The intent here is to suggest that advanced stabilization is beyond the operations level and requires the tools and techniques of a technician-level team.

A.12.4.2(4) Power tools (e.g., air bags, hydraulic spreaders and rams, hand tools, and other power tools) and training necessary to remove, cut, and move components displaced at a machinery search and rescue incident should be provided. "Specialized rescue equipment" can include, but is not limited to, hydraulic, pneumatic, and electrical spreading, cutting, lifting, and ram-type tools immediately available and in use by the organization.

A.12.4.2(5) In elevator rescues, the typical safe order of victim removal is as follows:

(1) Car at or near the landing (within 18 in.), floor level through the normal entranceway
(2) Car within 3 ft of the landing, floor above through the normal entranceway
(3) Car stalled more than 3 ft from the landing (stalled above the landing), floor below through the normal entranceway (barricade opening to shaft)
(4) Car stalled more than 3 ft from the landing (top escape hatch removal), top escape hatch (must use fall arrest system)

A.12.4.3 This procedure will eliminate the hazard of a moving elevator and remove potential of a falling hazard. Adjacent elevator(s) in excess of five (5) floors might have large counterweights operating in the rear portion of the hoistway. Securing these remaining elevator(s) can aid in removing a potential source of energy that travels the opposite direction of the intended direction of the car.

A 12 4 4 Lockout/tagout procedures should be initiated including confirma ion that all power sources have been secured in the off position.

A.13.2.3(2) Conventional emergency response PPE and other equipment (especially fire-related equipment) are often inappropriate for use in a cave setting. For instance, fire helmets and boots can increase one's potential for injury in the cave. Conventional emergency response skills such as using a sphygmomanometer and using an ambulance cot have very little application in the cave. Therefore, such skills and equipment will require modification to achieve the rescuer's desired goals in the cave. Caving is not simply confined space rescue on rope or in the dark. Typical travel times can be hours or even days to reach remote sections of caves. Rescuers should carry their own light with power source and spares, food, and other needs and be totally self-sufficient for at least 12 to 24 hours depending on the cave involved.

A.13.2.3(3) Organizations at the awareness and operational levels of cave search and rescue, that have caves in their operational area, should have a plan for contacting appropriate resources for cave rescue incidents. The National Cave Rescue Commission (NCRC) of the National Speleological Society provides a resource list of organizations with cave rescue capabilities, local caches of specialized cave rescue equipment, and local caving organizations. The NCRC provides training to both organizations and individuals in cave rescue.

A.13.2.3(5) General hazards associated with search and rescue operations in the cave can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards and, to help provide for their safety, ensure that members have the ability to recognize potential hazards that they could encounter. As many caves can be a mile or more from roadways, access to the cave entrance will bring the cave rescuer into many of the hazards also present in a wilderness response. In addition to those hazards, the following hazards will be encountered in-cave.

(1) *Personal Hazards.* In the cave environment, there are many dangers that pose personal injury and physiological hazards to responders. Personnel should be made aware of such hazards, including, but not limited to, blisters, scrapes, scratches, falls, blows, bruises, dehydration, and so forth.
(2) *Environmental Hazards.* Depending on the specific environment, there are many dangers that pose hazards to responders. Personnel should be made aware of such hazards, including, but not limited to, cold, chilling winds, water, exposure injuries (cold and heat), toxic plants, infectious organisms, and hazardous animal life.
(3) *Terrain Hazards.* Specific features in an environment can pose hazards to responders. Personnel should be made aware of such hazards, including, but not limited to, pits, sumps, waterfalls, standing water (e.g., ponds, lakes), moving water (e.g., rivers, streams), and so forth.
(4) *Man-Made Hazards.* Humans, whether intentionally or accidentally, can also cause unsafe conditions in the cave. Personnel should be made aware of such hazards, including, but not limited to, booby-trapped stills, labs (e.g., covert ethanol, drugs), gates, ladders, and inappropriate rigging.

A.13.2.3(6) One of the most important tasks for the first on-scene responders is to establish control of all cave entrances. A log should immediately be started and anyone leaving or entering the cave via any entrance should be logged in or out and details as to their assignment and the equipment they are carrying in should be logged as well.

A.13.2.3(7) Documents for the collection and recording of information can include the following:

(1) Information regarding the lost person(s)
(2) Entrance(s) control logs
(3) Information needed to determine search urgency
(4) Information required by the AHJ
(5) Information required by the incident management system (IMS)
(6) Information required to identify a subject's track (i.e., footprint)
(7) Information for development of search strategy

A.13.2.3(8) Isolation includes keeping the reporting party readily available for interviewers and isolated from media and the incident operations, as well as isolated from one another, in the case of multiple reporting parties.

A.13.3.2.1 In some cases, where minimum exposure to cave hazards exists, it can be appropriate for the AHJ to establish SOPs that permit an operations-level organization to conduct certain search and rescue operations without supervision of a technician-level organization. As a minimum, the members of the operations-level organization entering the cave should have the following:

(1) Proficiency in crawling, climbing, and moving over uneven surfaces and breakdown areas covered in mud, sand, or water

(2) Familiarity with chimneying, bridging, and other basic climbing techniques used in moving through caves
(3) Ability to move comfortably and efficiently in small spaces
(4) Ability to carry personal equipment and rescue equipment through the cave
(5) Ability to identify fragile cave environments and take measures to protect them
(6) Ability to maintain primary light sources
(7) Ability to be self-sufficient underground for 24 hours
(8) Ability to read cave maps and the special symbols associated with them
(9) Ability at both rappelling and ascending drops of 100 ft (30.48 m) or more, often in free fall
(10) Ability to change over from rappel to climbing and climbing to rappel in adverse situations such as complete darkness and in waterfalls
(11) Ability to pass a knot on rappel or ascent
(12) Ability to pass a re-belay point in-cave

A.13.3.3(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope and magnitude of the incident, including whether it is a search, rescue, or body recovery
(2) Assessment of time required
(3) Assessment of staffing needs
(4) Specific environmental factors involved
(5) Integrity and stability of the environment involved
(6) Number of known/potential victims
(7) Weather (current and forecast)
(8) Time to locate patient at unknown location in cave
(9) Difficulty of real-time communication flow underground
(10) Travel time to know patient location
(11) Transport time of patient(s) in restricted cave pas age
(12) Vertical rigging challenges
(13) Logistical issues with rotation of rescuers and/or resupply and rehabilitation of rescuers in place underground

A.13.3.3(2) See A.13.2.3(3).

