Advise staying on deck in the center of the boat and out of the boat's exhaust. If necessary, point out that they should vomit over the leeward rail.
6. When you arrive at the dive site, evaluate conditions. If you have questions, be sure to discuss what you observe with the captain and boat crew.



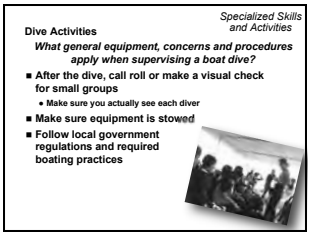
7. Conduct a complete dive briefing that also covers boat-specific entries and exits; use of swim or current lines, if any; surface signals to the boat and emergency recall procedures.
8. Observe divers as they get ready for the dive and offer assistance as necessary. Monitor as divers enter the water.

a. If supervising from the boat, watch for divers surfacing and be ready to help divers should problems occur.

b. If supervising in the water, be aware of changes in water conditions and movement, such as current.

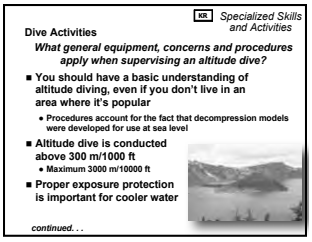
9. After the dive, call roll and make sure that you actually see each diver. Before the boat leaves the dive site, make sure equipment is stowed properly, and conduct a final visual roll call.

10. Be sure to follow all local government regulations and required boat diving practices for your area.



B. What general equipment, concerns and procedures apply when supervising an altitude dive?

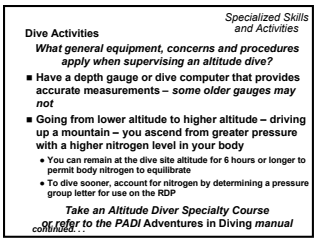
1. As a dive professional, you should have a basic understanding of altitude diving (even if you don't live in an area where altitude diving is popular), so that you can advise divers who may be traveling to an area where altitude diving is possible.



2. An altitude dive is conducted above 300 metres/1000 feet to maximum 3000 metres/10,000 feet.

3. Because altitude dives usually occur in mountainous lakes or rivers, it's important for divers to have the proper exposure protection for the cooler water. Dry suits or thick wet suits with hood, gloves and boots are most appropriate.

4. Another equipment consideration is having a depth gauge or dive computer that can provide accurate depth measurements at altitude. Most new depth gauges and computers are adjustable or adjust automatically, but be aware that older gauges may not.

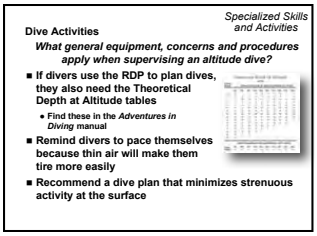


5. If you and the divers you'll supervise go from a lower altitude to a higher altitude, such as driving up a mountain to the dive site, you have effectively ascended from greater pressure and your body has a higher nitrogen level than the surrounding atmosphere. There are two ways to handle this:

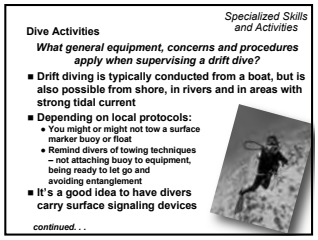
   a. The first is to remain at the dive site altitude for six hours or longer before diving to permit your body nitrogen to equilibrate with the surrounding pressure from sea level.

   b. To dive sooner than six hours, you account for the nitrogen by determining a pressure group letter for use on the RDP Table or eRDPML. To learn how to do this, take an Altitude Diver Specialty Course or refer to the PADI *Adventures in Diving* manual.

6. If some divers are using depth gauges and an RDP Table or eRDPML to plan dives, they also need to have Theoretical Depth at Altitude tables, which are used to convert depths at altitude to a depth that may be used on the RDP. You find these tables in the PADI *Adventures in Diving* manual.



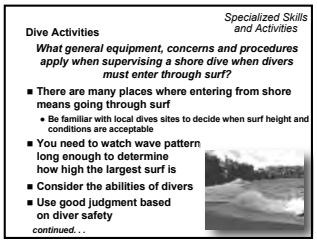
7. Remind divers to pace themselves, because the thin air will make them tire more easily during entries, exits and surface swims. Recommend a dive plan that minimizes strenuous activity at the surface.



C. What general equipment, concerns and procedures apply when supervising a drift dive?

1. Drift diving is typically conducted from a boat, but is also possible from shore in rivers and areas with strong tidal currents.
2. Depending on the dive site and local protocols, you may or may not tow a surface marker buoy or float during a drift dive, or you may have buddy teams or someone in the group tow a surface marker buoy.
   a. Remind divers of towing techniques such as not attaching the buoy to equipment and being ready to let go if necessary as well as avoiding entanglement in the line.
3. It's a good idea to have each diver carry a surface signal device.

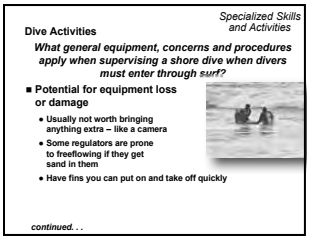
4. Before any drift dive, it's important to conduct a thorough briefing based on the specific circumstances of that dive. In general the briefing should cover:
   a. Entry techniques and descending as a group, if appropriate.
   b. Staying with a buddy or together as a group, and what to do if separated.
   c. Monitoring depth, time and air supply – especially if drifting along a wall where divers could get deeper than planned.
   d. Ascents and safety stop techniques – if the group comes up together or if buddy teams will ascend separately.
   e. Waiting on the surface and communicating with the boat, if appropriate, as well as exit techniques.
5. To gain more experience with drift diving, take a Drift Diver Specialty Course.



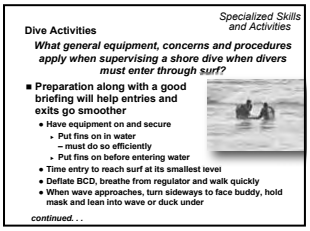
D. What general equipment, concerns and procedures apply to supervising a shore dive when divers must enter through surf?

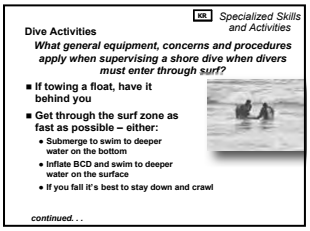
1. There are many places where entering from shore for a dive means going through surf. Being familiar with the local dive sites will help you decide when surf height and conditions are acceptable for making a dive.
   a. Keep in mind that you need to watch the wave pattern long enough to determine how high the largest surf is and when it hits.
   b. Along with evaluating conditions, you also need to consider the abilities of the divers making the dive.
   c. Use good judgment and make your decision based on diver safety.

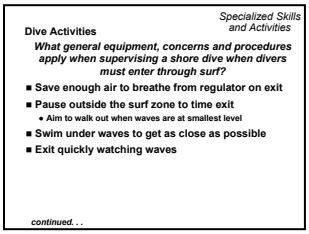
2. Keep in mind that the potential for equipment loss or damage, especially anything hand-carried, is greater if the surf is more than mild.
   a. It's usually not worth bringing anything extra along, like a camera, that you don't want to risk losing.
   b. Some regulators are prone to freeflowing if they get sand in them. If you frequently surf dive, you may want one of the more sand-tolerant models.
   c. It's also a good idea to have fins that you can put on and take off quickly to speed you through the surf zone.

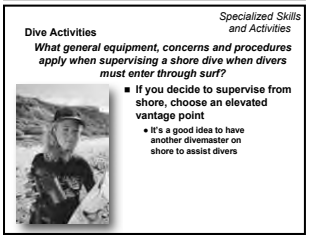


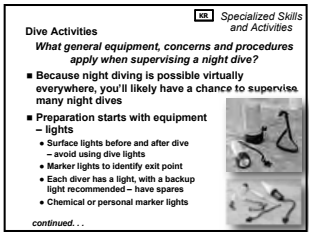
3. Preparation for the dive, along with a good briefing, will help entries and exits go smoother. During the briefing remind divers of these steps:
   a. Have all equipment on and secure (except fins, depending on entry technique) before heading for the water, so you can move quickly through the surf zone.
      - If the technique is to put fins on in the water, divers must do so efficiently, because delay increases the chance of being tumbled by a wave.
      - The alternative is to put fins on before entering the water. Divers should choose whichever method will get them through the surf zone the fastest.
   b. Time the entry to reach the surf when waves are at the smallest level in the pattern.
   c. When approaching the surf zone, deflate the BCD, breathe from the regulator and walk quickly backwards with fins on. When a wave approaches, turn sideways to face your buddy, hold the mask and lean into the waves or duck under it.
   d. If towing a float, have it behind you so that it can't get pushed into you by a wave.
   e. Get through the surf zone as fast as possible and either submerge to swim to deeper water on the bottom, or inflate the BCD and swim to deeper water on the surface. If you fall, it's generally best to stay down and swim, or crawl to deeper water.
   f. Save enough air to breathe from the regulator during the exit.
   g. When preparing to exit, pause outside the surf zone, and observe the waves to time the exit. Aim to be walking out when the waves are at the smallest level in the pattern.
   h. Swim under waves to get as close as possible to shore, then exit quickly watching waves. If you fall, it's usually easier to stay down and crawl out.
4. If you decide to supervise from shore, choose an elevated vantage point to better see over waves. It's a good idea to have another divemaster on shore ready to enter the water and assist divers, if necessary.

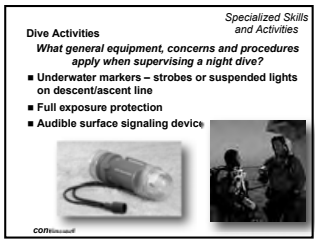


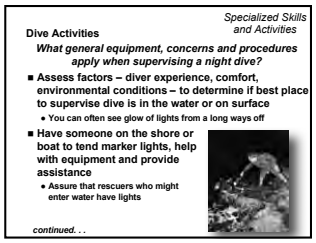


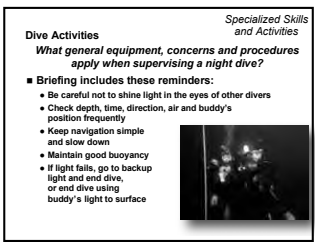












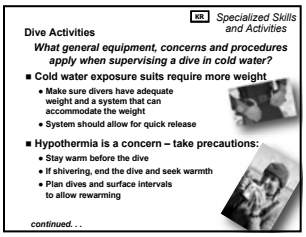
E. What general equipment, concerns and procedures apply when supervising a night dive?

1. Because night diving is possible virtually everywhere divers dive during the day, it's very likely that as a PADI Divemaster, you'll have the chance to supervise many night dives.
2. Preparation for a night dive starts with equipment – primarily lights.
   a. Make sure surface lighting is available as divers work with gear before and after the dive – for example, deck lights on the boat, a well-lit parking area, or bring along a lantern or extra lights. You want to avoid having to use dive lights for this purpose.
   b. Have marker lights to identify the exit point. Avoid anything that might be confused with navigational markers.
   c. Ensure that each diver has at least one dive light, with a backup light recommended. Have spares at hand in case a diver forgets a light, or one doesn't work.
   d. It's also a good idea to have chemical or personal marker lights for each diver.
   e. Underwater markers, such as strobes or a suspended light on a descent/ascent line, can aid navigation in reasonably clear water.
   f. Encourage divers to wear full exposure protection, even in warm water, because it's easier to bump into things in the dark.
   g. Encourage divers to have audible surface signaling devices as well as lights so they can attract attention in the dark in an emergency.
3. You need to assess all factors – for example, diver experience and comfort, environmental conditions, etc. – to determine if the best place for you to supervise the dive is in the water or from the surface.
   a. Keep in mind that you can often see the glow of dive lights from a long way off at night, making surface supervision an option.
   b. It's a good idea to have someone on the shore or boat to tend the marker lights, help with equipment, and provide assistance in case of an emergency.
   c. Assure that rescuers who might enter the water have lights and personal markers so they can be tracked in the darkness, and having ample light to handle emergency procedures.
4. As you brief the dive, include these reminders:
   a. Be careful not to shine a light in the eyes of other divers.
   b. Check depth, time, direction, air and your buddy's position frequently.
   c. Keep navigation simple, and slow down to avoid disorientation.
   d. Maintain good buoyancy control to avoid damaging aquatic life and to prevent accidental scrapes and scratches.

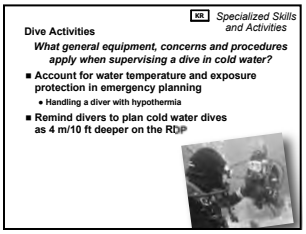
e. If a light fails, go to a backup light and end the dive. If not backup is available, end the dive using your buddy's light to surface and exit.

F. What general equipment, concerns and procedures apply when supervising a dive in cold water?

1. As a dive professional, you need to know about cold water diving (even if you live in an area where the water is warm), so that you can advise divers who may be traveling to an area where the water is cold.
2. To enjoy diving in colder water, a diver must be comfortable and as warm as possible. This requires proper exposure protection, which may range from a full, thick wet suit with hood, boots and gloves to a dry suit.
   a. Whatever exposure protection a diver wears, it must be adequate for the environment – for example, a full wet suit may be fine for temperate waters, but not enough for water just above freezing.
   b. The exposure protection needs to properly fit the diver to provide needed warmth.
   c. The diver should have worn the exposure protection before or have had an orientation to the suit in confined water before going on an open water dive. This is particularly important for dry suit use.

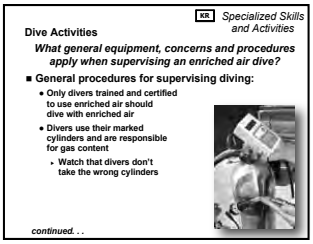


3. Cold water exposure suits require more weight than thinner exposure protection. Make sure each diver has adequate weight and that weight systems can accommodate the weight. The system should allow for a quick release to attain positive buoyancy, yet not be prone to releasing accidentally to cause a runaway ascent.
4. Because hypothermia is a concern, divers need to take these precautions:
   a. Stay warm before the dive if cool air temperatures are also a factor.
   b. If cold during the dive to the point of shivering, quickly end the dive and seek warmth out of the water.
   c. Plan dives and surface intervals to allow sufficient rewarming between dives.
5. When supervising cold water dives, you need to account for water temperature and exposure protection in emergency planning. Your plan should include procedures for handling a diver with hypothermia.
6. It's a good idea to remind divers to plan cold water dives with a depth 4 metres/10 feet deeper than actual on the RDP, or as instructed by their computer manufacturer.

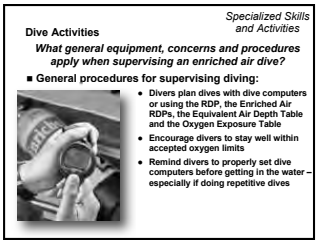


G. What general equipment, concerns and procedures apply when supervising an enriched air dive?

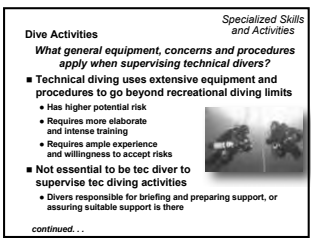
1. Diving using enriched air is very popular in many places around the world. If you're in an area where enriched air is available, you'll likely supervise divers using enriched air.
2. If you're not already a PADI Enriched Air Diver, you should consider becoming one to gain a better understanding of enriched air diving safety procedures. This will help you answer questions enriched air divers may have.
3. Regarding equipment, enriched air cylinders have a distinct green and yellow band just below the cylinder shoulder with "Enriched Air" or "Nitrox" visible on it. Local areas may have different markings stipulated by laws or regulations.
   a. Enriched air divers analyze the cylinders they will personally use, so the cylinder is also marked with the diver's name and analysis. Only that diver should use that cylinder.
   b. Although many divers have their own oxygen analyzers, having one at the dive site can be good customer service if there's question about analysis.



4. General procedures you should follow when supervising enriched air diving include:
   a. Only divers trained and certified to use enriched air should dive with enriched air.
   b. Divers use marked enriched air cylinders and each diver is responsible for checking the gas content of their assigned cylinder. Watch that divers don't mistakenly grab the wrong cylinder when preparing to get in the water.
   c. Divers plan their dives by either using their enriched air dive computers or with the RDP, the Enriched Air RDPs, the Equivalent Air Depth Table and the Oxygen Exposure Table.
      - Encourage divers to stay well within accepted oxygen limits to minimize the risk of oxygen toxicity. Oxygen toxicity causes a diver to convulse underwater, which often results in drowning.
   d. Remind divers to properly set their enriched air dive computers before getting in the water, especially if doing repetitive dives with a different enriched air mixes.



H. What general equipment, concerns and procedures apply when supervising technical divers?

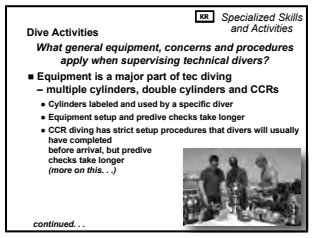


1. You probably are aware that technical diving uses extensive equipment and procedures to allow divers to go beyond the limits of recreational diving.

a. Tec diving has higher potential risk than recreational diving, so participants require more elaborate and intense training, plus ample experience and the willingness to accept the risks.

b. It's not always essential to be a tec diver when supervising tec diving activities because tec divers are responsible for briefing and preparing surface support personnel with little or no tec diving experience, or assuring that suitably qualified support is there.

2. Equipment is a major part of tec diving. Tec divers will usually have multiple cylinders, double cylinders and/or Closed Circuit Rebreathers (CCRs).

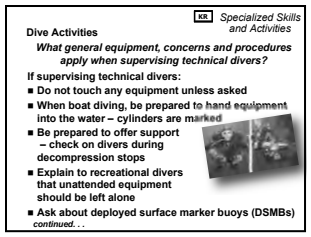


   a. As with enriched air diving, cylinders are labeled and each used by a specific diver who is responsible for its contents.

   b. Tec equipment setup and predive checks take longer than in recreational diving.

   c. CCR diving has strict setup procedures that the diver will usually have completed before arrival, but the predive check takes longer than open circuit. (More on CCRs procedures in a few minutes.)

3. If you are supervising technical divers, follow these general guidelines:



   a. Do not touch any equipment unless asked by the diver. This includes checking to see if valves are open as the diver enters the water as you might otherwise do for recreational divers.

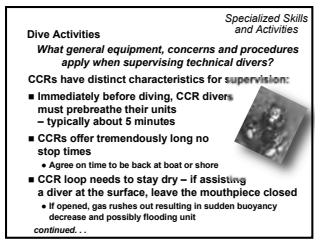
   b. When boat diving, be prepared to hand equipment into the water after the divers enter. Cylinders will be marked for individual divers. It is important that divers get their own cylinders; they are not interchangeable (unless directed by the divers). Also, they are likely to ask for particular cylinders in particular order.

   c. Be prepared to offer support, such as having someone check on the technical divers during decompression stops within recreational depths.

   d. If technical divers will leave stage bottles unattended within recreational limits, explain to recreational divers that such equipment isn't abandoned and should be left alone.

   e. Tec divers often carry deployed surface marker buoys (DSMBs) and lift bags. Some may be deployed routinely, and others may be a signal requesting assistance. Be sure to ask, so that you know the difference if you're not sure.

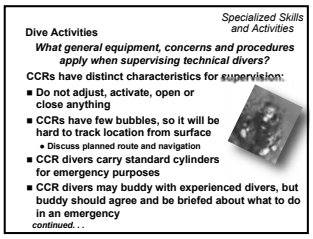
4. Closed Circuit Rebreathers (CCR) have distinct characteristics that affect supervision.



   a. As part of setup and immediately before diving, CCR divers must prebreathe their units – typically about 5 minutes.

b. CCRs offer divers tremendously long no stop times and durations. You will need to agree on a time to be back at the boat or shore because their duration capabilities are typically substantially longer than open circuit divers.

c. The CCR "loop" (breathing system) needs to stay dry, so the mouthpiece closes. If assisting a CCR diver at the surface in the water in an emergency situation, leave the mouthpiece closed because, if opened (when not in the mouth), the gas rushes out of the counterlung. This results in a sudden buoyancy decrease and possibly flooding the unit.

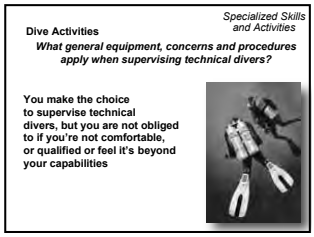


d. As with other tec gear, do not adjust, activate, open or close anything on a CCR unless asked to do so by the diver.

e. CCRs have few bubbles so it will be hard to track location from the surface. Sometimes it's possible for divers to tow a small float, but often not. Discuss the planned route and navigation so you know where to look should it be necessary.

f. CCR divers typically carry a standard cylinder with regulator for emergency purposes. Be prepared to hand this into the water.

g. CCR divers may buddy with experienced open circuit divers, but the CCR diver and buddy should agree, and the open circuit diver should be briefed by the CCR diver about what to do in an emergency, such as air sharing and how to establish buoyancy for the CCR diver.



5. Keep in mind that you make the choice to supervise technical divers, but are not obliged to if you are not comfortable, qualified or if you feel it is beyond your capabilities.

Summary

I. Floats, Marker Buoys and Signaling Devices

II. Mapping

III. Search and Recovery

IV. Deep Diving

V. Dive Activities

The Business of Diving and Your Career

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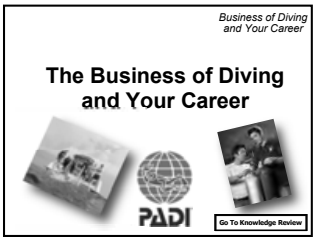
NOTES:

1. Use this presentation when divemaster candidates have not completed independent study through Divemaster Online, or by reading Chapter 7 of the PADI *Divemaster Manual*. You may also use this presentation for prescriptive remediation while reviewing the Chapter 7 Knowledge Review with candidates.
2. This presentation overviews the dive business and explains the opportunities candidates have as PADI Divemasters to grow within the dive industry.



Overview

I. Dive Business Focus

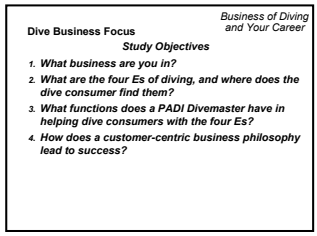
- **What business are you in?**
- **What are the four Es of diving, and where does the dive consumer find them?**
- **What functions does a PADI Divemaster have in helping dive consumers with the four Es?**
- **How does a customer-centric business philosophy lead to success?**

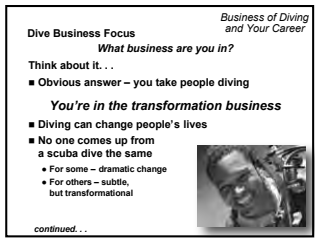
II. Your Career Focus

- **What are five reasons why you should consider continuing your training through the PADI Open Water Scuba Instructor level?**
- **What are six skills, outside of diver training, that can make you more valuable in the dive industry?**

III. Your PADI Membership

- **What are the annual PADI Membership renewal requirements and benefits for PADI Divemasters?**





Outline

I. Dive Business Focus

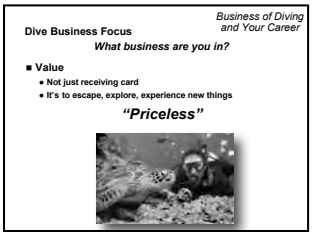
A. What business are you in?

[NOTE: Ask candidates this question. Encourage answers beyond taking people scuba diving. Conclude with the following concept:**]**

1. Although there are many ways to answer this question, one way to summarize the business of diving is to say that we are in the transformation business.
   a. No one comes up from a scuba dive the same. For some the experience brings about dramatic change through which they look at the world and their life plans differently.

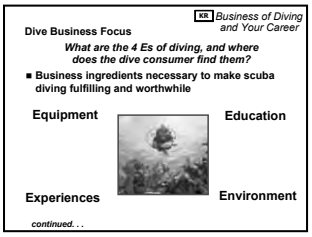
b. For others it's subtle, but still transformational in a personal way.

2. Think about how scuba diving has transformed your life.
   a. You've had fun, met new people, interacted with amazing aquatic creatures and have seen many beautiful scenes underwater.
   b. And, you've chosen to become a dive professional.
3. It's important to understand that the value of becoming a diver is not just receiving a card. It's about being able to escape, explore and experience new things. It's knowing that every dive will hold new adventures. This is truly "priceless" to most people.
4. As a dive professional, always remember that people come to you to go diving because they want to forget about their worries for a while and have fun. You need to be upbeat and positive and help them find the good times and happy moments underwater they're seeking.

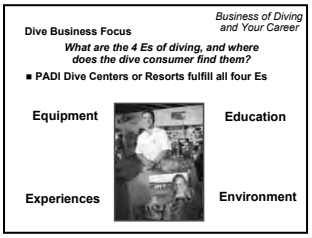


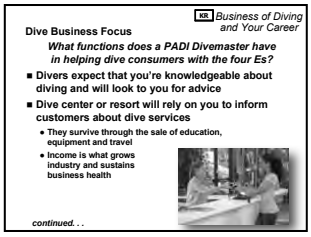
B. What are the four Es of diving, and where does the dive consumer find them?

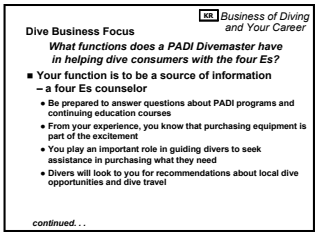
1. The four Es of diving describe the support and structure everyone needs to enjoy the dive adventure. These are the business ingredients necessary to make scuba diving fulfilling and worthwhile.
   a. The first E is education – to dive properly initially, and to progress to more challenging types of dive activities, divers need training.
   b. The second E is equipment – without it diving is impossible. Divers need access to equipment to buy or rent, plus the services to maintain their equipment.
   c. The third E is experiences – education and equipment have no value if divers can't do something with them. Divers need opportunities to dive, people to dive with, and reasons to escape and explore.
   d. The final E is environment – we all need healthy dive sites to visit and need to be a part of protecting the aquatic environment now and into the future.

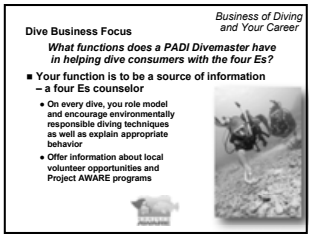


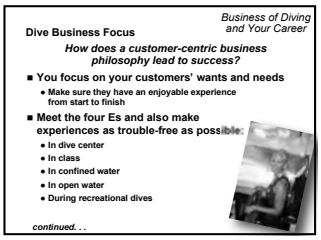
2. Full-service PADI Dive Centers or PADI Dive Resorts fulfill all four Es for dive consumers.
   a. Other dive industry entities may meet specific diver needs, but it's at a dive center or resort where it all comes together under one roof.
   b. Dive centers and resorts are the centralized place where people find what they need to be active divers.

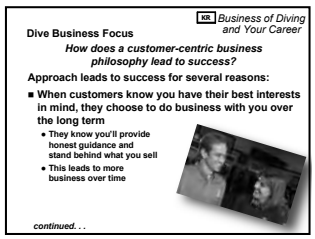












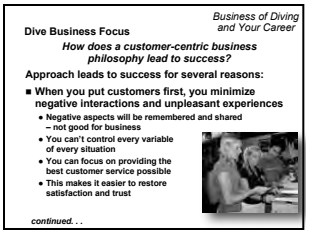
C. What functions does a PADI Divemaster have in helping dive consumers with the four Es?

1. As discussed in other sections, divers expect that, as a dive professional, you're knowledgeable about diving, and they will look to you for advice about the four Es.
2. The dive center or resort that you work with will rely on you to inform customers about the dive services they offer to meet the four Es.
   a. Keep in mind that the sale of education, equipment and travel is the lifeblood of dive centers and resorts.
   b. Income from product and service sales is what grows the dive industry and sustains business health.
3. Your function is to be a source of information, like a counselor, regarding the four Es.
   a. Be prepared to answer questions about PADI programs and continuing education courses and make suggestions based on a diver's interests.
   b. From your own experience, you know that purchasing new equipment is part of the excitement of being a scuba diver. You play an important role in guiding divers to seek assistance in purchasing what they need from the dive center or resort.
   c. Divers will look to you for recommendations for both local dive opportunities and dive travel adventures. Be ready to offer information about local dive events, dive boats and dive club activities. Also, know what trips the dive center or resort offers and learn about diving in those locations.
   d. On every dive you supervise, you have a chance to encourage environmentally sound diving techniques and explain appropriate behavior to help protect the underwater world. Also, be ready to offer information about local volunteer opportunities and Project AWARE environmental programs.

