Technical Committee on

Technical Rescue

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MacMillan Bloedel Packaging Inc., AL [U]

Joseph C. Burris, North Carolina Dept. of Insurance, NC [E]
Hugh Connor, Orem Fire Dept., UT [U]
Rep. Utah Fire and Rescue Academy
Donald C. Cooper, City of Cuyahoga Falls Fire Dept., OH [U]
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Tim Gallagher, Phoenix Fire Dept., AZ [U]
Carl Goodson, Fire Protection Publications, OK [M]
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George G. Howard, Nassau County Fire Academy, NY [SE]
Steve Hudson, Pigeon Mountain Industries, Inc., GA [M]
Jerry S. Koenig, Falcon Air Force Base Fire Dept., AZ [E]
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Mike McGroarty, City of La Habra Fire Dept., CA [E]
Christopher J. Naum, L. A. Emergency Mgmt. & Training, NY [SE]
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Brian E. Rousseau, New York State Office of Fire Prevention & Control, NY [E]
Chase N. Sargent, Virginia Beach Fire Dept., VA [E]
Robert P. Thornton, City of Mobile Fire Dept., AL [U]
Rep. University of South Alabama (CERT)
William J. Troup, U.S. Fire Administration, MD [SE]
William H. Weems, Safe State Program, AL [SE]

Alternates

Michael G. Brown, Virginia Beach Fire Dept., VA [U]
(Alt. to C. N. Sargent)
Fred J. Jackson, Cuyahoga Falls Fire Dept., OH [U]
(Alt. to D. C. Cooper)
John F. McCallum, Jr., Chicago Fire Dept., IL [U]
(Alt. to R. P. Thornton)
Michael R. Roop, Roco Rescue, Inc., LA. [M]
(Voting Alt. to RRI Rep.)

Staff Liaison: **Jerry W. Laughlin**

This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of this document.

Committee Scope: This Committee shall have primary responsibility for documents on technical rescue techniques, operations and procedures to develop efficient, proper and safe utilization of personnel and equipment.

The Report of the Technical Committee on **Technical Rescue** is presented for adoption in 2 parts.

Part I of this Report was prepared by the **Technical Committee on Technical Rescue**, and proposes for adoption a withdrawal to NFPA 1470-1994, **Standard on Search and Rescue Training for Structural Collapse Incidents**. NFPA 1470-1994 is published in Volume 8 of the 1997 National Fire Codes and in separate pamphlet form.

Part I of this Report has been submitted to letter ballot of the **Technical Committee on Technical Rescue**, which consists of 27 voting members; of whom 21 voted affirmatively and 6 ballots were not returned (Messrs. Fleming, Hall, McGroarty, Reimer, Rousseau, and Roop.)

Part II of this Report was prepared by the **Technical Committee on Technical Rescue**, and proposes for adoption a new document to NFPA 1670-1999, **Standard for the Operations and Training for Technical Rescue Incidents.**

Part II of this Report has been submitted to letter ballot of the **Technical Committee on Technical Rescue**, which consists of 27 voting members; of whom 18 voted affirmatively, 1 negatively after circulation of any negative votes (Mr. Sargent), 1 abstained (Mr. Troup), and 7 ballots were not returned (Messrs. Connor, Fleming, Hall, McGroarty, Reimer, Rousseau, and Roop.)

Mr. Sargent voted negatively stating:
(Log #CP9) I feel that it is inappropriate and unrealistic to restrict OPS and CS Personnel from entering IDLH spaces. See below:
"I feel that restricting operations level personnel from entering confined spaces that require the use of fresh air breathing apparatus is both inappropriate and unrealistic. The following reasons are submitted.
1. There are instances where victims of a confined space are within reach and access by operations personnel using SABA or SCBA, while meeting the use criteria established for the proper use of those types of fresh air breathing apparatus.
2. Since 90 percent of all confined space emergencies are as a result of atmospheric problems it seems logical to provide operations personnel with some capabilities to make entries into limited IDLH environments, using approved techniques and equipment.
3. It is unrealistic to expect departments unable to train to the technician level to stand by and wait in certain circumstances where the patient can be easily accessed and removed.
4. Entry into an unknown location without fresh air breathing apparatus as part of your PPE ensemble is danger. Even if not sued (masked up and breathed) entrants should still have them in place in case environmental or atmospheric conditions change while in the space.
Recommendations: Allow entry into IDLH spaces by operations level personnel using the following guidelines.
1. If SCBA is used it may not be removed from the users back for entry, exit or access to victim.
2. Victim must be within reach of the rescue team without traveling more than 25 feet, unobstructed.
3. All other verbiage should remain as is in the standard."
(Log #CP11)
"It is unrealistic and inappropriate to require personnel at the confined space technician level to also maintain technician level hazardous materials skills. In most instances these teams are completely separate due to the unique requirements of both, but most importantly due to the extreme number of training hours required for both initial and continuing education for maintenance of skills and certifications.
1. Hazmat and technical rescue teams should be maintained separate. Technician level CS personnel should have the operations level hazmat skills but do not need to possess the hazmat technician level skills. Hazmat teams can be called to the scene for research, advanced monitoring, etc., as needed.
2. Entry into confined spaces using gas tight suits (level A) is seldom accomplished. In fact I have never seen it done in 23 years of service.
3. When you place these types of requirements (technical level) on a confined space team remember that many operations have personnel who do much more than simply confined space and may be required to maintain technician level rope, trench, structural, water, etc., as part of a technical rescue team.
4. Training and recertificaiton time is astronomical for this: example (Virginia Beach)
Technical Rescue Technician, initial certification: 166 hours
Hazmat Technician: 192
Recert hours: Hazmat: 24 per year - Rescue Tech: 40 per year
Recommendations: Require technician level personnel to meet the operations level (defensive operations) for hazmat."

Mr. Troup abstained stating:
(Log #CP14)
"The United States Fire Administration requests administrative correction on this comment because of the following:
The United States Fire Administration requests that the following publication title listed in the Recommended Reading list in the standard be corrected as follows:
From: FEMA, New Techniques in Vehicle Extrication, Federal Emergency Management Agency, Emmitsburg, MD
To: United States Fire Administration, New Technologies in Vehicle Extrication, Federal Emergency Management Agency, Emmitsburg, MD
This change needs to be accomplished because this is the correct title of this document.

USFA requests that the following USFA Publications be added to the Recommended Reading list in the standard:

United States Fire Administration Technical Rescue Program Development Manual, Federal Emergency Management Agency, Emmitsburg, MD

United States Fire Administration Technical Rescue Technology Assessment, Federal Emergency Management Agency, Emmitsburg, MD

United States Fire Administration Protective Clothing and Equipment Needs of Emergency Responders for Urban Search and Rescue Missions, Federal Emergency Management Agency, Emmitsburg, MD

United States Fire Administration Investigations of Technical Rescue Incidents, Federal Emergency Management Agency, Emmitsburg, MD

These publications and investigation report should be added to the Recommended Reading list in the NFPA 1670 standard as they will be of great benefit to local level fire and rescue departments seeking reference information on technical rescue. The United States Fire Administration Technical Rescue Program Development Manual was used by the committee in writing this draft standard."

"As the ballot must be voted on in its entirety USFA abstains on the ballot due to abstention on the following comments:

Log #CP10 The United States Fire Administration wishes to abstain on this comment and ballot because of the following:

The establishment of minimum manning in terms of quantifiable numbers of individuals and not in language such as "adequate number" is not an issue this Federal Agency wishes to comment on.

Log #CP15 The United States Fire Administration wishes to abstain on this comment and ballot because of the following:

The carrying of firearms by authorized and qualified personnel at incident scenes is a local-level decision by the Authority Having Jurisdiction (AHJ) and not an issue this Federal Agency wishes to comment on.

Log #CP9 The Unites States Fire Administration requests that the following be clarified:

In Section A-5-3.3(f)(1) the term "fresh-air breathing apparatus" should be better defined. Does this include both Supplies Air Breathing Apparatus (SABA) as well as Self-Contained Breathing Apparatus (SCBA)?

In Section A-5-3(f)(3) it is stated that "this time is intended to ensure that the attendant can maintain direct observation of the entrants at all times". How can a line ensure this is confined space rescue where entrants may have to make turns to effect a rescue or recovery which would put them out of direct observation of the attendant outside of the confined space? This should be reworded or better clarified."

Mr. Hudson voted Affirmative with the following comment:

"Reading list has some old references and at least one duplication. Needs editing!

Log #CP3 The submitter should be "Keith Shaffer" in one place. Think this is a search and replace edit mistake."

Mr. Koenig voted Affirmative with the following comment:

"Recommend rejection of Log #CP10 and the return to the original text requiring a minimum of six individuals for both Technician and Operations level teams. This compromise allows operations level teams to operate below minimum safe manning levels."

NFPA 1470/1670 — F98 ROP

PART I

(Log #CP1)

1470- 1 - (Entire Document): Accept
SUBMITTER: Technical Committee on Technical Rescue
RECOMMENDATION: Withdraw the 1994 edition of NFPA 1470, Standard on Search and Rescue Training for Structural Collapse Incidents.
SUBSTANTIATION: The responsibility for NFPA 1470 was previously transferred to the Technical Committee on Technical Rescue, which has prepared a proposed new NFPA 1670, Standard on Operations and Training for Technical Rescue Incidents. Proposed NFPA 1670 incorporates the scope of NFPA 1470 and has an expanded scope of identifying and establishing levels of functional capability for safely and effectively conducting operations at technical rescue incidents. Structural collapse is one chapter in the proposed NFPA 1670.
COMMITTEE ACTION: Accept.

(Log #1)

1470- 2 - (5-1): Reject
SUBMITTER: Terence S. Hatton, NYC Fire Dept., Special Operations Command
RECOMMENDATION: Add new text to read as follows:
"The Incident Commander shall ensure that all personnel entering a collapse zone shall not be allowed to wear or carry firearms of any type."
SUBSTANTIATION: From my personal experiences having operated at numerous collapses, including collapse operations at the World Trade Center and Oklahoma City bombing incidents, I have worked side by side with law enforcement personnel wearing/carrying firearms. When these firearms are introduced to the collapse zone they pose an additional unnecessary risk to all rescue personnel.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The committee is recommending withdrawal of NFPA 1470 with the intent of proposing the new, broader NFPA 1670, Standard on Operations and Training for Technical Rescue Incidents, in which structural collapse will be one chapter. This proposal is rejected here on the basis of the withdrawal of NFPA 1470. However, the committee agrees that firearms should be addressed and has accepted a committee proposal for NFPA 1670. See Committee Proposal 1670- (Log #CP15).

PART II

(Log #27)

1670- 1 - (Title, 1-1.1, 1-1.2): Reject
SUBMITTER: Dan Goulke, W.L. Gore & Assoc.
RECOMMENDATION: Revise title to read:
NFPA 1670, Standard on Operations and Training for Special Operations.
Revise 1-1.1 to read:
"This standard...conducting special operations."
Revise 1-1.2 to read:
"The requirements...to special operations."
SUBSTANTIATION: Harmonization of the definition and title and scope of NFPA 1670 and NFPA 19xx is desired.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The current document already contains a definition for "Special Operations" and "Technical Rescue."
The words "Special Operations" are also used in paragraphs 2-3.1 and 2-5.1.3. The words "Technical Rescue Operations" are used in paragraphs 2-1.3, 2-4.2.4, 2-5.1.1, A-1-1.1, and A-2-4.1.1.
The committee spent a great deal of time discussing these definitions and their specific meanings and need. The definition for Special Operations is verbatim from the definition used in NFPA 1500, 1561, and 1521. The committee does not believe the suggested changes contribute to or should be used to change the document.

(Log #12)

1670- 2 - (1-3 Entry Team): Accept
SUBMITTER: Carl Goodson, IFSTA
RECOMMENDATION: In the definition of "Entry Team" add the word "space" between the words "the" and "trench".
SUBSTANTIATION: This addition will expand the definition beyond the limitations of the trench environment.
COMMITTEE ACTION: Accept.

(Log #9)

1670- 3 - (1-3 Search (New), and Search Incident (New)): Reject
SUBMITTER: Mark Clippinger, Arkansas State Parks
RECOMMENDATION: Add new definitions to read as follows:
Search. Those activities directed at locating lost persons, from unknown locations, at an emergency incident.
Search Incident. An emergency incident that primarily involves searching for and locating lost, injured and/or deceased persons who are, will or have been subject to physical dangers.
SUBSTANTIATION: Search operations are a common thread among several of the rescue disciplines. Obviously in numerous emergency response incidents a search, with its strategy, tactics, and management techniques, would be necessary to conduct prior to even accessing the individual to effect a rescue operation.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The committee chose not to define the word "search" because the standard dictionary (Webster's Third New International Dictionary) definition is acceptable, which reads "to look into or over carefully or thoroughly in an effort to find something."
Likewise, the committee accepted the standard dictionary definition of the word "incident."
It should be also be noted that the proposed document's scope and purpose focus on rescue, not search. However, there should be no doubt that searches can be every bit as complex and resource intensive as any rescue.

(Log #27a)

1670- 4 - (1-3 Special Operations, Technical Rescue Operations): Reject

SUBMITTER: Dan Goulke, W.L. Gore & Assoc.

RECOMMENDATION: Revise the following new definitions:

Special Operations. The activities of victim search, rescue, body recovery and site stabilization during complex operations, requiring specially trained personnel and special equipment to complete the mission. Special operations include water and swiftwater rescue, rope rescue, confined space entry, wilderness search and rescue, trench rescue, vehicle and machinery rescue, contaminated water diving, search and rescue, and building/structural collapse rescue.

Technical Rescue Operations. The activities of victim search, rescue, body recovery and site stabilization during complex operations requiring specially trained personnel and special equipment to complete the mission. Technical rescue operations include rope rescue, confined space entry, wilderness search and rescue, trench rescue, vehicle and machinery rescue, and building structural collapse, but not water and swiftwater rescue, contaminated water diving, and search and rescue.

SUBSTANTIATION: Harmonization of the definition and title and scope of NFPA 1670 and NFPA 19xx is desired.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The current document already contains a definition for "Special Operations" and "Technical Rescue."

The words "Special Operations" are also used in paragraphs 2-3.1 and 2-5.1.3. The words "Technical Rescue Operations" are used in paragraphs 2-1.3, 2-4.2.4, 2-5.1.1, A-1-1.1, and A-2-4.1.1.

The committee spent a great deal of time discussing these definitions and their specific meanings and need. The definition for Special Operations is verbatim from the definition used in NFPA 1500, 1561, and 1521. The committee does not believe the suggested changes contribute to or should be used to change the document.

(Log #13)

1670- 5 - (1-3 Technical Rescue, and Technical Rescue Incident): Accept

SUBMITTER: Carl Goodson, IFSTA

RECOMMENDATION: In the definitions of "Technical Rescue" and "Technical Rescue Incident" add the word "rescue" between the words "complex" and "situations".

SUBSTANTIATION: Adding the word "rescue" would focus attention on rescue situations as distinguished from other emergency situations.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The word "situation" does not occur in the definition of "Technical Rescue Incident." However, the committee determined that the submitter meant for the word "rescue" to be added after the word "complex" in both definitions.

(Log #14)

1670- 6 - (2-1.3): Accept in Principle

SUBMITTER: Carl Goodson, IFSTA

RECOMMENDATION: Change the sentence to read as follows:

"The authority having jurisdiction shall establish operational procedures to ensure that technical rescue operations are performed (conducted) in a safe manner."

SUBSTANTIATION: This change would shift the focus from the individual members of the team to the organization.

COMMITTEE ACTION: Accept in Principle.

Delete the first sentence of the paragraph and replace it with the following:

"The authority having jurisdiction shall establish operational procedures to ensure that technical rescue operations are performed in a safe manner consistent with the identified level of operational capability."

COMMITTEE STATEMENT: The intent of the committee was to address rescue operations that are not part of proposed NFPA 1670's current definition of "rescue incident," such as training, evidence searches, and body recoveries. Although these non-rescue-mode situations may not involve live victims, as implied in the definition of a "rescue incident," they nevertheless include operations performed by groups, teams, and organizations that will use this standard.