A.13.3.3(3) Organizations should have access to a basic understanding of the cave environment, including their regional differences in ambient cave temperature, normal hazards such as risk of hypothermia, and risk of potential changes in cave environment due to seasonal variations and outside weather.

A.13.3.3(4) Organizations should have special knowledge and equipment for medical treatment and patient transport specific to cave rescue, which can include the following:

(1) Familiarity with use of vapor barriers for in-cave patient protection from wind and water
(2) Familiarity with confined space drag sheet–type patient transport devices (such as the SKED® and Half-SKED®), spinal immobilization devices with built-in patient lift harness (for evacuation purposes), solid basket litters, and ability to identify litters appropriate for small spaces
(3) Practical experience in moving litters through long, narrow, uneven spaces

A.13.3.3(6) Personal support equipment should include that which is necessary to address the following needs, or potential needs, of a rescuer in a cave setting:

(1) Three sources of light, helmet mountable and capable of allowing the rescuer to enter the cave
(2) Personal medical (first aid) supplies
(3) Additional clothing appropriate for anticipated environment/weather
(4) Fluids and food appropriate for mission duration
(5) Personal safety and comfort gear [e.g., insulated pads for sitting on, shelter, body waste management container(s)]
(6) Navigation tools (e.g., compass, map)
(7) General marking and documentation tools (e.g., flagging tape, paper/pencil)
(8) Improvisational tools (e.g., wire, twine, leaf bag, safety pin)
(9) Emergency shelter, bivouac, and/or body protection
(10) Emergency communications (e.g., whistle, glow stick, candle)
(11) Cave-suitable pack for contents

A.13.3.3(7) The AHJ should establish procedures for negotiating and/or avoiding conditions and hazards specific to the cave environments and terrains in which rescuers can become involved. It is likely that some conditions and/or situations will exceed the capability of the organization. In such situations, additional, more experienced, specialized, or highly trained resources should be procured. It is possible that rescuers will have more than 6 hours travel time inside a cave that requires confined space, swift water, and vertical rope ascending and descending skills just to reach an injured patient in a cave. Having a pre-incident working relationship with local cavers who have been trained in cave rescue skills is an excellent way to augment the AHJ's cave rescue response. The National Cave Rescue Commission of the National Speleological Society provides training specific to the cave environment for both cavers and professional rescue resources.

A.13.3.3(13) Caves are often direct drainage for rainwater falling in the immediate area and in some cases from miles away. Weather forecast and local knowledge of drainage patterns should be used to prevent rescuers from being caught in or trapped by rising water.

A.13.3.3(14) Skills involved in supporting and participating in a search should include, but not be limited to, the following:

(1) Hasty, efficient, and thorough search techniques
(2) Principles of confinement of the search area
(3) Principles and importance of clue awareness
(4) Basic search theory application and terminology
(5) Principles of lost person behavior
(6) Procedures for serving as an air observer (e.g., searching from an aircraft)
(7) Procedures for handling, processing, and documenting evidence

A.13.3.3(17) The ability to discern limitations in accessing and/or evacuating should be based on the following:

(1) Individual and team expertise
(2) Qualified personnel available
(3) Ability to communicate from the patient scene
(4) Anticipated staffing and time

A.13.3.3(21) The organization should have the ability to establish communication system(s) appropriate for the cave environment and distance from incident command, including the following:

(1) Access to and ability to install wired communications
(2) Ability to operate field telephones

(3) Access to and ability to operate low-frequency cave radios
(4) Message runners if the above are not available

A.13.4.4 Cave search and rescue organizations at the technician level are not required to develop and maintain capabilities in all types of cave search and rescue operations [e.g., flooded or underwater caves, cave diving and recovery, and vertical over 200 ft (60.95 m)].

A.13.4.5(4) Members of an organization at the technician level should be adept and experienced at every skill required of subordinate personnel. Technician-level organizations should have the capability to address any potential operation that falls within their jurisdiction. To accomplish this, members of these organizations should be personally adept at cave skills, travel, and operations in the cave setting.

A.13.4.5(5) Such an operational plan should be based on the hazard identification and risk assessment performed according to Section 4.2, available resources, environmental influences and conditions, and the urgency of the situation. Specifically with regard to a search, the implemented plan should involve planning and search management techniques, including, but not necessarily limited to, the following:

(1) Determining the urgency of the search
(2) Developing a lost subject profile
(3) Establishing the search area and correctly dividing it into regions and segments as necessary
(4) Conducting an appropriate investigation and interviews
(5) Applying the mathematical concept of probability and search theory
(6) Designing, developing, and establishing appropriate search strategy and tactics
(7) Establishing and managing appropriate base camp
(8) Briefing and debriefing of operational personnel properly and thoroughly
(9) Considering suspension of the search when appropriate
(10) Demobilizing personnel and facilities
(11) Documenting the incident properly

A.14.1.2 Procedures for active underground structures and excavations are well covered by existing standards and regulations such as those of the Mine Safety and Health Administration (MSHA). In addition, existing regulations and standards address general operations in underground structures such as subway stations, road tunnels, and parking garages. This chapter is intended to address the requirements of search and rescue operations in and around inactive or abandoned underground structures and excavations, sometimes when the safety systems addressed by other standards and regulations have been compromised. "Search and rescue" in this context does not include fire-fighting operations in general, which are also covered by other standards and regulations.