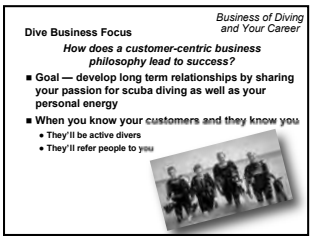
D. How does a customer-centric business philosophy lead to success?

1. Having a customer-centric business philosophy means that you focus on your customers' wants and needs, and also make sure they have an enjoyable experience from start to finish.
   a. This includes not only meeting the four Es, but also making each diver's experience as enjoyable and hassle-free as possible in the dive store, in class, in confined water, in open water and during recreational dives.
2. A customer-centric approach leads to success for several reasons:
   a. When customers know you have their best interests in mind, they choose to do business with you over the long term. They know you'll provide honest guidance and stand behind what you sell. This leads to more business over time.

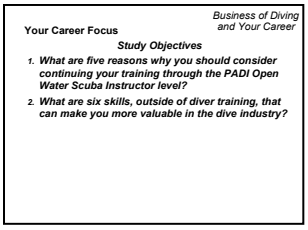
b. When you put the customer first, you minimize negative interactions and unpleasant experiences.
   - Any negative aspect will be remembered and likely shared with lots of other people, which is not good for business.
   - Although you can't control every variable of every situation, you can focus on providing the best customer service possible.
   - This makes it easier to restore satisfaction and trust, because customers recognize when you sincerely care that they're unhappy and want to make it right.



3. Your goal is to develop long term relationships with customers by sharing your passion for scuba diving as well as your personal energy. When you know your customers and they know you, they'll not only be active divers who do regular business with you, but will also refer people to you – thus increasing your success.

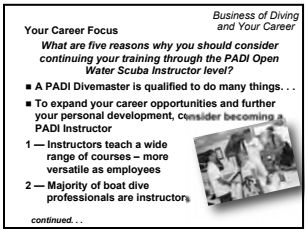


II. Your Career Focus

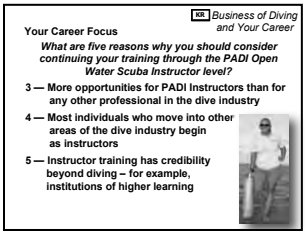


A. What are five reasons why you should consider continuing your training through the PADI Open Water Scuba Instructor level?

1. As you've learned so far, a PADI Divemaster is qualified to do many things – lead dives, assist with training and conduct dive programs. However, to expand your career opportunities and further your personal development, you should consider becoming a PADI Instructor.

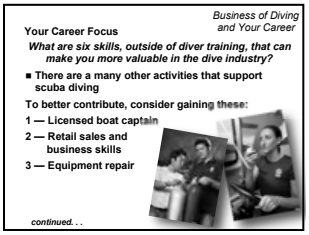


2. Here are a few reasons:
   a. Instructors are fully qualified to teach a wide range of PADI courses, which makes them more versatile as employees.
   b. Because of this versatility, the majority of dive boat professionals supervising divers are instructors.
   c. There are more opportunities for PADI Instructors than for any other professional in the dive industry.
   d. Most individuals who move into other areas of the dive industry – for example, manufacturer's representatives – begin as instructors.
   e. PADI Instructor training has credibility beyond diving. Institutions of higher learning recognize the quality of training and some credit it toward gaining qualifications in fields other than diving.



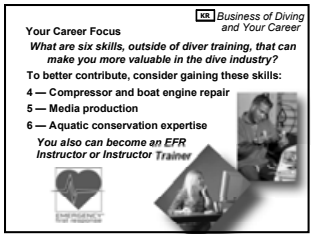
B. What are six skills, outside of diver training, that can make you more valuable in the dive industry?

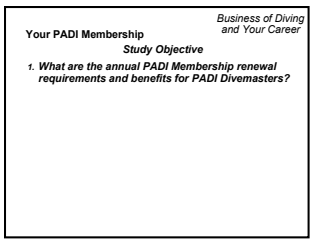
1. During the time you've spent in and around a dive center or resort, you've probably noticed that there are a lot other activities occurring



to support scuba diving — for example, filling cylinders, repairing regulators, stocking shelves with merchandise, training programs, etc.

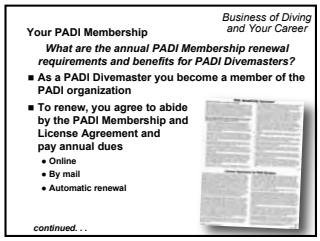
2. To better contribute to a dive operation and make yourself more valuable as an employee, you should consider gaining these additional skills:
   a. Become a licensed boat captain – in many areas, you must be licensed to operate a dive boat. Any training and experience you gain while working toward becoming a captain will also make you more valuable as a crew member.
   b. Having retail sales and basic business training is useful in virtually any dive operation. Continuing on through business management training is valuable for growth within a dive operation.
   c. Equipment repair technician certification for the brands carried by the diver center or resort will help expand a dive operation's services.
   d. Knowing how to work on compressors and boat engines is helpful, because nearly all dive operations have compressors and many have boats. These skills are especially valuable at dive resorts, particularly in remote destinations.
   e. Having media production skills, such as being able to create the dive center's newsletter, brochures or other marketing materials, or knowing how to update the dive center's website or social networking pages, are beneficial to have. If you add photo and video experience to the mix, you become a valuable asset to the dive business.
   f. As previously mentioned, becoming a specialty instructor for digital underwater photography and emergency oxygen administration will allow you to contribute to a dive center's training programs. You also can become an Emergency First Response Instructor or an Instructor Training and further expand the nondiving training available at the facility.





III. Your PADI Membership

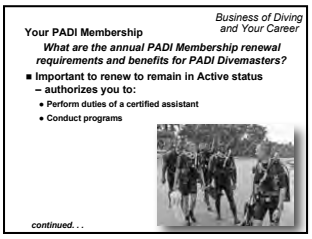
- **What are the annual PADI Membership renewal requirements and benefits for PADI Divemasters?**



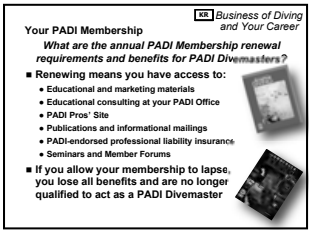
1. As a PADI Divemaster, you become a member of the PADI organization. To remain a member, you must renew your membership annually.
2. To renew, you agree to abide by the PADI Membership and License Agreement and must also pay your annual dues.
   a. You can do this online or by submitting the membership renewal document you receive in the mail.

b. Depending on where you live, automatic renewal may be available, which means that you'll receive notice that your membership dues will be charged to the credit card you have on file at your PADI Office. This also allows you to agree to current membership requirements.

3. It's important to renew each year to remain in Active status as a PADI Divemaster. This authorizes you to perform the duties of a PADI certified assistant and conduct the programs discussed in the presentation – Divemaster-Conducted Program.



4. Renewing your PADI membership also means that you have access to these additional benefits:
   a. A wide range of PADI educational and marketing materials as well as access to educational consulting at your PADI Office.
   b. The PADI Pros' Site, which allows you to check out what's new, update your contact information, reduce paperwork and streamline activities, such as ordering PADI materials, look for jobs on the employment board, network with other PADI professionals, etc.
   c. PADI publications and other informational mailings regarding standards changes and dive industry news.
   d. PADI-endorsed professional liability insurance and the support of the dive industry's most experienced legal defense team.
   e. PADI seminars and member forums – conducted in-person or online.



5. Remember that if you allow your membership to lapse, you lose all benefits and are no longer qualified to act in the capacity of a PADI Divemaster. If you don't renew for an extended period, retraining may be required before renewal to make sure you're up to date with standards and other changes in the PADI System.

Summary

I. Dive Business Focus

II. Your Career Focus

III. Your PADI Membership

Awareness of the Dive Environment

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NOTES:

1. Use this presentation when divemaster candidates have not completed independent study through Divemaster Online, or by reading Chapter 8 of the PADI *Divemaster Manual*. You may also use this presentation for prescriptive remediation while reviewing the Chapter 8 Knowledge Review with candidates.
2. This presentation discusses a divemaster's role in caring for the dive environment and explains biological and physical characteristics of the aquatic world.

Overview

I. Why Care About the Environment?

- **Why is it important to be knowledgeable about the biology and physical properties of the aquatic realm?**
- **How can you learn more about the aquatic realm?**
- **Why dive in an environmentally responsible manner?**

II. Aquatic World – Overview

- **What percentage of the Earth does water cover?**
- **What ultimately connects all the water on Earth?**
- **In what ways is the ocean vital to all life?**

III. Aquatic World – Biological

- **What is the base of the marine food chain, and why are some areas much more productive than others?**
- **Why are coral reefs important, and what benefits do they provide?**
- **What are the major threats to coral reefs?**
- **Why are wetlands important, and what contributes to the destruction of wetlands?**
- **Why are many marine fisheries near collapse, and how do you support sustainable fisheries?**
- **What effects do organic matter, solid wastes, oil, chemicals, plastics and heat effluent have on the aquatic environment?**
- **What effect does the introduction of alien species have on the aquatic environment?**
- **What are eight precautions to reduce the likelihood of being injured by an aquatic animal?**

IV. Aquatic World – Physical

- **What is a thermocline, and how does a thermocline affect divers?**
- **What forces are responsible for currents?**
- **How do you recognize a current and plan a dive when there is a current?**
- **What makes upwelling and downwelling occur, and what effects do they have?**
- **What causes the tides, and what affects the range of tides in an area?**
- **How do you plan a dive based on the tides?**
- **What is a wave, and what disturbing forces cause waves?**
- **What makes a wave break?**
- **How do waves affect divers?**

V. Project AWARE

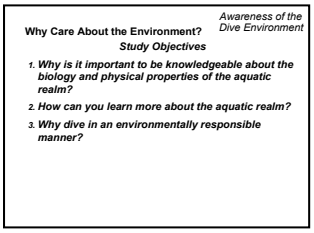
- **What is the Project AWARE Foundation?**
- **What are Project AWARE's "Ten Ways a Diver Can Protect the Underwater Environment?"**

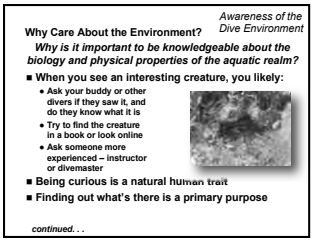
Outline

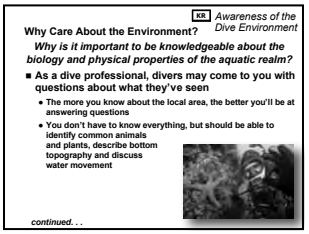
I. Why Care About the Environment?

A. Why is it important to be knowledgeable about the biology and physical properties of the aquatic realm?

1. When you see an interesting creature on a dive, you likely surface and do several things:
   a. Ask your buddy or other divers if they saw it, and do they know what it is.
   b. Try to find the creature in a book you have in your reference library or look it up online.
   c. Ask someone more experienced, such as an instructor or divemaster, about the creature.
2. You do this because being curious is a natural human trait and, as an underwater explorer, finding out what's there is a primary purpose of diving.
3. As a dive professional, it's important for you to be knowledgeable about the aquatic realm not just to satisfy your own curiosity, but because other divers may come to you with questions about what they've seen.

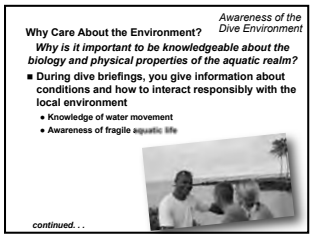






a. The more you know about the biology and physical characteristics of your local area, the better you'll be at answering their questions.

b. You don't have to know everything, but you should be able to identify the most common animals and plants, describe the bottom topography and discuss water movement at local dive sites.

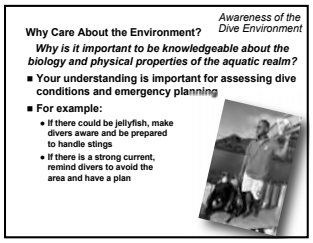


4. Another reason to be knowledgeable about local sites is that during dive briefings you need to be able to give divers as much information as they need about dive conditions and how to interact responsibly with the local environment.

   a. Your knowledge of water movement is critical to pass on so that divers can avoid problems with currents surge, surf, etc.

   b. When divers are aware of fragile aquatic life, they'll be more careful to avoid bumping, kicking or touching sensitive organisms.

   c. The more familiar divers are with underwater world, the better stewards they'll be for the local ecosystem.

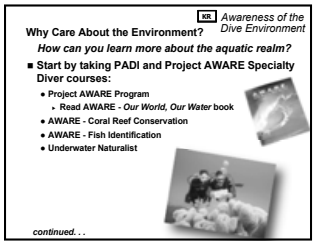


5. Besides including information in briefings, your understanding of the local aquatic realm is important for assessing dive conditions and emergency planning. For example:

   a. If you know there could be jellyfish in the area due to recent weather, even though you don't see any during the initial assessment, it may be appropriate to make divers aware of the possibility, and be prepared to handle any stings that may occur.

   b. If you know there is a strong current running down the coast and if divers venture outside the cove they are likely to get caught in it, you might not only remind them to avoid the area, but would have a plan for what you would do if it happened.

B. How can you learn more about the aquatic realm?



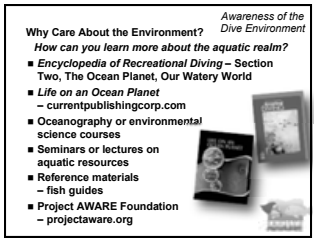
1. In addition to what is covered in this section, you have many options for learning more about the aquatic realm. A great place to start is taking PADI and Project AWARE Specialty Diver courses (if you haven't already) including:

   a. Project AWARE program, which includes reading the book AWARE - *Our World, Our Water*.

   b. AWARE - Coral Reef Conservation

   c. AWARE - Fish Identification

   d. Underwater Naturalist

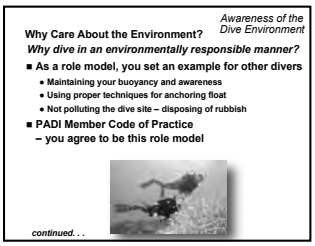


2. In your *Encyclopedia of Recreational Diving*, you can read Section Two – The Ocean Planet, Our Watery World, which takes a look at the physical ocean and then details ocean ecosystems. It also contains information about freshwater ecosystems.

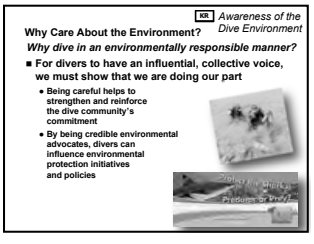
3. Another good resource is a marine science curriculum text called *Life on an Ocean Planet* by Current Publishing, which may be available through your PADI Office. You can also go to currentpublishingcorp.com for more information.
4. Look for oceanography or environmental science courses in your local area or take a course online.
5. Watch for seminars or lectures by experts on topics specific to local aquatic resources.
6. Use reference material, such as fish guides, fish identification slates and similar references, to gain regional information.
7. Check the Project AWARE Foundation's website – projectaware.org – regularly for news about environmental issues, educational opportunities and options for taking action to conserve your local aquatic realm.

C. Why dive in an environmentally responsible manner?

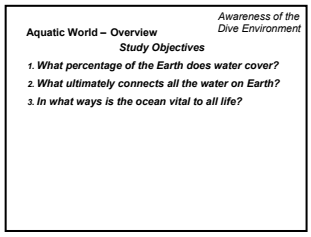
1. As a diver who has encountered amazing aquatic organisms, you naturally develop a sense of responsibility for protecting those creatures and the ecosystems they depend on. So, you probably already dive in an environmentally responsible manner to avoid harming aquatic life.
   a. You know that each bump or kick to a fragile organism can cause significant damage to that animal or plant.
   b. Although the damage caused by one kick may be minor to the overall ecosystem, the result of hundreds of kicks over time may be noticeable. Every diver needs to dive responsibly.

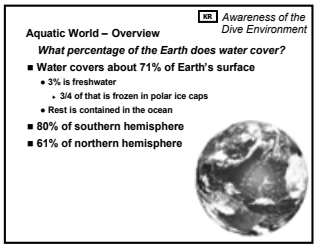


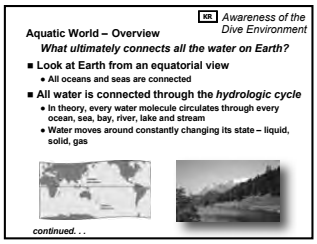
2. As a role model, you set the example for other divers, which is another reason to not just emphasize responsible diving, but to also practice it every time you are in or around the water.
   a. This includes not just maintaining your buoyancy and awareness underwater, but using proper techniques for anchoring a float, as discussed in the section – Specialized Skills and Activities.
   b. It also means not polluting the dive site. Always properly disposing of rubbish, etc.
   c. In the PADI Member Code of Practice, you agree to be this role model by following a professional code of practice toward the environment in all PADI-related activities.

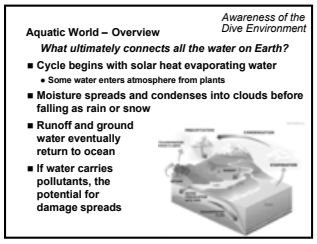


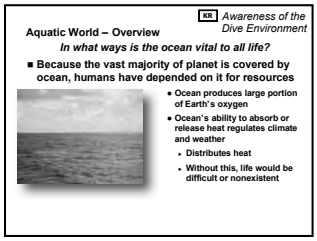
3. A final reason to dive environmentally responsibly is that for divers to have an influential collective voice about conservation and protection issues, we must show that we are doing our part.
   a. Being careful to have no or minimal negative effect on every dive helps to strengthen and reinforce the dive community's widespread commitment to protect the aquatic environment.











b. By being credible environmental ambassadors, divers represent a powerful constituency that can influence environmental protection initiatives and policies.

II. Aquatic World – Overview

A. What percentage of the Earth does water cover?

1. Water covers about 71 percent of the Earth's surface.
   a. Only about three percent is freshwater and three-quarters of that is frozen in the polar ice caps.
   b. The rest is contained in the ocean.
2. Water covers about 80 percent of the southern hemisphere, compared to 61 percent of the northern hemisphere.

B. What ultimately connects all the water on Earth?

1. If you look at the Earth from an equatorial view, you'll see that all the oceans and seas are connected.
2. Besides this global-view connection, all water is connected through the hydrologic cycle. In theory, given enough time, every water molecule eventually circulates through every ocean, sea, bay, river, lake or stream.
3. Through this continuous cycle, water moves around Earth constantly changing from liquid to solid to gas and back again.
   a. The cycle begins with solar heat evaporating water into the air from the ocean, rivers, lakes, and land.
      • Some water vapor also enters the atmosphere from plants.
   b. This moisture spreads over the planet and condenses into clouds before falling as rain or snow.
   c. Runoff and ground water ultimately return to the ocean, completing the cycle.
4. Keep in mind that if water carries pollutants with it, the potential for damage spreads. This is why water quality issues are a global, rather than regional, concern.

C. In what ways is the ocean vital to all life?

1. Because the vast majority of our planet is covered by ocean, humans have always depended on it for resources that are vital to life, such as food.
2. The ocean also provides a large portion of the Earth's oxygen through phytoplankton and cyanobacteria. (More on this next).
3. The ocean's ability to absorb or release heat regulates the world's climate and weather. It carries heat to areas that would otherwise be cooler, and absorbs heat in areas that would otherwise be hotter. Without this moderating influence, life would be difficult or nonexistent on Earth.

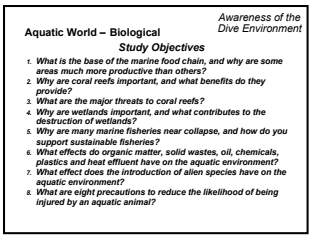
III. Aquatic World – Biological

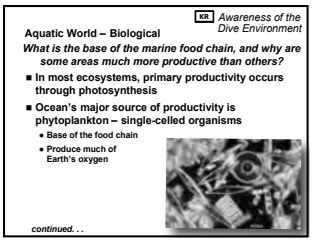
A. What is the base of the marine food chain, and why are some areas much more productive than others?

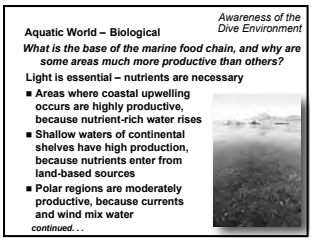
1. In most ecosystems, primary productivity occurs through photosynthesis, in which sunlight energy is converted into chemical energy or plant food.
2. The ocean's major source of productivity is phytoplankton – tiny, single-celled organisms. They are at the base of the marine food chain, and without them few other life forms in the ocean could exist.
   a. As mentioned, phytoplankton and cyanobacteria produce much of the Earth's oxygen as part of photosynthesis.
3. While light is essential for productivity, nutrients are also necessary.
   a. Areas where coastal upwelling occurs are highly productive, because deeper, nutrient-rich water rises to take the place of surface water driven offshore by winds or currents.
   b. The shallow waters of the continental shelves generally have high production, because nutrients enter from land-based sources such as rivers and estuaries.
   c. Polar regions are moderately productive, because currents and winds mix the water bringing up nutrients from deeper water
   d. The open ocean has little production due to the lack of nutrients – it is essentially a biological desert.
   e. Tropical waters, although very low in nutrients and phytoplankton, support abundant life where coral reefs are found. (More on these habitats next.)

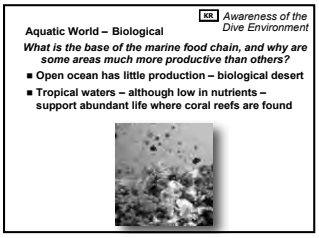
B. Why are coral reefs important and what benefits do they provide?

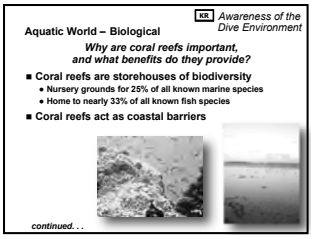
1. Coral reefs are important, because they are storehouses of biodiversity.
   a. They are the nursery grounds for 25 percent of all known marine species.
   b. They're also home to nearly 33 percent of all known fish species.
2. Coral reefs act as coastal barriers protecting islands and coastal communities from storms, wave damage and erosion.
3. Pharmacologists have found biomedical compounds on reefs, from anti-cancer agents, anti-HIV agents to antibiotics, and suspect there are thousands more yet to be discovered.
4. Many tropical nations base their tourism industries on the appeal of the surrounding coral reefs. In some areas, scuba diving or snorkeling tours are significant income sources and are foundational to the countries' economies.

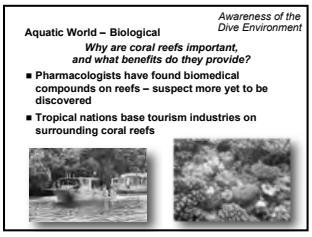


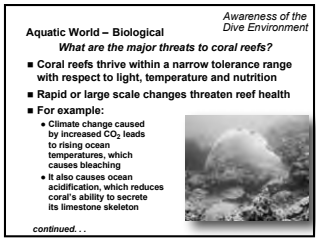






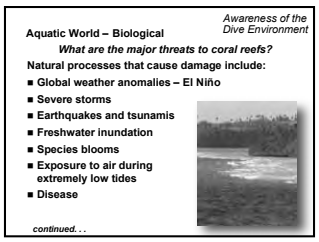




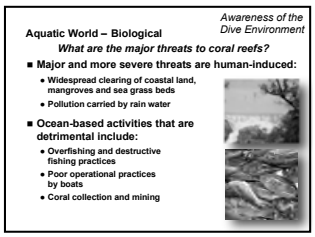


C. What are the major threats to coral reefs?

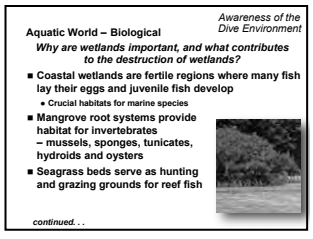
1. Coral reefs thrive within a narrow tolerance range with respect to light, temperature and nutrition. Rapid or large scale changes, whether from natural causes or human-induced, can threaten a reef's health.
   a. For example, climate change, caused by increased carbon dioxide emissions, leads to rising ocean temperatures, which causes coral bleaching. It also causes ocean acidification, which reduces coral's ability to secrete its limestone skeleton.



2. Natural processes that can damage a coral reef include:
   a. Global weather anomalies such as El Niño
   b. Severe storms (hurricanes, cyclones, typhoons, etc.)
   c. Earthquakes and tsunamis
   c. Freshwater inundation
   d. Species blooms
   e. Exposure to air during extremely low tides
   f. Diseases



3. Most of the major and more severe threats to coral reefs are human-induced. Many of these actually occur on land and end up in the ocean through runoff, for example:
   a. Widespread clearing of coastal land, mangroves and sea grass beds results in erosion and sediments pouring over the reef.
   b. Pollution, both chemical and organic, carried by rain water in to the ocean throws off the nutrient balance or simply kills marine species.
4. Ocean-based activities that are also detrimental to coral reefs include:
   a. Overfishing and destructive fishing practices, which cause reef decline and deplete spawning stock.
   b. Poor operational practices by both large and small boats, which causes continual abuse and damage.
   c. Coral collection and mining, which destroys reef structures.



D. Why are wetlands important, and what contributes to the destruction of wetlands?

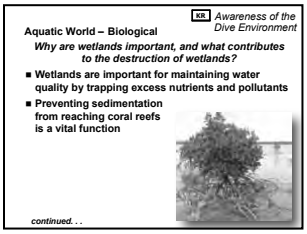
1. Coastal wetlands, such as mangrove forests, salt marshes and estuaries, are fertile regions where many fish species lay their eggs and juvenile fish develop. This makes them crucial habitats for marine species and also for the production of fish as a human food source.
   a. Mangrove root systems also provide habitat for invertebrates, such as mussels, sponges, tunicates, hydroids and oysters.

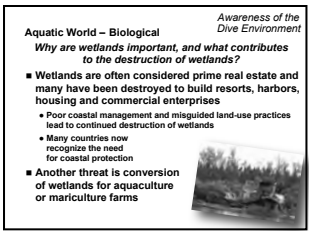
b. Seagrass beds serve as hunting and grazing grounds for reef fish who take nutrients to the reef through their fecal pellets.

2. Wetlands are also important for maintaining water quality by trapping excess nutrients and pollutants, along with sediment. Preventing sedimentation from reaching the coral reef is a vital function of mangroves and seagrass beds.

3. Because wetlands are along the coast, they're often considered prime real estate and many have been destroyed to build resorts, harbors, housing or commercial enterprises.
   a. Poor coastal management or misguided land-use practices continue to lead to the destruction of wetlands.
   b. However, many countries now recognize the need for coastal protection and are taking steps toward more complete coastal zone management.

4. Another threat is the conversion of wetlands into aquaculture or mariculture farms. Depending on the species, farms can introduce or increase waste, toxins, disease and chemicals into the surrounding natural environment.



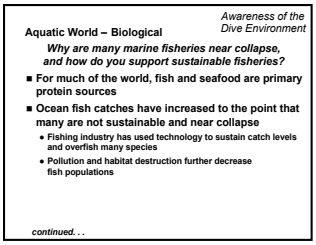


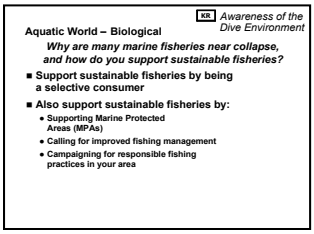
E. Why are many marine fisheries near collapse, and how do you support sustainable fisheries?

1. For much of the world, fish and other seafood are a primary protein source. Because of this need, ocean fish catches have increased to the point that many are not sustainable and near collapse.
   a. As competition for fish has increased and fish populations decreased, the fishing industry has used technology to sustain catch levels and overfish many species.
   b. In addition to overfishing, problems such as pollution and habitat destruction interfere with reproduction, which further decreases fish populations.

2. You can support sustainable fisheries by being a selective consumer and making sustainable seafood choices part of your lifestyle.