The committee agrees with the submitter that 2-1.3 seemed to imply individual rather than organizational emphasis, on which the committee has agreed to focus.

This change maintains the original intent in that the second sentence remains, while it refocuses on the organizational rather than the individual requirements.

(Log #CP6)

1670- 7 - (2-1.6.1): Accept

SUBMITTER: Technical Committee on Technical Rescue

RECOMMENDATION: Replace the word "periodic" with "annual" so that the paragraph reads :

2-1.6.1 The AHJ shall provide the necessary continuing education to maintain all requirements of the organization's identified level of capability. This shall include annual performance evaluations of the organization based on requirements of this standard.

SUBSTANTIATION: The Committee believes that the annual designation provides more guidance than the nonspecific "periodic" and is the proper interval for performance evaluations.

COMMITTEE ACTION: Accept.

(Log #15)

1670- 8 - (2-2.2): Accept

SUBMITTER: Carl Goodson, IFSTA

RECOMMENDATION: Add the word "potential" before "technical rescue incidents."

SUBSTANTIATION: This change would expand the hazard analysis and risk assessment to include "potential" as well as actual rescue situations.

COMMITTEE ACTION: Accept.

(Log #28)

1670- 9 - (2-4.2.5 (New)): Reject

SUBMITTER: Dan Goulke, W.L. Gore & Assoc.

RECOMMENDATION: Add new text to read as follows:

2-4.2.5 Appropriate personal protection equipment for technical rescue operations shall be compliant with NFPA 19xx, Standard on Protective Ensemble for Technical Rescue Operations.

SUBSTANTIATION: Provides a cross reference to the relevant NFPA document.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The indicated document is only a proposed document and the committee has not had sufficient time to review a draft copy. Because the draft document is not yet through even the public proposal period and is still subject to change, it is not appropriate to reference it at this time.

(Log #34)

1670- 10 - (2-5.4.1): Reject

SUBMITTER: Ralph Sproul, Chevron Prod. Co.

RECOMMENDATION: Delete:

~~"Chapter 8 of NFPA 1500, Standard on Fire Department Occupational Safety and Health Program."~~

Replace with:

"NFPA 1582, Medical Requirements for Firefighters."

SUBSTANTIATION: I feel that NFPA 1582 provides suitable medical requirements and is more widely accepted. NFPA 1500 was written for municipal fire departments. This could exclude a lot of other agencies (i.e., industrial lifeguard and private providers.)

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: NFPA 1582 deals with medical requirements for fire fighters, but NFPA 1500, Chapter 8, deals with medial requirements (including the inclusion of NFPA 1582 in its entirety), physical performance requirements, physical fitness, confidential health data base, infection control, FD physician, and post-injury/illness rehabilitation. Although NFPA 1582 also deals with some of the topics in Chapter 8 of NFPA 1500, many are not addressed at all.

It was the intent of the committee with 2-5.4.1 to address more than just medical requirements for fire fighters. And, although there have been great improvements with the 1997 draft version of NFPA 1582, NFPA 1500 seems to address more. In addition, Chapter 8 of NFPA 1500 specifically includes all of NFPA 1582.

The committee feels that the submitter's suggestion does not substantially improve the current paragraph. Further, the submitter's suggestions seem to narrow the committee's intent beyond its desire.

The submitter also makes mention of the fact that NFPA 1500 was meant for municipal FDs, and he implies that this is not the case with NFPA 1582. However, both NFPA 1500 and NFPA 1582 (both at 1-1.2) include in their scope applicability to all organizations providing rescue and other emergency services, including public, military, private, and industrial fire departments.

(Log #CP15)

1670- 11 - (3-1.2.1): Accept
SUBMITTER: Technical Committee on Technical Rescue
RECOMMENDATION: Add new text to read as follows:
3-1.2.1 The Incident Commander shall ensure that personnel entering a collapse zone shall not be allowed to wear or carry firearms of any type.
SUBSTANTIATION: This text was proposed as an addition to NFPA 1470, Standard on Search and Rescue Training for Structural Collapse. The committee agreed with the concept. Because NFPA 1470 is being recommended for withdrawal in favor of proposed NFPA 1670, the committee chose to bring this proposal forward in NFPA 1670.
COMMITTEE ACTION: Accept.

(Log #16)

1670- 12 - (4-1.3 Anchor Point): Accept
SUBMITTER: Carl Goodson, IFSTA
RECOMMENDATION: Replace the word "or" between the words "actual" and "potential" with the word "and".
SUBSTANTIATION: This would make the section inclusive rather than and/or.
COMMITTEE ACTION: Accept.

(Log #17)

1670- 13 - (4-1.3 Lowering System): Accept
SUBMITTER: Carl Goodson, IFSTA
RECOMMENDATION: In the definition of "Lowering System" replace the word "brute" with "excessive physical."
SUBSTANTIATION: This would replace a slang term with a more descriptive one.
COMMITTEE ACTION: Accept.

(Log #5)

1670- 14 - (4-1.3 Multi-point Anchor System): Reject
SUBMITTER: Douglas Shaffer, WA State Tag - Bellingham Fire Dept.
RECOMMENDATION: Delete Load Distributing Anchor Systems in definition of Multi-point Anchor System.
SUBSTANTIATION: Tests done on this system does not show load is transformed to perform equal or almost equal sharing of load; when weight of direction changes - load sharing anchor system is more appropriate.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The submitter is directed to see Committee Proposal 1670-15 (Log #CP3) where this concept is discussed in detail.

(Log #CP3)

1670- 15 - (4-1.3 Multi-point Anchor System): Accept
SUBMITTER: Technical Committee on Technical Rescue
RECOMMENDATION: Under the Multi-point Anchor System category definition of Load Distributing Anchor Systems, at (b) and between the words "reestablishes" and "equal", add the words "a state of near."

After the end of that sentence, add the following: "Also referred to as self-equalizing or self-adjusting."

The resulting definition reads: Multi-point Anchor System. System configuration providing load distribution over more than one anchor point; either proportionately or disproportionately. There are basically two categories of multi-point anchor systems:

Load Distributing Anchor Systems* - An anchor system established from two or more anchor points that: a) maintains near equal loading on the anchor points despite direction changes on the main line rope, and b) reestablishes a state of near equal loading on remaining anchor points if any one of them fails. Also referred to as self-equalizing or self-adjusting.

Load Sharing Anchor System* - An anchor system established from two or more anchor points that distributes the load among the anchor points somewhat proportionately but will not adjust to direction changes on the main line rope.

SUBSTANTIATION: A load distributing anchor is a type of multi-point anchor system. It must remain in the definition for the document to be accurate and complete. The committee has listed two types of multi-point anchor systems, one type which shares the load between the various anchor points but will not adjust directionality when the load shifts, and the second type which redistributes the load to each anchor point as the load shifts directionally or at the loss of one of the anchor points.

The type of anchor referred to and described has, in fact, historically been called a "self equalizing anchor system." Some years ago, Keith Shaffer (no relation to the submitter) undertook a study to determine which construction method would produce the most equally balanced self-equalizing anchor system, and to examine the potential forces on remaining anchor points in the event that one of the anchor points should fail. This project was developed and performed with the cooperation of Alpine Center for Rescue Studies. Keith's work was subsequently reviewed by Arnor Larson, another researcher in the rescue field.

Larson's chief observation of the study was that values measured at the anchor points within the anchor systems were never precisely equal, and that perhaps what the world has always known as self-equalizing anchors should be renamed load distributing anchors.

While Larson was technically correct, what he apparently did not consider is that the point of the study was to measure performance capabilities of the self-equalizing anchors, and that some of the construction types did in fact produce systems in which the values were quite close (within six pounds force in static tests, nine pounds force in dynamic tests), well within the error margin of the data collection system. Actual values were dependent on the measured outside angle, overall size of the self-equalizing anchor, and material used to build the anchor.

Despite this, the submitter seems to have over-relied on Larson's comments. With respect to this, the submitter changed all references to self-equalizing anchors to reflect the term load distributing anchor in subsequent magazine articles and presentations.

Larson also took this situation very seriously and began to change all of his references in lectures, testing, and presentations to reflect the new term.

This new term was never discussed or debated among a group of professionals with the intent to accept or decline its use. Rather, at the insistence of one individual, it was simply put into practice.

In fact, by definition the term load distributing is even more misleading as it describes any anchor which distributes the load among multiple points, not just that which is designed to redistribute the load by self-equalization in the event that the direction of pull changes, or in the event that one of the anchor points fails.

"Self equalizing" is the only term which accurately describes this redistributing function of a self-equalizing anchor. It is true that such systems may never have absolute equal load on each anchor point, but they will redistribute the load to a new state of equilibrium as the load vectors change on the anchor points.
COMMITTEE ACTION: Accept.

(Log #CP4)

1670- 16 - (4-1.3 Simple Rope Mechanical Advantage System): Accept
SUBMITTER: Technical Committee on Technical Rescue
RECOMMENDATION: Revise numbered paragraph 3 to read:
"(c) In the case of mechanical advantage systems greater than 2:1, one or more stationary pulleys or similar devices."
SUBSTANTIATION: The Committee considered this an editorial rewording to make the intent easier to understand.
COMMITTEE ACTION: Accept.

(Log #6)

1670- 17 - (4-4.2): Reject
SUBMITTER: Douglas Shaffer, WA State Tag - Bellingham Fire Dept.
RECOMMENDATION: Delete and replace with:
"procedures for the safe construction and use of load sharing anchor systems."
SUBSTANTIATION: Tests done on this system does not show load is transformed to perform equal or almost equal sharing of load; when weight of direction changes - load sharing anchor system is more appropriate.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The submitter is directed to see Committee Proposal 1670-15 (Log #CP3) where this concept is discussed in detail.

(Log #22)

1670- 18 - (Chapter 5): Reject
SUBMITTER: Paul Moledor, Cuyahoga Falls Fire Dept.
RECOMMENDATION: None.
SUBSTANTIATION: SCBA use is not discussed. Is it allowed? And if so, under what parameters?
line of site?
easy entry/egress?
etc.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The submitter has not recommended any text. However, the committee disagrees with the submitter's comment, "SCBA use is not discussed." Section 5-3.3(a) and A-5-3.3(a) discuss the use of PPE which, by the definition in 1-3, includes respiratory protection (i.e., SCBA). Also, section 5-3.3(f)(1) specifically excludes the use of fresh air breathing apparatus.
The committee agrees that entering a space is generally a skill performed by a Technician Level organization.
It is not the intent of this committee to dictate the use of SCBA to the AHJ. It is this committee's intent to dictate the use of fresh air breathing apparatus in certain confined space entry rescues.

(Log #CP10)

1670- 19 - (5-1.4 Confined Space Rescue Team): Accept
SUBMITTER: Technical Committee on Technical Rescue
RECOMMENDATION: Modify the definition of Confined Space Rescue Team to include the words "for organizations operating at the Technician Level and a minimum of four for organizations operating at the Operations Level," and add the word "equipped" between the words "trained" and "available" so that the definition reads:
5-1.4 Confined Space Rescue Team (or Team). A combination of individuals (minimum of six for organizations operating at the Technician Level and a minimum of four for organizations operating at the Operations Level) trained, equipped and available to respond to confined space emergencies. This team may be trained to one of three proficiency levels: Awareness, Operational, or Technical. A rescue team must meet the operational or technical levels to qualify as a Rescue Service dependent upon the type and complexity of the Confined space emergency.
Add an asterisk to 5-1.4 definition for Confined Space Rescue Team and add the following appendix text:
A-5-1.4 "Confined Space Rescue Team." While six personnel provide the recommended minimum for most entry-type confined space rescues, the committee recognizes that some of these will not require this number of personnel. The number of personnel required to perform these rescues must be based on the situation, hazards, and degree of difficulty of the situation confronted.
SUBSTANTIATION: A team is 'qualified' by its capability as a team, not by the individual qualifications of its members.
COMMITTEE ACTION: Accept.

(Log #25)

1670- 20 - (5-1.4 Entry Permit, NOTE): Accept in Principle
SUBMITTER: Paul Moledor, Cuyahoga Falls Fire Dept.
RECOMMENDATION: Revise definition Entry Permit (Note) to read as follows:
NOTE: In certain industry, (list industry) U.S. Federal law does not require a permit system even though spaces may be present meeting characteristics of confined space as defined within this standard. These include (listing of spaces)
SUBSTANTIATION: Vague wording. It should list the industry and spaces this standard is making reference to, either here or in an appendix.
COMMITTEE ACTION: Accept in Principle.
At the definition of Entry Permit:
Add an asterisk to the Entry Permit heading.
Delete the words "in applicable U.S. Federally regulated industrial facilities" so that the definition reads: "Entry Permit. A written or printed document, established by an employer for non-rescue entry into confined spaces, that:
(a) Authorizes specific employees to enter a confined space.
(b) Contains specific information as required."
Delete the final paragraph including the "Note" heading and add the paragraph to a new appendix item to read as follows:
A-5-1.4 Entry Permit. In certain industry, U.S Federal law does not require a permit system even though spaces may be present meeting the characteristics of confined spaces as defined within this standard. In these cases, as well as cases of unauthorized or non-regulated entry into confined spaces, a permit may not be available for reference by the rescue team. The space must be completely assessed before entry can be safely made. U.S. Federal Law does not require rescuers to have a permit to rescue although it is advisable for the rescue team to follow similar procedures to ensure safety.
COMMITTEE STATEMENT: The committee believes that removing the reference to unspecified Federal regulations from the main body of the definition makes the committee's intent clearer and would satisfy the submitter.
The committee believes that the "Note" under the definition of "Entry Permit" in 5-1.4 is useful and complete without further modification. However, on further discussion the committee decided to move this note to the appendix to make the definition itself more clear.

(Log #23)

1670- 21 - (5-1.4(c) Rescue Service): Reject
SUBMITTER: Paul Moledor, Cuyahoga Falls Fire Dept.
RECOMMENDATION: Revise definition of Rescue Service (c) to read as follows:
"Each member of the rescue service shall practice making confined space rescues at least once every 3 months."
SUBSTANTIATION: This needs to be defined more. It is unclear - does the member have to enter the space or be at the training and doing a support function such as tending the air supply or doing equipment needs?
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The committee agreed that the definition of Rescue Service needed to be revised, but it no longer agreed that the interval of every three months was appropriate as a requirement for all agencies, regardless of size and resources.
Committee Proposal 1670-22 (Log #CP5) was created to indicate the committee's intent for the preferred wording to refer to 2-1.6.
See Committee Proposal 1670-7 (Log #CP6) for the committee's determination that the desired interval at 2-1.6.1 for performance evaluations shall be annual.

(Log #CP5)

1670- 22 - (5-1.4(c) Rescue Service): Accept
SUBMITTER: Technical Committee on Technical Rescue
RECOMMENDATION: At the definition of Rescue Service, in subparagraph (c), delete the words "at least once every three months" and replace with the words "in accordance with the requirements of 2-1.6 of this document" so that the section reads:
"(c) The rescue service shall practice making confined space rescues in accordance with the requirements of 2-1.6 of this document, by means of simulated rescue operations in which they remove dummies, mannequins, or persons from actual confined spaces or from representative confined spaces. Representative confined spaces should, with respect to opening size, configuration, and accessibility, simulate the types of confined spaces from which rescue is to be performed."
SUBSTANTIATION: As a result of discussion about 1670-21 (Log #23), the Committee concluded that it could not agree with the submitter's recommendation but did agree that the definition subparagraph (c) needed to be better explained. The Committee preferred the existing guidance in 2-1.6 in which training is

required to be commensurate with the identified operational capability.

See also 1670-7 (Log #CP6) in which the Committee revises 2-1.6.1.

COMMITTEE ACTION: Accept.

(Log #24)

1670- 23 - (5-1.4(e) Rescue Service): Reject

SUBMITTER: Paul Moledor, Cuyahoga Falls Fire Dept.

RECOMMENDATION: Revise definition of Rescue Service (e) to read as follows:

"The rescue service must be capable of responding in ~~a timely manner~~ within 15 min to rescue summons."