Surface mines such as quarries and open pits are outside the scope of this chapter.

A.14.1.2.2 Generally, underground structures and excavations do not qualify as permit-required confined spaces such as those addressed in 29 CFR 1910.146 and/or equivalent local regulations, due to the long distances and other unique characteristics. However, tunnels or mines could have equipment, spaces, or areas that do meet the criteria for confined spaces. It is not the intent to exclude those areas from the requirements of other chapters in this document.

A.14.1.3 In the United States, the Department of Labor's Mine Safety and Health Administration (MSHA) has established regulations for mine rescue teams at operating mines. Tunnels under construction are regulated by the Occupational Safety and Health Administration (OSHA) or by equivalent state agencies.

A.14.1.3.2 The requirements of this section should be confirmed by an annual evaluation of the search and rescue organization's capabilities to perform mine and tunnel rescues in terms of overall timeliness, training, and equipment and to perform safe and effective search and rescue in those types of situations to which the team must respond.

A.14.1.3.4 Representative mines and tunnels should — with respect to opening size, configuration, and accessibility — simulate the types of mines and tunnels from which rescue is to be performed.

A.14.1.3.5 The term *timely* is based on many factors, such as perceived danger of the original entry (e.g., possible supplied breathing air required), distance to definitive medical care, capabilities of responding emergency medical services, and so forth. In trauma-related injuries, the "golden hour" principle can be used to determine how quickly the search and rescue organization should be able to respond to deliver the patient to the appropriate treatment facility within an hour of onset of injuries. The search and rescue organization should have a goal of responding to these emergencies within 15 minutes of the time they receive notification. OSHA 1926.800(g)(5) includes response time requirements for tunnel rescue teams.

A.14.1.4 U.S. federal regulations (30 CFR 49.2) require five members and one alternate for rescue teams to perform entry at working mines. The intent of the minimum staffing requirements in this document is to provide for adequate staffing to mobilize an appropriately sized entry team to perform the mission, provide for immediate rescue of team members, assist with victim packaging, and movement under long and difficult conditions. Nothing in this document is intended to mandate a minimum or maximum size of the actual entry team.

A.14.2.3(3) Hazards can include, but are not limited to, the following:

(1) Hazardous atmospheres
(2) Hazardous chemicals
(3) Temperature extremes
(4) Fall hazards
(5) Moving equipment

Some methods of recognition and assessment of hazards associated with mines and tunnels include, but are not limited to, the following:

(1) Assessment of the perimeter surrounding the mine or tunnel incident to determine the presence of or potential for a hazardous condition that could pose a risk to rescuers during approach
(2) Recognition of the need for decontamination of a patient or responder who might have been exposed to a hazardous material as per Chapter 11 of NFPA 472 and OSHA regulations in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response" (HAZWOPER)
(3) Recognition of the need for a search and rescue organization or additional resources

(4) Notification of the designated search and rescue organization and other resources necessary for initiation of mine or tunnel rescue
(5) Recognition of hazardous atmospheres or materials through visual assessment and information received from on-site personnel
(6) Recognition of potential fall hazards in and around the site
(7) Recognition of potential hazards associated with open excavations in and around the site

A.14.2.3(4) The term *tunnel* refers to a covered excavation used for the conveyance of people or excavations that are, or will be, connected to the tunnel, including shafts and trenches.

Underground mines are a series of tunnels and shafts underground used to obtain something from the soil through which they are excavated.

Tunnels and mines differ from each other in that in the construction of a tunnel the final product is the hole in the earth and the removed soil is a by-product of that process, while in mining, the tunnel is a by-product of the process of removing the soil.

A.14.2.3(5) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources. In addition, the system includes procurement of on-site information resources such as witnesses, entry supervisors, facility managers, engineers, or other responsible persons. Common formal information sources can include, but are not limited to, the following:

(1) Accountability system — which may be a "brass board," sign-in log, or o her means of personnel accountability
(2) Chemical information documents (i.e., SDS)
(3) Other site work permits
(4) Shift log or tie-over book
(5) Emergency response plan
(6) Mine maps (older abandoned mines might not have maps readily available, although local Mine Safety and Health inspectors might have these records archived from when the mine was active)
(7) Engineering drawings

A.14.2.3(6) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This process might include management of all civilian and nonemergency personnel and establishment of operational zones and site security. The organization should also ensure through written standard operating guidelines that the scene is rendered safe at the termination of the incident.

A.14.3.3(1) The assessment at this level should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Hazards such as engulfment potential, environmental hazards (e.g., chemical, atmospheric, temperature), harmful forms of energy (e.g., electrical, mechanical, movement due to gravity, hydraulic), configuration hazards (e.g., diverging walls, entrapment, obstructions, trip/fall hazards), and so forth
(2) Risk/benefit analysis (body recovery versus rescue)
(3) Available and necessary additional resources
(4) Establishment of control zones
(5) Magnitude of the hazard and isolation procedures
(6) Effectiveness of the non-entry or qualifying entry–type rescue
(7) Overall safety of search and rescue operations
(8) Level of search and rescue response (appropriate for the type of operations being attempted)
(9) Current and projected status of the planned response
(10) Personnel accountability

A site safety plan can also provide useful information for consideration during size-up and should include the following:

(1) Search and rescue team notification
(2) Acceptable entry conditions for rescue
(3) Hazard identification
(4) Risk assessment of hazards
(5) Site map
(6) Hazard abatement (including control zones, ventilation, and lockout/tagout procedures)
(7) Use of buddy system (where applicable)
(8) Communications (e.g., site, rescue attendant to rescue entrant)
(9) Command post
(10) Incident management organizational chart
(11) Standard operating guidelines
(12) Safe work practices
(13) Medical assistance
(14) Pre-entry safety briefings
(15) Pre- and postentry physicals (if indicated)

A.14.3.3(3) The AHJ should address the possibility of members of the organization having physical and/or psychological disorders (e.g., physical disabilities, fear of heights, fear of enclosed spaces) that could impair their ability to perform in mines or tunnels.