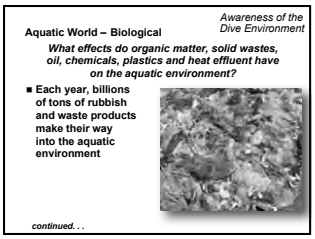
3. You can also support sustainable fisheries by supporting Marine Protected Areas (MPAs), calling for improved fisheries management and campaigning for responsible fishing practices in your area.

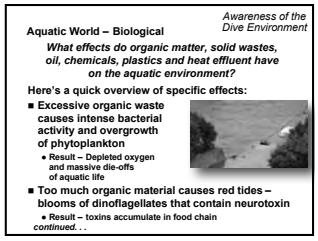




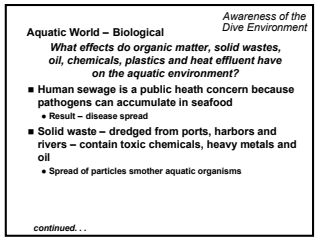
F. What effects do organic matter, solid wastes, oil, chemicals, plastics and heat effluent have on the aquatic environment?

1. Each year billions of tons of rubbish and waste products make their way into the aquatic environment. Some pollutants dissolve, some are ingested by aquatic organisms and some remain, like plastic, which can take hundreds of years to start breaking down.

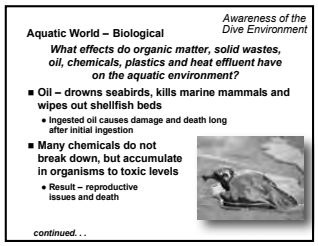




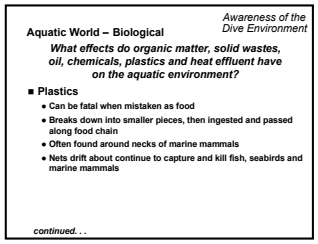
2. Here is a quick overview of the specific effects different kinds of pollution have on the aquatic environment:
   a. Excessive organic waste causes intense bacterial activity and overgrowth of phytoplankton, which depletes oxygen in the water. This can result in massive die-offs of aquatic life in the area.
   b. Nutrients added by too much organic material can cause red tides – dense blooms of dinoflagellates (types of algae) that contain a neurotoxin. The toxins can accumulate in the food chain, producing illness and death.



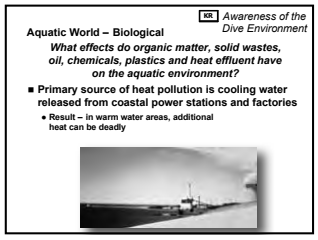
   c. Human sewage entering the aquatic environment is a public health concern, because pathogens can accumulate in seafood and result in disease spread, such as typhoid.
   d. Solid wastes, such as bottom material dredged from ports, harbors and rivers, sometimes contain toxic chemicals, heavy metals and oil and spread suspended particles that smother aquatic organisms.



   e. Oil from runoff, sewage treatment and spills can drown seabirds, kill marine mammals and wipe out shellfish beds. Ingested oil is passed up the food chain, causing damage and death long after the initial ingestion.
   f. Many chemicals, such as pesticides and industrial substances, that enter the aquatic environment do not break down over time, but accumulate in organisms to toxic levels, causing reproductive issues and death.

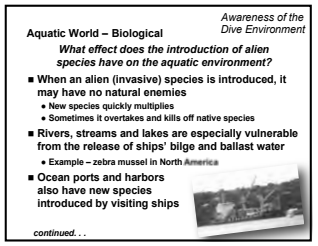


   g. Plastics can be fatal when they are mistaken for food by aquatic animals. As plastic breaks down into smaller pieces, it can be ingested by all kinds of aquatic creatures and passed along the food chain. Plastic materials are often found around the necks of marine mammals, causing infections and inhibiting breathing or feeding. Lost or discarded plastic nets drift about continuing to capture and kill fish, seabirds and marine mammals.



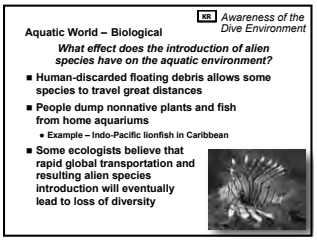
   h. A primary source of heat pollution is the cooling water released from coastal power stations and factories. In warm water areas where temperatures are already near the maximum thermal tolerance for many organisms, this additional heat can be deadly.

G. What effect does the introduction of alien species have on the aquatic environment?



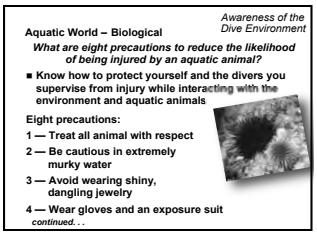
1. When an alien species is introduced (purposely or by accident) into an ecosystem, it may have no natural enemies. This allows the new species to quickly multiply, sometimes to the point that it overtakes and kills off native species.

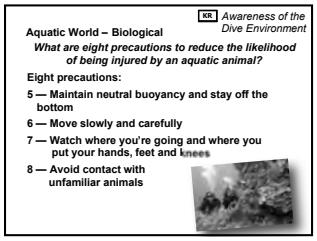
2. Rivers, streams and lakes are especially vulnerable to the introduction of alien species from the release of ships' bilge and ballast water.
    a. An example of this is the zebra mussels that was accidentally brought to lakes and rivers in the United States and Canada in the ballast water of vessels from Europe, likely in the mid-1980s. These freshwater species cause damage by clogging pipes, and they eat most of the available microscopic food supply, which starves native species.
3. Oceans ports and harbors also have new species introduced by visiting ships.
4. An increasing amount of human-discarded floating debris is also allowing some species to travel great distances across the ocean, which give them the opportunity to colonize new ecosystems.
5. Alien species have also been introduced when people dump nonnative plants and fish from their home freshwater aquariums into local streams and rivers or from their saltwater aquariums into the ocean.
    a. An example of this is the Indo-Pacific lionfish that is now spreading throughout the Caribbean and adjoining waters. One theory is that sometime in the 1990s, these fish were intentionally or accidentally set free from salt water aquariums. Lionfish eat a lot of other reef fish. With no natural enemy, they are a threat to the biological balance on many Caribbean reefs.
6. Some ecologists believe that rapid global transportation and the resulting alien species introduction will eventually lead to a significant loss of species' diversity.

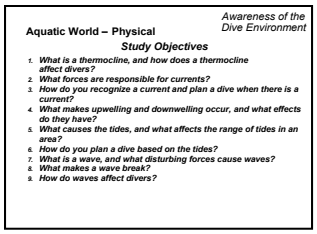


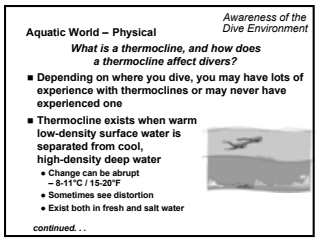
H. What are eight precautions to reduce the likelihood of being injured by an aquatic animal?

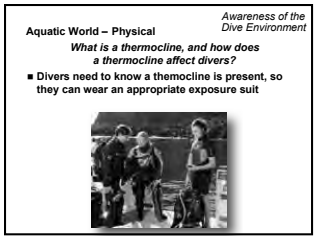
1. Along with understanding aquatic environmental threats and how you can act to protect our aquatic resources, you should know how to protect yourself and the divers you supervise from injury while interacting with the environment and aquatic animals.
2. As you learned from your previous training, here are eight precautions a diver should take to reduce the likelihood of being injured by an aquatic animal:
    a. Treat all animals with respect. Don't tease or intentionally disturb them. Remain an unobtrusive observer.
    b. Be cautious in extremely murky water where you may have trouble watching where you put your hands. Potentially aggressive animals could mistake you for prey in murky water, so you may want to avoid diving if they're known to be in the area.

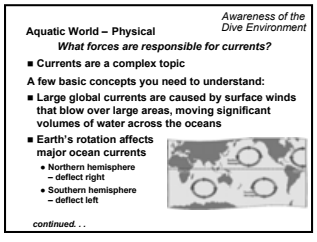


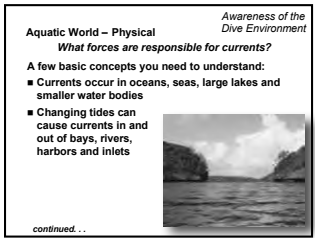












c. Avoid wearing shiny, dangling jewelry. These can resemble bait fish or other small prey and can attract the interest of some animals.

d. Wear gloves and an exposure suit to avoid stings and cuts.

e. Maintain neutral buoyancy, and stay off the bottom.

f. Move slowly and carefully.

g. Watch where you're going and where you put your hands, feet and knees.

h. Avoid contact with unfamiliar animals. If you don't know what something is, don't touch it.

V. Aquatic World – Physical

A. What is a thermocline, and how does a thermocline affect divers?

1. Depending on where you regularly dive, you may have a lot of experience with thermoclines or may never have experienced one.
2. A thermocline exists when relatively warm, low-density surface water is separated from cool, high-density deep water.
   a. The change between the layers can be abrupt, with a temperature difference above and below the thermocline as great as 8 to 11 degrees Celsius/15 to 20 degrees Fahrenheit.
   b. Sometimes you will see distortion at the thermocline, like the shimmering air that rises from a hot road, as the two temperature layers mix.
   c. Thermoclines exist both in fresh and salt water, and may change with seasonal temperature fluctuations.
3. Divers need to know that a thermocline is present at a dive site, so they can wear an appropriate exposure suit based on the temperature at depth. Make this information part of your dive briefing, as appropriate.

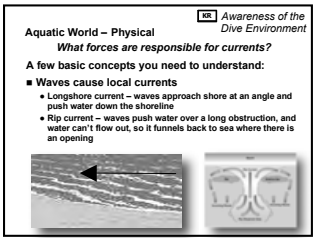
B. What forces are responsible for currents?

1. From a marine science perspective, currents are a complex topic. From a dive professional's point of view, there are a few basic concepts you need to understand including:
   a. Large, global currents are caused primarily by the influence of surface winds that consistently blow over large areas, moving significant volumes of water horizontally across the oceans.
   b. The Earth's rotation also affects the major ocean currents. In the northern hemisphere, major currents deflect to the right and in the southern hemisphere to the left.
   c. Currents occur in oceans, but also in seas, large lakes and smaller water bodies, to some extent.

d. Changing tides can cause local currents in and out of bays, rivers, harbors and inlets.

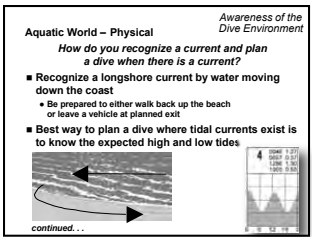
e. Waves cause local currents.

- A longshore current occurs where the waves approach the shore at a slight angle and push water down the shoreline.
- A rip current occurs when waves push water over a long obstruction such as a sand bar or reef. The water can't flow out through the obstruction, so it funnels back to sea where there is an opening.

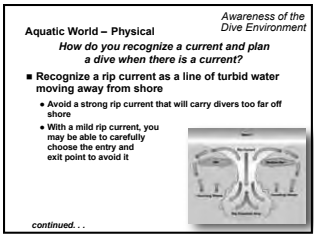


C. How do you recognize a current and plan a dive when there is a current?

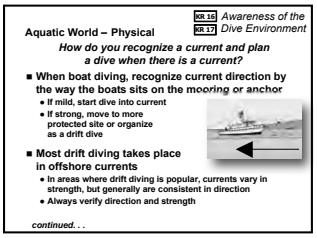
1. You recognize a longshore current by observing water generally moving down the coast, pushed by waves approaching the shore at an angle and assisted by the prevailing wind direction.
   a. To dive in a longshore current, you need to be prepared to either walk back up the beach to your start point at the end of the dive, or leave a vehicle at your planned exit point so you can drive back.
2. The best way to plan a dive where tidal currents exist is to first know the expected time of high and low tides at your dive site. We'll discuss this in more detail next.



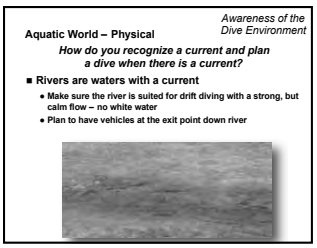
3. You can usually recognize a rip current as a line of turbid, foamy water moving away from shore. It may disrupt the waves where it rushes out to sea.
   a. You want to avoid a strong rip current that will carry divers too far off shore. If one exists, it may be best to go to another dive site.
   b. With a mild rip current, you may be able to carefully choose the entry and exit point to avoid it.



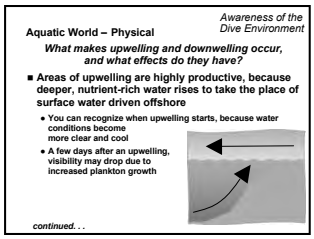
4. When boat diving, you can recognize the current direction by noticing the way the boat sits on the mooring or anchor.
   a. If the current is mild, start the dive into the current.
   b. If the current is strong, you may want to move to a more protected dive site or organize the dive as a drift dive.
5. Most drift diving takes place from a boat in offshore currents.
   a. In areas where drift diving is popular, currents can vary in strength, but generally are consistent in direction.
   b. Always verify the direction and strength and plan the dive to follow drift diving procedures.



6. Rivers are, by definition, waters with a current.
   a. If diving in a river make sure it is suited for drift diving with a strong but calm flow – no white water.

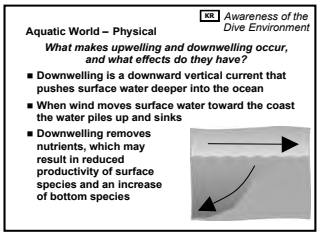


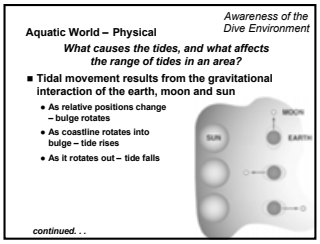
b. Similar to diving in a longshore current, you'll need to plan to have a vehicle at the exit point down river to pick you up.



D. What makes upwelling and downwelling occur, and what effects do they have?

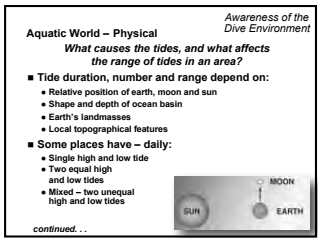
1. When discussing ocean productivity, you learned that areas where upwelling occurs are highly productive, because deeper, nutrient-rich waters rise to take the place of surface waters driven away by offshore winds or currents.
   a. In most areas, you can recognize when upwelling starts because the water conditions become more clear and cool than normal.
   b. A few days after an upwelling, the visibility may drop due to increased plankton growth from the nutrients in the water.
2. Downwelling is a downward vertical current that pushes surface water deeper into the ocean. When wind moves surface waters toward the coast, the water piles up and sinks.
   a. Downwelling removes organic nutrients from the surface water, which may result in reduced productivity of some surface species and an increase in the productivity of some bottom species.

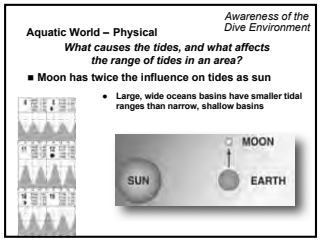


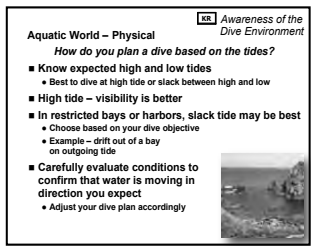


E. What causes the tides, and what affects the range of tides in an area?

1. Tidal movement results from the gravitational interaction of the earth, moon and sun, which creates two water bulges, or waves, on opposite sides of the earth.
   a. As the relative positions of the sun and moon change, the bulge rotates around the earth.
   b. As a coastline rotates into the bulge, the tide rises. As it rotates out, the tide falls.
2. Tide duration, number and range depend on the relative position of the earth, moon and sun, the shape and depth of the specific ocean basin, and the local topographical features.
   a. Some places have a single high and low tide daily. Other places have two roughly equal high and low tides, and still other have mixed tides where there are two unequal high and low tides daily.
   b. Because the moon has about twice the influence on tides as the sun, the difference between high and low tides changes throughout the month based on the phase of the moon.
   c. Large, wide ocean basins tend to have a smaller tidal range than narrow, shallow basins.







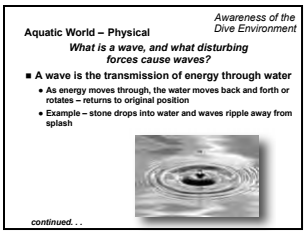
F. How do you plan a dive based on the tides?

1. As mentioned earlier, to plan a dive where tidal currents exist, you need to first know the expected time of high and low tides at your dive site.

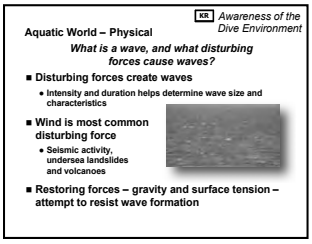
a. Keep in mind that there are locations where the tide is not a significant variable affecting diving. The water may be higher or lower, but otherwise tides have little or no significant effect on diving conditions.

2. In general, it's best to dive at the high tide or the slack period between high and low tides.
   a. At high tide, the visibility is likely better, because clearer water has come in from the sea.
   b. If you dive in restricted bays and harbors, slack tide may be the best choice, because there is little water movement.
   c. However, the time you choose to dive can vary based on your dive objective. For example, you may want to drift out of a bay on an outgoing tide.
3. When you arrive at the dive site, carefully evaluate conditions to confirm that water is moving in the direction you expect based on the tide, and that the water movement is not stronger than you expect. Adjust your dive plan accordingly.

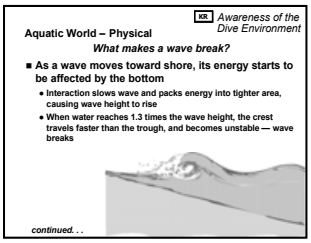
G. What is a wave, and what disturbing forces cause waves?



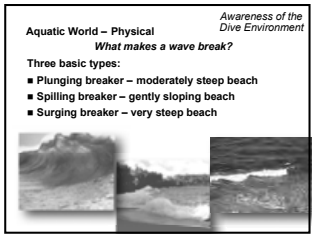
1. A wave is the transmission of energy through water.
   a. As energy moves through water, the water moves back and forth or rotates, but then returns to its original position.
   b. For example, when a stone drops into water, waves ripple away from the splash. However, the water particles do not move away, only the energy moves as a series of waves away from the disturbance.
2. It is disturbing forces, like a stone entering the water, that create waves. The intensity and duration of a disturbing force helps determine the wave size and characteristics.
   a. Wind is the most common disturbing force that causes ocean waves, but other events such as seismic activity, undersea landslides and volcanos can also cause waves.
3. Restoring forces, such as gravity and surface tension, attempt to resist ocean wave formation.



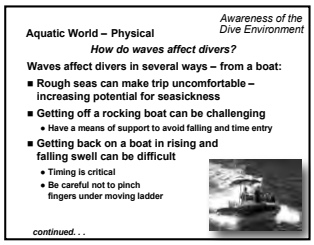
H. What makes a wave break?



1. As the wave moves toward shore, its energy starts to be affected by the bottom. This interaction slows the wave and packs the wave's energy into a tighter area, causing the wave height to rise.
2. Closer to shore, when the water depth is 1.3 times the wave height, the crest of the wave travels faster than its trough, and it becomes unstable. The instability causes the wave to break; its crest topples forward – spilling its energy as surf.

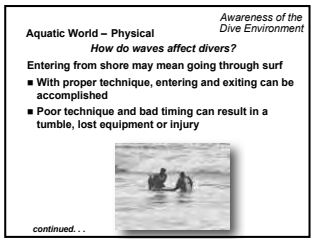


3. There are three basic types of breaking waves.
   a. Plunging breakers occur on moderately steep beaches. The wave curls as the top pitches through the air before splashing onto the bottom.
   b. Spilling breakers occur on gently sloping beaches. The top of the wave tumbles and slides down the front of the wave as it decelerates slowly.
   c. Surging breakers occur on very steep beaches. Since there's little or no bottom contact, the waves don't slow down, but surge virtually unbroken.

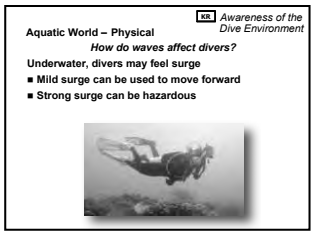


I. How do waves affect divers?

1. Waves affect divers in several ways, such as when diving from a boat:
   a. Rough seas can make the trip to the dive site uncomfortable, increasing the potential for seasickness.
   b. Getting off a rocking dive boat can be challenging when standing to do a giant stride or when doing a seated back roll. Having a means of support may be necessary to avoid falling and timing the entry to minimize the drop into the water is key.
   c. Getting back on to a dive boat that is rising and falling with a large swell can also be difficult. Timing is critical to avoid being hit by the boat or swim step. Being careful not to pinch a finger under a moving ladder is also important.



2. If you live in an area where entering from shore means going through surf, you're probably very familiar with how breaking waves affect divers.
   a. With proper technique, entering and exiting through surf can be accomplished with little difficulty (as discussed in the section on Specialized Skills and Activities.)
   b. Poor technique and bad timing can result in a tumble in the sand, lost equipment or worse, injury.



3. Underwater, divers may feel the waves as surge – being moved back and forth as the wave passes overhead.
   a. Mild surge can be used to move forward with the water's help. Divers wait while the water is pushing against them, then give a harder kick to more effectively move forward with the water.
   b, However, strong surge can be hazardous, especially in shallow, rocky areas.
4. To learn more about waves and other physical aspects of the aquatic environment, take Dive Theory Online or read *The Encyclopedia of Recreational Diving.*

V. Project AWARE

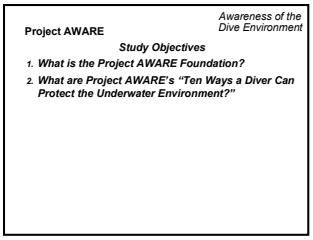
A. What is the Project AWARE Foundation?

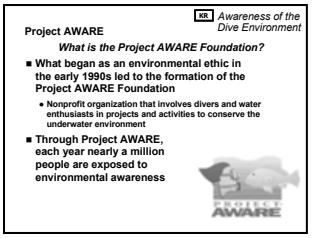
1. What began as an environmental ethic by PADI employees in the early 1990s led to the formation of the Project AWARE Foundation, a nonprofit organization that involves divers and water enthusiasts in projects and activities to conserve underwater environments.
2. Through Project AWARE, each year nearly a million people worldwide are exposed to environmental awareness through interactions with PADI Professionals. For up-to-date information, visit Project AWARE Foundation online at projectaware.org

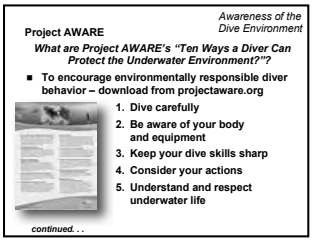
B. What are Project AWARE's "Ten Ways a Diver Can Protect the Underwater Environment?"

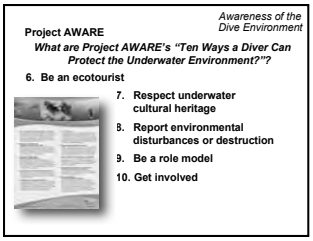
[**NOTE:** Tell candidates that they can download these guidelines along with tips for underwater photographers from projectaware.org]

1. Dive carefully to protect fragile aquatic ecosystems**.**
2. Be aware of your body and equipment placement when diving.
3. Keep your dive skills sharp through continuing education.
4. Consider how your interactions affect aquatic life.
5. Understand and respect underwater life.
6. Be an ecotourist by making informed decisions when selecting a destination and dive operator.
7. Respect underwater cultural heritage and maritime history.
8. Report environmental disturbances or destruction.
9. Be a role model for other divers and nondivers when interacting with the environment.
10. Get involved in local environmental activities and issues.









Summary

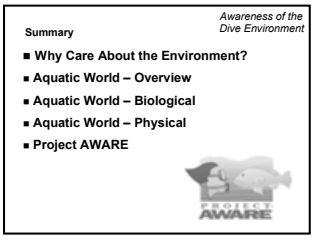
I. Why Care for the Environment?

II. Aquatic World – Overview

III. Aquatic World – Biological

IV. Aquatic World – Physical

V. Project AWARE



Dive Theory Review

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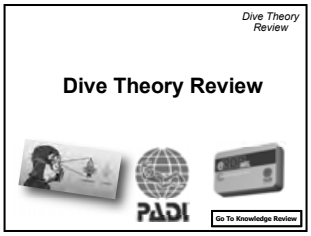
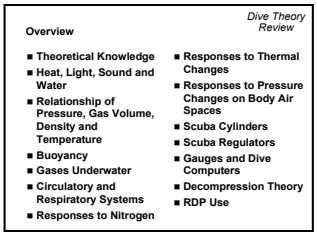
NOTES:

1. Use this presentation when divemaster candidates have not completed independent study through Divemaster Online, or completed the Dive Theory Online program, or read Chapter 9 of the PADI *Divemaster Manual*. You may also use this presentation for prescriptive remediation while reviewing the Chapter 9 Knowledge Review with candidates.
2. This presentation reviews dive theory concepts that candidates learned in previous courses. It's designed to reinforce the candidate's understanding to a level that allows the candidate to apply the principles to actual diving circumstances and also explain the concepts to others.
3. Some candidates may be familiar with the RDP Table, others with the eRDPML, and some may not be familiar with either, because they have only used a dive computer. Use the last part of the presentation to help candidates become comfortable using both RDP versions.