SUBSTANTIATION: Dispatching and en route time are of little importance compared to actual times of call till a rescue team is operating. This should be kept to a minimum time, example, under 15 min.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The committee agreed early in the process that requiring a 15-minute response would be too restrictive for some organizations, so the actual time recommendation was relegated to the appendix. In addition, some organizations could otherwise meet the requirements of a rescue service without "being capable of responding within 15 minutes," as the submitter suggests. The committee is comfortable with recommending a goal of a 15-minute response, as described in the end of A-5-1.4, rather than requiring an organization to be capable of a 15- minute response to be considered a rescue service.

(Log #32)

1670- 24 - (5-2.1): Reject

SUBMITTER: Gregory A. Milewski, Texaco Refining & Marketing Inc., Texaco Fire Dept.

RECOMMENDATION: Delete text as follows:

"... Awareness level requirements of 4-2 (rope rescue) ~~and the Awareness level requirements of NFPA 472 (Hazardous Materials).~~"

SUBSTANTIATION: This standard should stand on its' own. In addition, it should not be the direction to make Rescue Technicians somewhat Hazmat Technicians. If there are certain tasks or activities that need to address the contaminants of a confined space, then address those as specific operational considerations in this document.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: According to NFPA 472, "hazardous material" is defined as, "a substance (solid, liquid or gas) that when released is capable of creating harm to people, the environment, and property." It only makes sense, then, that organizations at the Awareness Level for confined space also be able to, "...recognize hazardous materials presence, protect themselves, call for trained personnel, and secure the area (NFPA 472 2-1.2)."

The committee does not believe that these requirements make a rescuer a "somewhat hazmat technician" as the submitter suggests. Rather, the committee believes these are prudent minimal requirements considering the great potential for risk in such historically unpredictable and dangerous situations.

(Log #CP7)

1670- 25 - (5-2.1): Accept

SUBMITTER: Technical Committee on Technical Rescue

RECOMMENDATION: Revise the reference to "NFPA 472 (Hazardous Materials)" to refer to "Chapter 2 (Competencies for the First Responder at the Awareness Level) of NFPA 472, Standard for Professional Competence of Responders to Hazardous Materials Incidents, 1997 Edition" so that the paragraph reads:

5-2.1 Organizations operating at the awareness level shall meet the requirements of this section (5-2), the Awareness Level requirements of 4-2 (rope rescue), and the requirements of Chapter 2 (Competencies for the First Responder at the Awareness Level) of NFPA 472 (Standard for Professional Competence of Responders to Hazardous Materials Incidents, 1997 Edition). Organizations at this level are responsible for performing certain non-entry rescue (retrieval) operations.

SUBSTANTIATION: This more complete and up-to-date reference to the correct section of NFPA 472 and is more useful to the reader.

COMMITTEE ACTION: Accept.

(Log #CP9)

1670- 26 - (5-3.3(f)): Accept

SUBMITTER: Technical Committee on Technical Rescue

RECOMMENDATION: Add an asterisk to 5-3.3(f) and add the following appendix text:

A-5.3.3(f) The intent of this paragraph 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 operational level teams not perform hazardous entries.

A-5.3.3(f)(1) If entries require the use of fresh-air breathing apparatus, there will be more difficulty operating within the space because of additional bulk of the apparatus and greater potential for entanglement.

A-5.3.3(f)(2) This line is intended to limit the danger of entanglement.

A-5.3.3(f)(3) This line is intended to ensure that the attendant can maintain direct observation of the entrants at all times, making recognition of problems more rapid.

A-5.3.3(f)(4) This line is intended to allow for easier retrieval of rescue entrants should this become necessary, and provide for passage through the opening without removal of necessary personal protective equipment.

A-5.3.3(f)(5) This line is intended to allow a "Buddy System" to be employed providing potentially faster response to a problem with one of the rescue entrants.

A-5.3.3(f)(6) This line is intended to ensure that hazards to rescuers in organizations at this level are kept to an absolute minimum.

SUBSTANTIATION: In the list of operations level functions at 5-3.3, including descriptions (a) through (j), each of the descriptions except (f) is accompanied by further appendix information. The committee felt that the additional appendix entries provides useful overview information for (f) and also helps to complete the appendix for the 5-3.3 descriptions.

COMMITTEE ACTION: Accept.

(Log #CP8)

1670- 27 - (5-3.3(f)4): Accept

SUBMITTER: Technical Committee on Technical Rescue

RECOMMENDATION: At the end of the sentence, at the phrase "(with room to spare)," remove the parentheses from these words.

SUBSTANTIATION: The Committee believed that the parentheses were not needed and that the phrase "with room to spare" should not be separated from the rest of the sentence.

COMMITTEE ACTION: Accept.

(Log #7)

1670- 28 - (5-3.3(f)4 and 5-3.3(f)5): Reject

SUBMITTER: Douglas Shaffer, WA State Tag - Bellingham Fire Dept.

RECOMMENDATION: 5-3.3(f)4 Delete "room to spare"

5-3.3(f)5 Delete "two or more rescuers in addition to"

SUBSTANTIATION: These are two unrealistic issues. Any person who is involved in rescue will enter to rescue victim, with proper back-up, especially in horizontal position, especially in a non toxic environment.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Such a limited size confined space does not meet the intent of the capability of organizations at the Operations Level as described in 5-3.3. This topic was discussed at some length by the committee and task group, and a space of adequate size to accommodate the victim and a rescuer (as per current language, with room to spare) meets the intent of the capability of organizations at the Operations Level as described in 5-3.3.

(Log #8)

1670- 29 - (5-3.3(j)): Reject
SUBMITTER: Douglas Shaffer, WA State Tag - Bellingham Fire Dept.
RECOMMENDATION: None.
SUBSTANTIATION: Why in only 1 type of rescue do you condone high angle environment and not in others. The safety factors and risks are as great and sometimes greater in confined spaces. If this is the case why not move high angle to all phases.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The submitter did not propose any text and the proposal was rejected on that basis.

However, the committee wishes to make the following comment: Rather than requiring organizations at the Operations Level in confined space rescue to meet all the requirements of an organization at the Technician Level of rope rescue, 5-3.3(j) was added to the Confined Space Operations Level to address the frequent need for high and low angle rope skills in the confined space environment. Using this same logic, high and low angle rope rescue requirements were not added to all disciplines when such skills were not likely to be required at the Operations Level of that discipline.

The committee finds high and low angle rope rescue capability to be a necessary component of the Operations Level of confined space rescue.

(Log #31)

1670- 30 - (5-4.2): Reject
SUBMITTER: Gregory A. Milewski, Texaco Refining & Marketing Inc., Texaco Fire Dept.
RECOMMENDATION: Delete 5-4.2 in its entirety.
SUBSTANTIATION: It is impractical to train and equip an individual or organization, whose mission is to provide confined space rescue service, to also perform trench rescue. If the individual or organization is to perform trench rescue, then they can use the requirements of Chapter 9, but only then. Also, this standard should stand on its' own and not be in the direction to make Rescue Technicians somewhat Hazmat Technicians. If there are certain task/activities that need to address contaminants in a confined space, then address those as specific operational considerations in this document.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The committee agrees that there is no great need for a confined space rescue team to meet the requirements of 9-3 of this document. Further, 5-3.2 addresses the need for organizations at the operations level (and above) to have awareness level in trench rescue. However, the second sentence in 5-4.2 is necessary to address the possibility of responders in certain situations needing to be competent in selected skills described in NFPA 472.

The submitter is also referred to Committee Proposal 1670-31 (Log #CP11).

(Log #CP11)

1670- 31 - (5-4.2): Accept
SUBMITTER: Technical Committee on Technical Rescue
RECOMMENDATION: Modify 5-4.2 to drop the reference to "all Operations Levels requirements specified in 9-3 (trench)." and to reword the reference to NFPA 472 so that the paragraph reads:

5-4.2* Organizations operating at the Technician Level shall meet the necessary requirements of NFPA 472, Standard for Professional Competence of Responders to Hazardous Materials Incidents, 1997 Edition.

SUBSTANTIATION: The entry capability at this level of confined space rescue requires a higher level of capability in other specialties, including haz mat, as well.
COMMITTEE ACTION: Accept.

(Log #33)

1670- 32 - (5-4.3(b)): Reject
SUBMITTER: Michael R. Roop, Roco Rescue
RECOMMENDATION: Revise text to read as follows:

"Procedures... take part in an initial baseline medical assessment prior to rescue team assignment."

Delete Medical Surveillance Program.

SUBSTANTIATION: Only a small percentage of confined space rescues occur in a hazardous material. The existing language is far too costly to implement for this average rescue _____.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The committee disagrees that "only a small percentage of confined space rescues occur in a hazardous material." According to NFPA 472, a hazardous material is "a substance (solid, liquid or gas) that when released is capable of creating harm to people, the environment, and property." Therefore, nearly any gas in a confined space that can be harmful to humans falls under this definition of a hazardous material.

It follows, then, as a prudent move to have potential involvement in such an environment be consistent with OSHA guidelines regarding medical surveillance. This also covers the potential for involvement with more dangerous hazardous materials as well.

The committee does understand that requiring a medical surveillance program would likely be cost-prohibitive for some confined space rescue organizations. However, there is no confined space rescue organization or member that wouldn't benefit from such a program in the long run. This language may be just what's needed to motivate an organization to implement such a valuable health and safety program.

In the end, this committee is more interested in protecting the health and safety of those who perform confined space rescue than in seeing that organizations who want to provide confined space rescue do it inexpensively.

(Log #35)

1670- 33 - (5-4.3(b)): Reject
SUBMITTER: Hugh Pike, HQ AFCESA/CEXF
RECOMMENDATION: Revise text to read as follows:
"~~a medical surveillance program~~ an initial baseline medical assessment prior to rescue team assignment."
SUBSTANTIATION: The NFPA 1006 committee feels that a full surveillance program is too costly and that a baseline followed by exams after any exposures could meet the intent.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: The submitter is directed to the Committee Statement for Proposal 1670-30 (Log #31), where the same subject is addressed.

(Log #29)

1670- 34 - (6-3.3(h)): Accept
SUBMITTER: Robert J. Schappert, III, Earleigh Heights Vol. Fire Co. (12)
RECOMMENDATION: Revise text to read as follows:
"Procedures for the mitigation and management of general/specific hazards including fires/explosions, associated with vehicle and/or machinery rescue incidents.
While this section may imply this, it is not specifically mentioned and needs to be addressed
SUBSTANTIATION: Rescue personnel may be riding on squads that carry water and other extinguishing devices. These providers may be called upon to establish primary fire control at the incident and must be able to properly use hoselines, fire extinguishers, and SCBA. Due to certain staffing levels these individuals may be called upon to utilize extinguishment equipment/devices from an engine company on location or assist as a backup/rapid intervention member.
COMMITTEE ACTION: Accept.

(Log #10)

1670- 35 - (7-3.9.2): Accept in Principle
SUBMITTER: Mark Clippinger, Arkansas State Parks
RECOMMENDATION: Delete the following text:
~~(a) Procedures to assess moving water in terms of hazards to the victim and rescuer.~~
~~(b) Procedures to determine the method of victim entrapment.~~
Add the following text:
(a)* Procedures to assess moving water characteristics and features. (*Some of these include eddy, downstream/upstream "V", standing waves, laminar/helical flow, confluence, cushion/pillow, and swift water classifications.)
(b) Procedures for establishing and maintaining communication techniques (i.e., hand/whistle) and scene orientation references (river left, river right, upstream, downstream).
(c) [Insert existing (d)*]

(d) Procedures to implement unique safety parameters; such as upstream spotter(s) and downstream safeties.
(e) [Insert existing (C)&], using tag lines, snag lines, and 2- or 4-point boat/rescue device tether.
(f)* Procedures to incorporate shallow water crossing techniques. (*single-person, triangle of support, line abreast, line astern, wedge, litter crossing).
(g) Procedures for the application of basic rope rescue techniques (i.e., tension diagonal) in the swift water environment.
(h) Procedures to conduct other lower risk options to effect the rescue.
SUBSTANTIATION: It is my opinion that additional requirements were needed in this area as two of the ones listed [7-3.9.2(a) and (b)] were just restated from general operational requirements listed in 7-3.5. More direction and delineation was needed between operational and technical requirements.
COMMITTEE ACTION: Accept in Principle.
1. In order to address the submitter's suggestion (a), modify 7-3.5(b) and A-3.5(b) to read as follows:
7-3.9.2(a)* Procedures to assess moving water conditions, characteristics, and features in terms of hazards to the victim and rescuer.
A-7-3.9.2(a) The ability to assess moving water is important for safe operations. Examples of water characteristics and features that should be identifiable include eddies, downstream/upstream "Vs", standing waves, laminar/helical flows, confluence, cushion/pillows, and swift water classifications.
2. In order to address the need for shallow water crossing at the Technician Level, add an asterisk to 7-4.6(d) and add the following appendix paragraph:
A-7-4.6(d) "Go" techniques include, but are not limited to, the following:
Shallow water crossing.
In-water contact rescues with or without floating rescue devices, including rescue tubes, boards, and so forth.
Rescuer combat techniques (i.e., blocks/escapes) when conducting in-water contact rescues.
The use of specialized PPE (i.e., rescue release personal flotation devices, and so forth) and other specialized equipment and techniques utilized by the AHJ.
Advanced rope rescue techniques including the use of high lines.
Other "go" techniques, and more advanced options, utilized by the AHJ."
3. In order to add the tension diagonal, modify 7-3.9.2(c) and A-7-3.9.2(c) to read as follows:
(c)* Procedures for using tag lines, snag lines and tension diagonals (zip lines).
A-7-3.9.2(c) A "tag line" is a line stretched across a river and brought to the level of a stationary victim. A "floating tag line" has a floatation device attached to the line to keep the rope on the surface of the water and to provide something for the victim to grasp. A "snag line" is a variation of the tag line which is weighted to reach an object beneath the surface of the water. A "tension diagonal," or "zip line," is a line positioned at an angle greater than 45 degrees diagonal to the water's flow and just above the surface of moving water, anchored at both ends and tensioned tightly. This type of taut, diagonal line can be used in a variety of ways as an operational rescue tool.
4. Add a subsection 7-3.5(q) to read as follows:
"7-3.5(q) Procedures for surface water-based search operations."
COMMITTEE STATEMENT: The water task group, and later the full committee, agreed to have operations level water rescue organizations generally be capable of support functions and limited rescue techniques while actually near (or on) the water or ice. Actual deployment in the water (i.e., diving, go rescues, etc.), the committee agreed, was reserved for technician level teams. Adopting the submitter's suggestions would require a major reevaluation and adjustment of that decision.
The committee has agreed to keep deployment in the water environment for technician level organizations because it allows simple and logical categorization of other required skills in the environment (i.e., recognition [awareness] and support [operations]).
Language in the current document already addresses many of the submitter's suggestions. For instance:
Although some could argue that submitter's suggested (a) is already addressed in the language of 7-3.5(b) and A-7-3.5(b), we believe that the capability to "read the river" is important enough to warrant its own language. This is added in 7-3.9.2(a) and A-7-3.9.2(a).
Submitter's suggested (b) is already addressed in 7-3.5(a) [see A-7-3.5(a)].
Submitter's suggestion (d) is implied in the language currently included in 7-3.5(a), and A-7-3.5(a) gives examples of safety procedures ("...but not limited to...") that could easily be inferred to include the submitter's suggestion (d). We also do not believe that upstream/downstream spotters/safeties constitute "unique" safety parameters as the submitter suggests. In rescues involving moving water, these are quite conventional safety measures.
Submitter's suggested (e) is implied in the language currently included in 7-3.5(n). The submitter sites two specific types of boat-based rescue techniques; neither of which are excluded by the current language. Further, the current language offers flexibility for the possible inclusion of other techniques not mentioned by the submitter.
In keeping with the line drawn by the committee regarding involvement in the water environment by Operations Level organizations, the submitter's suggestion (f) must be relegated to the Technician Level. This is done at A-7-4.6(d).
The inclusion of a tension diagonal as per submitter suggestion (g) is a good idea and should be included in the document. This is done at 7-3.9.2(c) and A-7-3.9.2(c).
As long as submitter's suggestion (h) does not require venturing into the water or out on the ice, it is already addressed in 7-3.5(p). The language currently in 7-3.5(p) does not exclude any low-risk, non-go rescue techniques, nor does it exclude the use of basic rope rescue techniques. The language is purposefully flexible so that these diverse options remain available. However, in keeping with the line drawn by the committee regarding involvement in the water environment by Operations Level organizations, any suggestion by the submitter involving entry into the water, or venturing out onto the ice, must be relegated to the Technician Level.