A.14 3.3(4) Roles, functions, and responsibilities for these team positions should be consistent with the organization's standard operating guidelines for mine and tunnel rescues.

A.14.3.3(5) See A.7.3.6(5).

A.14.3.3(6) The requirement for emergency egress respiratory protection can be satisfied with a self-contained self-rescuer device designed and approved for use in a mine or tunnel environment, such as those meeting the requirements of MSHA/NIOSH.

A.14.3.3(7) The intent of this item is to restrict entries made by operations-level organizations to those that would absolutely minimize risk to rescue entrants. It is the intent of this document that operations-level teams not perform hazardous entries.

A.14.3.3(7)(i) The intent of this item is to allow for easier retrieval of rescue entrants should this become necessary and to provide for passage through the opening without removal of necessary PPE, including fresh air breathing apparatus.

A.14.3.3(7)(j) The intent of this item is to allow a "buddy system" to be employed, providing potentially faster response to a problem with one of the rescue entrants.

A.14.3.3(7)(k) The intent of this requirement is to ensure that hazards to rescuers in organizations at this level are kept to an absolute minimum.

A.14.3.3(8) "Packaging devices" that can be used in mines and tunnels include, but are not limited to, the following:

(1) Full spine immobilization devices
(2) Short spine immobilization devices
(3) Cervical spine immobilization devices
(4) Litters
(5) Prefabricated full-body harnesses
(6) Tied full-body harnesses
(7) Wrist loops (wristlets)

A.14.3.3(11) Organizations at the operations level are expected to safely apply lowering and raising systems (rope- or non-rope based) as appropriate during mine or tunnel emergencies. These applications can involve the use of rope rescue systems in the high-angle environment both to lower rescuers into and to remove rescuers and victims from mines and tunnels. The determination of what systems are most appropriate to accomplish these tasks should be dictated by the circumstances surrounding the incident.

A.14.4.2 While five people are the recommended minimum for most entry-type mine and tunnel rescue operations, some such rescues will require more or fewer rescuers. The number of personnel required should be determined by the situation, hazards, and degree of difficulty of the situation confronted. A team is "qualified" by its capability as a team, not by the individual qualifications of its members.

A.14.4.2.1 Depending on the size of the space, its configuration, and associated travel distances, it might be more beneficial to have all or a portion of the backup team positioned inside the space at a fresh air base or forward staging area.

A.14.4.2.2 The requirement for emergency egress respiratory protection can be satisfied with a self-contained self-rescuer device designed and approved for use in a mine or tunnel environment, such as those meeting the requirement of MSHA/NIOSH.

A.14.4.2.4 "Verbal" in this context means any method of conveying voice messages from one person to another, including direct speech and electronic technology.

A.14.4.2.4.1 Tunnels under construction in particular have specific action levels for certain contaminants, such as methane, which might vary from more conventional action levels for atmospheric hazards.

A.14.4.2.6 The requirement of this section can be met by having each entry team member wear an MSHA/NIOSH-approved oxygen generating self-rescuer.

A.14.4.3(6) The size-up/assessment at this level should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Available and necessary additional resources
(2) Hazard isolation and control requirements

A.14.4.3(7) Procedures should be consistent with local, state, and federal guidelines, such as those found in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response" (HAZWOPER).

A.14.4.3(8) See Annex G.

A.14.4.3(9) The health and safety regulations regarding the construction of tunnels apply to all. See 3.3.155 for the definition of tunnel. Also see Annex G.

A.15.1.2 One intent of this chapter is to distinguish between three levels of capability for organizations using helicopters at search and rescue operations. Organizations at the awareness level are capable of recognizing hazards, using PPE, and implementing techniques necessary to operate in the vicinity of the helicopter. Organizations at the operations level are capable of recognizing hazards, using PPE, and implementing techniques necessary to operate in a support function inside and immediately outside of a helicopter. Organizations at the technician level are capable of recognizing and mitigating hazards, using helicopter search and rescue equipment, and performing advanced search and rescue helicopter techniques, both inside and outside the aircraft, commensurate with the needs of the organization.

A.15.2.2(8) General hazards include, but are not limited to, temperature, altitude, rain, wind, fog, snow, utility wires/poles, trees/canopy, and loose debris, any of which could impede safe operation and/or performance of a helicopter.

A.15.2.2(9) The AHJ shall ensure that all personnel wear and use PPE during helicopter search and rescue operations. Personal protective equipment should, as a minimum, include an appropriate helmet, eye protection, hearing protection, protective clothing appropriate for the environment, footwear, and gloves.

A.15.2.2(12) A pre-flight safety briefing should include, but not be limited to, the following:

(1) Rotor hazard zones
(2) Safely approaching and departing from the helicopter
(3) Use of safety belts
(4) Operation of doors and emergency exits
(5) Location of survival equipment
(6) Location and use of required flotation equipment
(7) Location and operation of fire extinguishers
(8) Location and opera ion of emergency locator transmitter (ELT)
(9) Location and operation of emergency fuel shutoff
(10) Crash and emergency procedures

A.15.3.2(2) Standard crew complements can be addressed in existing guidance, such as the *International Aeronautical and Maritime Search and Rescue Manual*. However, no fewer than one observer, in addition to the pilot, is recommended in an aircraft during helicopter search operations and, no fewer than two personnel (one a rescuer, one a crew chief/spotter), in addition to the pilot, are recommended in an aircraft during helicopter rescue operations.