Overview



I. Theoretical Knowledge

- **Why do you need a solid understanding of dive theory?**

II. Heat, Light, Sound and Water

- **Why does water dissipate body heat faster than air does, and at what rate does it do so?**
- **What effect does water's ability to dissipate heat have on a diver?**
- **What does light do when it passes from air into water, or vice-versa, and how does this affect a diver?**
- **Why does sound travel faster in water than in air, and approximately how much faster is it in water?**
- **How does the speed of sound in water affect hearing?**

III. Relationship of Pressure, Gas Volume, Density and Temperature

- **What are meant by a*mbient, absolute* and *gauge* pressure?**
- **What is the relationship between changes in absolute pressure and a gas volume?**
- **What is the relationship between depth and gas density?**
- **What is the relationship of pressure, volume and temperature on a gas?**

IV. Buoyancy

- **How do you change an object's buoyancy by increasing displacement or adding weight to make it positively, negatively or neutrally buoyant in both fresh and salt water?**

V. Gases Underwater

- **What is *partial pressure*?**
- **How does the physiological effect of breathing a given percentage of gas at depth compare to breathing the same percentage of the gas at the surface?**
- **What happens when you raise the pressure of a gas in contact with a liquid?**
- **What happens when you reduce the pressure of a gas in contact with a liquid?**

VI. Circulatory and Respiratory Systems

- **What are the organs, structure and functions of the circulatory and respiratory systems?**
- **What is *dead air space*, and how do you avoid problems caused by it?**
- **How does the body respond when breath-hold diving, and how can you extend breath-hold time?**
- **Why should you avoid a wet suit hood or dry suit collar that excessively restricts the neck, and what are the two physiological explanations for the concern?**
- **What are the physiological effects of carbon monoxide while diving, and how do you avoid them?**
- **What are the two types of oxygen toxicity, and how do you avoid them?**
- **What is the primary first aid for a near drowning accident?**
- **How do you administer oxygen to a breathing injured diver and to a nonbreathing injured diver?**

VII. Responses to Nitrogen and Inert Gas

- **What causes gas narcosis, at approximately what depth is it likely using air/enriched air, and what are common signs/symptoms of it?**
- **What are the physiological mechanisms by which the body absorbs and releases nitrogen (or other inert gases) while diving?**
- **What causes decompression sickness (DCS), and what are the two types?**

- **What factors may predispose a diver to DCS?**
- **What are the recommendations for DCS first aid and treatment?**
- **What is the difference between DCI and DCS?**

VIII. Responses to Thermal Changes

- **How does the body respond to excess heat?**
- **How does the body respond to insufficient heat?**

IX. Responses to Pressure Changes on Body Air Spaces

- **How do the ears and sinuses respond to changing pressure?**
- **What injuries or incidents may occur as a result of ear and sinus squeezes or reverse blocks?**
- **What are the causes and physiologies of mask and dry suit squeezes?**
- **How do the lungs respond to changing pressure?**
- **What are the causes and physiologies of the lung overexpansion injuries: air embolism, pneumothorax, mediastinal emphysema and subcutaneous emphysema?**
- **What are the recommendations for lung overexpansion injury first aid and treatment?**

X. Scuba Cylinders

- **How do you identify, and what are the meanings of, the following scuba cylinder marks: hydrostatic test date and working pressure?**
- **What are the different types of cylinder valves?**
- **What device prevents an over-pressurized cylinder from exploding, and how does it work?**
- **Why should a cylinder receive an annual visual inspection?**
- **What are the steps and procedures of a hydrostatic test?**
- **What functional problems can occur with cylinders and valves?**

XI. Scuba Regulators

- **How does a scuba regulator work?**
- **What is meant by "fail-safe" with respect to regulators, and how does it work?**
- **What is the purpose of a regulator environmental seal?**
- **What functional problems can occur with regulators?**

XII. Dive Computers and Gauges

- **What are the different operating principles and designs for depth gauges, SPGs and compasses?**
- **What are the procedures for using dive computers appropriately?**
- **What special equipment requirements and considerations do you have when diving with enriched air?**
- **What functional problems can occur with gauges and dive computers?**

XIII. Decompression Theory

- **What is the basic structure and operation of the Haldanean decompression model?**
- **For whom was the Recreational Dive Planner developed, and how was it tested?**
- **Why do you need to know your approximate altitude when diving?**
- **How do dive computers apply decompression models to provide more no stop dive time?**

XIV. RDP Use

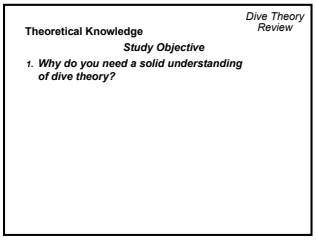
- **What are the general rules and recommendations for diving with the Recreational Dive Planner, including those for flying after diving and emergency decompression?**
- **How do you find a no decompression limit for a first and repetitive dive using both the RDP Table and the eRDPML?**
- **How do you calculate dive profiles for three or more repetitive dives using both the RDP Table and the eRDPML?**
- **How do you plan a multilevel dive using the eRDPML?**

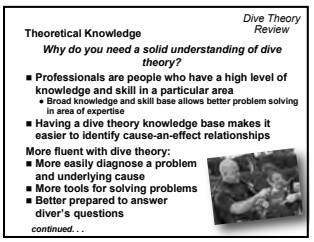
Outline

I. Theoretical Knowledge

A. Why do you need a solid understanding of dive theory?

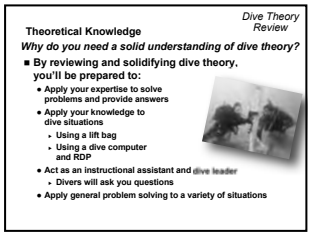
1. In the presentation – The Role and Characteristics of a PADI Divemaster – you learn that professionals are people who have a high level of knowledge and skill in a particular area.
   a. This broad knowledge and skill base is what allows professionals to be better at solving problems specific to their area of expertise.
   b. Having a dive theory knowledge base makes it easier to identify cause-and-effect relationships when dealing with problems and creating solutions.





c. The more fluent you are with dive theory, the more easily you can diagnose a problem because you better grasp the underlying causes. It gives you more tools for solving problems that aren't easily predicted or predefined. It prepares you to answer divers' questions.

d. By reviewing and solidifying your dive theory knowledge, you'll be better prepared to apply your expertise to solve problems and provide answers, both during the this course, and when acting as a dive supervisor or certified assistant.



2. You'll also apply your dive theory knowledge to a variety of dive situations during practical application exercises and workshops during this course.

   a. For example, gas pressure and volume relationships apply when using a lift bag during the Search and Recovery Scenario.

   b. Another example is applying dive computer and RDP use as well as decompression theory to the Deep Dive Scenario.

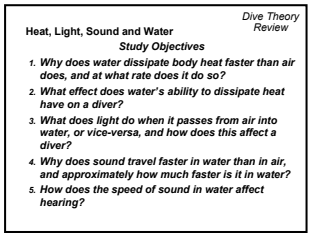
3. You will use dive theory knowledge when acting as an instructional assistant or dive supervisor.

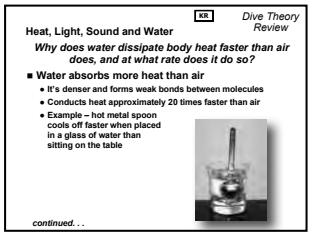
   a. Student divers ask you questions about what they are learning in the course.

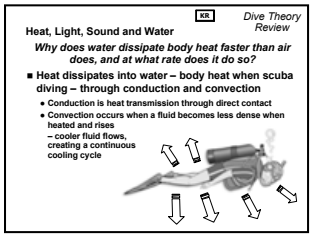
   b. Certified divers may also ask questions as they plan their dives and expect that you can remind them of key concepts.

   c. You'll apply what you're learning for general problem solving in a variety of situations.

4. The following topics review the dive theory knowledge you've already acquired and asks you to apply the concepts to diving.







II. Heat, Light, Sound and Water

A. Why does water dissipate body heat faster than air does, and at what rate does it do so?

1. Water absorbs more heat than air, which is why you use water to cool things. It conducts heat approximately 20 times faster than air does. For example, a hot metal spoon cools off much faster when placed in a glass of water than if left sitting on the table.

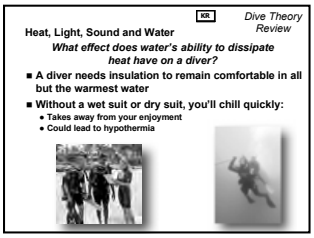
2. Heat dissipates into water, such as your body heat when scuba diving,through *conduction* and *convection*.

   a. Conduction is heat transmission through direct contact.

   b. Convection occurs when a fluid becomes less dense when heated and rises. As it rises, cooler fluid flows in to replace it – creating a continuous cooling cycle.

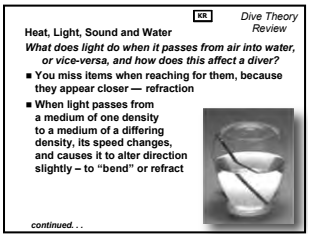
B. What effect does water's ability to dissipate heat have on a diver?

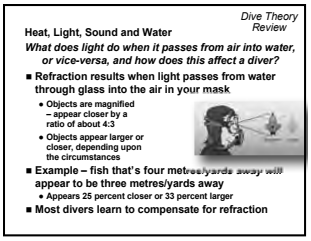
1. Due to conduction and, to a lesser extent, convection, a diver needs insulation to remain comfortable in all but the warmest water.
2. Without the insulation of a wet suit or dry suit, a diver will chill quickly, which not only takes away from the enjoyment, but also could lead to hypothermia. (More on how your body responds to insufficient heat later.)



C. What does light do when it passes from air into water, or vice-versa, and how does this affect a diver?

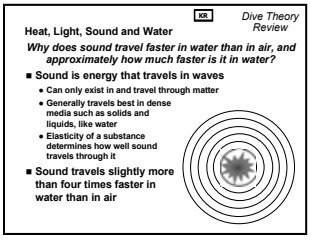
1. You may recall that as a new diver, you sometimes missed items underwater when reaching for them, because they appear closer than they actually are. This is due to *refraction*.
2. When light passes from a medium of one density to a medium of a differing density – like from air to water or vice-versa – its speed changes, and causes it to alter direction slightly – to "bend" or refract.
3. When you're diving, refraction results when light passes from water through glass into the air in your mask. The effect is that objects underwater are magnified so they appear closer by a ratio of about 4:3. This makes the object appear larger or closer, depending upon the circumstances.
   a. For example, a fish that's actually four metres/yards away will appear to be three metres/yards away.
   b. This makes the fish appear to be 25 percent closer than it actually is, or 33 percent larger than it actually is.
4. With experience, most divers learn to compensate for refraction without even thinking about it.





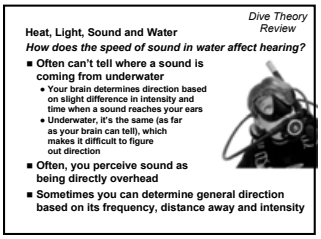
D. Why does sound travel faster in water than in air, and approximately how much faster is it in water?

1. Sound is energy that travels in waves and can only exist in and travel through matter.
   a. It generally travels best in dense media such as solids and liquids, like water.
   b. Actually, it's the elasticity of a substance that determines how well sound travels through it. Most substances that are denser have more elasticity.
2. Because of water has more elasticity than air, sound travels slightly more than four times faster in water than in air.



E. How does the speed of sound in water affect hearing?

1. The faster speed of sound in water means that you often can't tell where a sound is coming from underwater.



2. Your brain determines sound direction based on the slight difference in intensity and the time when a sound reaches each of your ears. Underwater, the intensity and time are the same (as far as your brain can tell), which makes it difficult to figure out direction.
3. Often, you perceive sound as being directly overhead. Sometimes you can determine a sound's general direction based on its frequency, distance away and intensity.

[NOTE: Use the following questions to test candidate understanding. Ask candidates to explain their answers.**]**

Q: Water _____ body heat faster than air does because it absorbs heat approximately _____times faster than air does.

A: dissipates, 20

Q: Due to water's ability to dissipate heat, a diver should wear _____ to avoid becoming quickly chilled underwater.

A: an exposure suit; a dry suit; a wet suit

Q: Light changes _____ when it passes through a substance of one density into a substance of a different density.

A: speed and direction

Q: Refraction explains why objects appear to be _____ by a factor of about _____ when viewed underwater.

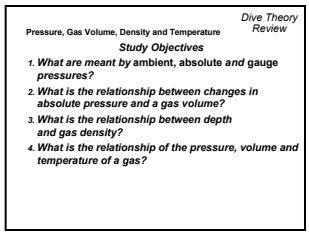
A: closer, 4:3

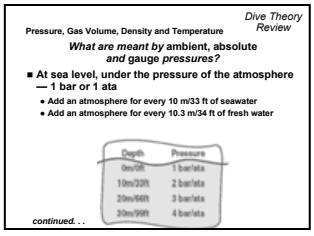
Q: Sound travels approximately _____ times faster in water than it does in air because water is denser (has more elasticity).

A: four

Q: Divers have difficulty determining the direction of sound underwater because the brain perceives that sound reaches each ear _____.

A: at the same time.





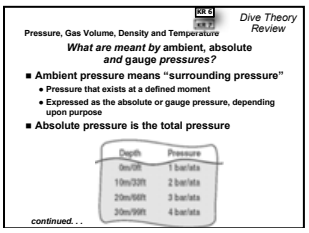
III. Relationship of Pressure, Gas Volume, Density and Temperature

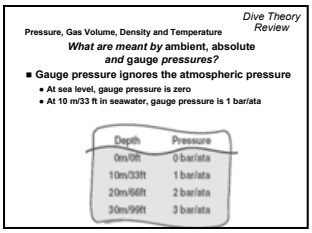
A. What are meant by *ambient, absolute* and *gauge* pressure?

1. You know from your previous training that at sea level you're under the pressure of the atmosphere, which results from the weight of the air. Atmospheric pressure is expressed as: 1 bar or 1 ata.
   a. Due to the weight of water, you add another atmosphere of pressure for every 10 metres/33 feet of seawater as you descend. For fresh water, you add 1 bar/atm every 10.3 m/34 ft.
2. Ambient pressure means "surrounding pressure." It means the pressure that exists around something at a defined moment and can be expressed

as the absolute pressure or as gauge pressure, depending upon your purpose.

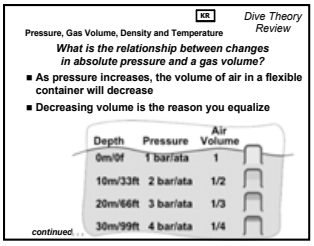
3. Absolute pressure is the total pressure, which is what you use to understand the effects of pressure on gases and your body.
   a. At sea level you are at 1 bar/ata. At 10 m/33 ft underwater in the ocean, the absolute pressure is 2 bar/ata, because you add the atmospheric pressure to the water pressure.
   b. For seawater the pressure increases as follows:
      - 20 m/66 ft – the absolute pressure is 3 bar/ata.
      - 30 m/99 ft – the absolute pressure is 4 bar/ata.
      - 40 m/132 ft – the absolute pressure is 5 bar/ata.
   c. For fresh water the pressure increases as follows:
      - 20.6 m/68 ft – the absolute pressure is 3 bar/ata.
      - 30.9 m/102 ft – the absolute pressure is 4 bar/ata.
      - 41.2 m/136 ft – the absolute pressure is 5 bar/ata.
4. Gauge pressure is a measurement that ignores the atmospheric pressure. At sea level, gauge pressure is zero. At 10 m/33 ft in seawater, the gauge pressure is 1 bar/ata.

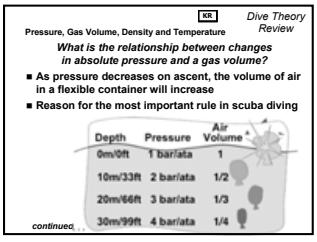




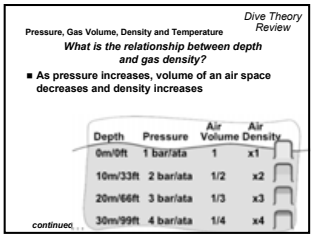
B. What is the relationship between changes in absolute pressure and a gas volume?

1. As a new diver, you learned that as pressure increases, the volume of air in a flexible container will decrease. Using a balloon as an example, if you take it to:
   a. 10 m/33 ft – the volume will decrease to 1/2 its original size.
   b. 20 m/66 ft – the volume will decrease to 1/3 its original size.
   c. 30 m/99 ft – the volume will decrease to 1/4 its original size.
   d. 40 m/132 ft – the volume will decrease by 1/5 its original size.
2. Decreasing volume on descent is the reason you need to equalize your body air spaces, such as your ears and mask.
3. The opposite is also true – as pressure decreases on ascent, the volume of air in a flexible container will increase. Again, using a balloon as an example, if you take it from:
   a. 10 m/33 ft to the surface – the volume will increase by two times its original size.
   b. 20 m/66 ft to the surface – the volume will increase by three times its original size.
   c. 30 m/99 ft to the surface – the volume will increase by four times its original size.
   d. 40 m/132 ft to the surface – the volume will increase by five times its original size.



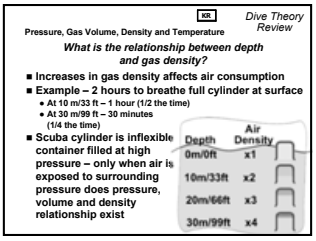


4. The relationship between pressure changes and gas volume is the reason for the most important rule in scuba diving – breathe continuously and never hold your breath. As air expands upon ascent, it needs to be able to escape.

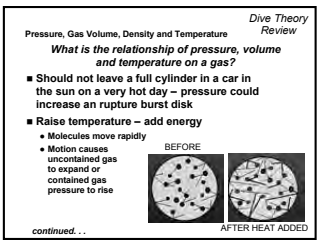


C. What is the relationship between depth and gas density?

1. You learned in your initial diver training that as water pressure increases with depth and the volume of an air space decreases, the density of the air inside the space increases, because the molecules are squeezed closer together.
2. As the depth increases and gas volume decreases, the gas density is as follows for seawater:
   a. At 10 m/33 ft, the density of a gas will increase by two times.
   b. At 20 m/66 ft, the density of a gas will increase by three times.
   c. At 30 m/99 ft, the density of a gas will increase by four times.
   d. At 40 m/132 ft, the density of a gas will increase by five times.



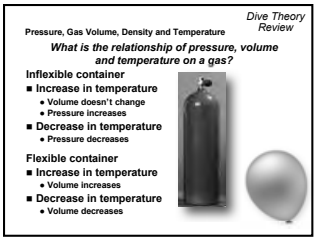
3. This increase in gas density affects a diver's air consumption rate, because at depth each breath the diver inhales contains more molecules. The deeper the dive, the faster the diver uses air.
   a. For example, let's say it takes two hours for a diver to breathe most of the air from a full scuba cylinder at the surface.
   b. At 10 metres/33 feet in the sea, given that the diver maintains the same breathing rate, the same full cylinder would only last for 1 hour, which is 1/2 of the time, because the air is twice as dense.
   c. At 30 metres/99 feet in the sea, the same full cylinder would only last for 30 minutes, which is 1/4 of the time. because the air is four times as dense.
4. Remember that a scuba cylinder is an inflexible container filled at high pressure, so at depth the gas inside is not affected by the water pressure. It's only when a diver breathes the air – exposing it to the surrounding pressure – that this pressure, volume and density relationship exists.



D. What is the relationship of pressure, volume and temperature on a gas?

1. You know that you should not leave a full scuba cylinder in a car in the sun on a very hot day, because cylinder pressure could increase to a point that it ruptures the burst disk.
2. The reason is that when you raise the temperature of a gas, you add energy, which causes the molecules to move rapidly. Increased molecular motion causes an uncontained gas to expand, or contained gas pressure to rise.

3. In an inflexible container like a scuba cylinder, the volume doesn't change, but increasing temperature will increase the pressure. The opposite is also true – decreasing temperature will decrease the pressure.
4. In a flexible container, like a balloon, as the temperature rises the molecules also move more rapidly, but instead of raising the pressure, the balloon expands. As the temperature increases, the volume of a flexible container increases. And, as the temperature decreases, the volume of a flexible container will decrease.



[NOTE: Use the following questions to test candidate understanding. Ask candidates to explain their answers.**]**

Q: If a diver is in fresh water at 10.3 metres/34 feet, what is the ambient pressure?

A: 2 bar/ata

Q: What is the absolute pressure at 25 metres/82.5 feet of seawater?

A: 3.5 bar/ata (half way between 20 m/66 ft and 30 m/99 ft)

Q: What is the absolute pressure at 20.6 metres/68 ft of fresh water?

A: 3 bar/ata

Q: If a 12 litre balloon is taken from the surface down to 20 m/66 ft in the ocean, what will its volume be?

A: 4 litres

Q: If a balloon is filled with two litres of air at 30 metres/99 feet, sealed and then released, what will its volume be when it reaches the surface (given that it doesn't burst)?

A: 8 litres

Q: The density of a gas will be _____ at 30 metres/99 feet what it is at the surface.

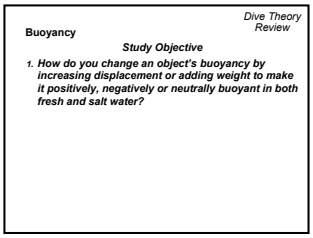
A: 4 times

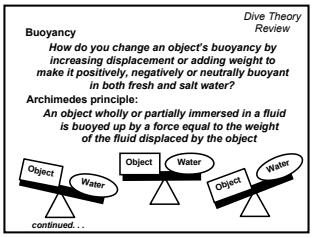
Q: If it takes a diver 45 minutes to breathe half a cylinder of air at the surface, about how long will it take that diver to breathe the same amount of air at 20 m/66 ft (assuming all variables remain the same)?

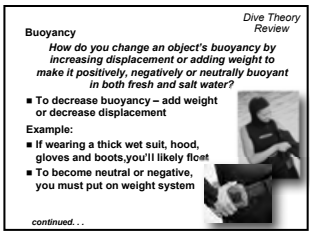
A: 15 minutes

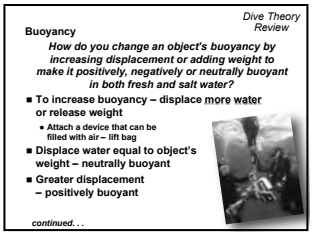
Q: If a scuba cylinder is filled to capacity at room temperature, what will you notice if you use the cylinder on a cold water dive?

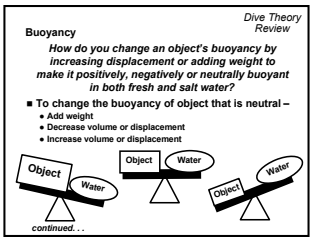
A: The cylinder pressure may be lower upon entering the water – the decrease in temperature causes a decrease in pressure.

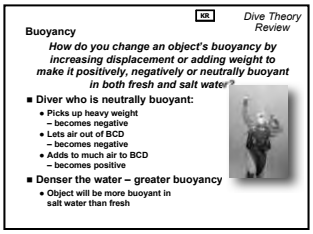












IV. Buoyancy

A. How do you change an object's buoyancy by increasing displacement or adding weight to make it positively, negatively or neutrally buoyant in both fresh and salt water?

1. You may have heard of Archimedes principle, which states that an object wholly or partially immersed in a fluid is buoyed up by a force equal to the weight of the fluid displaced by the object. This means that:
   a. An object that weighs less than the water it displaces will float and is positively buoyant.
   b. An object that weighs more than the water it displaces will sink and is negatively buoyant
   c. An object that weighs exactly the same as the water it displaces will neither float nor sink – it's neutrally buoyant.
2. To decrease the buoyancy of an object, you must add weight or decrease its displacement.
   a. For example, if you get into the water wearing a thick wet suit with a hood, gloves and boots, you will likely float very well. To become neutral or negatively buoyant, you must put on a weight system with lead weights.
3. To increase the buoyancy of an object, you must displace more water without adding weight, or release weight.
   a. The most effective way to do this is to attach a device that can be filled with air to the object, such as a lift bag.
   b. A lift bag filled with air increases the object volume by displacing water.
   c. Exactly displacing the amount of water that is equal to what the object weighs will make the object neutrally buoyant. A greater displacement can make the object positively buoyant.
4. To change the buoyancy of an object that is neutral, you simply either add weight, decrease the volume or displacement, or increase the volume or displacement. For example:
   a. When a diver who is neutrally buoyant picks up a heavy lead weight off the bottom, the diver will not be neutral anymore, but will become negatively buoyant.
   b. When a diver who is neutrally buoyant wants to kneel on the bottom, the diver lets air out of the BCD and sinks slowly, becoming negatively buoyant.
   c. When a diver who is adjusting for neutral buoyancy adds too much air into the BCD – displacing too much water – the diver will become positively buoyant.

5. You probably also recall from your previous training that the denser (heavier) the water, the greater the buoyancy for a given displacement. Salt water (due to its dissolved salts) weighs more than fresh water, so an object will be more buoyant in salt water than in fresh.

[NOTE: Use the following questions to test candidate understanding. Ask candidates to explain their answers.**]**

Q: If an object is neutrally buoyant, what are three ways you can change its buoyancy?

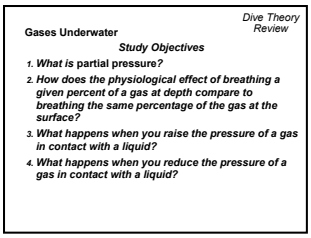
A. Add weight, drop weight, decrease the displacement, or increase the displacement

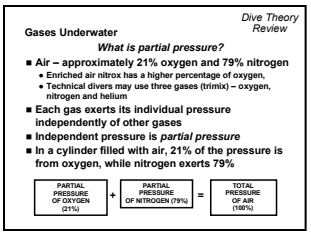
Q: An object will be more buoyant in _____ than it would be in _____, due to the weight of the water.

A: salt water, fresh water

Q: While scuba diving, you fine-tuning your buoyancy through breath control. This is an example of changing buoyancy by changing _____.

A: displacement



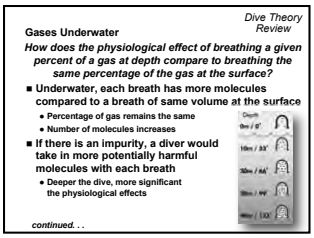


V. Gases Underwater

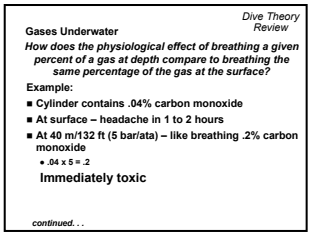
A. What is *partial pressure*?

1. A scuba cylinder may be filled with regular air, which contains approximately 21 percent oxygen and 79 percent nitrogen, or enriched air nitrox, which has a higher percentage of oxygen, such as a 32 percent oxygen and 68 percent nitrogen mix. Technical divers may fill their cylinders with three gases (trimix) – oxygen, nitrogen and helium.
2. No matter what is in a gas mixture, each gas exerts its individual pressure independently of the other gases in the mixture. The independent pressure of a gas is its *partial pressure*.
3. For a given pressure, each individual gas only exerts a percentage of the pressure. For example, in a scuba cylinder filled with air, 21 percent of the pressure is from oxygen, while nitrogen exerts 79 percent.

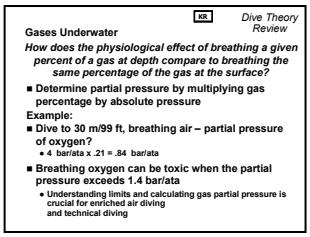
B. How does the physiological effect of breathing a given percentage of gas at depth compare to breathing the same percentage of the gas at the surface?



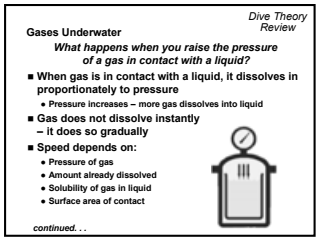
1. From the discussion on depth and density, you know that when a diver inhales underwater, each breath has more molecules compared to a breath of the same volume at the surface. This means that while the percentage of each gas in a mixture remains the same, the number of gas molecules increases with the pressure.



2. If there is an impurity in the gas, a diver would take in more potentially harmful molecules with each breath at depth. The deeper the dive, the more significant the physiological effects. For example:
   a. Breathing from a scuba cylinder that contains .04 percent carbon monoxide at the surface would cause a headache in one to two hours, but would not be immediately life threatening.
   b. However, breathing from this cylinder at 40 metres/132 feet (5 atmospheres) in the ocean would be like breathing .2 percent carbon monoxide (.04 multiplied by 5 equals .2,) which is immediately toxic.

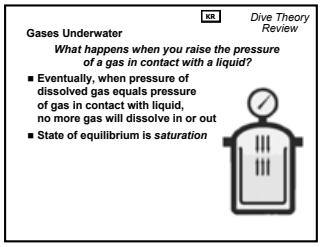


3. As just shown in the example, you determine partial pressure by multiplying the gas percentage in the mixture by the absolute pressure.
   a. For example, if you're planning a dive to 30 m/99 ft in the ocean breathing air and want to know the partial pressure of oxygen at that depth, the calculation is: 4 atmospheres multiplied by .21 (21 percent oxygen) equals .84 bar/ata.
4. Besides impurities, breathing oxygen at depth can be toxic when the partial pressure exceeds 1.4 bar/ata.
   a. Although you won't exceed this limit diving with air within recreational limits, you can if using enriched air nitrox due to its higher oxygen content.
   b. Understanding limits and calculating gas partial pressures is crucial for enriched air diving and technical diving, in which divers use various gas mixes. This is one reason why you need certification as a PADI Enriched Air Diver to use EANx.



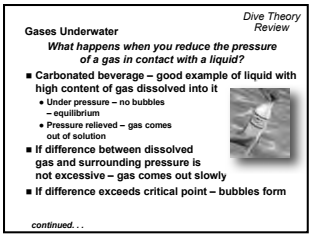
C. What happens when you raise the pressure of a gas in contact with a liquid?

1. When gas is in contact with a liquid, it dissolves into the liquid proportionately to the pressure. If the pressure increases, more gas dissolves into the liquid.
2. Gas does not dissolve instantly into or out of a liquid when the pressure changes. It does so gradually over a period. The speed depends on the pressure of the gas, the amount already dissolved, the solubility of the gas in the liquid, and the surface area where the gas and liquid make contact.

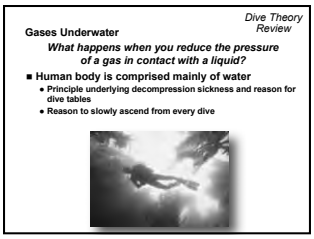


3. Eventually, however, the pressure of the gas dissolved within the liquid will become equal to the pressure of the gas in contact with it and no more gas will dissolve in or out. This equilibrium is referred to as *saturation*.