(Log #3)

1670- 36 - (7-4.7.1): Accept in Principle
SUBMITTER: Michael R. Ange, Dunn, NC
RECOMMENDATION: Revise text to read as follows:
"At the entry level and for any specialties utilized by an organization at the technician level, the authority having jurisdiction shall provide certification by a nationally recognized agency providing sanctioned training for public safety diving operations."
SUBSTANTIATION: Several of the agencies referenced prohibit training of public safety personnel or any other training which is not "specifically recreational" in nature. These courses are ill designed for public safety diver training and may open departments up to liability concerns. The additional text will preclude that from occurring.
Note: Supporting material is available for review at NFPA Headquarters.
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: Refer to Committee Action and Committee Statement for 1670-49 (Log #4), which addresses the same issue.

(Log #11)

1670- 37 - (7-4.10.2): Accept in Principle
SUBMITTER: Mark Clippinger, Arkansas State Parks
RECOMMENDATION: Delete the following text referenced in 7-4.10.2 to be included in 7-4.10.2(e):
~~"Technician level functions at swift water rescues shall include the development and implementation of procedures for the application of rope rescue techniques in the swift water environment."~~
Add the following text:
(a) Procedures for utilizing in-water contact rescues with or without floating rescue devices, including rescue tubes, boards, etc.
(b) Procedures for implementing rescuer combat techniques (i.e., blocks/escapes) when conducting in-water contact rescues.
(c) Procedures to conduct search management, strategy and tactics for shore and surface water based search operations in the swift water environment.
(d) Procedures to utilize specialized personal protective equipment (i.e., rescue release personal flotation devices) and other specialized equipment/techniques.
(e) Procedures for the application of advanced rope rescue techniques (i.e., highlines) in the swift water environment.
(f) Procedures to conduct other higher risk, "go" and more advanced, options to effect the rescue.

SUBSTANTIATION: It is my opinion more direction and additional requirements were needed in this area, especially since various standing training programs, throughout the country, instruct similar technique and curriculum. These suggested requirements will provide more delineation between operational and technical levels.

Text deletion is again included, but under 7-4.10.2(e).

COMMITTEE ACTION: Accept in Principle.

COMMITTEE STATEMENT: The submitter is directed to the changes indicated in the Committee Action and Committee Statement on Proposal 1670-35 (Log #10).

(Log #21)

1670- 38 - (8-3.2): Reject

SUBMITTER: Paul Moledor, Cuyahoga Falls Fire Dept.

RECOMMENDATION: Revise text to read as follows:

"Operations level functions performed in the wilderness ~~shall~~ should be under the supervision of personnel from technician level organizations.

SUBSTANTIATION: Shall should be replaced with the word should. This is the only place in the document where operations level people can't function on their own. Makes no sense to redo some search to the level you are training during an incident. Technical level people may be hours away.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Just as the respective task group and full committee have decided to relegate water operations within the water environment to the Technician Level in Chapter 7, actual operations within the wilderness setting have been relegated to the Technician Level in Chapter 8. Technician Level teams are intended to be more senior, more experienced, better leaders, and better trained for the unpredictable and uncontrollable nature of the wilderness environment. Operations Level teams are intended to support and assist Technician Level organizations when operating inside, and to act autonomously when operating outside the wilderness environment. Awareness Level organizations are not intended to be deployed into the wilderness even when supervised.

In order to allow some flexibility with the Operations/Technician concept, section 8-3.2 was devised to allow personnel from Operations Level organizations to operate in the wilderness environment as long as they are supervised by a Technician Level team.

The wilderness environment can be just as dangerous as any other rescue environment, but most rescuers are simply unaware of the potential hazards. In addition, the extreme isolation of the environment makes operations, and often mere existence, within it extremely difficult and complex. So, in deference to these possibilities, including the unpredictable nature of the environment, the potential for extreme isolation, the potential for environmental extremes, and the potential for confronting uncontrollable situations, supervision by a Technician Level team while operating in the wilderness is essential for safe operations.

To address the submitter's statements, Operations Level organizations can certainly operate on their own. They simply must be supervised if their operations involve activities within the wilderness environment. Further, if, as the submitter suggests, members of a Technician Level team are "hours away," we suggest that the Operations Level team does not have immediate capability to operate in the wilderness environment. We all have operational limitations. In the scenario described, the Operation Level team simply would not have the capability to operate in the wilderness until the Technician Level team arrived. The Operations Level team should not claim capability beyond their actual ability to meet the requirements of the standard.

(Log #20)

1670- 39 - (8-4.4(a)): Accept in Principle

SUBMITTER: Paul Moledor, Cuyahoga Falls Fire Dept.

RECOMMENDATION: This is good text. Place it in operations level under 8-3.

SUBSTANTIATION: All operations people must deal with the media and family, so train them in addition to technician level people.

COMMITTEE ACTION: Accept in Principle.

Delete 8-4.4(a) and reletter (b) through (e) to reflect the removal of (a).

Delete A-8-4.4(a).

Revise A-2-5.3.1 to read as follows:

A-2-5.3.1 The incident management system utilized at all technical rescue incidents should be structured to address the unique groups, divisions, or branches, that may be necessary to effectively manage the specific type of incident (e.g., structural collapse, trench/excavation cave-in, etc.).

Managing external influences such as family, news media, and political entities includes instructing subordinates in how to deal with them should they be encountered.

NFPA 1561, Standard on Fire Department Incident Management System, 1995 Edition, in section 3-2.2.1, describes the use of an Information Officer (a member of the command staff) to address *these types of influences. Where encounters with family, news* media, or political influences are likely, such a function should be filled as soon as possible.

COMMITTEE STATEMENT: Although the committee agrees that the referenced passage [8-4.4(a)] substantially contributes to the document, the committee doesn't think moving it to section 8-3 is appropriate. Rather, we think 8-4.4(a) *should be incorporated into* the core material of Chapter 2.

8-2.3(c) already addresses the implementation of site control and scene management, and A-8-2.3(c) mentions the management of civilian and non-emergency personnel. Since "external influences" such as family, news media, and politicians easily fall under the category of civilian and non-emergency personnel, it makes sense that personnel in an Awareness Level organization should have the capability to manage them. It follows, then, that since personnel from an Awareness Level organization may be confronted with any of the described external influences early in an incident (while they are incident commanders), and since an Awareness Level organization is required by 8-2.3(c) to implement site control and scene management, the language currently in 8-4.4(a) should be incorporated in Awareness Level requirements. Without this language, personnel in an Awareness Level organization may be unprepared for dealing with this type of common occurrence.

It is notable that although NFPA 1561 (IMS) does describe the existence of an information officer (NFPA 1561 3-2.1), it does not describe the specific duties of such a position within an IMS hierarchy. Therefore, the language currently contained in proposed NFPA 1670, section 8-4.4(a) cannot be considered implied in section 2-5.3.1 with its required compliance with NFPA 1561.

(Log #2)

1670- 40 - (8-4.4(f) and (g) (New)): Accept in Principle

SUBMITTER: William M. Lokey, Pierce County Dept. of Emerg. Mgmt

RECOMMENDATION: Add new text to read as follows:

(f) Determining search urgency, establishing the search area, doing appropriate interviewing and investigations, and using the concept of search probabilities.

(g) Doing appropriate base camp management, briefing and debriefing, mission suspension, demobilization, and post mission documentation.

SUBSTANTIATION: The addition of this language in this section will complete the technician level standard to meet more of the accepted skill level and strategies of current search management philosophy and practice.

COMMITTEE ACTION: Accept in Principle.

To the end of A-8-4.4(e) add the following new text:

"Specifically with regard to a search, the implemented plan should involve proper search management techniques including, but not necessarily limited to, the following:

I. Determining the urgency of the search
II. Development of a lost subject profile
III. Properly establishing and segmenting the search area
IV. Conducting an appropriate investigation and interviews
V. Application of the concept of search probability theory
VI. Design, development, and establishment of appropriate search strategy and tactics
VII. Appropriate base camp establishment and management
VIII. Proper and thorough briefing and debriefing of operational personnel
IX. Appropriate consideration given to suspension of the search
X. Demobilizing personnel and facilities
XI. Properly documenting the incident."

COMMITTEE STATEMENT: The specifics suggested by the submitter fall under the category of the implementation of an operational plan, and, therefore, are addressed in section 8-4.4(e). However, the committee does understand the submitter's frustration in that none of the important techniques and/or capabilities he suggests are specified in the current language. He is

also correct in that the current language does not reflect the currently accepted skill levels and/or strategies of search management philosophy and practice.

So, in keeping with the way in which the committee has dealt with other operational details in this document, the committee recommends that section A-8-4.4(e) be modified to include the submitter's suggestions in a textural form.

(Log #CP12)

1670- 41 - (9-1.3 Strongback): Accept
SUBMITTER: Technical Committee on Technical Rescue
RECOMMENDATION: Add the following reference to 9-1.3:
"Strongback. See "uprights"."
SUBSTANTIATION: The addition of the term Strongback was added in response to 1670-42 (Log #19) and in recognition of the fact that the word "strongback" is included in the definition of "Traditional Sheeting and Shoring" (and six other locations in the document) but is itself not defined.
COMMITTEE ACTION: Accept.

(Log #19)

1670- 42 - (9-1.3 Strongback (New)): Reject
SUBMITTER: Paul Moledor, Cuyahoga Falls Fire Dept.
RECOMMENDATION: Add a new definition to read as follows:
Strongback. Strongback is at least a 2 in. x 12 in. by 12 ft long Douglas fir board that is bolted to a 4 ft x 8 ft sheet panel. This assembly makes up the shoring system.
SUBSTANTIATION: Strongback is talked about many times in Chapter 9. However, it is not defined. For clarity and completeness it should be added. This is different than an upright.
COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: Contrary to the submitter's suggestion, the committee believes that the trench rescue community considers "strongbacks" to mean the same thing as "uprights." They also both mean the same thing to members of the trench task group, thus the current language to that effect. To further illustrate this fact, after the word "strongback" in the glossary of his book "First Due Trench Rescue" (Second Edition, Mosby-Year Book, Inc., 1996), James Gargan writes, "see uprights."
The current NFPA 1670 document includes a definition of "Uprights." See the Committee Proposal for 1670-41 (Log #CP12), which makes the submitter's proposal unnecessary.

(Log #18)

1670- 43 - (9-1.3 Traditional Sheeting and Shoring): Accept in Principle
SUBMITTER: Paul Moledor, Cuyahoga Falls Fire Dept.
RECOMMENDATION: Revise text to read as follows:
"Traditional Sheeting and Shoring... (at the end add the following)"
"New style sheeting and shoring may not require strongback. Refer to Manufacturer's Recommendations."
SUBSTANTIATION: Many new types of shoring do not require strongback air shore, multishore systems, hydraulic systems.
COMMITTEE ACTION: Accept in Principle.
Add the following new sentence to the end of the definition for Traditional Sheeting and Shoring:
"Some newer style sheeting and shoring may not require a strongback attachment (refer to manufacturer recommendations)," so that the complete definition reads:
Traditional Sheeting and Shoring. The use of 4 feet by 8 feet sheet panels, usually with a strongback attachment, supplemented by a variety of conventional shoring options such as hydraulic, screw, and/or pneumatic shores. Some newer style sheeting/shoring may not require a strongback attachment (refer to manufacturer's recommendations).
COMMITTEE STATEMENT: The committee accepts the submitter's suggestion about uprights not being required with some newer style sheeting/shoring. "Traditional sheeting and shoring" was intended to be differentiated from "supplemental sheeting and shoring." So, the submitter's suggestion does not seem to violate the intent of the task group's definition of "traditional sheeting and shoring."

(Log #CP13)

1670- 44 - (Chapter 10): Accept
SUBMITTER: Technical Committee on Technical Rescue
RECOMMENDATION: Revise 10-1.1 to include the following NFPA Publications:
10-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.
NFPA 472, Chapter 2 (Awareness)
NFPA 472, Chapter 3 (Operations)
NFPA 472, Chapter 4 (Technician)
NFPA 1500, Section 3-5 (Special Operations)
NFPA 1500, Section 6-4 (Members Operating at Emergency Incidents)
NFPA 1500, Section 6-5 (Rapid Intervention for Rescue of Members)
NFPA 1500, Chapter 8
NFPA 1521
NFPA 1561
NFPA 1983"
Revise 10-1.2 to include the following other publications, so that the section reads:
10-1.2 Other Publications.
10-1.2.1 Superintendent of Documents Publication. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
29 CFR 1926 Subpart P, Appendix A, B and C.
29 CFR 1926.652 (c)(3) and (c)(4) (Shield Systems)
FEMA USAR Response System, Appendix C (Task Force Building Marking System)
FEMA USAR Response System, Appendix D (Structure Triage, Assessment and Marking System)
US Dept. of Transportation, First Responder Guidelines
10-1.2.2 American Hospital Association
AHA Health Care Provider CPR
10-1.2.3
ARC CPR for Professional Rescuer
National Safety Council equivalent to ARC CPR for Professional Rescuer"
SUBSTANTIATION: The Committee reviewed the draft document and found these references in the text of the document.
COMMITTEE ACTION: Accept.

(Log #1)

1670- 45 - (10-2): Accept in Principle
SUBMITTER: Don Cooper, Emergency Response Inst.
RECOMMENDATION: Delete all of 10-2.
SUBSTANTIATION: This section is in its current state, incomplete, and does not contribute to the document. As is, the references only include water rescue, not other disciplines. Deleting this section will alleviate having to decide what additional references should be included.
COMMITTEE ACTION: Accept in Principle.
Delete 10-2.
COMMITTEE STATEMENT: Rather than delete this section altogether, the submitter and the committee agreed to move the current information that was in 10-2 into C-1.2.6, titled "Recommended Reading," and add to it the books and documents that members of the committee believe to be beneficial reading for users of the document.
Refer to Committee Proposal 1670-48 (Log #CP14)for the recommended reading list.

(Log #26)

1670- 46 - (A-9-3.3(r)): Accept in Principle
SUBMITTER: Paul Moledor, Cuyahoga Falls Fire Dept.
RECOMMENDATION: Revise text to read as follows:
"...for example, heavy equipment might be used to place a box or to dig a ~~parallel~~ trench for access."
SUBSTANTIATION: This "parallel" trench is not really parallel. It should be either a "hole" or perpendicular trenching operation to allow the sides of collapsed trench to be "pulled into". This whole idea is controversial and need defined!!
COMMITTEE ACTION: Accept in Principle.
COMMITTEE STATEMENT: The submitter is correct that there is some controversy throughout the trench rescue community regarding the use of heavy equipment at a trench rescue incident. However, the language used in A-9-3.3(r) is not very strong and allows great latitude in the use, or non-use, of heavy equipment.

It was the intent of the task group when this passage was written to leave the issue of the use of heavy equipment up to the authority having jurisdiction. Thus, the language currently used in A-9-3.3(r) is, by design, relatively vague and only suggestive, not mandatory.

The submitter is also referring to Proposal 1670-47 (Log #30) where additional modifications were made to this section.

(Log #30)

1670- 47 - (A-9-3.3(r)): Accept in Principle

SUBMITTER: Timothy J. Lombardi, Cuyahoga Falls Fire Dept.

RECOMMENDATION: Revise the third paragraph to read as follows:

"~~However, there may be circumstances when heavy equipment may be appropriate for accessing victims of trench and evacuation emergencies with the appropriate level of supervision. For example, heavy equipment might be used to place a trench box or to dig a parallel trench for access.~~ The use of heavy equipment in the trench rescue environment is discouraged both in practice and by federal regulations. However, circumstances may warrant considerations of deviating from is practice. not without consideration of the negative impact of extreme superimposed loads adjacent to the trench, vibration, etc., on trench interim and ultimate effect on the victim."

SUBSTANTIATION: We felt the original text too vague and leaving the entire issue of heavy equipment usage to individual interpretation. It would be great if parameters and usage criteria be developed.