A.15.3.2(5) Crash egress and survival training appropriate to the environment includes being taught how to exit the helicopter post-crash and how to survive in any environment that might be encountered in the area of operation until rescued.

A.15.4.2(6) For more information, see the *Aeronautical Information Manual* (AIM) (or a similar document), available at www.faa.gov.

A.15.4.2(7) A temporary landing zone is any nonpermanent location selected for a helicopter to land away from an airport. A helispot is an incident command system (ICS) term for a similar location that is defined as "a location where a helicopter can take off and land; some helispots may be used for temporary loading."

A.16.2.3(2) The assessment phase includes an evaluation of the subject's condition and the subject's ability to assist in his or her own rescue. Consideration should be given to the need for

other types of water rescue early in the assessment phase. The best intended surface rescue could eventually require other capabilities.

A.16.2.3(3) See A.4.2.5.

A.16.2.3(4) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

A.16.2.3(5) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.16.2.3(6) General hazards associated with water search and rescue operations can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members:

(1) *Utilities.* Control of the utilities in and around a water incident is critical to ensure the safety of responding personnel and victims. The AHJ should provide its members with training in the control of these services to provide a safe environment for them to operate in and to ensure the safety of victims. The following utilities should be considered when providing training:
   (a) Electrical services (primary and secondary)
   (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)
   (c) Water/steam
   (d) Sanitary systems
   (e) Communications
   (f) Secondary service systems (such as compressed medical, or industrial gases)

(2) *Hazardous Materials.* Water incident sites might include various materials unique to a site that, when released during a search and rescue operation, could pose a hazard to victims and responders. The AHJ should provide its members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.

(3) *Personal Hazards.* At the site of any water incident, there are many dangers that pose personal injury hazards to the responders. The AHJ should train its members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards to help ensure members' safety. Every member should be made aware of hazards such as trips, falls, blows, punctures, impalement, and so forth.

(4) *Confined Space.* Some water incident sites necessitate a confined space rescue. Responding personnel should be familiar with and trained in confined space rescue requirements and techniques. The AHJ should determine the applicable laws and standards related to confined space rescue and should provide training to its members in confined space rescue.

(5) *Hazards That Are Immediately Dangerous to Life and Health.* These hazards include swift water with currents exceeding those in which a person or watercraft can safely and effectively operate.

(6) *Other Hazards.* There are numerous other hazards associated with water search and rescue operations. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide its members with training and awareness of these other hazards to allow them to perform search and rescue operations safely and effectively.

(7) *General Area.* The general area around a water incident site is the entire area around a search and rescue site. Any member operating within the vicinity of the water's edge can accidentally enter the hazard zone. PPE should be utilized accordingly. Making the general area safe includes, but is not necessarily limited to, the following:
   (a) Controlling/limiting access to the area by unnecessary personnel
   (b) Identifying hazards and removing or reducing their impact
   (c) Using personal flotation devices (PFDs) and other PPE

A.16.2.3(7) While in rescue mode, the assessment to move to recovery is an ongoing process that should be updated as incident information becomes available. The AHJ should have procedures in place to optimize the survivability of the potential victim during this process. This typically includes actions that maximize the benefit to the subject but pose minimal risk to the responder. At the awareness level there is little action expected of responders that could introduce risk to the operation. Consequently, the bias should lean toward rescue mode unless there is a clear indication that the event is not survivable. As resources with greater capability arrive, the ability to conduct a more comprehensive risk benefit analysis can be conducted. Figure A.16.2.3(7) illustrates just one example of how contributing factors can be compiled into a risk benefit analysis for surface water rescue operations

A.16.3.3 For the purposes of this chapter, a rescue watercraft includes powered and non-powered vessels and craft that are intended to carry rescuers and victims. It is not intended to include rescue devices such as swim aids, paddle boards, and rescue boards that might accommodate a victim but are typically not classified as vessels or watercraft.

The intent of 16.3.3 is to ensure that members responsible for operating the watercraft or its equipment and systems are trained to perform the related functions under conditions that are as similar as possible to the most demanding potential work environment. This requirement does not to apply to rescuers aboard the watercraft who are using the craft as a work platform to fulfill the rescue mission and whose primary function is exclusive of operating the vessel or its systems.

A.16.3.4 For the purposes of this chapter a rescue watercraft includes powered and non-powered vessels and craft that are intended to carry rescuers and victims. It is not intended to include rescue devices such as swim aids, paddle boards, and rescue boards that might accommodate a victim but are typically not classified as vessels or watercraft. The intent of 16.3.4 is to ensure that members responsible for actually operating the watercraft or its equipment and systems are trained to perform the related functions under conditions that are as similar as possible to the most demanding potential work environment. This requirement does not apply to rescuers aboard the watercraft who are using the craft as a work platform to fulfill the rescue mission and whose primary function is exclusive of operating the vessel or its systems.