D. What happens when you reduce the pressure of a gas in contact with a liquid?



1. A carbonated beverage is a good example of a liquid that has a high content of gas dissolved into it.
   a. When under pressure, a carbonated beverage has no bubbles, because the gas within the liquid is in equilibrium with the gas in contact with the liquid.
   b. As soon as the pressure is relieved, the dissolved gas in the liquid has a higher pressure than the gas in contact with the liquid and the dissolved gas comes out of solution.
   c. If the difference between the dissolved gas pressure and the surrounding gas pressure is not excessive, gas comes out of solution slowly through the contact area.
   d. If the difference exceeds a critical point, however, then the gas dissolves out faster than it can escape through the contact area and bubbles form within the liquid.



2. Because the human body is comprised mainly of water, this is the principle underlying decompression sickness and the reason for dive tables. It's also the reason that you slowly ascend from every dive, avoiding rapid ascents and quick reduction of pressure.

[NOTE: Use the following questions to test candidate understanding. Ask candidates to explain their answers.**]**

Q: The independent pressure of a gas in a mixture is called _____.

A: partial pressure

Q: Breathing from a scuba cylinder that contains .03 percent carbon monoxide at the surface is like breathing _____ percent carbon monoxide at a depth of 20 m/66 ft, which is potentially harmful.

A: .09 (.03 multiplied by 3 atmospheres equals .09)

Q: If an enriched air diver plans to dive to 30 m/99 ft in the ocean using a gas mixture that contains 32 percent oxygen, will the diver reach the point where the partial pressure of oxygen may be toxic?

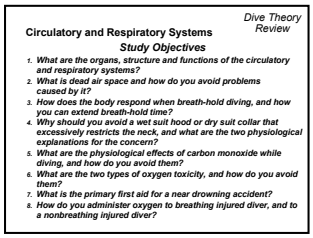
A: No (4 atmospheres multiplied by .32 equals 1.28 bar/ata)

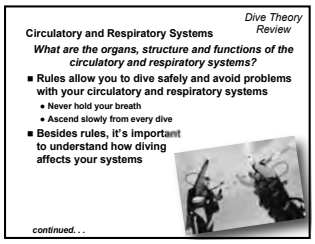
Q: If a glass of water has been placed in a chamber pressured at 1 ata, what will happen if the pressure is raised to 2 ata?

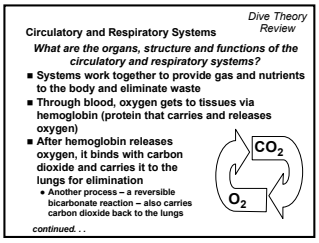
A: The gas dissolved within the liquid will increase.

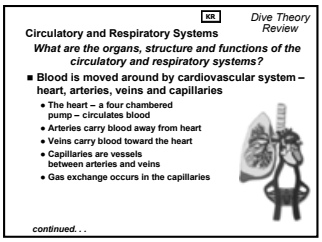
Q: If the pressure surrounding a liquid-filled container is quickly decreased, such as when opening a soda can, the amount of gas dissolved in the liquid will _____ and _____.

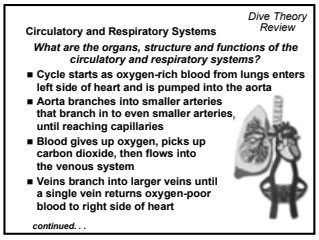
A: decrease, gas bubbles may form

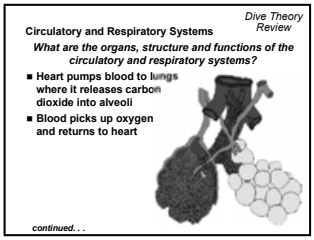


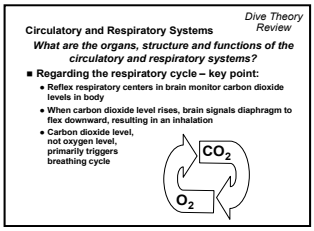












VI. Circulatory and Respiratory Systems

A. What are the organs, structure and functions of the circulatory and respiratory systems?

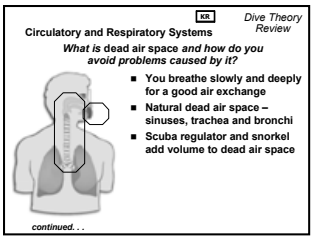
1. In your initial dive training, you learned the rules that allow you to dive safely and avoid problems with your circulatory and respiratory systems. These included never hold your breath; ascend slowly from every dive, etc. Besides knowing the rules, it's important for you, as a dive professional, to understand how diving affects your body's circulatory and respiratory systems.
2. The circulatory and respiratory systems work together to provide gas and nutrients to the body and to eliminate waste.
3. Through blood, oxygen gets to body tissues via hemoglobin, a protein that readily carries and releases oxygen.
   a. After hemoglobin releases oxygen, it binds with carbon dioxide and carries it to the lungs for elimination.
   b. Another process – a reversible bicarbonate reaction – also carries carbon dioxide back to the lungs.
4. Blood is moved around by the cardiovascular system – the heart, arteries, veins and capillaries.
   a. The heart – a four chambered pump – circulates blood.
   b. Arteries carry blood away from the heart.
   c. Veins carry blood toward the heart.
   d. Capillaries are microscopic vessels between arteries and veins. Gas exchange occurs in the capillaries.
5. The cycle starts as oxygen-rich blood from the lungs enters the left side of the heart and is pumped into the aorta, the body's largest artery.
   a. The aorta branches into smaller arteries that branch in to even smaller arteries throughout the body, until reaching the capillaries.
   b. Blood gives up oxygen, picks up carbon dioxide, then flows into the venous system.
   c. Veins branch into larger veins until a single vein returns oxygen-poor blood to the right side of the heart.
   d. The heart pumps oxygen-poor blood to the lungs where it releases carbon dioxide into alveoli, which are air sacs surrounded by the pulmonary capillaries. The blood then picks up oxygen and returns to the left side of the heart to begin another cycle.
6. Regarding the respiratory cycle, one key point is knowing what actually triggers the breathing cycle and keeps the whole system functioning effectively.

a. The reflex respiratory centers in the brain monitor the carbon dioxide levels in the body.

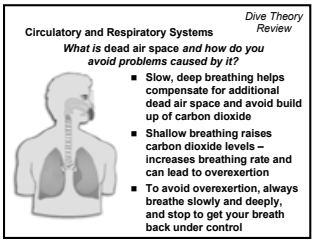
b. When the carbon dioxide level rises, the brain signals the diaphragm – the large muscle below the lungs – to flex downward, resulting in an inhalation.

c. So, it's the carbon dioxide level, not the oxygen level, that primarily triggers the breathing cycle.

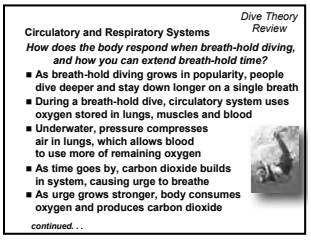
B. What is *dead air space*, and how do you avoid problems caused by it?



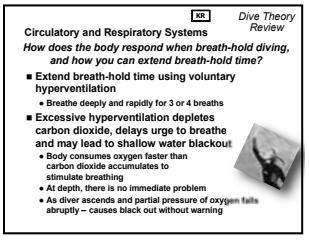
1. You breathe slowly and deeply while diving for a good air exchange.
2. As you recall, natural dead-air space consists of your sinuses, trachea and bronchi where no direct gas exchange occurs. Your scuba regulator and snorkel add additional volume to your dead-air space.
3. Slow, deep breathing helps you compensate for the additional dead air space and avoid a build up of carbon dioxide through a good air exchange.
4. Shallow breathing raises carbon dioxide levels, which increases the breathing rate, and can lead to a feeling of air starvation or overexertion.
5. To avoid overexertion, always breathe slowly and deeply, and stop to get your breath back under control if you feel your breathing rate increase.



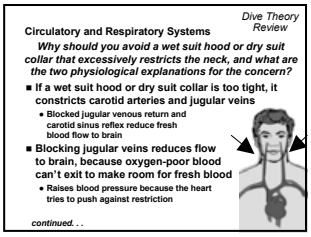
C. How does the body respond when breath-hold diving, and how can you extend breath-hold time?



1. As breath-hold diving or free diving grows in popularity, people continue to dive deeper and stay down longer on a single breath. They do this through extensive training and by understanding how the body responds during a dive.
2. During a breath-hold dive, the circulatory system uses oxygen stored in the lungs, muscles and blood to supply tissues.
   a. Underwater, the pressure compresses the air in the lungs, raising the oxygen partial pressure, which allows the blood to use more of the remaining oxygen than would be possible at surface pressures.
   b. As time goes by, carbon dioxide builds in the circulatory system and causes the urge to breathe. The initial urge is weak, but the urge grows stronger as the body consumes oxygen and produces more carbon dioxide.
3. You can extend breath-hold time using a techniques called voluntary hyperventilation. You do this by breathing deeply and rapidly for three or four breaths. Doing this reduces circulatory carbon dioxide so it takes longer to accumulate enough to stimulate breathing.

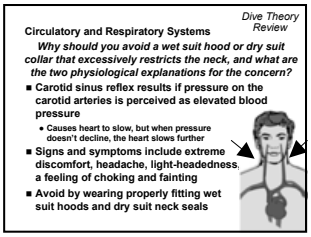


4. However, excessive voluntary hyperventilation depletes carbon dioxide to a point where it delays the urge to breathe and may lead directly to a condition called shallow water blackout.
    a. If a diver excessively hyperventilates, the diver's body consumes oxygen faster than carbon dioxide accumulates to stimulate breathing.
    b. At depth, there is no immediate problem because increased pressure keeps the partial pressure of oxygen high enough to meet the body's needs.
    c. When carbon dioxide levels finally rise enough to stimulate breathing, the diver ascends and the partial pressure of oxygen falls abruptly. This causes the diver to black out without warning because the oxygen partial pressure is insufficient to meet the body's needs. This could lead to drowning and can also damage tissue.

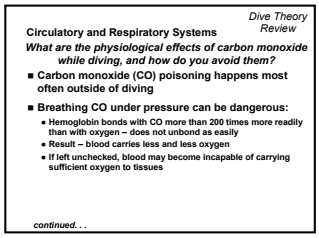


D. Why should you avoid a wet suit hood or dry suit collar that excessively restricts the neck, and what are the two physiological explanations for the concern?

1. If a wet suit hood or dry suit collar is too tight, it constricts the carotid arteries, which supply blood to the brain, and the jugular veins, which carry blood from the brain back to the heart.
2. The two possible concerns are called the carotid sinus reflex and blocked jugular venous return. Both can reduce fresh blood flow to the brain.
3. Blocking jugular return reduces flow to the brain, because the oxygen-poor blood can't exit fast enough to make room for fresh blood. This raises blood pressure because the heart tries to push against the restriction.



4. Carotid sinus reflex results if pressure on the carotid arteries is perceived by the body as elevated blood pressure. This causes the heart to slow, but when the perceived high blood pressure doesn't decline, the heart slows further.
5. Signs and symptoms of this constriction include extreme discomfort, headache, light-headedness, a feeling of choking and eventually fainting.
6. Physiologists debate which of these two mechanisms is the primary concern. Both can be avoided by wearing properly fitting wet suit hoods and dry suit neck seals.



E. What are the physiological effects of carbon monoxide while diving, and how do you avoid them?

1. Although carbon monoxide poisoning happens most often outside of diving, breathing carbon monoxide under pressure while diving can be dangerous – as discussed earlier in the topic, Gases Underwater.

a. The reason it's dangerous is that hemoglobin bonds with carbon monoxide more than 200 times more readily than with oxygen, but does not unbond as easily.

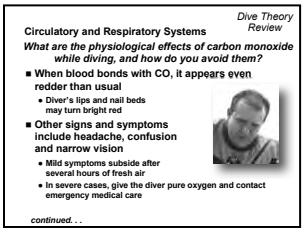
b. This results in the blood carrying less and less oxygen. If left unchecked, the blood may become incapable of carrying sufficient oxygen to the tissues.

2. When blood bonds with carbon monoxide, it appears even redder than usual. A diver's lips and nail beds may turn bright red after breathing air contaminated with carbon monoxide (though this may be difficult to see underwater).

   a. Other signs and symptoms include headache, confusion and narrow vision.

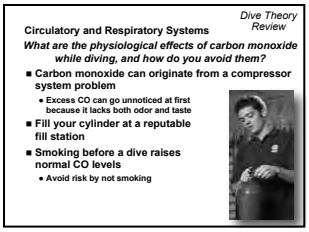
   b. Mild symptoms subside after several hours of fresh air.

   c. In severe cases, give the diver pure oxygen and contact emergency medical care.



3. Although carbon monoxide rarely contaminates a diver's air supply, it can originate from a compressor system problem. Excess carbon monoxide can go unnoticed at first because carbon monoxide lacks both odor and taste. Only fill your cylinder at a reputable fill station.

4. Smoking before a dive raises normal carbon monoxide levels in the blood three to 12 times. Avoid risking this cause of carbon monoxide poisoning by simply not smoking before diving.

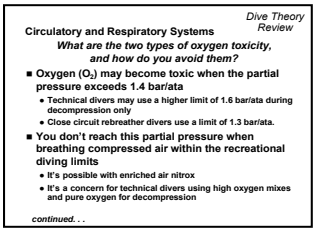


F. What are the two types of oxygen toxicity, and how do you avoid them?

1. You learned earlier in the topic – Gases Underwater – that oxygen may become toxic when the partial pressure exceeds 1.4 bar/ata.

   a. Note that technical divers may use a slightly higher limit of 1.6 ata/bar during decompression only. Close circuit rebreather divers generally use a limit of 1.3 bar/ata.

2. You don't reach this partial pressure when breathing compressed air within the recreational diving limits. However, it is possible when divers use enriched air nitrox, and it is a concern for technical divers using high oxygen mixes and pure oxygen for decompression.

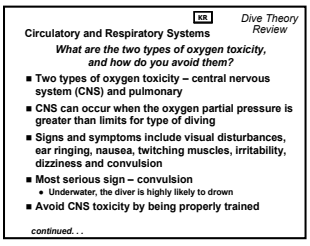


3. The two types of oxygen toxicity are central nervous system (CNS) toxicity and pulmonary toxicity.

4. CNS can occur when the oxygen partial pressure is greater than the threshold limits for the type of diving.

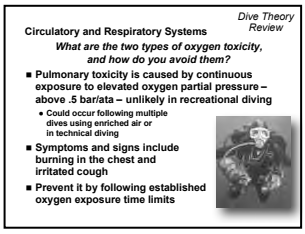
   a. Signs and symptoms include visual disturbances, ear ringing, nausea, twitching muscles, irritability, dizziness and convulsion.

   b. The most serious sign is a convulsion – usually without warning. A convulsion is not usually fatal in itself, but if it happens underwater, the diver is highly likely to drown.



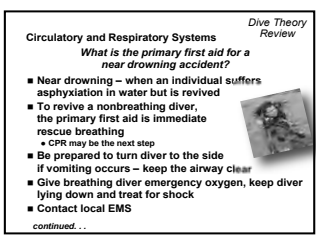
c. You avoid CNS toxicity by being properly trained to use enriched air and not exceeding an oxygen partial pressure of 1.4 bar/ata.

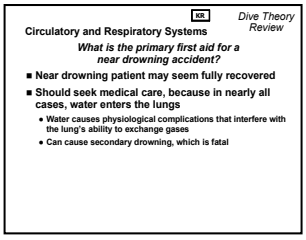
5. Pulmonary toxicity is caused by continuous exposure to elevated oxygen partial pressure – above approximately .5 bar/ata – making it unlikely in recreational diving.
   a. It could occur following multiple dives using enriched air or in technical diving where long decompressions stops require using pure oxygen.
   b. Symptoms and signs include burning in the chest and an irritated cough.
   c. You prevent it by following established oxygen exposure time limits.



G. What is the primary first aid for a near drowning accident?

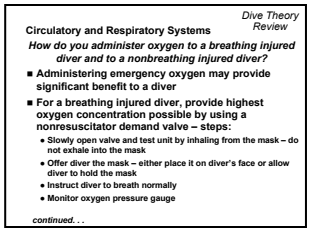
1. Near drowning is defined as when an individual suffers asphyxiation in water but is revived.
2. To revive a nonbreathing diver who had drowned – turning a drowning into a near drowning – the primary first aid is immediate rescue breathing.
   a. CPR may be the next step if the diver has no heartbeat.
   b. Be prepared to turn the diver to the side if vomiting occurs when breathing resumes, to keep the airway clear.
   c. Give the breathing diver emergency oxygen, keep the diver lying down and treat for shock.
   d. Contact the local EMS.
3. A near drowning patient may quickly seem fully recovered. However, the patient should seek medical care, because in nearly all cases, water enters the patient's lungs.
   a. Over a period of hours, the water causes physiological complications that interfere with the lung's ability to exchange gases. This can cause secondary drowning, which is fatal.





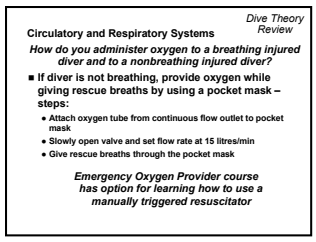
H. How do you administer oxygen to a breathing injured diver and to a nonbreathing injured diver?

1. From your rescue diver training, you know that administering emergency oxygen is accepted practice for most diving injuries, such as decompression illness and near drowning, because it may provide significant benefit to the diver.
2. For a breathing injured diver, you want to provide the highest oxygen concentration possible by using the nonresuscitator demand valve on the oxygen unit. Follow these steps:
   a. With the oxygen kit set up, slowly open the valve and test the unit by inhaling from the mask. Do not exhale into the mask (for sanitation reasons).



b. Offer the diver the oxygen mask – either place it on the diver's face or allow the diver to hold the mask in place.
c. Instruct the diver to breath normally.
d. Monitor the oxygen pressure gauge so that it doesn't run empty with the mask still on the diver.

3. If the diver is not breathing, you can still provide oxygen while giving rescue breaths by using a pocket mask with an oxygen inlet valve. Follow these steps:
   a. Have someone attach the oxygen tube from the continuous flow outlet to the pocket mask while you continue rescue breaths.
   b. Slowly open the valve and set the flow rate at 15 litres per minute.
   c. Give rescue breaths through the pocket mask as usual.
4. In the Emergency Oxygen Provider course there is an option for learning how to use a manually triggered resuscitator.



[NOTE: Use the following questions to test candidate understanding. Ask candidates to explain their answers.**]**

Q: Arteries carry oxygen-rich blood away from heart and _____ carry oxygen-poor blood toward heart.

A. veins

Q: The heart pumps oxygen-poor blood to the lungs where it releases _____ into alveoli and then picks up oxygen.

A. carbon dioxide.

Q: You can compensate for the increased _____ space resulting from breathing through the snorkel or regulator by breathing _____ and _____.

A: dead-air, slowly, deeply

Q: The reflex respiratory centers in the brain trigger the breathing cycle based on the body's _____ level, not the _____ level.

A: carbon dioxide, oxygen

Q: To extend a breath-hold dive, the diver should take no more than_____ rapid, deep breaths before submerging.

A: three or four

Q: A wet suit hood or dry suit collar that is too tight can reduce fresh _____ flow to the brain and raises blood _____.

A: blood, pressure

Q: Carbon monoxide bonds with blood more than _____ times more readily than oxygen and may turn a diver's lips and nail beds bright _____.

A: 200, red

Q: The most serious sign of Central Nervous System (CNS) toxicity is _____ .

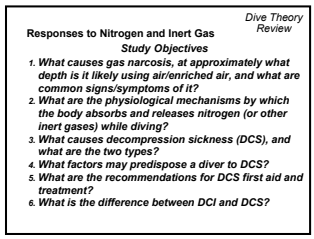
A: convulsion

Q: The primary first aid for near drowning is _____.

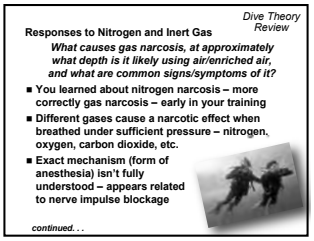
A: rescue breathing

Q: For a breathing diver, you'd likely administer oxygen using a _____, and for a nonbreathing diver you'd use _____ .

A: nonresuscitator demand valve, continuous flow with a pocket mask

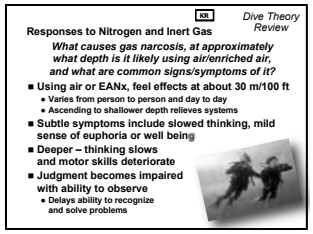


VII. Responses to Nitrogen and Inert Gas

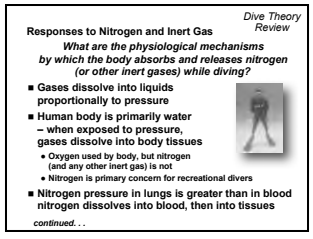


A. What causes gas narcosis, at approximately what depth is it likely using air/enriched air, and what are common signs/symptoms of it?

1. You learned about nitrogen narcosis, or more correctly, gas narcosis, early in your diver training.
   a. Different gases can cause a narcotic effect when breathed under sufficient pressure. This includes nitrogen, oxygen and carbon dioxide among others.
   b. The exact mechanism causing gas narcosis – which is a form of anesthesia – isn't full understood, but it appears related to nerve impulse blockage due to gas dissolved in nerve cells.



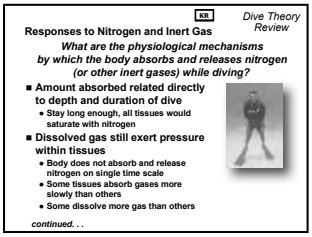
2. Most divers begin to feel the effects of gas narcosis at about 30 metres/100 feet, though this varies not only from person to person, but within one individual from day to day. As you know, ascending to a shallower depth quickly relieves the symptoms.
3. Subtle symptoms include slowed thinking, and some divers get a mild sense of euphoria or well being.
   a. At deeper depths, thinking slows further and motor skills begin to deteriorate.
   b. The diver's judgment may become impaired, along with the ability to accurately observe what's occurring, which may delay a diver's ability to recognize and solve problems.

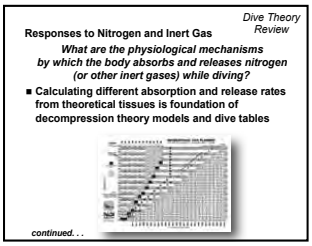


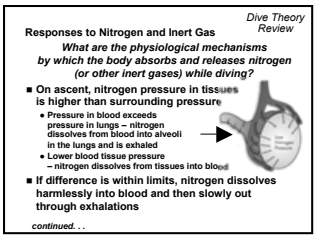
B. What are the physiological mechanisms by which the body absorbs and releases nitrogen (or other inert gases) while diving?

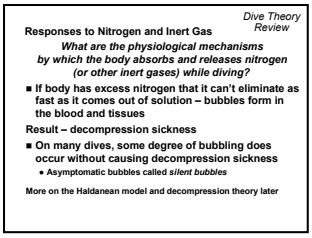
1. In the topic – Gases Underwater – you may recall that gases dissolve into liquids proportionately to the pressure. Because the human body is primarily water, when it is exposed to pressure, gasses dissolve into body tissues.
2. Oxygen is used by the body, but nitrogen (and any other inert gas) is not. Nitrogen is the gas that primarily concerns recreational divers.

3. At depth, nitrogen pressure in the lungs is greater than in the blood, so nitrogen dissolves into blood, then from the blood into the tissues.
4. The amount of nitrogen absorbed relates directly to the depth and duration of the dive.
5. Dissolved gas still exerts pressure within the body tissues.
    a. The body does not absorb and release nitrogen on a single time scale. Some tissues are thought to absorb gases more slowly than others; some are thought to be able to dissolve more gas than others.
    b. Calculating different absorption and release of inert gases from theoretical tissues is the foundation of decompression theory models and dive tables.
6. On ascent from a dive, nitrogen pressure in tissues is higher than the surrounding pressure. Nitrogen pressure in blood exceeds pressure in the lungs, so the nitrogen dissolves from the blood into the lungs and is exhaled. This lowers blood tissue pressure, so nitrogen dissolves from body tissues into blood.
7. If the difference between surrounding pressure and tissue pressure is within limits, the nitrogen dissolves harmlessly into the blood and then slowly out of the body through exhalations.
8. If the body has absorbed so much excess nitrogen that it can't eliminate it as fast as it comes out of solution, the excess nitrogen forms bubbles in the blood vessels and tissues, resulting in decompression sickness.
    a. Note that on many dives, physiologists think some degree of bubbling does occur in the body without causing decompression sickness.
    b. These asymptomatic bubbles are called *silent bubbles.*
9. We'll look at the Haldanean model and decompression theory in more detail later in this presentation.



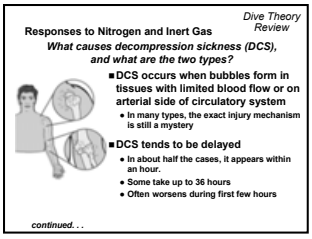


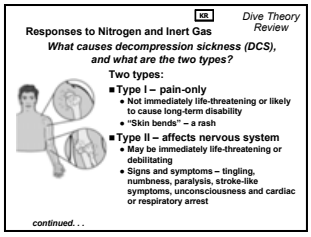




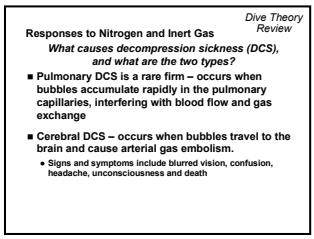
C. What causes decompression sickness (DCS), and what are the two types?

1. Decompression sickness occurs when bubbles form in tissues with limited blood flow or on the arterial side of the circulatory system. In many types of DCS, the exact injury mechanism is still a mystery, because the interaction between bubbles and tissues is complex.
2. DCS tends to be delayed after a dive, though in about half the cases it appears within an hour. Some take up to 36 hours. It often worsens during the first few hours after onset.



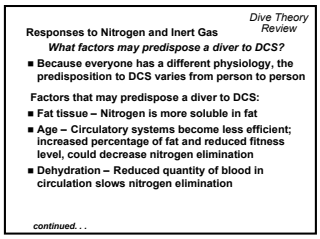


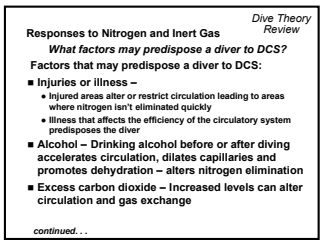
3. DCS cases are generally categorized into two types:
   a. Type I is pain-only that presents signs and symptoms that are not immediately life-threatening or likely to cause immediate long-term disabilities.
      - "Skin bends" – cutaneous decompression sickness that forms a rash – is also considered Type I if it occurs by itself.
   b. Type II has symptoms that affect the nervous system and may be immediately life-threatening or debilitating.
      - Signs and symptoms include tingling, numbness, paralysis, stroke-like signs/symptoms, unconsciousness and cardiac or respiratory arrest.
      - Pulmonary DCS is a rare form that occurs when bubbles accumulate rapidly in the pulmonary capillaries, interfering with blood flow and gas exchange.
      - Cerebral DCS occurs when bubbles travel to the brain via the carotid arteries and cause arterial gas embolism. Symptoms and signs include blurred vision, confusion, headache, unconsciousness and death.

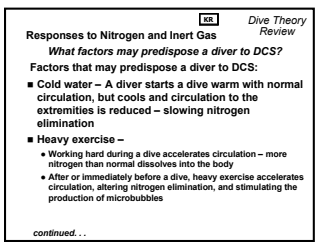


D. What factors may predispose a diver to DCS?

1. Because everyone has a slightly different physiology, the predisposition to DCS varies from person to person. However, the following are a few factors that may predispose a diver to DCS:
   a. Fat tissue – Nitrogen is more soluble in fat than in water. A diver with a disproportionate amount of body fat may have more nitrogen in solution after a dive.
   b. Age – As we age, our circulatory systems become less efficient. This, along with increased percentage of fat and a reduced fitness level, could decrease the speed of nitrogen elimination.
   c. Dehydration – Dehydration reduces the quantity of blood in circulation, which slows nitrogen elimination.
   d. Injuries or illness – Injured areas could alter or restrict circulation leading to localized areas where nitrogen isn't eliminated quickly. Any illness that affects the efficiency of the circulatory system predisposes the diver.
   e. Alcohol – Drinking alcohol before or after diving accelerates circulation, dilates capillaries and promotes dehydration, all of which can alter nitrogen elimination and bubble formation.
   f. Excess carbon dioxide – Increased carbon dioxide levels can alter circulation and gas exchange.
   g. Cold water – If a diver starts a dive warm with normal circulation, but cools during the dive, circulation to the extremities is reduced, thus slowing nitrogen elimination from those areas.