(a) In "rescue mode" heavy equipment is a viable option in the following situations:

1. Digging around an extinguishing structure
2. Placing a trench box or other protective devils.

(b) In recovery mode, cutback, etc...

In all cases text would be welcomed that encouraged professional rescuer to professional operating engineers communication to learn capabilities and potential options at an incident!

COMMITTEE ACTION: Accept in Principle.

Modify A-9-3.3(r) to read as follows:

A-9-3.3(r) Procedures for disentanglement and removing the entrapment mechanism may include but are not be limited to:

- Hand digging
- Lifting using air bags, pneumatic, or other mechanical advantage devices
- Suctioning
- Cutting using air knives, saws, or other power tools
- Dewatering
- Heavy equipment.

Procedures and equipment involved in removal systems should comply with NFPA 1983, Standard on Fire Service Life Safety Rope and System Components, 1995 Edition.

Heavy or mechanical equipment and/or mechanical winches, of any kind, should not be used to physically lift, pull, or extricate victims from a trench. However, there may be circumstances when heavy equipment may be appropriate for accessing victims of trench and evacuation emergencies with the appropriate level of supervision and after careful consideration is given to the negative impact of such actions on the victim including the effects of extreme superimposed loads and vibration adjacent to the trench. For example, heavy equipment might be used to dig an adjacent trench or hole for access, but the excessive loading and vibration of the area adjacent to the trench may cause a rapid deterioration in the condition of, and in the immediate environment surrounding, the victim. In any case, to best establish viable options and available capabilities, the advice of experienced and knowledgeable on-site personnel should be sought in order to make the best decisions possible.

COMMITTEE STATEMENT: Much like the submitter's comments on Proposal 1670-46 (Log #26), this submitter refers to the controversy within the trench rescue community regarding the use of heavy equipment at a trench rescue incident.

It was the intent of the task group when A-9-3.3(r) was written to leave the issue of the use of heavy equipment up to the authority having jurisdiction. Thus, the language currently used in this section is, by design, only suggestive, not mandatory. There are some benefits, however, to adopting some of the concepts addressed in the submitter's comments.

(Log #CP14)

1670- 48 - (Appendix C): Accept

SUBMITTER: Technical Committee on Technical Rescue

RECOMMENDATION: Add new C-1.2.6 with the heading of "Recommended Reading." Include in the new C-1.2.6 the following list:

Recommended Reading

ADC. *Consensus Standards for Commercial Diving Operations*, Third Edition, American National Standards Institute,1991.

Auerbach, Paul S., Ed. *Wilderness Medicine: Management of Wilderness and Environmental Emergencies*, Third Edition, Mosby-Year Book, Inc., 1995.

Barsky, Steven M. *Diving in High Risk Environments*, Second Edition, Dive Rescue International, Inc., 1993.

Bechel, Les and Ray, Slim. *River Rescue*, Appalachian Mountain Books, Boston, MA.., 1989, 2nd Ed.

Cooper, Donald C.; La Valla, Patrick; Stoffel, Robert. *Search and Rescue Fundamentals: Basic Skills and Knowledge to Perform Search and Rescue*, Third Edition, Emergency Response Institute, Inc. and National Rescue Consultants, Olympia, WA,1990.

CMC Rescue, Inc. Staff. *Confined Space Entry and Rescue: A Training Manual*, CMC Rescue, Inc., 1996.

Drabek, Thomas E. *The Professional Emergency Manager*, University of Colorado, Institute of Behavioral Science, 1987.

Drabek, Thomas E., et. al. *Managing Multiorganizational Emergency Responses: Emergency Search and Rescue Networks in Natural Disaster and Remote Area Settings*, University of Colorado, Institute of Behavioral Science, 1981.

Linton, S.J., Rust, D.A., and Gilliam, T.D. *Diver Rescue Specialist Training Manual*, Dive Rescue Inc./ International, Fort Collins, CO, 1986.

Downey, Ray. *The Rescue Company*, Fire Engineering, Saddle Brook, NJ, 1992

Dunn, Vincent. *Collapse of Burning Buildings, A Guide to Fireground Safety*, Fire Engineering, New York, NY, 1988.

Dunn, Vincent. *Safety and Survival on the Fireground*, Fire Engineering, Saddle Brook, NJ, 1992.

Fasulo, David J. *SelfRescue*, Chockstone Press, Evergreen, CO, 1996.

Field, Ernest, K., Ed. *Mountain Search And Rescue Operations*, Grand Teton Natural History Association, Moose, WY, 1969.

FEMA. *Urban Search and Rescue Response System–Operational System Description and Mission Operational Procedures*. Federal Emergency Management Agency, Emmitsburg, MD.

FEMA. *New Techniques in Vehicle Extrication*, Federal Emergency Management Agency, Emmitsburg, MD, September, 1994.

Frank, James A.; Patterson, Donald E. *Rappel Manual*, Second Edition, CMC Rescue, Inc., Santa Barbara, CA, 1997.

Frank, James A. & Smith Jerrold B. *Rope Rescue Manual*, CMC Rescue, Inc., Second Edition. 1992.

Gargan, James B. *Trench Rescue.*, Mosby Lifeline, Second Edition, 1996.

Graydon, Don and Hanson, Kurt, Eds. *Mountaineering: The Freedom Of The Hills*. 6th edition. Seattle, WA: The Mountaineers; 1997.

Hill, Kenneth, Ed. *Managing the Lost Person Incident*. National Association for Search and Rescue, Fairfax, VA, 1997.

Hudson, Steve, Ed. *Manual Of U. S. Cave Rescue Techniques*, Second Edition, National Speleological Society, Huntsville, AL,1988.

Goodson, Carl, Ed. *Fire Service Rescue*, Sixth Edition, IFSTA (International Fire Service Training Association), Fire Protection Publications, Stillwater, OK, 1996.

LaValla, P., Stoffel, R. and Dr. A.S.G. Jones. *Search is an Emergency: A Text for Managing Search Operations*, Fourth Edition-Revised, Emergency Response Institute, Olympia, WA, 1996.

Lipke, Rick. *Technical Rescue Riggers Guide*. Bellingham, WA: Conterra Technical Systems Inc., 1997.

Long, John. *Climbing Anchors*, Chockstone Press, Evergreen, CO, 1993.

Long, John; Gaines, Bob. *More Climbing Anchors*, Chockstone Press, Evergreen, CO, 1996.

Lonsdale, Mark V., *SRT Diver*, LosAngeles, 1989.

March, Bill. *Modern Rope Techniques In Mountaineering*. Cicerone Press, Milnthorpe, Cumbria, England, 1976.

MacInnes, Hamish. *International Mountain Rescue Handbook*, Charles Scribner's Sons, New York, NY, 1972.

Martin, Tom. *Rappelling*, Second Edition, SEARCH, Mt. Sterling, KY, 1988.

May, W.G. *Mountain Search And Rescue Techniques*, Rocky Mountain Rescue Group, Inc., Boulder, CO, 1973.

MacInnes, Hamish. *International Mountain Rescue Handbook.* New York,
NY: Charles Scribner's Sons; 1972.
Montgomery, Neil, R. *Single Rope Techniques.* Sydney, Australia: The Sydney Speleological Society; 1977.
NFPA. *Comprehensive Glossary of Terms*, Version 2.0, NFPA Publications, Qunicy, MA, 1997.
Norman, John. *Fire Officer's Handbook of Tactics.* Fire Engineering, Saddle Brook, NJ, 1991.
Nudell, Mayer and Antokol, Norman. *The Handbook for Effective Emergency and Crisis Management*, Lexington Books, Lexington, MA, 1988.
Ohio Department of Natural Resources, Division of Watercraft. *River Rescue,* Instructional Materials Laboratory, Ohio State University, 1980.
Padgett, Allen; Smith, Bruce. *On Rope*, National Speleological Society, Huntsville, AL, 1987.
Peters, Ed, Ed. *Mountaineering: The Freedom Of The Hills*, Fourth Edition, The Mountaineers, Seattle, WA, 1982.
Ray, Slim. *Swiftwater Rescue*, CFS Press, Asheville, NC, 1997.
Roco Corporation, *Compliance Guidelines for Confined Space Rescue,* Current Edition.
Rekus, John F., *Complete Confined Spaces Handbook,* Lewis Publishers.
Revised Instructional Standards Minimum Course Content for Entry Level Scuba Certification, September 1986.
Roop, M., Wright, R., and Vines, T., *Confined Space and Structural Rescue,* Mosby, 1997.
Taylor, A. and Cooper, D.C. *Fundamentals of Mantracking: The Step-By-Step Method,* Second Edition, Emergency Response Institute, Olympia, WA, 1995.
Thrun, Robert. *Prusiking*, National Speleological Society, Huntsville, AL, 1973.
United States Fire Administration. *Technical Rescue Technology Assessment*, Federal Emergency Management Agency, Emmitsburg, MD, January 1995.
U.S. Navy. *U.S. Navy Diving Manual,* Commander, Naval Sea Systems Command and Best Publishing Co., 1993.
United States Lifesaving Association, *Guidelines for Training & Standards of Aquatic Rescue Response Teams*, 1996.
U.S. Department of Commerce, *NOAA Diving Manual,* October 1991.
Vines, Tom; Hudson, Steve. *High Angle Rescue Techniques: A Student Guide For Rope Rescue Classes,* National Association For Search and Rescue, Fairfax, VA, 1989.
Wieder, Michael A., Ed. *Principles of Extrication*, First Edition, IFSTA (International Fire Service Training Association), Fire Protection Publications, Stillwater, OK, 1990.
Wheelock, Walt. *Ropes, Knots And Slings For Climbers*, La Siesta Press, Glendale, CA, 1967.
Worsing, Robert A., Jr., MD. *Basic Rescue And Emergency Care,* American Academy of Orthopaedic Surgeons, Park Ridge, IL, 1990.

Federal Response Plan (Public Law 93-288)
National Search and Rescue Plan
Incident Command System, Fire Protection Publications
NFPA 1600, 471, 472, 1600, 1581, 1982, 220
29 CFR 1926.652
FEMA USAR Response System (Appendix C and D)
29 CFR 1910.1030 (OHSA Blood-bourne Pathogens)
29 CFR 1910.120 (Standard on Hazardous Waste Operations and Emergency Response)
29 CFR 1926.651 (Specific Excavation Requirements)
ASTM Soil Classification System
US Dept. of Agricultural Textural Classification System
29 CFR 1910.134 (Respiratory Protection)
29 CFR 1910.146 (Permit Required Confined Spaces)

SUBSTANTIATION: The committee reviewed Appendix C and wanted to add these additional references to assist the user in becoming aware of the resource materials that are available on the variety of subjects addressed in this document.
COMMITTEE ACTION: Accept.

(Log #4)

1670- 49 - (Entire Document): Accept in Principle
SUBMITTER: John B. Slate, Nat'l Academy of Scuba Educators (NASE)
RECOMMENDATION: It is my suggestion that the diver training standards be modified to state that acceptable training must be provided through a nationally recognized certifying agency that provides and sanctions training specific to the needs of the fire rescue community and that the courses approved must be designed to address the specific hazards and need of the community.
SUBSTANTIATION: It is my belief that the diving industry is uniquely qualified to provide quality training. The required resources and limited availability of experience instructors make providing this type of training out of reach for many traditional training academies in the fire service. I note that your standard also recognizes that fact by referring divers back to the nationally recognized certifying agency for diver specific training. The Association should note that some of the agencies listed as recognized training agencies specifically prohibit training for "non recreational" activities required of Public Safety Divers. Additionally, it is my belief, that there are now and will continue to exist instructors who lack the training and background to train public safety professionals to dive. (Please note that I do not question their ability to train recreational which is what they have been trained to do.) Unfortunately, a small number of there individuals have attempted in the past and will use this standard in the future to provide training below the standards required by fire rescue professionals. I feel that a simple strengthening of your standard for diver training would serve to preclude that situation from occurring.

I would like to note at this point, that even though my agency offers public safety diving training we are certainly not alone in that field. It is possible that my suggestion to the commission may be perceived as a conflict of interest due to my position with this agency. I do not feel that this is the case. However, I will admit that I have an ulterior motive. That motive is to see an increase in the safety of diving generally. Increasing the safety of our industry is no doubt good business but it is also the right thing to do.
COMMITTEE ACTION: Accept in Principle.

Add the following sentence to the end of the paragraph:
"The curriculum for such certification shall be oriented toward the needs and operational requirements of public safety diving as defined herein." so that the complete paragraph reads:
7-4.7.1 At the entry level and for any specialties utilized by an organization at the Technician Level, the AHJ shall provide certification by a nationally recognized agency. The curriculum for such certification shall be oriented toward the needs and operational requirements of public safety diving as defined herein.
COMMITTEE STATEMENT: Most of the agencies mentioned in A-7-4.7.1 offer exclusively recreational dive training, and there are distinct differences between recreational and public safety diving in the areas of equipment, training, and specific skills required. It would be preferable if the certification suggested in 7-4.7.1 could be specific to public safety diving.

Currently, however, there is only a limited number of nationally recognized agencies that actually offer certification in public safety diving. Most of these agencies only offer to certify divers in their conventional, recreational curricula (i.e., open water, etc.). Some teach their standard diving curricula but add an emphasis on the application of the skills in the public safety diving environment. Most of these, however, still certify divers in recreational diving when the training is complete. In the end, only a limited number of nationally recognized agencies can actually certify divers in public safety diving. This substantially limits one's options when public safety diving certification is the goal.

Section 7-4.7.1 was designed to require Technician Level divers to be certified by a nationally recognized agency using their standard curriculum. This was not meant to suggest that this is the only dive training that organizations attempting to use this standard would ever need. It was meant to offer only a certain amount of standardization in the fundamental training of divers in order to address the fact that many public safety diver deaths are due to the lack of basic diving skills.

With the limitations regarding public safety diving certification in mind, and considering the fact that lack of basic diving skills can be dangerous, and with the submitter's comments in mind, the committee believes that this modification is responsive.

(Log #CP1)

1670- 50 - (Entire Document): Accept
SUBMITTER: Technical Committee on Technical Rescue
RECOMMENDATION: Adopt the proposed new NFPA 1670, Standard on Operations and Training for Technical Rescue Incidents, as shown at the end of this report. All committee actions have been incorporated into the draft.
SUBSTANTIATION: Technical rescue has increasingly become an important activity for the emergency services. Its areas of specialization, from structural collapse to wilderness to water rescue and others, have become very complex, yet there were no agreed upon protocols that applied nationally. The responsibility for an existing document, NFPA 1470, Standard on Search and Rescue Training for Structural Collapse Incidents, was transferred to the Technical Committee on Technical Rescue, which identified the need for a broader approach than focusing only on structural collapse. The result was this proposed new NFPA 1670 document. With the development of proposed new NFPA 1670, the committee is recommending withdrawal of NFPA 1470.
COMMITTEE ACTION: Accept.

NFPA 1670

Standard on
Operations and Training for
Technical Rescue Incidents

1999 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Chapter 10 and Appendix C.

Chapter 1 Administration

1.1 Scope.

1-1.1* This standard identifies and establishes levels of functional capability for safely and effectively conducting operations at technical rescue incidents.

1-1.2* The requirements of this standard apply to organizations that provide response to technical rescue incidents.

1-2* Purpose. The purpose of this standard is to assist the authority having jurisdiction (AHJ) in assessing a technical rescue hazard within the response area, to identify the level of operational capability, and to establish operational criteria. The functional capabilities of this standard shall be permitted to be achieved in a variety of ways.

1-3 Definitions.

Acceptable Entry Conditions. Conditions in a space that must exist to allow entry and to ensure that employees can safely enter into and work within the space.

Approach Assessment. The period of time from the moment when the incident site first becomes visible, to the moment when the initial size-up is completed.

Approved.* Acceptable to the authority having jurisdiction.

Assessment Phase (Size-Up). The process of assessing the conditions and the scene and the subject's condition and ability to assist in one's rescue.

Authority Having Jurisdiction (AHJ).* The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

Body/Property Recovery. An operation involving the retrieval of either (1) the remains of a deceased victim or (2) property, but in no case a living person.