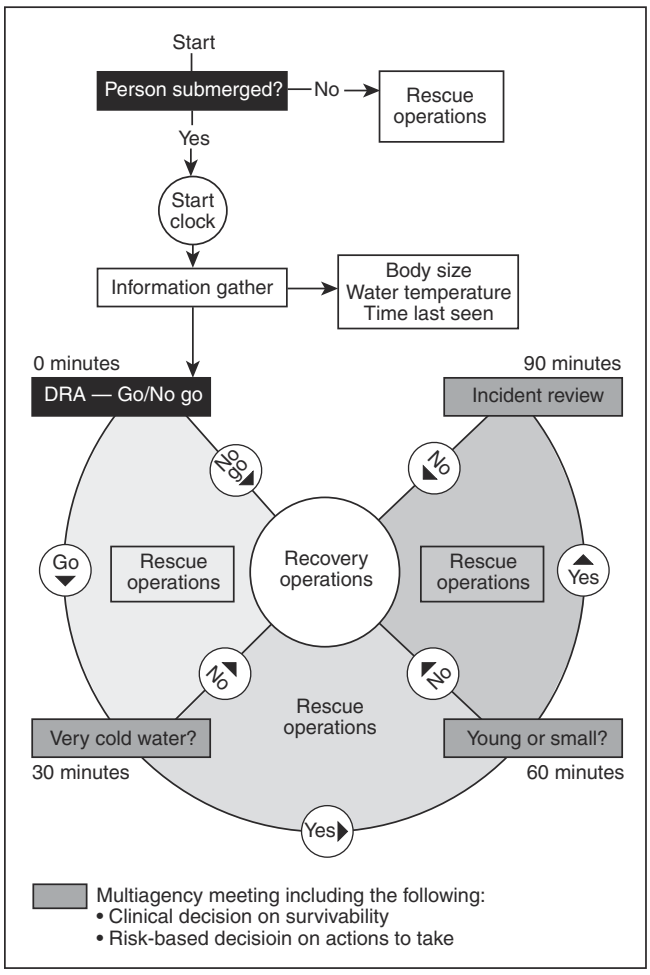

FIGURE A.16.2.3(7) UK Submersion Guidelines. ***(Courtesy of the UKFRS National Operational Guidance Programme.)***

A.16.3.5(1) The victim survival window will depend on many factors, including whether the victim's location is known, water and weather conditions, immersion time, age, physical condition, and factors that contributed to the immersion such as injury or illness. Medical research is continually providing new information on criteria that impacts the survival of near-drowning victims. Agencies that perform these rescue operations should have adequate guidance available to potential rescuers to determine the likelihood of survival of water-bound victims. See Figure A.16.2.3(7) for awareness-level surface water rescue.

A.16.3.5(2) Risks associated with water rescue operations can be dynamic, involving tides, weather, water conditions, and other factors that the rescuer cannot influence as part of the rescue plan. There are also components of the risk assessment that can be influenced by the agency, both in the planning phase and in the response phase. These include the size and capabilities of the rescue team and the condition of its members, the establishment of intervention resources or procedures, facilitating methods of removal or egress of rescuers from the hazard zone, rescue equipment provided, and the staffing levels of responding teams. The risk level can typically be adjusted or moderated as additional resources are moved into place, but this is often at the expense of the survivability profile as time continues to elapse.

A.16.3.6 For the purposes of this chapter, the PPE is intended to protect a rescuer from the effects of accidental immersion and to help facilitate timely removal from the water to ensure survival. Rescuers at the operations level are not expected to enter the water as part of the rescue plan. The term "hazard zone" as it is used here is intended to describe areas where the combination of water depth and the likelihood for accidental immersion pose a risk toot the responder. It is recognized that additional PPE might be required based on the task the rescuer has been assigned, environmental conditions, physical hazards, and other factors that could pose a risk to the responder.

A.16.3.6(1) Flotation aids, personal flotation devices, and other water-related PPE can come with a range of certifications and approvals from various national and international agencies. The same PFD might not be appropriate for all water rescue incidents to which the agency responds, or even for to rescuers with different roles at the same incident. The intent of 16.3.6(1) is that the device be capable of being worn or attached to the rescuer and will provide no less than 15.5 lb of inherent or on-demand positive buoyancy. The AHJ is responsible to perform a task analysis and to ensure that responders are provided the proper PPE for the work to be performed.

Agencies that provide information for approval for such devices include the following:

(1) The Lifesaving and Fire Safety Division of the United States Coast Guard
(2) The Office of Boating Safety of Transport Canada

CE and ISO standards deal with various categories of buoyancy performance. The rating is for an adult size, so smaller sizes have proportionally less buoyancy

(1) EN 393 (ISO12402-5), covers buoyancy aids, providing a minimum of 5 kg of buoyancy. Products that carry this approval include anglers vests, waterski vests, personal watercraft vests, wakeboarding vests, and various dinghy and canoe vests.
(2) EN 395 (ISO12402-4), covers lifejackets, providing a minimum of 10 kg of buoyancy. Products that carry this approval include foam lifejackets for both adults and children.
(3) EN 396 (ISO12402-3), covers lifejackets providing a minimum of 15 kg of buoyancy. Products that carry this approval include the majority of manual and automatic lifejackets for both adults and children.
(4) EN 399 (ISO12402-2), covers lifejackets providing a minimum of 27.5 kg of buoyancy. Products that carry this approval include lifejackets for offshore use.

In addition to "approved" PFD's, the AHJ might designate hazard- or mission-specific PPE or rescue tools as providing a trained responder sufficient reserve buoyancy, negating the need for an additional PFD. Examples include inherently buoyant ice rescue suits, diving buoyancy compensators and water rescue floatation cans with a leash.

A.16.3.6(3) This would include reflective striping, strobes, flashlights, chemical light sticks, or other light sources as recognized by the AHJ.

A.16.3.7(1) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(1) Scope, magnitude, and nature of the incident

(2) Location and number of victims
(3) Risk benefit analysis
(4) Separation, isolation, security, and interviewing of witnesses
(5) Hazards such as disrupted or exposed utilities, standing or flowing water, mechanical hazards, hazmat, and explosives
(6) Access to the scene
(7) Environmental factors
(8) Resource assessment, internal and external
(9) Rescue versus recovery

A.16.3.7(2) These procedures include, but are not limited to, ensuring rescuers are wearing the wearing of proper PPE, using procedural checklists, ensuring site security (keeping bystanders back), reviewing the operational plan (and one's place in the plan), reviewing communications procedures (rescuer to tender, tender to shore, rescuer to rescuer), reviewing emergency procedures, wearing proper attire for the potential weather, reviewing procedures for equipment handling, and ensuring proper rest and attitude for the operation. For positive outcomes, water rescue requires a combination of knowledge, skills, abilities, physical fitness, and judgment. All will be gained through a combination of training and experience.