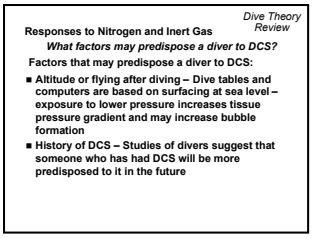




h. Heavy exercise – Working hard during a dive accelerates circulation so more nitrogen than normal dissolves into the body. Immediately after a dive, heavy exercise accelerates circulation, altering nitrogen elimination, and stimulating the production of microbubbles that can grow into larger DCS causing bubbles.

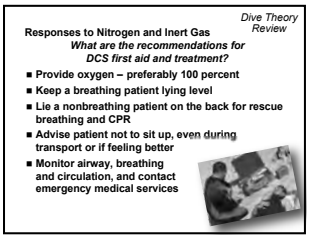
i. Altitude or flying after diving – Dive tables and computers are based on surfacing at sea level, thus exposure to lower pressure increases the tissue pressure gradient and may increase bubble formation.

j. History of DCS – Studies of divers as well as other people working under pressure suggest that someone who has had DCS will be more predisposed to it in the future.



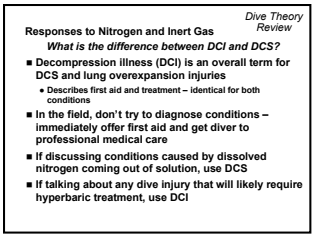
E. What are the recommendations for DCS first aid and treatment?

1. If you suspect a diver has DCS, start by providing oxygen – preferably 100 percent.
2. Keep a breathing patient lying level.
   a. Lay a nonbreathing patient on the back for rescue breathing and CPR.
   b. Advise patient not to sit up, even during transport or if feeling better.
3. Monitor airway, breathing and circulation, and contact emergency medical services.



F. What is the difference between DCI and DCS?

1. Decompression illness (DCI) is an overall term for DCS and lung overexpansion injuries used in describing first aid and treatment, which is identical for both conditions.
   a. In the field, divers are discouraged from trying to diagnose the two different conditions, but are encouraged to immediately offer first aid to an injured diver and get the diver to professional medical care.
2. If discussing the conditions caused by dissolved nitrogen coming out of solution, use the term DCS.
3. If talking about any dive injury that will likely require hyperbaric treatment, use DCI.



[NOTE: Use the following questions to test candidate understanding. Ask candidates to explain their answers.**]**

Q: The signs and symptoms of gas narcosis usually begin to occur at around _____metres/ _____ feet.

A. 30, 100

Q: Nitrogen dissolved in the body after a dive comes out harmlessly and slowly if the difference between _____ pressure and _____ pressure is within limits.

A: surrounding, tissue

Q. Type I DCS is characterized by _____, which is not immediately life-threatening, and Type II DCS has symptoms that affect the _____ system and may be immediately life-threatening or debilitating.

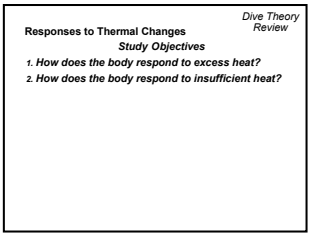
A: pain only, nervous

Q: List factors that may predispose a diver to DCS:

A: Fat tissue, age, dehydration, injury, illness, alcohol, excess carbon dioxide, cold water, heavy exercise, altitude or flying after diving, and history of DCS.

Q: What is the first step you should take in providing aid to a diver suspected of having DCS?

A: Provide 100% oxygen

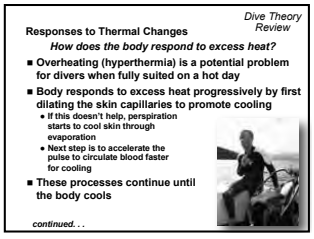


Q: Decompression illness (DCI) is an overall term for _____ and _____.

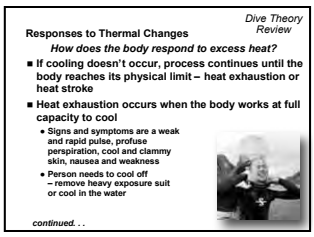
A. DCS, lung overexpansion injuries

VIII. Responses to Thermal Changes

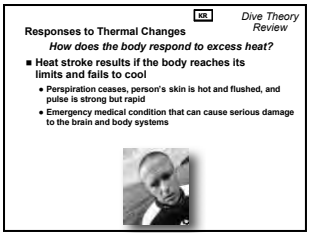
A. How does the body respond to excess heat?



1. Overheating (*hyperthermia*) is a potential problem for divers when fully suited in wet suits or dry suits on a hot day, and there is a delay in getting in to the water.
2. The body responds to excess heat progressively by first dilating the skin capillaries to promote cooling.
   a. If this doesn't help, perspiration starts in an attempt to cool the skin through evaporation.
   b. The next step the body takes is to accelerate the pulse to circulate blood faster for cooling.
3. These processes continue until the body cools. For example, the hot diver gets in to the water.
4. If cooling doesn't occur, the process continues until the body reaches its physical limit, which may mean heat exhaustion or heat stroke.
5. Heat exhaustion occurs when the body works at full capacity to cool.
   a. Signs and symptoms are a weak and rapid pulse, profuse perspiration, cool and clammy skin, nausea and weakness.
   b. Someone with heat exhaustion needs to cool off, which may means removing a heavy exposure suit or cooling in the water.

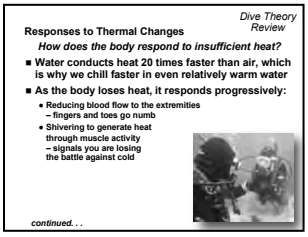


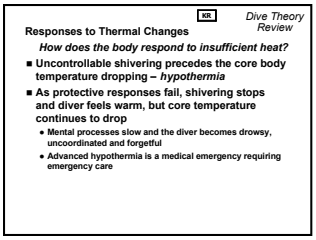
6. Heat stroke results if the body reaches its limits and fails to cool.
   a. Perspiration ceases and the person's skin is hot and flushed. The pulse is strong but rapid.
   b. This is an emergency medical condition that can cause serious damage to the brain and body systems.



B. How does the body respond to insufficient heat?

1. In the topic – Heat, Light, Sound and Water – you learned that water conducts heat 20 times faster than air, which is why we chill faster in even relatively warm water.
2. As the body loses heat, it responds progressively, first reducing blood flow to the extremities. For example, your fingers and toes may start to go numb.
3. The next step is shivering to generate heat through muscle activity. In the water, shivering signals that you are losing the battle against the cold.
4. Uncontrollable shivering precedes the core body temperature dropping, which is *hypothermia*.
   a. Mental processes slow and the diver becomes drowsy, uncoordinated and forgetful.
   b. Advanced hypothermia is a medical emergency requiring emergency care.





[NOTE: Use the following questions to test candidate understanding. Ask candidates to explain their answers.**]**

Q: The body responds to excess heat by first dilating the _____ , then beginning _____, and finally accelerating the _____ to circulate blood faster for cooling.

A. skin capillaries, perspiration, pulse

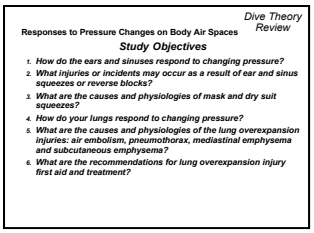
Q: The body responds to cold by reducing blood flow to the _____, and then by _____ to generate heat through muscle activity.

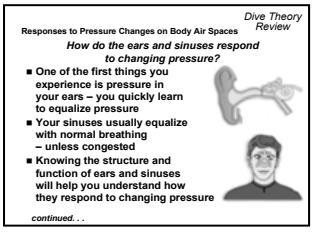
A. extremities, shivering

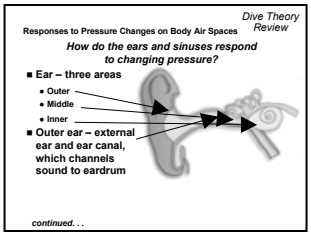
IX. Responses to Pressure Changes on Body Air Spaces

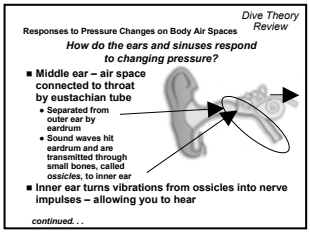
A. How do the ears and sinuses respond to changing pressure?

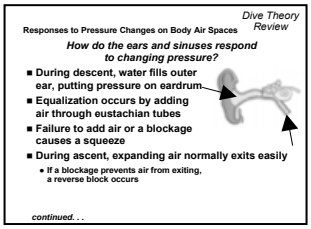
1. One of the first things you experience when going underwater is pressure in your ears, and as a new diver, you quickly learned to equalize that pressure.
2. You may not have ever felt any pressure in your sinuses while diving, because they usually equalize with normal breathing – that is unless they are congested, which is why you know not to dive with a cold.
3. Knowing more about the structure and function of the ears and sinuses, will help you better understand how they respond to changing pressure.



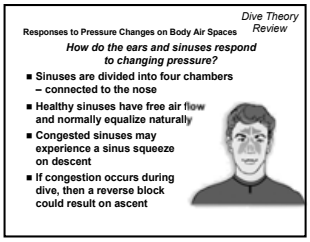




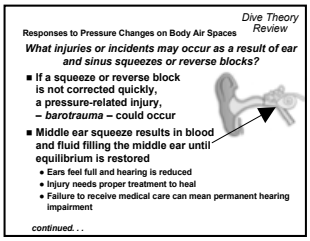




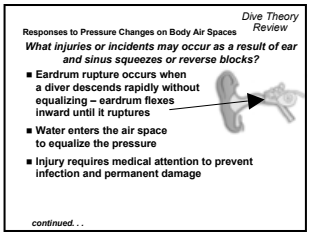
4. The ear is divided into three areas – the outer, middle, and inner ear.
   a. The outer ear consists of the external ear and the ear canal, which channels sound to the eardrum.
   b. The middle ear is an air space that is connected to the throat by the eustachian tube. The middle ear is separated from outer ear by the eardrum. Sound waves hit the eardrum and are transmitted through small bones, called ossicles, to the inner ear.
   c. The inner ear turns vibrations from the ossicles into nerve impulses that are sent to the brain – allowing you to hear.
5. During descent, water fills the outer ear, putting pressure on the eardrum.
   a. Equalization occurs by adding air through the eustachian tubes to each middle ear.
   b. As you know, failure to add air or a blockage that prevents air from getting to the middle ear causes a squeeze.
6. During ascent, expanding air normally exits easily without the diver even being aware of it. However, if a blockage prevents air from exiting, a reverse block occurs, which we'll discuss in a few minutes.
7. The sinuses are divided into four chambers that are connected to the nose.
   a. As mentioned, healthy sinuses have free air flow and normally equalize naturally on descent and ascent.
   b. Congested sinuses, however, may experience a sinus squeeze on descent.
   c. If congestion occurs during the dive, then a reverse block could result on ascent.



B. What injuries or incidents may occur as a result of ear and sinus squeezes or reverse blocks?

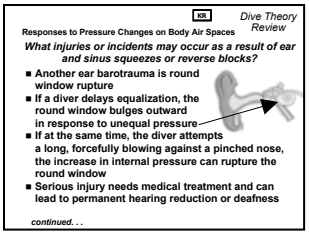


1. If a squeeze or reverse block is not corrected quickly, a pressure-related injury, called a *barotrauma*, could occur.
2. A middle ear squeeze that is not equalized results in blood and fluid filling the middle ear until equilibrium is restored.
   a. The ears feel full and hearing is reduced.
   b. This injury needs proper treatment to heal. Failure to receive medical care can mean permanent hearing impairment.

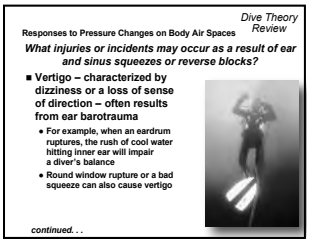


3. Eardrum rupture occurs when a diver descends rapidly without equalizing, and the eardrum flexes inward until it ruptures.
   a. Water enters the air space through the ruptured eardrum to equalize the pressure.
   b. This injury requires medical attention to prevent infection and permanent damage due to water contaminating the middle ear.

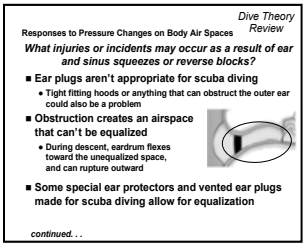
4. Another ear barotrauma that can occur to the inner ear is round window rupture.
   a. If a diver delays equalization, the round window bulges outward into the middle ear in response to the unequal pressure. If at the same time, the diver attempts to equalize by using a long, forcefully blowing against a pinched nose, the combined increase in internal pressure can rupture the round window.
   b. This serious injury needs medical treatment and can lead to permanent hearing reduction or deafness in the affected ear.



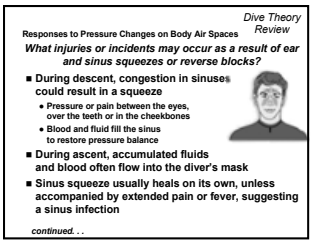
5. Vertigo, which is characterized by dizziness or a loss of sense of direction, often results from ear barotrauma.
   a. For example, when an eardrum ruptures underwater, the rush of cool water hitting the inner ear will impair the diver's balance, resulting in vertigo.
   b. Round window rupture or a bad squeeze can also cause vertigo.



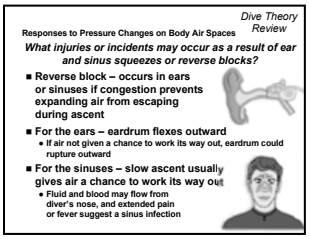
6. You already know that ear plugs aren't appropriate for scuba diving because they create an air space that you can't equalize. Be aware that tight fitting hoods or anything that can obstruct the outer ear could also be a problem.
   a. When the outer ear is blocked, the obstruction creates an airspace between the block and the eardrum that can't be equalized.
   b. During descent, the eardrum flexes toward the unequalized space, and if the descent continues, the eardrum can rupture outward.
   c. There are some special ear protectors and vented ear plugs made specifically for scuba diving that allow for pressure equalization.



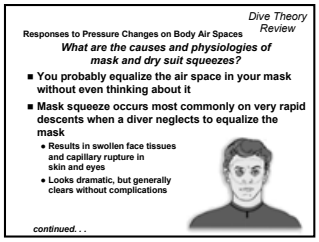
7. During descent, congestion in the sinuses could result in a squeeze, which is characterized by pressure or pain between the eyes, over the teeth or in the cheekbones.
   a. Just like a middle ear squeeze, blood and fluid from surrounding tissues fill the sinus to restore the pressure balance.
   b. During ascent, the accumulated fluids and blood often flow into the diver's mask – an unpleasant sight.
   c. A sinus squeeze usually heals on its own, unless accompanied by extended pain or fever, suggesting a sinus infection.



8. A reverse block can occur in either the ears or sinuses if congestion occurs during the dive and prevents expanding air from escaping during ascent.
   a. For the ears, this causes the eardrum to flex outward. If a very slow ascent does not give the air a chance to work its way out, the eardrum could rupture outward.

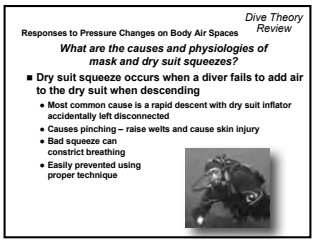


b. For the sinuses, a very slow ascent usually gives the air a chance to work its way out. Similar to a sinus squeeze, fluid and blood may flow from the diver's nose, and extended pain or fever suggest a sinus infection.

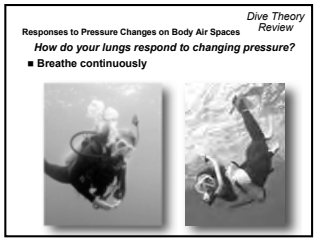


C. What are the causes and physiologies of mask and dry suit squeezes?

1. As an experienced diver, you probably equalize the air space in your mask without even thinking about it. Newer divers, however, sometimes need to be reminded to exhale through their noses into their masks.
2. Mask squeeze occurs most commonly on very rapid descents when a diver neglects to equalize the mask.
   a. Failure to do so results in swollen face tissues and capillary rupture in the skin and eyes.
   b. The effect of mask squeeze looks dramatic, but generally clears without complications.

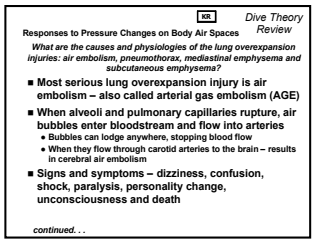


3. Dry suit squeeze occurs when a diver fails to add air to the dry suit when descending.
   a. The most common cause is a rapid descent with the dry suit inflator accidentally left disconnected.
   b. The squeeze causes pinching and can raise welts and cause skin injury. A bad squeeze can also constrict breathing.
   c. Like a mask squeeze, dry suit squeeze is easily prevented using proper technique to equalize the dry suit during descents.



D. How do the lungs respond to changing pressure?

1. You know that the most important rule in scuba diving is to breathe continuously, because this allows you to automatically equalize your lungs on descent and ascent. Closing the airway off during ascent can lead to a lung overexpansion injury – which we'll discuss next.
2. When you skin dive, holding your breath, the pressure compressing your lungs has no effect when diving to normal depths, because the drop in lung volume during descent and is restored during ascent – provided you started with a full breath.



E. What are the causes and physiologies of the lung overexpansion injuries: air embolism, pneumothorax, mediastinal emphysema and subcutaneous emphysema?

1. From your rescue diver training, you recall that the most serious lung overexpansion injury is air embolism – also called arterial gas embolism (AGE).
   a. This occurs when alveoli and pulmonary capillaries rupture, allowing air bubbles to enter the bloodstream and flow into the arteries.

b. These bubbles can lodge anywhere, stopping blood flow to tissues.

c. When they flow through the carotid arteries to the brain, it results in a cerebral air embolism.

d. Signs and symptoms are similar to stroke and include dizziness, confusion, shock, paralysis, personality change, unconsciousness and death.

2. Pneumothorax is a serious injury that occurs when air from the rupture collects between the lung and chest wall, causing the lung to collapse. Symptoms include chest pain and coughing up blood.

3. Mediastinal emphysema occurs when air from a lung rupture accumulates in the center of the chest over the heart.

a. Air can press on the heart and vessels, and interfere with circulation.

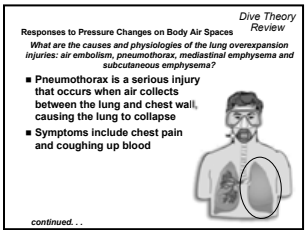
b. Signs and symptoms include feeling faint and having shortness of breath.

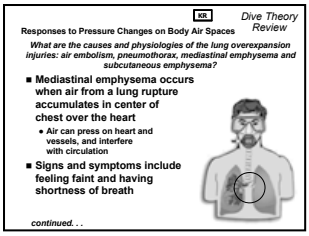
4. Subcutaneous emphysema occurs when air from the rupture accumulates in soft tissues at the base of the neck.

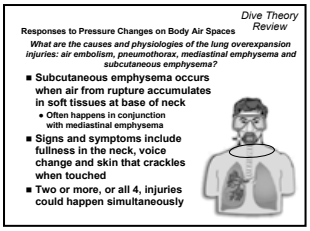
a. This injury often happens in conjunction with a mediastinal emphysema.

b. Signs and symptoms include fullness in the neck, voice change and skin that crackles when touched.

5. Keep in mind that two or more, or all four, injuries could happen simultaneously.







F. What are the recommendations for lung overexpansion injury first aid and treatment?

1. As discussed earlier, the treatment for lung overexpansion injuries is the same as for decompression sickness – they are both considered decompression illness.

a. Give oxygen – preferably 100 percent.

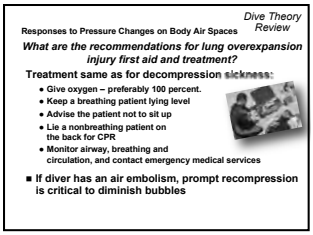
b. Keep a breathing patient lying level.

c. Advise the patient not to sit up, even during transport or if feeling better.

d. Lie a nonbreathing patient on the back for rescue breathing and CPR.

e. Monitor airway, breathing and circulation, and contact emergency medical services.

2. If the diver does have an air embolism, prompt recompression is critical to diminish bubbles in the bloodstream and force them into solution.



[**NOTE:** Use the following questions to test candidate understanding. Ask candidates to explain their answers.]

Q: The middle ear is most affected by changing pressure, because it is an _____ that is connected by the eustachian tube to the throat.

A: air space

Q: If congestion occurs during the dive, then a _____ could result on ascent in either the ears or sinuses.

A: reverse block

Q: A ruptured eardrum may immediately cause _____ underwater and may also lead to infection due to water entering the _____.

A: vertigo, middle ear

Q: If a middle ear squeeze or sinus squeeze is not equalized, _____ will fill the air space until equilibrium is restored.

A: blood and fluid

Q: Mask and dry suit squeeze are caused by _____ to add air during descent.

A: failure

Q: The most important rule in scuba diving is to breathe _____ and never hold your _____.

A: continuously, breath

Q: The most serious form of lung overexpansion injury is an _____, because air bubbles enter the arterial circulation.

A: air embolism

Q: _____ emphysema occurs when the expanding air accumulates under the skin.

A: Subcutaneous

Q: Pneumothorax is characterized by a _____ .

A: collapsed lung.

Q: Mediastinal emphysema occurs when the expanding air becomes lodged in the _____ between the lungs.

A: chest cavity (the mediastinum)

Q: If a diver does have an air embolism, prompt _____ is critical to diminish bubbles and force them into solution.

A: recompression (hyperbaric treatment)

X. Scuba Cylinders

A. How do you identify and what are the meanings of the following scuba cylinder marks: hydrostatic test date and working pressure?

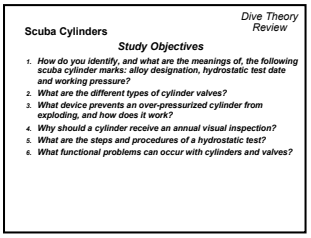
1. Scuba cylinders have various markings stamped at the neck that provide information, such as the government agency responsible for approving compressed gas containers, the type of metal used (alloy designation), the maximum pressure, etc.
2. As a divemaster, you need to be familiar with the cylinder markings – specifically, you should know how to identify when the last hydrostatic test was completed and the working or fill pressure of the cylinder.
3. A cylinder's initial hydrostatic test date will usually appear as the last item in the last row of information originally stamped on the cylinder.
   a. The hydrostatic test date consists of numbers representing the month and year in which the cylinder was tested.
   b. These numbers may be separated by either the hydrostatic tester's initials or by the tester's special registered symbol.
   c. Subsequent hydrostatic test dates may appear anywhere on the cylinder's neck.
4. Cylinders are also marked with a maximum pressure or working pressure to which a cylinder may be filled for normal use. This may be in psi (pounds-per-square-inch), bar or MP (mega-pascal)

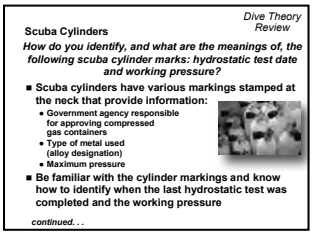
B. What are the different types of cylinder valves?

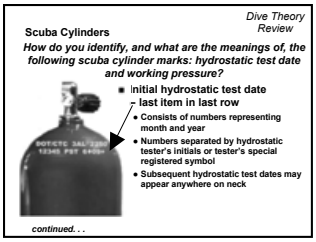
1. A scuba cylinder is fitted with a standard chrome plated brass valve — either the yoke system or the DIN system valve.
2. With the yoke system, the regulator fits down over the valve where the its first stage opening meets the valve's high pressure opening. The regulator is tightened in place with it's yoke screw and seals against the valve's o-ring.
3. DIN stands for Deutsche Industrie-Norm — a German national standards organization.
   a. With the DIN system, the sealing o-ring mounts on the regulator, which screws into the DIN valve.
   b. The five thread DIN fitting can be used for pressures up to 200 bar/3000 psi, and the seven thread DIN fitting for higher working pressures.

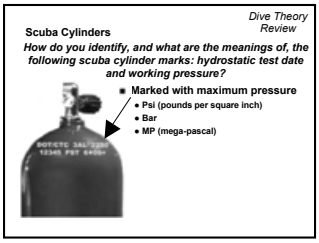
C. What device prevents an over-pressurized cylinder from exploding, and how does it work?

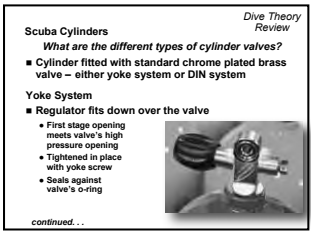
1. A safety device called a burst disk is part of many cylinder valves to protect against damage that may occur from accidental overfilling,

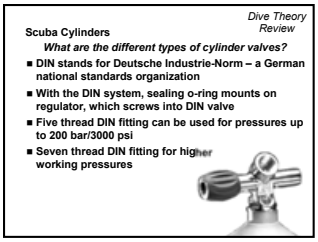


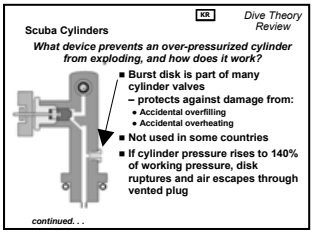






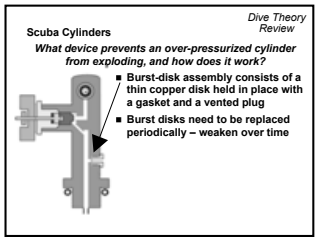






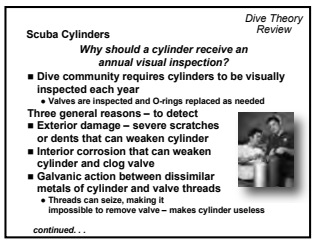
but more often from accidental overheating. They are not used in some countries.

2. If cylinder pressure rises to approximately 140 percent of the working pressure, the disk ruptures, and the air escapes through the vented plug.
3. A burst-disk assembly consists of a thin copper disk held in place with a gasket and a vented plug.
4. Burst disks need to be replaced periodically, as they weaken over time.

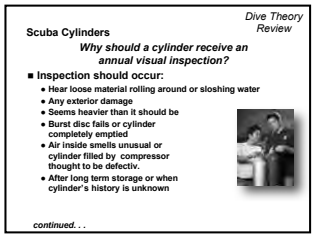


D. Why should a cylinder be visually inspected annually?

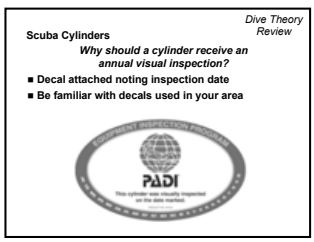
1. The dive community standards is for cylinders to be visually inspected each year, even though in most areas this is not required by law. At inspection time, valves are also inspected and O-rings replaced as needed and appropriate.
2. There are three general reasons:
   a. First, to detect exterior damage such as severe scratches or dents. Severe external damage can weaken the cylinder. The outside is also inspected for cracks around the valve neck.
   b. The second reason is to detect severe interior corrosion, which can weaken the cylinder and clog the valve. In steel cylinders, corrosion called "pitting" can weaken the cylinder structurally in a small area, causing it to fail.
   c. Lastly, the inspection is important to spot any galvanic action between the dissimilar metals of the cylinder and valve threads. If galvanic action progresses, the valve and cylinder threads can seize, making it impossible to remove the valve without destroying the threads, which makes the cylinder useless.



3. A visual inspection should also occur any time:
   a. You hear loose material rolling around inside the cylinder, or you hear sloshing water in it.
   b. There is any exterior damage to the cylinder.
   c. The cylinder seems heavier than it should be, because it could have water in it.
   d. A burst disc fails, or the cylinder is completely emptied.
   e. Air inside smells unusual or the cylinder was filled by a compressor thought to be defective.
   f. After long term storage or when the cylinder's history is unknown.



4. After inspection, a decal is usually attached to the cylinder noting the inspection date. You should be familiar with the decals used in your area, so you can tell if a cylinder is within a year of its last inspection.