Critical Incident Stress Debriefing (CISD).

Competent Person. One who is capable of identifying existing and predictable conditions in the surroundings or in the working area that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate such conditions.

Cribbing. Short lengths of robust, usually hardwood, timber, 4 × 4 inches and 18 to 24 inches long, that are used in a variety of ways, usually in the stabilization of vehicles. Cribbing can be combined and/or cut to form "wedges" (incline-shaped timber) or "chocks" (stair-step shaped timber).

Emergency Incident. A specific emergency operation.

Emergency Medical Service (EMS). The organization(s) responsible for the care and transport of sick and injured persons to an appropriate emergency care facility. Referred to as Emergency Services in U.S. Federal confined space regulations.

Engulfment. The surrounding and effective capture of a person by a fluid (e.g., liquid, finely divided particulate) substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entry. The action by which a person passes into a confined space. Entry includes ensuing work or rescue activities in that environment and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space, trench, or excavation.

Entry Team. The group of individuals, with established communications and leadership, assigned to perform work or rescue activities beyond the opening of, and within, the space, trench, or excavation.

Federal Response Plan.* The Federal Response Plan (for Public Law 93-288, as amended) describes the basic mechanisms and structures by which the federal government will mobilize resources and conduct activities to augment state and local disaster and emergency response efforts. It is designed to address the consequences of any disaster or emergency situation in which there is a need for Federal response assistance under authority of the Stafford Act.

Flammable. A combustible that is capable of easily being ignited and rapidly consumed by fire. Flammables can be solids, liquids, or gases that exhibit these qualities.

Flammable Liquid. Any liquid having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 psi (276 kPa) (absolute) at 100°F (37.8°C).

Hazard Analysis. The process of identifying situations or conditions that have the potential to cause injury to people, damage to property, or damage to the environment.

Hazardous Atmosphere. Any atmosphere that is oxygen deficient, contains a toxic or disease-producing contaminant, or is potentially explosive. A hazardous atmosphere could be immediately dangerous to life and health, but not necessarily.

Heavy Object. An item of such size and weight that it cannot be moved without the use of power tools (e.g., hydraulic lifting devices) or complex mechanical advantage systems.

Immediately Dangerous to Life or Health (IDLH). Any condition that would do one of the following:

(a) Pose an immediate or delayed threat to life
(b) Cause irreversible adverse health effects
(c) Interfere with an individual's ability to escape unaided from a hazardous environment

Imminent Hazard. An act or condition that is judged to present a danger to persons or property and is so immediate and severe that it requires immediate corrective or preventive action.

Incident Command System (ICS). The combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure with responsibility for the management of assigned resources to effectively accomplish stated objectives pertaining to an incident (as described in the document, Incident Command System, ISBN 0-87939-051-4, First Edition 10/83, Fire Protection Publications, Oklahoma State University, Stillwater, OK 74078) or training exercise.

Incident Commander. The person responsible for all decisions relating to the management of the incident. The incident commander is in charge of the incident site.

Incident Management System. The management system or command structure used during emergency operations to identify clearly who is in command of the incident and what roles and responsibilities are assigned to various members.

Incident Response Plan. Written procedures, including standard operating guidelines, for managing an emergency response and operation.

Incident Scene. The location where activities related to a specific incident are conducted. This shall include the entire area subject to incident related hazards and all areas used by incident personnel and equipment in proximity to the incident.

Lockout. A method for keeping equipment from being set in motion and endangering workers. A disconnect switch, circuit breaker, valve, or other energy-isolating mechanism to hold equipment in a safe position. A lock is attached in accordance with U.S. Federal Regulations, so that equipment cannot be energized. This is usually performed in combination with a tagout procedure in which a warning tag is applied to the lockout device to alert personnel to the danger.

Mitigation. Activities taken, either prior to or following an incident, to eliminate or reduce the degree of risk to life and property from hazards.

National Search and Rescue Plan. A document that identifies responsibilities of U.S. Federal agencies and serves as the basis for the National Search and Rescue Manual, which discusses search and rescue organizations, resources, methods, and techniques utilized by the Federal government. According to this plan, all maritime or navigable water search and rescue (SAR) is the responsibility of the U.S. Coast Guard, and all inland SAR is the responsibility of the U.S. Air Force.

Oxygen-Deficient Atmosphere. Air atmospheres containing less than 19.5 percent oxygen by volume at one standard atmosphere pressure.

Oxygen-Enriched Atmosphere. Air atmospheres containing more than 23.5 percent oxygen by volume at one standard atmosphere pressure.

Personal Protective Equipment (PPE). The equipment provided to shield or isolate personnel from infectious, chemical, physical, and thermal hazards. PPE includes protective apparel (i.e., clothing, footwear, gloves, headgear, etc.) as well as personal protective devices (i.e., goggles, faceshields, hearing protectors, respirators, etc.). Adequate PPE shall protect the respiratory system, skin, eyes, face, hands, feet, body, and ears.

Personnel. Any individual participating within the incident scene.

Pre-Entry Briefing. Information passed to all personnel prior to entry into a confined space or trench/excavation environment.

Preparation Phase. All actions and planning conducted prior to the initial receipt of alarm.

Rapid Intervention Crew. At least two members available for rescue of a member or a team if the need arises. Rapid intervention crews shall be fully equipped with the appropriate protective equipment (PPE), protective clothing, and any specialized rescue equipment that might be needed given the specifics of the operation underway.

Recovery. Activities and programs designed to return the entity to an acceptable condition.

Recovery Mode. Level of operational urgency where there is no chance of rescuing a victim alive.

Rescue. Those activities directed at locating endangered persons at an emergency incident, removing those persons from danger, treating the injured, and providing for transport to an appropriate health care facility.

Rescue Team Leader. The person designated within the incident command system as rescue group/division officer responsible for direct supervision of the rescue team operations.

Rescue Incident. An emergency incident that primarily involves the rescue of persons subject to physical danger and that could include the provision of emergency medical care, but not necessarily.

Rescue Mode. Level of operational urgency where there is a chance that a victim will be rescued alive.

Resources. All personnel and equipment that are available, or potentially available, for assignment to incidents.

Resource Assessment. The component of the assessment phase that involves the determination for the need for additional resources. Resource assessment can be ongoing throughout the entire incident.

Respiratory Protection. Equipment designed to protect the wearer from the inhalation of contaminants.

Response Agency. Organization capable of providing emergency services.

Risk. A measure of the probability and severity of adverse effects. These adverse effects result from an exposure to a hazard.

Risk Assessment. An assessment of the likelihood, vulnerability, and magnitude of incidents that could result from exposure to hazards.

Risk/Benefit Analysis. A decision made by a responder based on a hazard and situation assessment that weighs the risks likely to be taken against the benefits to be gained for taking those risks. Traditionally in search and rescue, this analysis involves the assessment of the general status of the victim(s) in order to apply the proper urgency to the situation (rescue versus body recovery). A live victim suggests a rescue and its associated high level of urgency. A deceased victim, however, is a body recovery that suggests a far less urgent response.

Safety Officer. An individual qualified by the authority having jurisdiction to maintain a safe working environment.

Search Marking System. A separate and distinct marking system used to identify information related to the location of a victim(s).

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Size-Up. A mental process of evaluating the influencing factors at an incident prior to committing resources to a course of action.

Special Operations. Those emergency incidents to which the responding agency responds that require specific and advanced technical training and specialized tools and equipment. Special operations include water rescue, rope rescue, confined space entry, wilderness search and rescue, trench rescue, vehicle and machinery rescue, dive search and rescue, and other operations requiring specialized training.

Standard Operating Guideline. An organizational directive that establishes a course of action or policy.

Standard Operating Procedure. An organizational directive that establishes a standard course of action.

Tagout. A method of tagging, labeling, or otherwise marking an isolation device during hazard abatement operations to prevent accidental removal of the device. *(See also Lockout.)*

Technical Rescue. The application of special knowledge, skills and equipment to safely resolve unique and/or complex rescue situations.

Technical Rescue Incident. Complex rescue incidents requiring specially trained personnel and special equipment to complete the mission.

Termination. That portion of incident management in which personnel are involved in documenting safety procedures, site operations, hazards faced, and lessons learned from the incident. Termination is divided into three phases: debriefing the incident, post-incident analysis, and critiquing the incident.

Wire Rope. Rope made of twisted strands of wire.

Chapter 2 General Requirements

2-1 General.

2-1.1 The AHJ shall establish levels of operational capability needed to conduct operations at technical rescue incidents safely and effectively based on hazard analysis, risk assessment, training level of personnel, and availability of internal and external resources.

2-1.2 The AHJ shall establish written standard operating procedures consistent with one of the following operational levels.

(a) *Awareness.* This level represents the minimum capability of a responder who, in the course of their regular job duties, could be called upon to respond to, or could be the first on the scene of, a technical rescue incident. This level can involve search, rescue, and recovery operations. Members of a team at this level are generally not considered rescuers.

(b) *Operations.* This level represents the capability of hazard recognition, equipment use, and techniques necessary to safely and effectively support, and participate in, a technical rescue incident. This level can involve search, rescue, and recovery operations, but usually operations are carried out under the supervision of technician-level personnel.

(c) *Technician.* This level represents the capability of hazard recognition, equipment use, and techniques necessary to safely and effectively coordinate, perform, and supervise a technical rescue incident. This level can involve search, rescue, and recovery operations.

2-1.3 The authority having jurisdiction shall establish operational procedures to ensure that technical rescue operations are performed in a safe manner consistent with the identified level of operational capability. In addition, the same techniques used in a rescue operation shall be considered appropriate for training, body recovery, evidence search, and other operations with a level of urgency commensurate with the risk/benefit analysis.

2-1.4 Operational procedures shall not exceed the identified level of capability established in 2-1.1.

2-1.5* Medical care shall be provided for victims of rescue operations and shall be, as a minimum, at the basic life support (BLS) level.

2-1.6 The AHJ shall provide training in the responsibilities that are commensurate with the identified operational capability of each member. The minimum training for all members shall be at the awareness level. Members expected to perform at a higher operational level shall be trained to that level.

2-1.6.1 The AHJ shall provide the necessary continuing education to maintain all requirements of the organization's identified level of capability. This shall include annual performance evaluations of the organization based on requirements of this standard.

2-1.6.2* The AHJ is responsible for the documentation of all required training. This documentation shall be maintained and available for inspection by individual team members and their authorized representatives.

2-1.7 Prior to operating at a technical rescue incident, an organization shall meet the requirements of Chapter 2 of this standard along with the appropriate requirements of one or more of Chapters 3 through 9 for the specific technical rescue incident.

2-1.8 The AHJ shall ensure that there is a standard operating procedure to evacuate members from an area and account for their safety when an imminent hazard condition is discovered. This procedure shall include a method to notify all members in the affected area immediately by any effective means including audible warning devices, visual signals, and radio signals.

2-1.9* The AHJ shall comply with all applicable local, state, and federal laws.

2-1.10 The AHJ shall train appropriate personnel in procedures for invoking relevant components of the National Search and Rescue Plan, The Federal Response Plan, and other state and local response plans.

2-2 Hazard Analysis and Risk Assessment.

2-2.1* The AHJ shall conduct a hazard analysis and risk assessment of the response area and shall determine the feasibility of conducting technical rescue. Potential hazards and their likelihood of causing an incident shall be identified.

2-2.2 The hazard analysis and risk assessment shall include an evaluation of the environmental, physical, social, and cultural factors influencing the scope, frequency, and magnitude of a potential technical rescue incident and the impact they might have on the ability of the AHJ to respond to and to operate safely at those incidents.

2-2.3* The AHJ shall identify the type and availability of internal resources needed for technical rescue incidents and shall maintain a list of these resources.

2-2.4* The AHJ shall identify the type and availability of external resources needed to augment existing capabilities for technical rescue incidents and shall maintain a list of these resources. This list shall be updated at least on an annual basis.

2-2.5* The AHJ shall establish procedures for the acquisition of those external resources needed for technical rescue incidents.

2-2.6 The hazard analysis and risk assessment shall be documented.

2-2.7 The hazard analysis and risk assessment shall be reviewed and updated on a scheduled basis and as operational or organizational changes occur.

2-2.8 The AHJ shall conduct periodic surveys in the organization's response area, for the purpose of identifying the types of technical rescues that are most likely to occur.

2-3 Incident Response Planning.

2-3.1 The procedures for a technical rescue emergency response shall be documented in the special operations incident response plan. The plan shall be a formal, written document.

2-3.1.1 Where external resources are required to achieve a desired level of operational capability, mutual aid agreements shall be developed with other organizations.

2-3.2 Copies of the technical rescue incident response plan shall be distributed to agencies, departments, and employees having responsibilities designated in the plan.

2-3.3 A record shall be kept of all holders of the technical rescue incident response plan and a system implemented for issuing all changes or revisions.

2-3.4 The technical rescue incident response plan shall be approved by the AHJ through a formal, documented, approval process and shall be coordinated with participating agencies and organizations.

2-4 Equipment.

2-4.1 Operational Equipment.

2-4.1.1* The AHJ shall provide safety equipment, commensurate with the respective operational capability, for safe and effective operations at technical rescue incidents and training exercises.

2-4.1.2 Training shall be provided to ensure that all equipment is used and maintained in accordance with the manufacturers' instructions.

2-4.1.3 Procedures for the inventory and accountability of all equipment shall be developed and used.

2-4.2 Personal Protective Equipment (PPE).

2-4.2.1 The AHJ shall provide appropriate protective clothing and equipment to provide protection from those hazards to which personnel are exposed or could be exposed. Such protective equipment shall be appropriate to the tasks that are expected to be performed during technical rescue incidents and training exercises.

2-4.2.2 Personnel shall be trained in the care, use, inspection, maintenance, and limitations of the protective clothing and equipment assigned or available for their use.

2-4.2.3 The AHJ shall ensure that all personnel wear and use appropriate personal protective equipment while working in known or suspected hazardous areas during technical rescue incidents and training exercises.

2-4.2.4* The AHJ shall ensure that fresh-air breathing apparatus in the form of supplied air respirators or self-contained breathing apparatus (SCBA) are available when required for technical rescue operations. All apparatus shall be worn in accordance with the manufacturer's recommendations. An adequate supply source providing a minimum of Grade D breathing air shall be provided for all fresh-air breathing apparatus. Supplied Air Respirators must be used in conjunction with a self-contained breathing air supply capable of providing enough air for egress in the event of a primary air supply failure.

2-5 Safety.

2-5.1 General.

2-5.1.1 All personnel shall receive training related to the hazards and risks associated with technical rescue operations.

2-5.1.2 All personnel shall receive training for conducting rescue operations in a safe and effective manner while using appropriate PPE.

2-5.1.3 The AHJ shall ensure that members assigned duties and functions at technical rescue incidents and training exercises meet the requirements of Sections 3-5, 6-4, and 6-5 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program.*

2-5.1.4* Where members are operating in positions or performing functions at an incident or training exercise that pose a high potential risk for injury, members qualified in basic life support (BLS) shall be standing by.

2-5.2 Safety Officer.

2-5.2.1 At technical rescue training exercises and in actual operations, the incident commander shall assign a safety officer with specific responsibility for the identification, the evaluation, and, when possible, the correction of hazardous conditions and unsafe practices. This assignment shall meet the requirements in Chapter 4 of NFPA 1521, *Standard for Fire Department Safety Officer.*

2-5.2.2 The safety officer shall be trained to the operational level, as a minimum, at which the organization is operating.

2-5.2.3* The safety officer shall be readily identifiable.

2-5.3 Incident Management System.

2-5.3.1* The AHJ shall utilize, and provide training on the implementation of, an incident management system that meets the requirements in Chapters 2 and 3 of NFPA 1561, *Standard on Fire Department Incident Management System*, with written standard operating procedures applying to all members involved in emergency operations. All members involved in emergency operations shall be familiar with the system.

2-5.3.2 The AHJ shall provide training on the implementation of an incident personnel accountability system that meets the requirements of Section 2-6 of NFPA 1561, *Standard on Fire Department Incident Management System.*

2-5.3.3 The incident commander shall ensure rotation of personnel to reduce stress and fatigue.