A.16.3.7(3) Hazards to both victim and rescuer include, but are not limited to, the following:

(1) Holes
(2) Strainers
(3) Hydraulics
(4) Low head dams
(5) Debris
(6) Cold water
(7) Currents
(8) Undercuts
(9) Backwash
(10) Outwash
(11) Contamination
(12) Obstructions
(13) Turbidity

A.16.3.7(6) It is important that the organization be capable of to continuously evaluating the effectiveness of the chosen plan of action. If the initial plan is not working, or requires modification to ensure safety or effectiveness, the plan should be changed. The potential for “tunnel vision” (a narrow focus excluding important influences) should be considered by those running the operation.

A.16.3.7(7) Shore-based rescues include, but are not limited to, reaching to a victim, throwing something to a victim (e.g., rope, buoy), and talking a victim into self-rescue. Items readily available on shore can be used to reach to a victim in the water while not exposing the rescuer to undue risk. Important aspects of reaching techniques include body position and reaching device selection (i.e., anything that can be used to extend a rescuer's reach). Many items found on shore (e.g., throw bag, PFD, ring buoy, manufactured flotation or rope-throwing devices) can be thrown to a victim to use as a flotation device or to pull the victim to shore.

A.16.3.7(8) The accurate use of throw bags takes practice and knowledge of proper body position, throwing technique, rope retrieval technique, and target selection (e.g., upstream in moving water, slightly beyond the victim).

A.16.3.7(9) Members of organizations at the operations level should have the ability to assist other rescue personnel with the construction of rope rescue systems. Skills involved in supplying this assistance include, but are not limited to, equipment identification, knot-tying capability, and limited knowledge of how the applicable rope rescue equipment should be used.

A.16.3.7(10) The intent of 16.3.7(10) is to include both incident-specific actions, such as staging of resources (e.g., ladders, life rings, vessels, or standby swimmers) for the intervention of rescuers, and organizational elements, such as training members on accidental immersion survival and removal tactics for the specific conditions responders are likely to encounter.

Procedures for survival swimming and self-rescue from entrapment are important because a rescuers might find themselves unintentionally in the water and trapped. These procedures should include, but are not limited to, the following abilities:

(1) Floating and swimming with and without flotation
(2) Conserving body heat while immersed in water (heat escape–lessening position)
(3) Using one's clothing for flotation
(4) Removing oneself from the water by climbing into a boat and, exiting at shore, from a pool's edge
(5) Extricating oneself from foot, body, and equipment entanglements

A.16.3.7(11) Environmental conditions such as weather and temperature play an important role in a rescuer's safety and comfort. Cold temperatures can lead to hypothermia and/or local cold injuries that can seriously impair a rescuer's ability to think and act. Wetness, through perspiration or from the environment, can substantially increase the speed at which a rescuer becomes affected by cold Therefore, thermal protection from the elements is essential for safe operations in cold and wet environments.

It is also very important to remember that all environments can lead to heat stress as well. For example, much of the apparel designed for rescue operations is waterproof and insulated to protect the rescuer from wetness and heat loss. Unfortunately, such garments impair the body's most effective means of thermal regulation: the evaporation of perspiration from the skin. In all environments and conditions, rescuers wearing PPE should be monitored for thermal stress (e.g., overheating). Pre-operation physical exams, appropriate hydration/nutrition, and monitored rehabilitation are essential for safe operations and healthy personnel.

A.16.3.7(14) Boat-based operations include, but are not limited to, the capability to perform surface support operations from within a boat while in surf, on the water, or on ice (whichever is applicable). Agencies that operate watercraft as part of their rescue operation would comply with the watercraft chapter of this document.

A.16.3.7(16) Accessible victims are those who can be retrieved without the rescuer having to venture out onto the ice or into the water.

A.16.3.7(18) This might include methods of search, stabilization, or access that do not require rescuers to enter the water or the water-bound vehicle.

A.16.4.3(3) The intervention plan might include one or more of the following: the use of a back-up rescuer(s), downstream safety, team, spotters, standby watercraft, and retrieval lines or ladders.

A.16.4.3(4) For example, establish a last seen point as a primary search area.

A.17.2.3(2) The assessment phase includes an evaluation of the subject's condition and the subject's ability to assist in his or her own rescue. Consideration should be given to the need for dive rescue early in the assessment phase. The best intended surface rescue could eventually require dive capability.

A.17.2.3(3) See A.4.2.5.

A.17.2.3(4) The emergency response system includes, but is not limited to, operations- and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

A.17.2.3(5) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.17.2.3(6) General hazards associated with water search and rescue operations can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members.

(1) *Utilities.* Control of the utilities in and around a water incident is critical to ensure the safety of responding personnel and victims. The AHJ should provide its members with training in the control of these services to provide a safe environment for them to operate in and to en ure the safety of victims. The following u ilities should be considered when providing training:
   (a) Electrical services (primary and secondary)
   (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)
   (c) Water/steam
   (d) Sanitary systems
   (e) Communications
   (f) Secondary service systems (such as compressed, medical, or industrial gases)

(2) *Hazardous Materials.* Water incident sites might include various materials unique to a site that, when released during a search and rescue operation, could pose a hazard to victims and responders. The AHJ should provide its members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.

(3) *Personal Hazards.* At the site of any water incident, there are many dangers that pose personal injury hazards to the responders. The AHJ should train its members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards to help ensure members' safety. Every member should be made aware of hazards such as trips, falls, blows, punctures, impalement, and so forth.