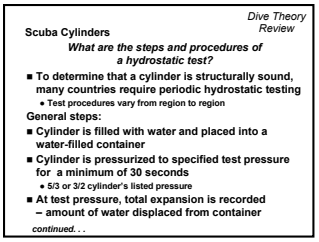


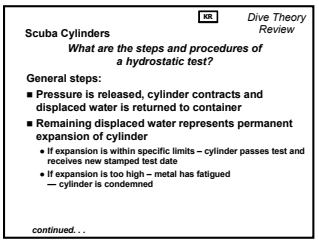
E. What are the steps and procedures of a hydrostatic test?

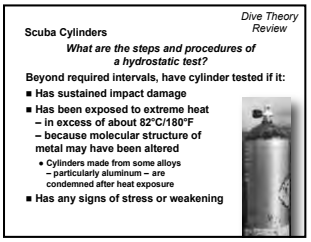
1. To determine that a cylinder is structurally sound, many countries require periodic hydrostatic testing. As a divemaster, you should be familiar with hydrostatic test requirements for your area.
2. Hydrostatic test procedures vary from region to region, but follow these general steps:
   a. The cylinder is filled with water and placed into a water-filled container.
   b. The cylinder is pressurized to the specified test pressure for a minimum of 30 seconds.
   c. At test pressure – typically 5/3 or 3/2 the cylinder's listed pressure – the total expansion is recorded, usually by the amount of water displaced from the container.
   d. The pressure is released, the cylinder contracts and the displaced water is returned to the container.
   e. Any remaining displaced water above zero (if any) represents permanent expansion of the cylinder.
   f. If the expansion is within specific limits, then the cylinder passes the test and receives a new stamped test date.
   g. If expansion is too high, the metal has fatigued and is no longer capable of safely holding high pressure gases. The cylinder is condemned.
3. Beyond required intervals, you should have a cylinder hydrostatically tested if the cylinder:
   a. Has sustained impact damage.
   b. Has been exposed to extreme heat – in excess of about 82°C/180°F – because the molecular structure of the metal may have been altered and become more brittle. Note that cylinders made from some alloys – particularly aluminum – are condemned immediately after heat exposure due to the high risk of molecular damage.
   c. Has any signs of stress or weakening.

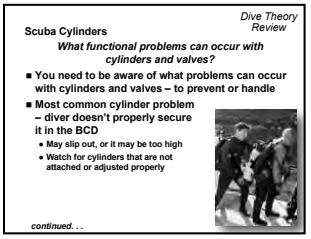
F. What functional problems can occur with cylinders and valves?

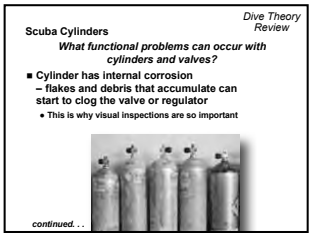
1. As a divemaster and problem solver, you need to be aware of what problems can occur with equipment, such as cylinders and valves, so you can help prevent those problems or quickly handle them when they do occur.
2. The most common cylinder problem that occurs is when a diver doesn't properly secure it in the BCD.
   a. The cylinder may slip out, or it may be too high and bang against the diver's head.

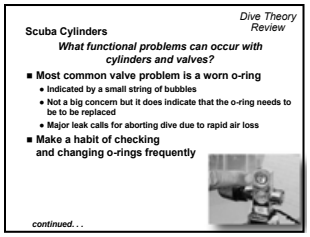


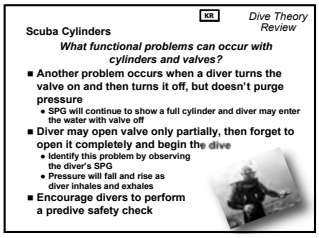












b. Watch for cylinders that are not attached or adjusted properly. Be aware of cylinders that start to slip when a diver stands or enters the water.

3. If a cylinder has internal corrosion, the flakes and debris that accumulate can start to clog the valve or regulator, potentially causing significant damage. Again, this is why visual inspections are so important.
4. The most common valve problem is a worn o-ring.
   a. This would normally be indicated by a small string of bubbles during a dive. This is not a big concern but it does indicate that the o-ring needs to be to be replaced as soon as possible.
   b. A major leak calls for aborting the dive due to rapid air loss.
   c. Make a habit of checking o-rings frequently, before they show wear.
5. Another valve problem occurs when a diver turns the valve on to check the air supply and then turns it off, but doesn't purge the pressure. The SPG will continue to show a full cylinder and the diver may enter the water with the valve off.
6. Similarly, a diver may open the valve only partially to check the pressure, then forget to open it completely, and begin the dive with the valve barely open.
   a. You can identify this problem underwater by observing the diver's SPG. The pressure will usually fall and rise sharply as the diver inhales and exhales.
7. Encouraging divers to perform a predive safety check before each dive will help prevent these problems.

[**NOTE:** Use the following questions to test candidate understanding. Ask candidates to explain their answers.]

Q: The hydrostatic test date is found on the cylinder's _____ and consists of numbers representing the _____ in which the cylinder was tested.

A: neck, month and year

Q: A scuba cylinder valve is either the _____ system or the _____ system.

A: yoke, DIN

Q: If cylinder pressure rises to approximately 140 percent of the working pressure, the _____ will rupture, which allows air to escape.

A: burst disk

Q: During a cylinder's visual inspection, the inspector looks for exterior _____, interior _____ and _____ action between the dissimilar metals of the cylinder and valve threads.

A: damage, corrosion, galvanic

Q: During a hydrostatic test, the cylinder is pressurized to the specified test pressure and the total _____ is recorded, usually by the amount of _____ displaced from the testing container.

A: expansion, water

Q: The most common cylinder problem that occurs is when a diver doesn't properly secure it in the _____.

A: BCD

Q: The most common valve problem is a worn _____.

A: o-ring

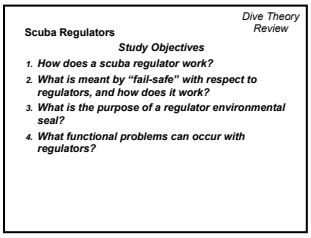
XI. Scuba Regulators

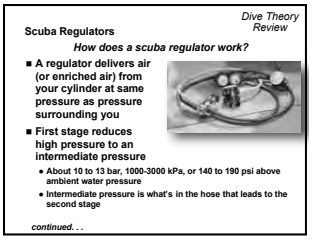
A. How does a scuba regulator work?

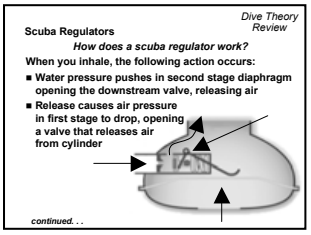
1. From your previous training, you know that a regulator delivers air (or enriched air) to you from your cylinder at the same pressure as the pressure surrounding you.
2. The regulator first stage reduces the high pressure delivered by the cylinder to an intermediate pressure, usually about 10 to 13 bar, 1000-3000 kPa, or 140 to 190 psi above the ambient water pressure. This intermediate pressure is what's in the hose that leads to the regulator second stage.
3. When you inhale, the following action occurs:
   a. Water pressure pushes in the second stage diaphragm opening the downstream valve, releasing air from the hose.
   b. This release causes the air pressure in the first stage to drop, opening a valve that releases air from the cylinder until the diver stops inhaling.
   c. When you stop inhaling, the second stage diaphragm returns to its relaxed position, and the downstream valve closes.
   d. This allows the intermediate pressure to build back up in the hose, closing the first stage valve so that air no longer flows.
4. To learn more about how different types of first and second stages function, take Dive Theory Online or read *The Encyclopedia of Recreational Diving* – Chapter 3, Dive Equipment.

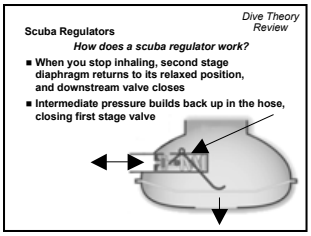
B. What is meant by "fail-safe" with respect to regulators, and how does it work?

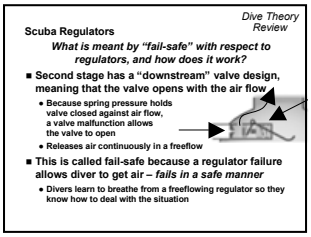
1. As just mentioned, the regulator's second stage has a "downstream" valve design, meaning that the valve opens with the air flow.



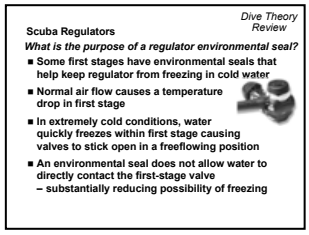






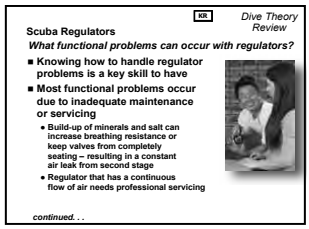


2. Because spring pressure holds the valve closed against the air flow, a valve malfunction allows the valve to open. This releases air continuously in a freeflow.
3. This is called fail-safe because a regulator failure allows the diver to get air. That is, it fails in a safe manner.
4. Open water divers learn to breathe from a freeflowing regulator so if this occurs, they know how to deal with the situation and breathe from the regulator while ascending.



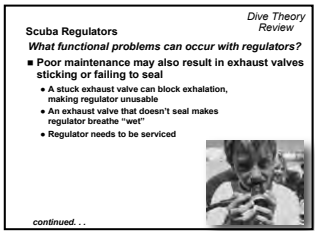
C. What is the purpose of a regulator environmental seal?

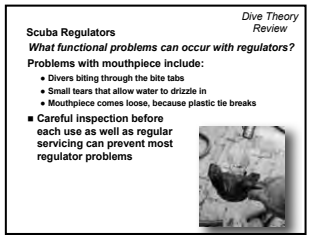
1. Some regulator first stages have environmental seals that help keep the regulator from freezing in cold water.
2. Normal air flow causes a temperature drop in the regulator first stage. In extremely cold conditions, this can result in water quickly freezing within the first stage causing valves to stick open in a freeflowing position.
3. An environmental seal does not allow water to directly contact the first-stage valve, thus substantially reducing the possibility of freezing.



D. What functional problems can occur with regulators?

1. Knowing how to spot and handle regulator problems is a key skill to have as a divemaster.
2. Most functional problems with a regulator, including an alternate air source, occur due to inadequate maintenance or servicing.
   a. The build-up of minerals and salt on regulator parts can increase breathing resistance or keep the valves from completely seating, resulting in a constant air leak from the second stage.
   b. A regulator that has a continuous flow of air needs professional servicing.
3. Poor maintenance may also result in the second stage exhaust valves sticking or failing to seal.
   a. A stuck exhaust valve can block exhalation, making the regulator unusable.
   b. An exhaust valve that doesn't seal makes the regulator breathe "wet," which is very uncomfortable for a diver.
   c. In both cases, the regulator needs to be serviced as soon as possible.





4. Problems with the regulator mouthpiece may include:
   a. Divers biting through the bite tabs, making the mouthpiece difficult if not impossible to use.
   b. Small tears that allow water to drizzle in during a dive, which makes it very uncomfortable for the diver.

c. The mouthpiece comes loose, because the plastic tie that secures it to the second stage breaks.

5. Careful inspection of the regulator, including the alternate air source, before each use as well as regular servicing can prevent most regulator problems.

[NOTE: Use the following questions to test candidate understanding. Ask candidates to explain their answers.**]**

Q: A regulator first stage reduces the _____ pressure delivered by the cylinder to an _____ pressure.

A: high, intermediate

Q: When a diver inhales, water pressure pushes in the second stage _____, opening the _____, releasing air from the hose.

A: diaphragm, downstream valve

Q: If there is a regulator malfunction, the second stage downstream valve will be pushed open, causing the regulator to _____, which is referred to as a _____ design.

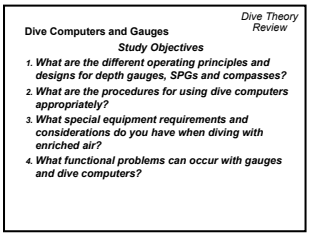
A: freeflow, fail-safe

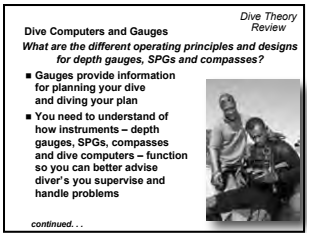
Q: An environmental seal reduces the risk that a regulator will _____ in _____ water.

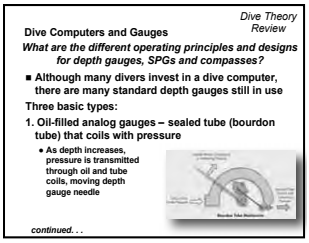
A: freeze, cold

Q: Most functional problems with a regulator, such as air _____ and stuck _____, occur due to inadequate maintenance or servicing.

A: leaks, valves







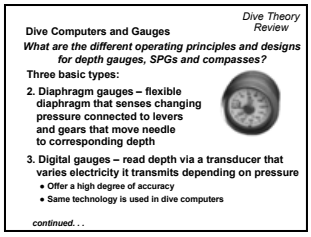
XII. Dive Computers and Gauges

A. What are the different operating principles and designs for depth gauges, SPGs and compasses?

1. As an experienced diver, you know how important the information your gauges provide is for planning your dive and diving your plan. As a divemaster, you need to have a broad understanding of how instruments such as depth gauges, SPGs, compasses and dive computers function so that you can better advise the diver's you supervise and better handle problems that may occur.

2. Although many divers invest in a dive computer as soon as possible after certification, there are many standard depth gauges still in use. The three basic types of depth gauges include:

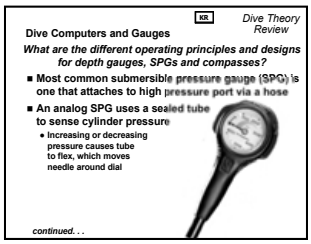
   a. Oil-filled analog gauges have a sealed tube (bourdon tube) that coils with pressure. As depth increases, the additional pressure is transmitted through the oil and the tube coils more tightly, moving the depth gauge needle.



b. Diaphragm gauges function by connecting a flexible diaphragm that senses the changing pressure to a series of levers and gears that move the display needle to the corresponding depth.

c. Digital gauges read depth via a transducer that varies its electrical transmission depending on the pressure exerted on it. These gauges offer a high degree of accuracy, and this same technology is used in dive computers to determine depth. Today, this by far the most common type of gauge.

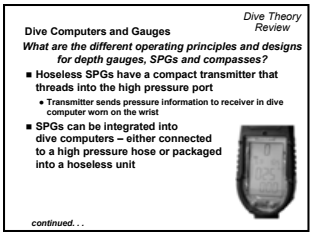
3. The most common submersible pressure gauge (SPG) is one that attaches to the regulator's high pressure port via a hose.



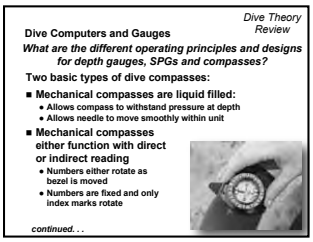
a. An analog SPG uses a sealed tube, similar to an oil-filled depth gauge, to sense cylinder pressure. Increasing or decreasing pressure causes the tube to flex, which moves the needle around the dial.

b. There are hoseless SPGs that have a compact transmitter that threads into the high pressure port. The transmitter sends pressure information to a receiver in a dive computer worn on the wrist.

c. SPGs can also be integrated into dive computers – either connected to a high pressure hose or packaged into a hoseless unit.

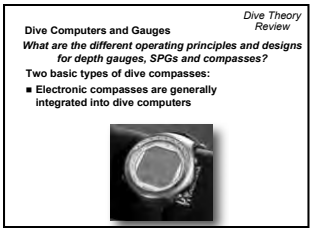


4. There two basic types of dive compasses – the conventional, mechanical compass and the newer electronic compass with digital readouts.



a. Most mechanical compasses are liquid filled, which allows the compass to withstand pressure at depth. The liquid also allows the needle to move smoothly within the unit.

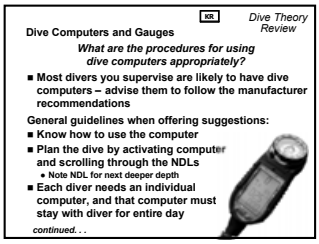
b. Mechanical compasses either function with direct or indirect reading – meaning that the numbers either rotate as the bezel is moved, or the numbers are fixed and only the index marks rotate around.



c. Electronic compasses are generally integrated into dive computers.

B. What are the procedures for using dive computers?

1. Because most of the divers you will supervise are likely to have dive computers, advise them to follow the manufacturer recommendations for their particular units.



2. Use the following as general guidelines when offering suggestions for dive computer use:

a. First, know how to use the computer. Sometimes divers get a new computers and need to thoroughly review the manufacturer's directions or get a complete orientation to a specific dive computer before using it.

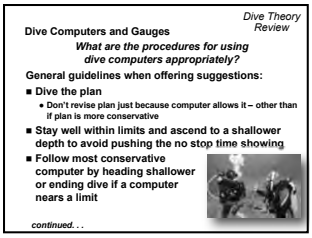
b. The next step is to plan the dive by activating the computer and scrolling through the NDLs. It's a good idea to note the NDL for the planned depth, as well as for the next deeper depth.

c. Divers shouldn't share computers. Each diver needs an individual computer, and that computer must stay with the diver for the entire dive day. Because the computer tracks depth closely, it's only accurate for the diver wearing the computer.

d. In the water, dive the plan. Don't revise your plan just because the dive computer allows it, other than if you change the plan to be more conservative.

e. Stay well within limits and ascend to a shallower depth to avoid pushing the no stop time showing.

f. Follow the most conservative computer within a buddy team or group by heading shallower or ending the dive, together, if a computer nears a limit.

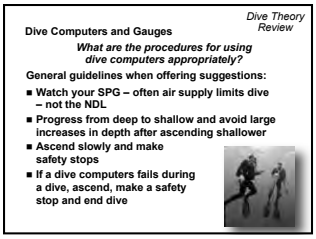


g. Watch your SPG because often air supply limits the dive – not the NDL.

h. Progress from deep to shallow and avoid large increases in depth after ascending to a much shallower one.

i. Ascend slowly and make safety stops. Use your computer's ascent rate indicators and alarms to help.

j. Although very rare, if a dive computer fails during a dive, ascend, make a safety stop and end the dive.



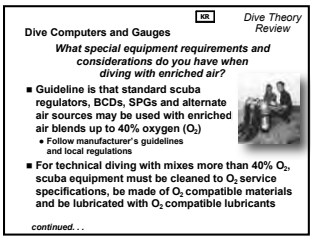
C. What special equipment requirements and considerations do you have when diving with enriched air?

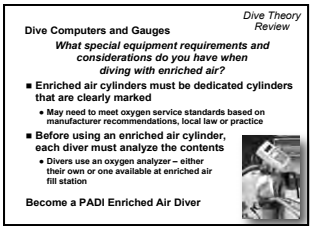
1. The dive community guideline is that standard scuba regulators, BCDs, SPGs and alternate air sources may be used with enriched air blends that have up to 40% oxygen without modification. However, follow the manufacturer's guidelines and local regulations regarding using scuba equipment with enriched air.

2. For technical diving with gas mixes containing more than 40% oxygen, scuba equipment must be cleaned to oxygen service specifications, be made of oxygen compatible materials and be lubricated with oxygen compatible lubricants.

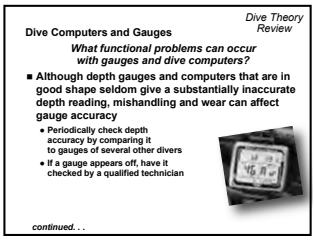
3. Enriched air cylinders must be dedicated cylinders that are clearly marked. They may need to meet oxygen service standards based on manufacturer recommendations, local law or local practice.

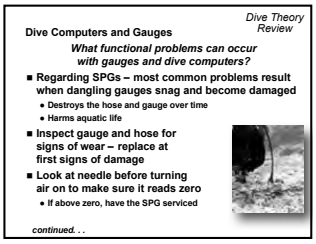
4. Before using an enriched air cylinder, each diver must analyze the contents to confirm the percentage of oxygen so they can plan the dive and set their enriched air dive computers properly. To do this, divers use an oxygen analyzer – either their own or one available at the enriched air fill station.

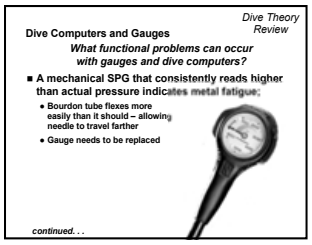


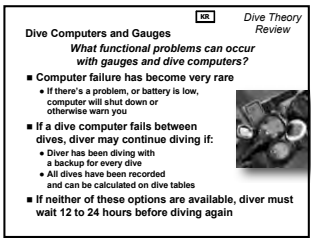


5. If you aren't already a PADI Enriched Air Diver, taking this specialty will further orient you to the equipment and procedures for enriched air diving.









D. What functional problems can occur with gauges and dive computers?

1. Although depth gauges and computers that are in good shape seldom give a substantially inaccurate depth reading, mishandling and wear can affect gauge accuracy. Periodically check depth accuracy by comparing it to the gauges of several other divers. If a gauge appears off, have it checked by a qualified technician.
2. Regarding SPGs, the most common problems result when dangling gauges snag and become damaged during entry, or continually bang into things underwater, which destroys the hose and gauge over time — plus harms aquatic life in the process.
   a. Inspect the gauge and hose for signs of wear, and replace SPG hoses at the first signs of damage.
   b. Also, look at the SPG needle before turning the air on to make sure it reads zero. If it is above zero, have the SPG serviced to correct its accuracy before using it.
   c. A mechanical SPG that consistently reads higher than the actual pressure indicates metal fatigue; the bourdon tube flexes more easily than it should because it is weak, allowing the needle to travel farther at a given pressure. The gauge needs to be replaced.
3. As mentioned, computer failure has become very rare because most models self-check themselves and monitor battery power. If there's a problem, or the battery is low, the computer will shut down or otherwise warn you.
   a. If a dive computer fails between dives, the diver may continue diving if the diver has been diving with a backup for every dive.
   b. Another option is switching to dive tables, but only if all dives have been recorded and can be calculated on the tables.
   c. If neither of these options are available, the diver must wait 12 to 24 hours before diving again using a working computer.

[**NOTE:** Use the following questions to test candidate understanding. Ask candidates to explain their answers.]

Q: An analog depth gauge or SPG uses a _____ to sense pressure changes, and as it flexes, it moves the needle around the dial.

A: sealed tube (bourdon tube)

Q: When diving with dive computers, _____ diver needs an individual computer, and the _____ must stay with the diver for the entire dive day.

A: each, same dive computer

Q: A buddy team should follow the most _____ computer and go shallower or end the dive if a computer nears a _____.

A: conservative, limit

Q: Enriched air cylinders must be _____ marked, and before using the cylinder, you must _____ to confirm the percentage of oxygen.

A: clearly, analyze the contents

Q: The most common problem with gauges tends to be damage caused by _____ that snag or bump into things underwater.

A: dangling gauges or consoles

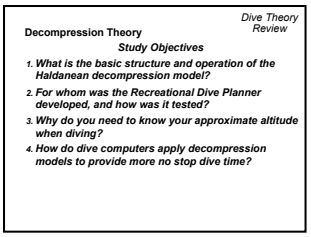
Q: If a dive computer fails between dives, the diver may continue diving with a _____ that has been used on al previous dives, or by switching to _____, only if all dives have been recorded.

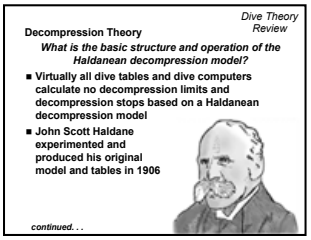
A: backup dive computer, dive tables

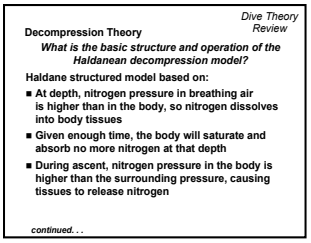
XIII. Decompression Theory

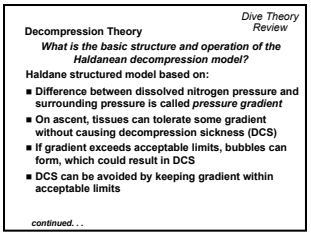
A. What is the basic structure and operation of the Haldanean decompression model?

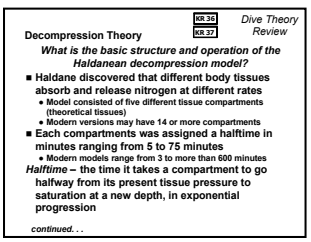
1. Virtually all dive tables and dive computers calculate no decompression limits and decompression stops based on a Haldanean decompression model.
   a. John Scott Haldane experimented and produced his original model and tables in 1906.
2. Haldane structured his model based on the following concepts:
   a. At depth, nitrogen pressure in breathing air is higher than in the body, so nitrogen dissolves into body tissues.
   b. Given enough time, the body will saturate and absorb no more nitrogen at that depth.
   c. During ascent, nitrogen pressure in the body is higher than the surrounding pressure, causing tissues to release nitrogen.
   d. The difference between the dissolved nitrogen pressure and the surrounding pressure (whether ascending or descending) is called the pressure gradient.
   e. On ascent, tissues can tolerate some gradient of high tissue pressure without causing decompression sickness (DCS).
   f. If the gradient exceeds acceptable limits, bubbles can form, which could result in DCS.
   g. DCS can be avoided by keeping the gradient within acceptable limits.
3. Haldane discovered that different body tissues absorb and release dissolved nitrogen at different rates. To account for this, his model consisted of five different tissue compartments (theoretical tissues). Modern versions may have 14 or more compartments.









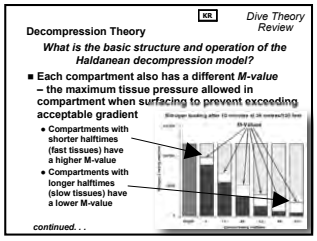


a. Each of his compartments was assigned a halftime in minutes ranging from 5 to 75 minutes. Modern models range from 3 to more than 600 minutes.

b. Halftime is the time, in minutes, it takes a compartment to go halfway from its present tissue pressure to saturation at a new depth, in exponential progression.

c. Each compartment also has a different M-value – the maximum tissue pressure allowed in the compartment when surfacing to prevent exceeding the acceptable gradient.

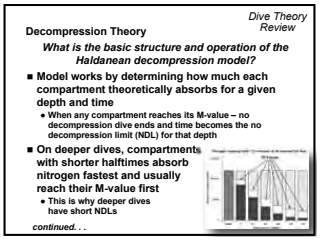
d. Compartments with shorter halftimes have a higher M-value, and compartments with longer halftimes have a lower M-value.



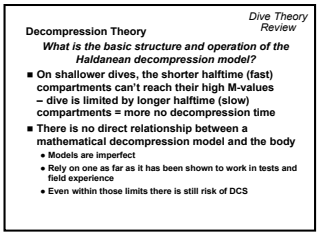
4. The model works by determining how much each compartment theoretically absorbs for a given depth and time. When any compartment reaches its M-value, a no decompression dive would end and that time becomes the no decompression limit for that depth.

a. On deeper dives, compartments with shorter halftimes absorb nitrogen the fastest and usually reach their M-value first – this is why deeper dives have short no decompression limits.

b. On shallower dives, the shorter halftime (fast) compartments can't reach their high M-values, thus the dive is limited by the longer halftime (slow) compartments, affording more no decompression time.

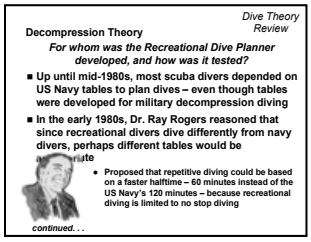


5. It's important to keep in mind that there is no direct relationship between a mathematical decompression model and the body. Models are imperfect, and you can only rely on one as far as it has been shown to work in tests and field experience, and even within those limits there is still some risk of DCS.



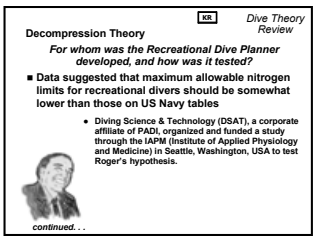
B. For whom was the Recreational Dive Planner developed, and how was it tested?