2-5.3.4 The incident commander shall ensure that all personnel are aware of the potential impact of their operations on the safety and welfare of other rescuers, victims, and other activities at the incident site.

2-5.4* **Fitness.** The AHJ shall ensure that members are psychologically, physically, and medically capable to perform assigned duties and functions at technical rescue incidents and to perform training exercises in accordance with Chapter 8 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program.*

Chapter 3 Structural Collapse

3-1 General Requirements.

3-1.1 Organizations operating at structural collapse incidents shall meet all the requirements specified in Chapter 2 of this standard.

3-1.2* The AHJ shall evaluate the effects of severe weather, extremely hazardous collapse sites, and other difficult conditions to determine whether their present training program has prepared the organization to operate safely.

3-1.2.1 The incident commander shall ensure that personnel entering a collapse zone shall not be allowed to wear or carry firearms of any type.

3-1.3 Special Definitions.

Accepted Engineering Practices. Those requirements that are compatible with standards of practice required by a registered professional engineer.

Collapse Zone. See Rescue Area.

Failure. The breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

FEMA Task Force Structure Marking System, Structure Identification Within a Geographic Area.* Distinct markings made with international orange spray paint to label buildings with their street number so that personnel can differentiate one building from another. The primary method of identification shall include the existing street name, hundred block, and building number. Structure identification within a geographic area is used to differentiate buildings by groups, such as by block(s) or by jurisdictional area. Figure A-3-1.2(i)(c) illustrates the building ID and location marking system.

FEMA Task Force Search and Rescue Marking System.* Distinct markings made with international orange spray paint near a collapsed structure's most accessible point of entry. Markings are made by drawing a 2 ft × 2 ft "X" and denoting in each of the quadrants of the "X" relevant search information (e.g., search status, findings, hazards found, time and date of search, team involved). Figure A-3-2.2(i)(a) illustrates the search marking system.

FEMA Task Force Structure/Hazard Evaluation Marking System.* Distinct markings made with international orange spray paint, after performing a building hazard assessment, near a collapsed structure's most accessible point of entry. Markings are made by drawing a 2 ft × 2 ft square box and denoting in and around the box specific relevant hazard information (e.g., general level of operation safety, direction of safest entry, time and date of search, hazards found, team involved). Figure A-3-1.2(i)(b) illustrates the structure/hazard evaluation marking system.

General Area (or Warm Zone).* An area surrounding the incident site (e.g., collapsed structure, trench, etc.) whose size is proportional to the size and nature of the incident. Within this general area, access by people, heavy machinery, and vehicles is limited and strictly controlled.

Registered Professional Engineer. A person who is registered as a professional engineer in the state where the work is to be performed. However, a registered professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for manufactured protective systems or tabulated data to be used in the construction of protective systems.

Rescue Area (or Hot, Danger, or Collapse Zone).* An area surrounding the incident site (e.g., collapsed structure, trench, etc.) whose size is proportional to the hazards that exist.

3-2 Awareness.

3-2.1 Organizations operating at the awareness level shall meet all awareness level requirements regarding confined space rescue specified in Section 5-2.

3-2.2 Awareness level functions at structural collapse incidents shall include the following:

(a)* Size-up of existing and potential conditions at structural collapse incidents

(b)* Identification of the resources necessary to conduct safe and effective structural collapse search and rescue operations

(c)* The development and implementation of procedures for carrying out the emergency response system for structural collapse incidents

(d)* The development and implementation of procedures for carrying out site control and scene management

(e)* Recognition of general hazards associated with structural collapse incidents including the recognition of applicable construction types and categories and the expected behaviors of components and materials in a structural collapse

(f)* Identification of five types of collapse patterns and potential victim locations

(g)* Recognition of the potential for secondary collapse

(h)* The development and implementation of procedures for conducting visual and verbal searches at structural collapse incidents, while using appropriate methods for the specific type of collapse

(i)* The development and implementation of procedures for the recognition and implementation of the FEMA Task Force Search and Rescue Marking System, Building Marking System (Structure/Hazard Evaluation), and Structure Marking System (Structure Identification Within a Geographic Area)

(j) The development and implementation of procedures for the removal of readily accessible victims from structural collapse incidents

3-3 Operations.

3-3.1 Organizations operating at the operations level shall meet all awareness level requirements specified in Section 3-2. In addition, members shall be capable of hazard recognition, equipment use, and techniques necessary to operate safely and effectively at structural collapse incidents involving the collapse or failure of light-frame, ordinary construction, unreinforced and reinforced masonry construction.

3-3.2 Organizations operating at the operations level shall meet all operations level requirements regarding rope, confined space, transportation/machinery, and trench specified in Sections 4-3, 5-3, 6-3, and 9-3. Organizations operating at the operations level shall also meet all awareness level requirements regarding water rescue specified in Section 7-2.

3-3.3 Operations level functions at structural collapse incidents for light-frame ordinary construction and reinforced and unreinforced masonry construction shall include the development and implementation of the following:

(a) Procedures for recognizing unique collapse or failure hazards

(b)* Procedures for search operations intended to locate victims trapped inside and beneath collapse debris

(c)* Procedures for accessing victims trapped inside and beneath collapse debris

(d)* Procedures for performing extrication operations involving packaging, treating, and removing victims trapped within and beneath collapse debris

(e) Procedures for stabilizing the structure

3-4 Technician.

3-4.1 Organizations operating at the technician level shall meet all operations level requirements specified in Section 3-3 and all awareness level requirements specified in Section 3-2. In addition, members shall be capable of hazard recognition, equipment use, and techniques necessary to operate safely and effectively at structural collapse incidents involving the collapse or failure of concrete tilt-up, reinforced concrete, and steel construction.

3-4.2 Organizations operating at the technician level shall meet all technician level requirements regarding rope, confined space, transportation/machinery, and trench specified in Sections 4-4, 5-4, 6-4, and 9-4.

3-4.3 Technician level functions at structural collapse incidents for concrete tilt-up, reinforced concrete, and steel construction shall include the development and implementation of the following:

(a) Procedures for recognizing unique collapse or failure

hazards

(b)* Procedures for search operations intended to locate victims trapped inside and beneath collapse debris

(c)* Procedures for accessing victims trapped inside and beneath collapse debris

(d)* Procedures for performing extrication operations involving packaging, treating, and removing victims trapped within and beneath collapse debris

(e) Procedures for stabilizing the structure

Chapter 4 Rope Rescue

4-1 General Requirements.

4-1.1 Organizations operating at rope rescue incidents shall meet all the requirements specified in Chapter 2 of this standard.

4-1.2* The AHJ shall evaluate the effects of severe weather, extreme heights, and other difficult conditions to determine whether the present training program has prepared the organization to operate safely.

4-1.3 Special Definitions.

Abrasion. The damaging effect on rope and other equipment caused by friction-like movement.

Anchor Point. A single, structural component used either alone or in combination with other components to create an anchor system capable of sustaining the actual and potential load on the rope rescue system.

Anchor System. One or more anchor points rigged in such a way as to provide a structurally significant connection point for rope rescue system components.

Ascent Device. An auxiliary equipment system component; a friction or mechanical device utilized alone or in combination with other mechanical devices to allow ascending a fixed rope.

Ascending (line). A means of safely traveling up a fixed line with the use of one or more ascent devices.

Auxiliary Rope Rescue Equipment. System components, other than life-safety rope and harnesses, that are load-bearing accessories — including, but not limited to, ascending devices, carabiners, descent control devices, rope grab devices, and snap links — designed to be utilized for rescue.

Belay. The method by which a potential fall distance is controlled to minimize damage to equipment and/or injury to a live load. This can be accomplished by a second line in a raise or lowering system or by managing a single line with a friction device in fixed-rope ascent or descent. Belays also protect personnel exposed to the risk of falling not otherwise attached to the rope rescue system.

Bend. A knot that joins two rope or webbing pieces together.

Bight. The open loop in a rope or piece of webbing formed when it is doubled back on itself.

Compound Rope Mechanical Advantage System. A combination of individual rope mechanical advantage systems created by stacking the load end of one rope mechanical advantage system onto the haul line of another or others to multiply the forces created by the individual system(s).

Counter Balance. A raising system utilizing a 1:1 mechanical advantage and a weighted object (human or otherwise) to reduce the need for additional force to lift the load.

Critical Angle. An angle created between two rope rescue system components wide enough so as to create excessive force on the anchor points to which they are attached. Angles of this type greater than 120 degrees are considered unacceptable.

Descending (line). A means of safely traveling down a fixed line using a descent control device.

Descent Control Device. A rope rescue system component; a friction or mechanical device utilized with rope to control descent.

Edge Protection. A means of protecting software components within a rope rescue system from the potentially harmful effects of exposed sharp or abrasive edges.

Fixed Line (Fixed Line System). A rope rescue system consisting of a nonmoving rope attached to an anchor system.

Hardware. A rigid mechanical auxiliary rope rescue component that can include, but is not limited to, anchor plates, carabiners, and mechanical ascent and descent control devices.

Harness. See Life Safety Harness.

High Angle. Refers to an environment in which the load is predominately supported by the rope rescue system.

Highline System. A system of using rope suspended between two points for movement of persons or equipment over an area that is a barrier to the rescue operation. This includes systems capable of movement between points of equal or unequal height.

Hitch. A knot that attaches to or wraps around an object. When the object is removed, the knot will fall apart.

Knot. A fastening made by tying together lengths of rope or webbing in a prescribed way. Knots include bights, bends, and hitches.

Life Safety Harness. A system component; an arrangement of materials secured about the body and used to support a person during rescue.

Life Safety Rope. A compact but flexible, torsionally balanced, continuous structure of fibers produced from strands that are twisted, plaited, or braided together and that serve primarily to support a load or transmit a force from the point of origin to the point of application.

Litter. A transfer device designed to support and protect a victim during movement.

Litter Attendant. A person who both accompanies and physically manages the litter.

Load. That which is being lowered or raised by rope in a high angle system. Some examples include a rescue subject, a rescuer, and subjects in a litter with a litter attendant.

Load Test. A method of preloading a rope rescue system to ensure all components are set properly to sustain the expected load. Generally performed by multiple personnel to exert force on the system at the load attachment point in the manner of function before life loading.

Low Angle. Refers to an environment in which the load is predominately supported by itself and not the rope rescue system (e.g., flat land or mild sloping surface).

Lowering System. A rope rescue system used to lower a load under control. Lowering systems shall incorporate a mechanism to prevent the uncontrolled descent of the load during the lowering operation. This mechanism can reduce the need for excessive physical force to control the lowering operation.

Maximum Working Load. Weight supported by the life safety rope and system components that must not be exceeded.

Mechanical Advantage (M/A).* A force created through mechanical means including, but not limited to, a system of levers, gearing, or ropes and pulleys; usually creating an output force greater than the input force and expressed in terms of a ratio of output force to input force.

Multi-point Anchor System. System configuration providing load distribution either proportionately or disproportionately over more than one anchor point. There are basically two categories of multi-point anchor systems:

*Load Distributing Anchor Systems.** An anchor system established from two or more anchor points that (a) maintains near equal loading on the anchor points despite direction changes on the

main line rope and (b) reestablishes a state of near equal loading on remaining anchor points if any one of them fails. (Also referred to as *self-equalizing* or *self-adjusting.*)

*Load Sharing Anchor System.** An anchor system established from two or more anchor points that distributes the load among the anchor points somewhat proportionately but will not adjust to direction changes on the main line rope.

Pulley. A device with a free-turning, grooved metal wheel (sheave) used to reduce rope friction. Side plates are available for a carabiner to be attached.

Packaging (Patient Packaging). The process of securing a subject in a transfer device, with regard to existing and potential injuries/illness, so as to avoid further harm during movement.

Raising System.* A rope rescue system used to raise a load under control.

Rope. See Life Safety Rope.

Rope-Based Mechanical Advantage System (Rope Mechanical Advantage System). A rope rescue system component incorporating the reeving of rope through moving pulleys (or similar devices) to create mechanical advantage.

Rope Rescue Equipment. Components used to build rope rescue systems including life safety rope, life safety harnesses, and auxiliary rope rescue equipment.

Rope Rescue System. A system comprised of rope rescue equipment and an appropriate anchor system intended for use in the rescue of a subject.

Simple Rope Mechanical Advantage System. A rope mechanical advantage system containing the following:

(a) A single rope

(b) One or more moving pulleys (or similar devices), all traveling at the same speed and in the same direction, attached directly or indirectly to the load

(c) In the case of mechanical advantage systems greater than 3:1, one or more stationary pulleys or similar devices

Single-Point Anchor System. An anchor system configuration utilizing a single anchor point to provide the primary support for the rope rescue system. This includes those anchor systems that utilize one or more additional nonloaded anchor points as backup to the primary anchor point.

Software. A flexible fabric component of rope rescue equipment that can include, but is not limited to, anchor straps, pick-off straps and rigging slings.

System Safety Check.* A method of evaluating the safe assembly of a rescue system.

System Stress. Any condition creating excessive force (i.e., exceeding the maximum working load of any component) to components within a rope rescue system that could lead to damage or failure of the system.

Transfer Device. Various devices used with rope rescue systems to package and allow safe removal of a subject from a specific rescue environment. These can include litters and harnesses.

Vertical Environment. See High Angle.

Webbing. Woven material in the form of a long strip; it can be of flat or tubular weave.

4-2 Awareness.

4-2.1 Organizations operating at the awareness level shall meet all the requirements of Section 4-2.

4-2.2 Awareness level functions shall include the following:

(a)* Size-up of existing and potential conditions where rope rescue operations will be performed

(b)* Identification of the resources necessary to conduct safe and effective rope rescue operations

(c)* The development and implementation of procedures for carrying out the emergency response system where rescue is required

(d)* The development and implementation of procedures for carrying out site control and scene management

(e)* Recognition of general hazards associated with rope rescue and the procedures necessary to mitigate these hazards within the general rescue area

(f)* The development and implementation of procedures for the identification and utilization of personal protective equipment (PPE) assigned for use at a rope rescue incident

4-3* Operations.

4-3.1 Organizations operating at the operations level shall meet all requirements specified in Section 4-2 and Section 4-3.

4-3.2 Operations level functions shall include the development and implementation of the following:

(a) Procedures for the selection, construction, and use of rope-based mechanical advantage systems

(b) Procedures for establishing the need, selecting the proper equipment, and placing edge protection

(c)* Procedures for the safe construction and use of single- and multi-point anchor systems within the scope of the organization's training

(d) Procedures for the safe selection, construction, and use of an appropriate belay system

(e)* Procedures for selection, construction, and use of a lowering system within the scope of the organization's training

(f)* Procedures for properly tying any knots used by the rope rescue team

(g)* Procedures for assuring safety in rope rescue operations

(h) Procedures for appropriately packaging a patient in a litter

(i) Procedures for the selection, use, and maintenance of proper rope rescue equipment and rope rescue systems

(j)* Procedures for selection, construction, and use of a raising system in the low angle environment

(k) Procedures for safely ascending and descending a fixed rope within the scope of the organization's training

(l) Procedures for using litter attendants in the low angle environment

4-4 Technician.

4-4.1 Organizations operating at the technician level shall meet all requirements specified in Sections 4-2, 4-3, and 4-4.

4-4.2 Technician level functions shall include the development and implementation of the following:

(a) Procedures for the safe construction and use of load distributing anchor systems

(b) Procedures for the selection, construction, and use of a high-line rope system within the scope of the organization's training

(c)* Procedures for the selection, construction and use of a rope-based raising system in a high angle environment within the scope of the organization's training

(d) Procedures for passing knots through a rope rescue system

(e) Procedures for using litter attendants in the high angle environment

Chapter 5 Confined Space

5-1 General Requirements.

5-1.1 Organizations operating at confined space incidents shall meet all the requirements specified in Chapter 2 of this standard.

5-1.2* The AHJ shall evaluate the effects of severe weather, extremely hazardous situations, and other difficult conditions to determine whether the present training program has prepared the organization to operate safely.

5-1.3* **Operational Capability.** The requirements of this chapter apply to organizations that provide varying degrees of response to confined space emergencies. The scope of this standard includes all confined space rescue incidents and response organizations including those not regulated by U.S. federal mandates.