(4) *Confined Space.* Some water incident sites necessitate a confined space rescue. Responding personnel should be familiar with and trained in confined space rescue requirements and techniques. The AHJ should determine the applicable laws and standards related to confined space rescue and should provide training to its members in confined space rescue.

(5) *Hazards That Are Immediately Dangerous to Life and Health.* These hazards include swift water with currents exceeding those in which a person or watercraft can safely and effectively operate.

(6) *Other Hazards.* There are numerous other hazards associated with water search and rescue operations. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide its members with training and awareness of these other hazards to allow them to perform search and rescue operations safely and effectively.

(7) *General Area.* The general area around a water incident site is the entire area around a search and rescue site. Any member operating within the vicinity of the water's edge can accidentally enter the hazard zone. PPE should be utilized accordingly.

Making the general area safe includes, but is not necessarily limited to, the following:

(1) Controlling/limiting access to the area by unnecessary personnel
(2) Identifying hazards and removing or reducing their impact
(3) Using personal flotation devices (PFDs) and other PPE

A.17.3.4(3) Further requirements of PPE are included in 4.4.2 of this standard. This requirement applies to all the described disciplines.

A.18.2.3(2) The assessment phase includes an evaluation of the subject's condition and the subject's ability to assist in his or her own rescue Consideration should be given to the need for dive rescue early in the assessment phase. The best intended surface rescue could eventually require dive capability.

A.18.2.3(3) See A.4.2.5.

A.18.2.3(4) The emergency response system includes, but is not limited to, operations and technician-level organizations capable of responding to various types of search and rescue incidents, as well as local, state, and national resources.

A.18.2.3(5) These procedures should include the process of achieving and maintaining control of the site and the perimeter. This might include management of all civilian and nonemergency personnel and establishment of operational zones and site security.

A.18.2.3(6) General hazards associated with water search and rescue operations can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members:

(1) *Utilities.* Control of the utilities in and around a water incident is critical to ensure the safety of responding personnel and victims. The AHJ should provide its members with training in the control of these services to provide a safe environment for them to operate in and to ensure the safety of victims. The following utilities should be considered when providing training:
   (a) Electrical services (primary and secondary)
   (b) Gas, propane, fuel oil, or other alternative energy sources (primary systems)

(c) Water/steam
(d) Sanitary systems
(e) Communications
(f) Secondary service systems (such as compressed, medical, or industrial gases)

(2) *Hazardous Materials.* Water incident sites might include various materials unique to a site that, when released during a search and rescue operation, could pose a hazard to victims and responders. The AHJ should provide its members with training in the recognition of potential hazardous material releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials to conduct operations safely and effectively.

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(6) *Other Hazards.* There are numerous other hazards associated with water search and rescue operations. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide its members with training and awareness of these other hazards to allow them to perform search and rescue operations safely and effectively.

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(a) Controlling/limiting access to the area by unnecessary personnel
(b) Identifying hazards and removing or reducing their impact
(c) Using personal flotation devices (PFDs) and other PPE

A.18.2.3(7) See language on rescue versus recovery in Chapter 16. Additionally, the search for a missing diver should include an assessment of the diver's experience, the type of equipment the diver was using, and the estimated remaining air supply balanced against the depth of the water and other conditions.

A.18.3.4(1) See the annex material in Chapter16 for more information on PFDs.

A.18.3.5(1) Hazards associated with dive operations include, but are not limited to, the following:

(1) Barotraumas (decompression sickness, nitrogen narcosis, oxygen toxicity, etc.)
(2) Drowning
(3) Hyperventilation, hypercarbia, and other respiratory problems
(4) Anxiety reactions
(5) Fatigue and exhaustion
(6) Dehydration (electrolyte imbalances)
(7) Heat stress (i.e., heat exhaustion, stroke, and cramps)
(8) The combination of prescription medication or smoking and diving
(9) Pre-existing medical conditions or injuries
(10) Hypothermia

A.18.3.5(2) Support personnel are called upon to assist divers in preparing to dive and to dress and equip divers; to provide search pattern control and direction; to monitor divers' time, depth, dive profile, and air supply; and to provide a communication link to the surface via electronic communication equipment or manual rope pull signals.

A.18.3.5(4) Surface support personnel should be capable of recognizing, maintaining, and operating all surface support equipment used by the organization.

A.18.3.5(7) Darkness or unusual or extreme environmental conditions can require very specialized dive and/or surface support training specific to the situation(s) encountered.

A.18.4.4 Training in SCUBA diving should include, but not be limited to, the information conveyed in a widely recognized SCUBA diving program that emphasizes the role of a public safety agency or rescue organization in dive operations.

A.18.4.5 Fitness provides reserve capacity to deal with physical challenges that can occur during dive operations. Research indicates that the fitness evaluations specified in Figure A.18.4.5(a) and Figure A.18.4.5(b) provide a minimum aerobic capacity to SCUBA dive safely. Annual skill evaluations help ensure diver competence relative to fundamental survival skills. Many investigators, researchers, and authors support the belief that poor SCUBA skills are a direct or indirect cause of diver fatalities.

A.18.4.6(1) The dive supervisor is responsible for the overall management of the dive operation. At a minimum, dive supervisors possess the same knowledge and understanding of hyperbaric work as the divers and generally exceed the skill set and authority of a dive tender. The term *dive supervisor* is a term used in many commercial or governmental standards on diving and will often have a specific definition and scope of authority.

A.18.4.6(3) It is the intent of the requirement that the safety diver, also called the *backup diver*, be prepared to immediately descend and contact a diver in distress or search for a missing diver. To accomplish this, the safety diver is typically in the water with all equipment, including a face piece, in place and ready to submerge. He/she must maintain a constant situational awareness of the general location of the divers and of any unusual events or circumstances that might require deployment. In cases where depth or distance makes timely deployment of a safety diver impractical, deploying two divers as partners might be required to manage any potential diver emergencies.