1. Up until the mid-1980s, most scuba divers around the world depended on the US Navy tables to plan dives – even though the US Navy tables were developed primarily for military decompression diving.



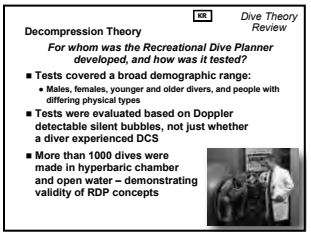
2. In the early 1980s, Dr. Ray Rogers reasoned that since recreational divers dive differently from navy divers, perhaps different tables would be more appropriate.

a. Specifically, Rogers proposed that repetitive diving could be based on a faster halftime – 60 minutes instead of the US Navy's 120 minutes – because recreational diving is limited to no stop diving.

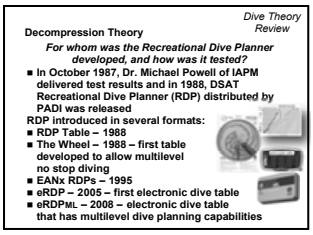


b. Rogers also knew that data suggested that the maximum allowable nitrogen limits for recreational divers should be somewhat lower than those on the US Navy tables.

3. Diving Science & Technology (DSAT), a corporate affiliate of PADI, organized and funded a study through the IAPM (Institute of Applied Physiology and Medicine) in Seattle, Washington, USA to test Dr. Roger's hypothesis.
   a. The tests covered a broad demographic range including males, females, younger and older divers, and people with differing physical types, to better match the recreational diver population.
   b. Tests were evaluated based on Doppler detectable silent bubbles, not just whether a diver experienced DCS.
   c. More than 1000 individual dives were made in the hyperbaric chamber and open water, successfully demonstrating the validity of the RDP concepts.

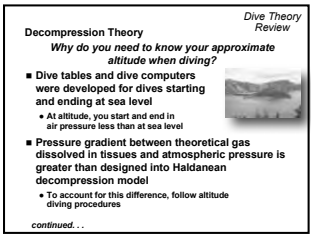


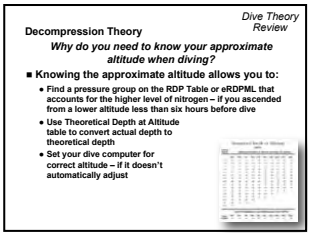
4. In October 1987, Dr. Michael Powell of IAPM delivered the test results and based on this research, in 1988, the DSAT (Diving Science and Technology) Recreational Dive Planner (RDP) distributed by PADI was released.
5. Over the years, the RDP has been introduced in several formats, some of which are no longer available.
   a. RDP Table – Introduced in 1988
   b. The Wheel – Introduced in 1988, this was the first table developed to allow multilevel no stop diving. Its unique circular format reduced unnecessary rounding with more depth and time increments found on tables.
   c. EANx RDPs – Introduced in 1995, the EANx RDPs are special version of the RDP Table specifically calculated for use with EANx32 and EANx36.
   d. eRDP – Introduced in 2005. The world's first electronic dive table, the eRDP carried out all the functions of the RDP Table in a calculator format.
   e. eRDPML – Introduced in 2008 as the successor to the eRDP. The eRDPML is an electronic dive table that duplicates the smaller depth increments and multilevel dive planning capabilities originally found in The Wheel.



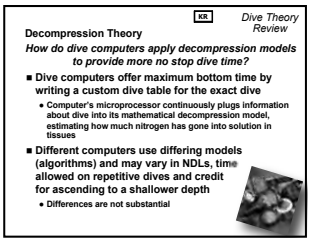
C. Why do you need to know your approximate altitude when diving?

1. Dive tables and dive computers were developed for dives starting and ending at sea level. If diving in a high mountain lake, you start and end the dive in air pressure less than at sea level.
2. The pressure gradient between the theoretical inert gas dissolved in the tissues and the atmospheric pressure is much greater than designed into the Haldanean decompression model. To account for this difference, you follow altitude diving procedures as discussed in the section – Specialized Skills and Activities.





3. Knowing the approximate dive site altitude allows you to:
   a. Find a pressure group on the RDP Table or eRDPML that accounts for the higher level of nitrogen in your body, if you've ascended from a lower altitude less than six hours before the dive, such as driving up the mountain from sea level.
   b. Use the Theoretical Depth at Altitude table to convert the actual depth to theoretical depth, so you can plan dives using the RDP Table or eRDPML.
   c. Set your dive computer for the correct altitude, if the computer doesn't automatically adjust.



D. How do dive computers apply decompression models to provide more no stop dive time?

1. Dive computers offer the maximum bottom time essentially by writing a custom dive table for the exact dive. This eliminates unnecessary rounding and provides more dive time.
2. The computer's microprocessor continuously plugs information about the dive into its mathematical decompression model, estimating how much nitrogen has gone into solution in the diver's body tissues.
3. Different dive computers use somewhat differing decompression models (algorithms) and may vary somewhat in their no decompression limits, time allowed on repetitive dives and the credit for ascending to a shallower depth. However, the differences are not substantial, though you may note them if your buddy's diving with a different computer brand.

[**NOTE:** Use the following questions to test candidate understanding. Ask candidates to explain their answers.]

Q: The Haldanean decompression model is based on the concept that _____ can be avoided by keeping the pressure gradient between dissolved _____ in the tissues and the surrounding pressure within acceptable limits.

A: DCS, nitrogen

Q: According to the decompression model, on deeper dives, compartments with _____ halftimes usually reach their M-value first – this is why deeper dives have short no decompression limits.

A: shorter

Q: If diving at altitude without having been at the dive site altitude for six hour, you need to know the approximate altitude so that you can find a _____on the RDP Table or eRDPML that accounts for the higher level of nitrogen in your body.

A: pressure group

Q: Using its mathematical decompression model, a dive computer _____ how much nitrogen has gone into solution in the diver's body and _____ a custom dive table during the dive – eliminating unnecessary rounding and providing more dive time.

A: estimates, writes

XIV. RDP Use

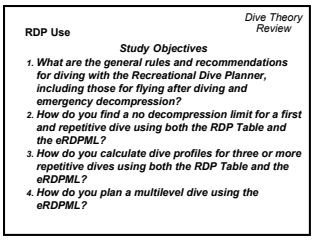
A. What are the general rules and recommendations for diving with the Recreational Dive Planner, including those for flying after diving and emergency decompression?

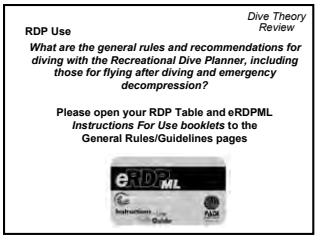
[NOTE: Have candidates open their RDP Table and eRDPML *Instructions For Use* booklets to the General Rules/Guidelines pages and review each point.**]**

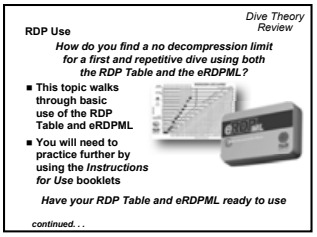
B. How do you find a no decompression limit for a first and repetitive dive using both the RDP Table and the eRDPML?

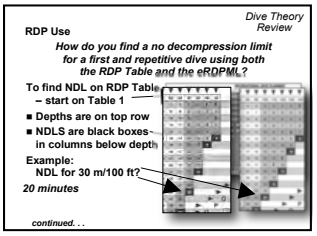
[NOTE: Ask candidates to have the RDP Table and eRDPML ready to use.**]**

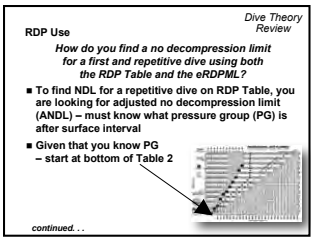
1. You may be comfortable using both the RDP Table and eRDPML, or this could be the first time. Either way, this topic walks through basic use of both RDP versions. You will need to practice further by using the *Instructions for Use* booklets.
2. To find the no decompression limits on the RDP Table for a first dive, you start on Table 1.
   a. Depths are shown on the top row.
   b. No decompression limits are in black boxes in the columns below the depth.
   c. For example, the no decompression limit for 30 metres/ 100 feet is 20 minutes.
3. To find the no decompression limit for a repetitive dive on the RDP Table, you are actually looking for an adjusted no decompression limit, and you must know what your pressure group is after the surface interval.
   a. Given that you know the pressure group, you'll start at the bottom of Table 2. Let's say that your pressure group is L.
   b Flip the table over to Table 3 and find L in the top row.
   c. Follow that column down until it intersects with the 30 metre/100 foot row.
   d. The box contains two numbers. The top number - 17 - is the residual nitrogen time. The bottom number - 3 - is your adjusted no decompression limit.
   e. This means that as an L diver going to 30 metres/100 feet, the maximum allowed time is 3 minutes.

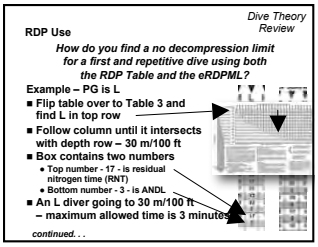


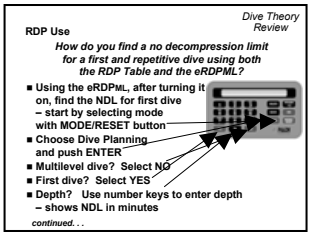




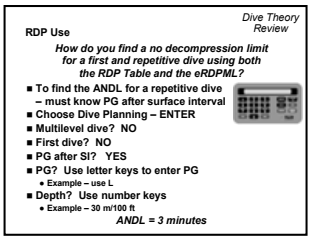




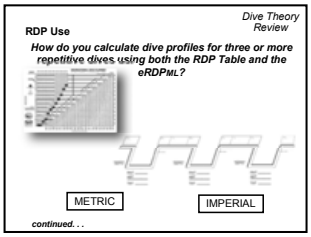




4. After turning on the eRDPML, to find the no decompression limits for a first dive, start by selecting the mode with the MODE/RESET button:
   a. Choose Dive Planning and push ENTER.
   b. It asks if this is a multilevel dive – select NO.
   c. It asks if this is the first dive – select YES.
   d. It asks for the depth – use the number keys to enter the depth, and it shows the no decompression limit in minutes.



5. Using the eRDPML, to find the adjusted no decompression limit for a repetitive dive, you must know what your pressure group is after the surface interval.
   a. Choose Dive Planning and push ENTER.
   b. It asks if this is a multilevel dive – select NO.
   c. It asks if this is the first dive – select NO.
   d. It asks if you know the PG after the SI – select YES
   e. It asks for the PG – use the letter keys to enter the PG - for this example, use L.
   f. It asks for the depth – use the number keys to enter 30 metres/100 feet - for this example.
   g. It shows the no decompression limit as 3 minutes.



C. How do you calculate dive profiles for three or more repetitive dives using both the RDP Table and the eRDPML?

1. Let's look at a three-dive profile that not only allows you to plan and record dives, but also allows you to apply some of the special RDP rules. Examples are divided into metric and imperial – choose the measuring system you are familiar with:

METRIC

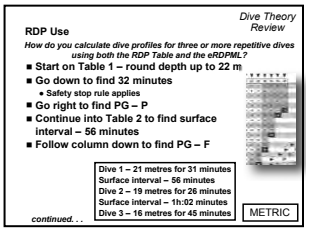
Dive 1 – 21 metres for 31 minutes

Surface interval – 56 minutes

Dive 2 – 19 metres for 26 minutes

Surface interval – 1h:02min

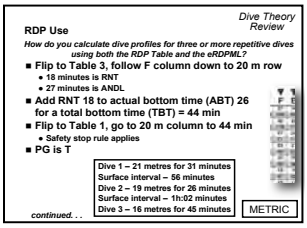
Dive 3 – 16 metres for 45 minutes



2. Start on Table 1 and find 22 metres along the top. You must round up and use 22 metres.
   a. Follow the 22 metres column until you find a time equal to or greater than 31 minutes.
   b. You must use 32 minutes, which puts you in a shaded box. This means that the safety stop rule applies.
   c. Follow the row to the right to find the pressure group of P.
   d. Continue right along the row into Table 2 to find a surface interval box that includes 56 minutes. You'll see that it falls between 52 and 59 minutes.

e. Follow the column down to see that after the surface interval, you are in F pressure group.

f. Flip the RDP over to Table 3 and follow the F column down to where it meets the 20-metre row, because you must round up from 19 metres.

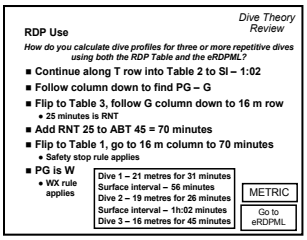


g. The box contains two numbers. The top number – 18 – is the residual nitrogen time (RNT). The bottom number – 27 – is the adjusted no decompression limit (ANDL).

h. You must add the 18 (RNT) to the actual bottom time (ABT) – 26 – for a total of 44 minutes.

i. Flip back to Table 1, go to the 20 metres column, and follow it down to 44 minutes, which is in a shaded box – so the safety stop rule applies. You are in pressure group T after the second dive.

j. Continue right along the T row into Table 2 to find a surface interval box that includes 1 hour and 2 minutes. You'll see that it falls between 1:00 and 1:06.



k. Follow the column down to see that after the surface interval, you are in G pressure group.

l. Flip the RDP over to Table 3 and follow the G column down to where it meets the 16-metre row.

m. The residual nitrogen time is 25 minutes. Add the RNT 25 to the ABT 45 for a total of 70 minutes.

n. Flip back to Table 1, go to the 16 metres column, and follow it down to 70 minutes, which is in a shaded box – so the safety stop rule applies.

o. You are in pressure group W after the third dive. This means that if planned to do a fourth dive the WX rule applies, and you would need at least 1 hour surface interval between dives.

3. **IMPERIAL**

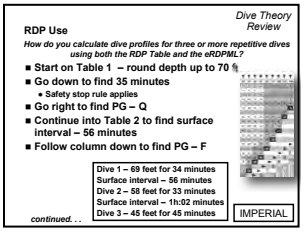
Dive 1 – 69 feet for 34 minutes

Surface interval – 56 minutes

Dive 2 – 58 feet for 33 minutes

Surface interval – 1h:02min

Dive 3 – 45 feet for 45 minutes

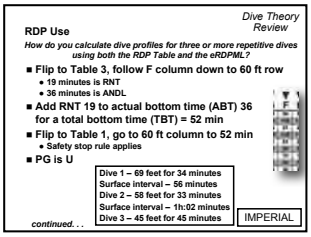


a. Start on Table 1 and find 70 feet along the top. You must round up and use 70 feet.

b. Follow the 70 foot column until you find a time equal to or greater than 34 minutes.

c. You must use 35 minutes, which puts you in a shaded box. This means that the safety stop rule applies.

d. Follow the row to the right to find the pressure group of Q.



e. Continue right along the row into Table 2 to find a surface interval box that includes 56 minutes. You'll see that it falls between 56 and 1hour and 3 minutes.

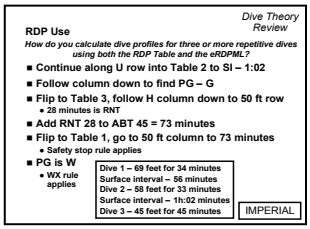
f. Follow the column down to see that after the surface interval, you are in F pressure group.

g. Flip the RDP over to Table 3, and follow the F column down to where it meets the 60 foot row, because you must round up from 58 feet.

h. The box contains two numbers. The top number – 19 – is the residual nitrogen time (RNT). The bottom number – 36 – is the adjusted no decompression limit (ANDL).

i. You must add the 19 (RNT) to the actual bottom time (ABT) – 33 – for a total of 52 minutes.

j. Flip back to Table 1, go to the 60 foot column, and follow it down to 52 minutes, which is in a shaded box – so the safety stop rule applies. You are in pressure group U after the second dive.



k. Continue right along the U row into Table 2 to find a surface interval box that includes 1 hour and 2 minutes. You'll see that it falls between 57 and 1:02.

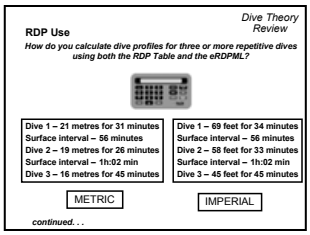
l. Follow the column down to see that after the surface interval, you are in H pressure group.

m. Flip the RDP over to Table 3, and follow the H column down to where it meets the 50 foot row – you need to round up from 45 feet.

n. The residual nitrogen time is 28 minutes. Add the RNT 28 to the ABT 45 for a total of 73 minutes.

o. Flip back to Table 1, go to the 50 foot column, and follow it down to 73 minutes, which is in a shaded box – so the safety stop rule applies.

p. You are in pressure group W after the third dive. This means that if you plan to do a fourth dive the WX rule applies, and you would need at least 1 hour surface interval between dives.



4. Let's try the same three-dive profile using the eRDPML:

METRIC

Dive 1 – 21 metres for 31 minutes

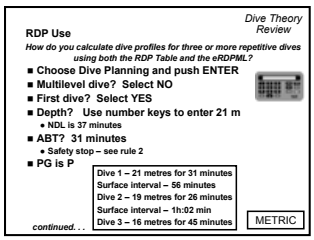
Surface interval – 56 minutes

Dive 2 – 19 metres for 26 minutes

Surface interval – 1h:02min

Dive 3 – 16 metres for 45 minutes

a. Select the mode with the MODE/RESET button, Choose Dive Planning and push ENTER.



b. It asks if this is a multilevel dive – select NO.

c. It asks if this is the first dive – select YES.

d. It asks for the depth – select 21 then ENTER. It tells you that the no decompression limit (NDL) is 37 minutes – push ENTER

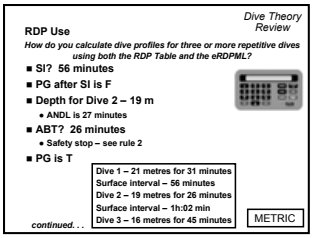
e. It asks for the ABT (actual bottom time) – select 31 then ENTER. It displays a Safety Stop of 3 minutes and See rule 2 message.

f. It then tells you that you are in pressure group P at the end of the dive – push ENTER.

g. It asks you to enter a surface interval – press 56 then ENTER.

h. You see that your pressure group after the surface interval is F – push ENTER.

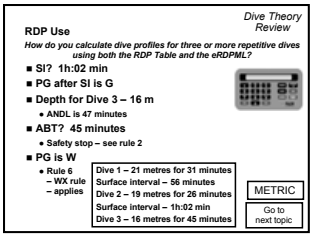
i. Enter the depth for dive 2, which is 19 metres – then ENTER. It tells you that your adjusted no decompression limit (ANDL) is 27 minutes - push ENTER.



j. It asks for your ABT – enter 26. Again, it alerts you that rule 2 about a required safety stop applies – push ENTER.

k. It tells you that your pressure group after this dive is T.

l. It asks you to enter a surface interval – press 1:02 then ENTER. Your pressure group after the surface interval is G – push ENTER.



m. Enter the depth for dive 3, which is 16, then ENTER. It tells you that your adjusted no decompression limit (ANDL) is 47 minutes - push ENTER.

n. It asks for your ABT - push 45 ENTER. Again, it alerts you that rule 2 applies - push ENTER.

o. It tells you that your pressure group after this dive is again W. When you push ENTER, it alerts you that rule 6 – the WX rule – applies, in case you were planning a fourth dive.

5. Let's try the same three-dive profile using the eRDPML:

IMPERIAL

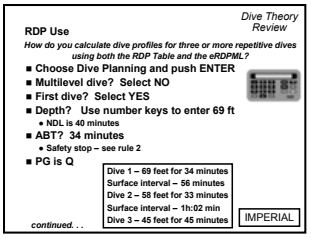
Dive 1 – 69 feet for 34 minutes

Surface interval – 56 minutes

Dive 2 – 58 feet for 33 minutes

Surface interval – 1h:02min

Dive 3 – 45 feet for 45 minutes

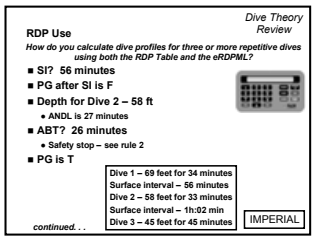


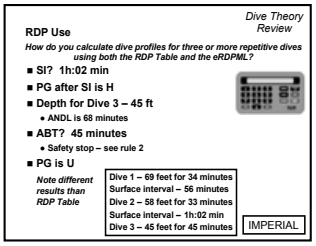
a. Select the mode with the MODE/RESET button. Choose Dive Planning and push ENTER.

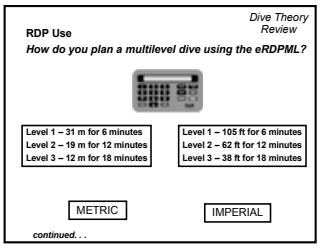
b. It asks if this is a multilevel dive – select NO.

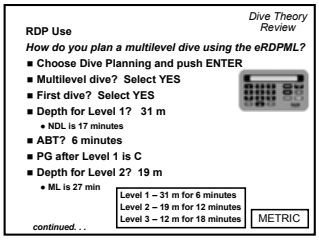
c. It asks if this is the first dive – select YES.

d. It asks for the depth – select 69 then ENTER. It tells you that the no decompression limit (NDL) is 40 minutes – push ENTER









e. It asks for the ABT (actual bottom time) – select 34 then ENTER. It displays a Safety Stop of 3 minutes and See rule 2 message.

f. It then tells you that you are in pressure group Q at the end of the dive – push ENTER.

g. It asks you to enter a surface interval – press 56 then ENTER.

h. You see that your pressure group after the surface interval is F – push ENTER.

i. Enter the depth for dive 2, which is 58 feet – then ENTER. It tells you that your adjusted no decompression limit (ANDL) is 36 minutes - push ENTER.

j. It asks for your ABT – enter 33. Again, it alerts you that rule 2 about a required safety stop applies – push ENTER.

k. It tells you that your pressure group after this dive is U.

l. It asks you to enter a surface interval – press 1:02 then ENTER. Your pressure group after the surface interval is H – push ENTER.

m. Enter the depth for dive 3, which is 45, then ENTER. It tells you that your adjusted no decompression limit (ANDL) is 68 minutes – push ENTER.

n. It asks for your ABT – push 45 ENTER. It tells you that your pressure group after this dive is again U.

o. Note that this is different than the results you got with the RDP Table, because, the numbers did not have to be rounded up. The eRDPML is able to calculate using the exact depth and time – not several feet or minutes greater.

D. How do you plan a multilevel dive using the eRDPML?

1. Calculating a multilevel dive on the eRDPML is very similar to figuring out a three-dive profile.
2. Examples are divided into metric and imperial – choose the measuring system you are familiar with:

METRIC

Level 1 – 31 metres for 6 minutes

Level 2 – 19 metres for 12 minutes

Level 3 – 12 metres for 18 minutes

a. Start by selecting the Dive Planning mode with the MODE/RESET button and push ENTER.

b. It asks if this is a multilevel dive - select YES.

c. It asks if this is the first dive - select YES.

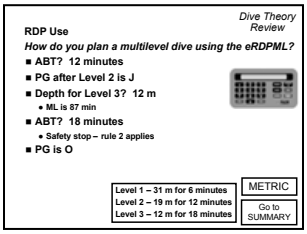
d. It asks for the depth of level 1 – select 31 then ENTER. It tells you that the no decompression limit (NDL) is 17 minutes – push ENTER.

e. It asks for the ABT – select 6 then ENTER.

f. It then tells you that your pressure group after this level is C – push ENTER.

g. It asks for the depth of level 2 - select 19 then ENTER. It tells you that the multilevel limit (ML) is 27 minutes – push ENTER.

i. It asks for the ABT – select 12 then ENTER. It tells you that your pressure group after this level is J – push ENTER.



j. It asks for the depth of level 3 – select 12 then ENTER. It tells you that the multilevel time limit is 87 minutes – push ENTER.

k. It asks for your ABT – select 18 then ENTER. It alerts you that rule 2 applies, because your deepest depth is below 30 metres.

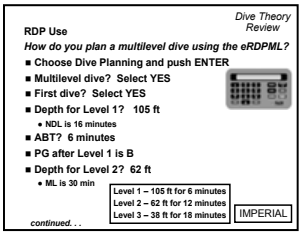
l. Your ending pressure group is O.

3. **IMPERIAL**

Level 1 – 105 metres for 6 minutes

Level 2 – 62 metres for 12 minutes

Level 3 – 38 metres for 18 minutes



a. Start by selecting the Dive Planning mode with the MODE/ RESET button and push ENTER.

b. It asks if this is a multilevel dive - select YES.

c. It asks if this is the first dive - select YES.

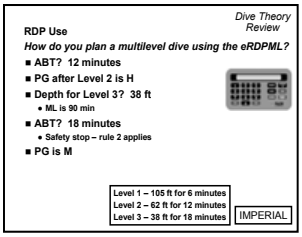
d. It asks for the depth of level 1 – select 105 then ENTER. It tells you that the no decompression limit (NDL) is 16 minutes – push ENTER.

e. It asks for the ABT – select 6 then ENTER.

f. It then tells you that your pressure group after this level is B – push ENTER.

g. It asks for the depth of level 2 - select 62 then ENTER. It tells you that the multilevel limit (ML) is 30 minutes – push ENTER.

i. It asks for the ABT – select 12 then ENTER. It tells you that your pressure group after this level is H – push ENTER.



j. It asks for the depth of level 3 – select 38 then ENTER. It tells you that the multilevel time limit is 90 minutes – push ENTER.

k. It asks for your ABT – select 18 then ENTER. It alerts you that rule 2 applies, because your deepest depth is below 100 feet.

l. Your ending pressure group is M.

[**NOTE:** Use the following questions to test candidate understanding. Ask candidates to explain their answers.]

Q: When using the RDP, a safety stop is required after any dive to _____ or deeper and any time you surface within _____ pressure groups of an NDL.

A: 30 metres/100 feet, three

Q: What is the no decompression limit for a first dive to 25 metres/90 feet – on the RDP Table and eRDPML?

A: 29 minutes / 25 minutes

Q: What is the adjusted no decompression limit for a J diver going to 12 metres/40 feet – on the RDP Table and eRDPML?

A: 102 minutes / 96 minutes

Q: What is the ending pressure group for the following three dive profile using the eRDPML?

METRIC

Dive 1 – 30 metres for 18 minutes
Surface interval – 35 minutes
Dive 2 – 19 metres for 25 minutes
Surface interval – 55 minutes
Dive 3 – 14 metres for 35 minutes

IMPERIAL

Dive 1 – 90 feet for 18 minutes
Surface interval – 35 minutes
Dive 2 – 64 feet for 25 minutes
Surface interval – 40 minutes
Dive 3 – 47 feet for 45 minutes

A: T / X

Q: What is the ending pressure group for the following three dive profile using the RDP Table?

METRIC

Dive 1 – 24 metres for 20 minutes
Surface interval – 44 minutes
Dive 2 – 16 metres for 33 minutes
Surface interval – 37 minutes
Dive 3 – 11 metres for 65 minutes

IMPERIAL

Dive 1 – 82 feet for 20 minutes
Surface interval – 44 minutes
Dive 2 – 49 feet for 33 minutes
Surface interval – 37 minutes
Dive 3 – 38 feet for 55 minutes

A: W / V

Q: What is the ending pressure group for the following multilevel dive using the eRDPML?

METRIC

Level 1 – 30 metres for 10 minutes

Level 2 – 17 metres for 13 minutes

Level 3 – 11 metres for 25 minutes

IMPERIAL

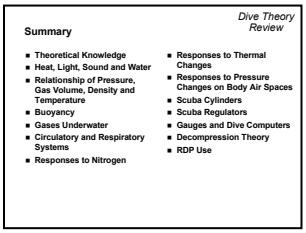
Level 1 – 100 feet for 10 minutes

Level 2 – 52 feet for 13 minutes

Level 3 – 40 feet for 25 minutes

A: R / Q

Summary



I. Theoretical Knowledge

II. Heat, Light, Sound and Water

III. Relationship of Pressure, Gas Volume, Density and Temperature

IV. Buoyancy

V. Gases Underwater

VI. Circulatory and Respiratory Systems

VII. Responses to Nitrogen

VIII. Responses to Thermal Changes

IX. Responses to Pressure Changes on Body Air Spaces

X. Scuba Cylinders

XI. Scuba Regulators

XII. Gauges and Dive Computers

XIII. Decompression Theory

XIV. RDP Use