5-1.4 **Special Definitions.** Terms contained herein are defined for the purpose of this chapter as it relates to confined space rescue. For additional applicable definitions refer to chapter 2 of this document.

Acceptable Entry Conditions. The conditions that must exist in a confined space to allow entry-type rescue and to ensure that personnel involved with a confined space rescue are properly protected from atmospheric hazards and can safely enter into and work within the space.

Attendant. A term used to describe U.S. Federally regulated industrial workers who are qualified to be stationed outside one or more confined spaces, who monitor authorized entrants, and who perform all of the following duties:

(a) Remains outside the confined space during entry operations until relieved by another attendant

(b) Summons rescue and other needed resources as soon as the attendant determines that authorized entrants might need assistance to escape from confined space hazards

(c) Performs non-entry rescues as specified by the rescue procedure listed on the permit *(See Entry Permit)*

This term can also be used to designate rescue personnel assigned to perform the task of attendant during rescue operations involving entry-type rescue. In this case the term "Rescue Attendant" is used.

Authorized Entrant.* A term used to describe U.S. Federally regulated industrial workers who are designated to enter confined spaces and who meet the following training requirements for each specific space they enter:

(a) *Hazard Recognition.* The ability to recognize the signs and symptoms of exposure to a hazardous material or atmosphere within the space and to understand the consequences of exposure and the mode of transmission (i.e., injection, ingestion, inhalation, or absorption) for the hazard.

(b) *Communications.* The ability to carry out the method by which rescue services are to be summoned in the event of an emergency, to carry out the method by which the entrant will communicate with the attendant on the outside of the space, and to carry out a backup method of communication should the primary system fail.

(c) *Personal Protective Equipment (PPE).* The ability to use all PPE appropriate for the confined space. Proper training and documentation of training in the use of PPE is also necessary.

(d) *Self-Rescue.* The ability to carry out the method by which the entrant will escape from the space should an emergency occur. This includes self-actuated methods (such as climbing a ladder or crawling through a horizontal manway opening) as well as those methods externally applied and operated (such as a hauling system attached to the entrant and operated by the rescue team.

Blanking and Blinding. A form of hydraulic energy isolation. The absolute closure of a pipe, line, or duct by fastening a solid plate (such as a spectacle blind or skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure within the pipe, line, or duct with no leakage beyond the plate.

Confined Space.* A space that has the following characteristics:

(a) Is large enough and so configured that a person can enter and perform assigned work

(b) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits)

(c) Is not designed for continuous human occupancy

(d) Has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere

2. Contains a material that has the potential for engulfing an entrant

3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section

4. Contains any other recognized serious safety or health hazard (including fall, environmental, and equipment hazards)

Confined Space Entry. Ensuing work activities in a confined space; confined space entry is considered to have occurred as soon as any part of the entrants body breaks the plane of an opening into the space.

Confined Space Rescue Equipment. The equipment (including life safety rope, Class III harnesses, manually operated lowering and lifting devices, anchoring systems, and other adjunct rescue equipment as appropriate) used for entry-type rescue of persons from confined spaces. All equipment shall meet the appropriate standards in Chapters 3, 4, 5, and 6 established in NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components*, and shall be certified by the manufacturer as equipment designed for rescue. All equipment must be used in a manner approved by the manufacturer.

Confined Space Rescue Team (or Team).* A combination of individuals (a minimum of six for organizations operating at the technician level and a minimum of four for organizations operating at the operations level) trained, equipped, and available to respond to confined space emergencies. This team shall be trained to one of three proficiency levels: awareness, operational, or technical. A rescue team must meet the operational or technical levels to qualify as a rescue service dependent upon the type and complexity of the confined space emergency.

Confined Space Retrieval Equipment. See Retrieval Equipment.

Entry Permit.* A written or printed document, established by an employer, for nonrescue entry into confined spaces.

An entry permit authorizes specific employees to enter a confined space and contains specific information as required.

Hazardous Atmosphere for Confined Space. Any atmosphere that could expose personnel to the risk of death, incapacitation, injury, acute illness, or impairment of the ability to self-rescue, due to one or more of the following causes:

(a) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL)

(b)* Airborne combustible dust at a concentration that meets or exceeds its LFL

(c) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent

(d) Atmospheric concentration of any hazardous substance that could result in exposure to personnel in excess of its dose or permissible exposure limit (PEL)

(e) Any other atmospheric condition that is immediately dangerous to life or health (IDLH)

Rescue Attendant. A member of the rescue service who meets all requirements of Attendant as defined within this standard and who acts in that capacity during a confined space rescue. *(See also Attendant.)*

Rescue Entrant. A person entering a confined space for the specific purpose of rescue. This person shall meet the training requirements of an Authorized Entrant specific to the space to be entered for rescue and shall meet all requirements of members of the Rescue Service as defined within this standard. *(See also Authorized Entrant and Rescue Service.)*

Rescue Equipment. See Confined Space Rescue Equipment.

Rescue Service. The confined space rescue team designated by the AHJ to rescue victims from within confined spaces. This includes operational and technical levels of industrial, municipal, and private sector organizations. All rescue services shall meet the following minimum requirements:

(a) Each member of the rescue service shall be provided with, and trained to use properly, the personal protective equipment and rescue equipment necessary for making rescues from confined spaces according to their designated level of competency.

(b) Each member of the rescue service shall be trained to perform the assigned rescue duties corresponding to their designated level of competency. Each member of the rescue service shall also receive the training required of authorized rescue entrants.

(c) Each member of the rescue service shall practice making confined space rescues, in accordance with the requirements of 2-1.6 of this document, by means of simulated rescue operations in which they remove dummies, mannequins, or persons from actual confined spaces or from representative confined spaces. Representative confined spaces should — with respect to opening size, configuration, and accessibility — simulate the types of confined spaces from which rescue is to be performed.

(d) Each member of the rescue service shall be certified to the level of first responder or equivalent according to U.S Federal Department of Transportation (DOT) guidelines. Each member of the rescue service shall also successfully complete a course in cardiopulmonary resuscitation (CPR) taught through the American Heart Association (AHA) to the level of a "Health Care Provider," through the American Red Cross (ARC) to the "CPR for the Professional Rescuer" level, or through the National Safety Council's equivalent course of study.

(e)* The rescue service must be capable of responding in a timely manner to rescue summons.

(f) Each member of the rescue service shall be properly equipped, trained and capable of functioning appropriately to perform confined space rescues within the area for which they are responsible at their designated level of competency. This must be confirmed by an annual evaluation of the rescue service's capabilities to verify that the needed capabilities are present to perform confined space rescues in terms of overall timeliness, training, and equipment and of performing safe and effective rescue in those types of spaces to which the team must respond.

(g) Each member of the rescue service shall be aware of the hazards they may confront when called on to perform rescue within confined spaces for which they are responsible.

(h) If required to provide confined space rescue within U.S. Federally regulated industrial facilities, the rescue service shall have access to all Confined spaces from which rescue could be necessary so that they can develop appropriate rescue plans and practice rescue operations according to their designated level of competency.

Retrieval Equipment (or Retrieval System). Combinations of rescue equipment used for non-entry (external) rescue of persons from Confined spaces. In U.S. Federally regulated industrial facilities, these systems are required whenever an authorized entrant enters a confined space unless the retrieval system would increase the overall risk of entry or would not contribute to the rescue of the entrant. For confined space rescue operations, these systems shall be in place prior to entry (into vertical or horizontal spaces) in such a manner that retrieval of rescue entrants can begin immediately in the event of an emergency. Retrieval systems can also be used to act as fall arresting devices for rescue personnel.

5-2 Awareness.

5-2.1 Organizations operating at the awareness level shall meet the requirements of Sections 4-2 and 5-2 of this document and Chapter 2 of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents.* Organizations at this level are responsible for performing certain non-entry rescue (retrieval) operations.

5-2.2 Awareness level functions for confined space rescue incidents shall include the following:

(a)* Size-up of existing and potential conditions

(b) Initiate contact and establish communications with victims where possible

(c)* Recognition and identification of the hazards associated with non-entry confined space emergencies

(d)* Recognition of confined spaces

(e)* Procedures to perform a non-entry retrieval

(f)* Procedures for implementing the emergency response system for confined space emergencies

(g)* Procedures for implementing site control and scene management

5-3 Operations.

5-3.1 Organizations operating at the operations level shall meet the requirements of Sections 5-2 and 5-3. The organization at this level is responsible for the development and training of a confined space rescue team consistent with the requirements of this section.

5-3.2 Organizations operating at the operations level shall meet all operations level requirements specified in Section 4-3 and the requirements of a confined space rescue service as defined herein. In addition, organizations operating at the operations level shall meet all requirements specified in Section 9-2.

5-3.3 Operations level functions for confined space rescue operations shall include the following:

(a)* Procedures for protecting personnel from hazards within the confined space

(b)* Continued size-up of existing and potential conditions

(c)* Procedures for assuring personnel are capable of appropriately managing the physical and psychological challenges that effect rescuers entering confined spaces

(d)* Identify the duties of the rescue entrant(s) and back-up rescue entrant(s), rescue attendant, and rescue team leader as defined herein

(e)* Procedures to monitor continuously, or at frequent intervals, the atmosphere in all parts of the space to be entered and to monitor, in the following order, for (1) oxygen content, (2) flammability (LEL/ LFL), and (3) toxicity

(f)* Procedures for entry-type rescues into confined spaces meeting all of the following specific qualifying characteristics:

1.* The rescue does not require the use of fresh air breathing apparatus.

2.* The internal configuration of the space is clear and unobstructed so retrieval systems can be utilized for rescuers without possibility of entanglement.

3.* The victim can be easily seen from the outside of the space's primary access opening.

4.* Rescuers in appropriate PPE can pass easily through the access/egress opening(s) with room to spare.

5.* The space can accommodate two or more rescuers in addition to the victim.

6.* All hazards in and around the confined space have been identified, isolated, and controlled.

(g)* Procedures for the safe and effective use of victim packaging devices that could be employed in confined space rescue

(h) Procedures for the transfer of victim information including location, surroundings, condition when found, present condition, and other information pertinent to Emergency Medical Services (EMS)

(i)* Procedures for planning and implementing an appropriate confined space rescue operation

(j)* Procedures for selection, construction, and use of a rope lowering and raising system in the high-angle environment

5-4 Technician.

5-4.1 Organizations operating at the technician level shall meet the requirements of Sections 5-2, 5-3, and 5-4. The organization at this level is responsible for the development and training of a confined space rescue team consistent with the requirements of this section.

5-4.2* Organizations operating at the technician level shall meet the requirements in Chapter 4 of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents.*

5-4.3 Technician level functions for confined space rescue operations shall include the following:

(a)* Continued size-up of existing and potential conditions

(b)* Procedures to assure that rescue team members shall take part in a medical surveillance program

(c)* Planning response for entry-type confined space rescues in hazardous environments

(d)* Implementing the planned response

Chapter 6 Vehicle and Machinery

6-1 General Requirements.

6-1.1* Organizations operating at vehicle and/or machinery rescue incidents shall meet all the requirements specified in Chapter 2 of this standard.

6-1.2* The AHJ shall evaluate the effects of severe weather, extremely hazardous situations, and other difficult conditions to determine whether their present training program has prepared the organization to operate safely.

6-1.3 Special Definitions.

Disentanglement. The cutting of a vehicle and/or machinery away from trapped or injured victims.

Extrication. The removal of trapped victims from a vehicle or machinery.

Machinery. The moving parts of a particular machine.

Primary Access. The existing opening of doors and/or windows that provide a pathway to the trapped and /or injured victim(s).

Secondary Access. Openings created by rescuers that provide a pathway to trapped and/or injured victims.

Vehicle. A device or structure for transporting persons or things; a conveyance.

6-2 Awareness.

6-2.1 Organizations operating at the awareness level shall meet all requirements specified in Chapter 2 of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents.*

6-2.2 Awareness level functions at vehicle and machinery rescue incidents shall include the development and implementation of the following:

(a)* Procedures to conduct a size-up of existing and potential conditions

(b)* Procedures for the identification of the resources necessary to conduct safe and effective operations

(c)* Procedures for implementing the emergency response system for vehicle and/or machinery rescue incidents

(d)* Procedures for implementing site control and scene management

(e)* Recognition of general hazards associated with vehicle and/or machinery rescue incidents

(f) Procedures for the initiation of traffic control

6-3 Operations.

6-3.1 Organizations operating at the operations level shall meet all the requirements specified in Sections 6-2 and 6-3. In addition, members shall be capable of hazard recognition, equipment use, and techniques necessary to operate safely and effectively at incidents involving persons injured or entrapped in a vehicle or machinery.

6-3.2 Organizations operating at the operations level shall meet all requirements specified in Chapter 3 of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents.*

6-3.3 Operations level functions at vehicle and/or machinery rescue incidents shall include the development and implementation of the following:

(a) Procedures to identify probable victim locations and survivability

(b)* Procedures for making the rescue area safe, including the stabilization and isolation (e.g., "lock out/tag out") of all vehicles and/or machinery

(c) Procedures to identify, contain, and stop fuel release

(d) Procedures for the protection of a victim during extrication/disentanglement

(e) Procedures for the packaging of a victim prior to extrication and/or disentanglement

(f) Procedures for accessing victims trapped in a vehicle and/or machinery

(g)* Procedures for performing extrication and disentanglement operations involving packaging, treating, and removing victims trapped in vehicles and/or machinery through the use of hand tools

(h)* Procedures for the mitigation and management of general and specific hazards (i.e., fires and explosions) associated with vehicle and/or machinery rescue incidents

(i) Procedures for the procurement and utilization of the resources necessary to conduct safe and effective vehicle and/or machinery rescue operations

(j) Procedures for maintaining control of traffic at the scene of vehicle and/or machinery rescue incidents

6-4 Technician.

6-4.1 Organizations operating at the technician level shall meet all the requirements specified in Sections 6-2, 6-3, and 6-4. In addition, members shall be capable of hazard recognition, equipment use, and techniques necessary to operate and effectively supervise at vehicle and/or machinery rescue incidents.

6-4.2 Technician level functions at vehicle and/or machinery rescue incidents shall include the development and implementation of the following:

(a)* Procedures for performing extrication and disentanglement operations involving packaging, treating, and removing victims injured and/or trapped in large/heavy vehicles and/or machinery

(b)* Procedures for the advanced stabilization of unusual vehicle and machinery rescue situations

(c)* Procedures for the use of all specialized rescue equipment immediately available and in use by the organization

Chapter 7 Water

7-1 General Requirements.

7-1.1 Organizations operating at water incidents shall meet all the requirements specified in Chapter 2 of this standard.

7-1.2* The AHJ shall evaluate the effects of severe weather, extreme water conditions, and other difficult conditions to determine whether the present training program has prepared the organization to operate safely.

7-1.3 Special Definitions.

Alternate Air System. A secondary air supply system that involves an alternate second-stage regulator provided by either a separate dedicated second-stage or a multi-purpose second-stage regulator coupled with a buoyancy compensator inflator valve.

Dive. An exposure to increased pressure whether underwater or in a hyperbaric chamber.

Diver. An individual using breathing apparatus that supplies compressed breathing gas at the ambient pressure.

Dive Operation. A situation requiring divers to complete an assigned task.

Dive Team. An organization of public safety divers and members in training.

Public Safety Diver. An individual who performs public safety diving as defined herein.

Public Safety Diving. Underwater diving, related to team operations and training, performed by any member, group, or agency of a community or government-recognized public safety diving or water rescue team.

"Reach, Throw, Row, Go." The four sequential steps in water rescue with progressively more risk to the rescuer. Specifically, a "go" rescue involves physically entering the medium (e.g., in the water or on the ice).

Redundant Air System. An independent secondary underwater breathing system (i.e., pony bottle with first and second stage, or a pony bottle supplying a bailout block).

Safety Diver. An on-site diver available in a sufficient state of readiness to assist another diver in the water.

Swift Water. Water moving at a rate greater than one knot (1.15 mph).

Tender. An individual trained in the responsibilities of diver safety who provides control of search patterns from the surface of the water.

Water Hazard Zone. In water rescue, the water hazard zone includes the area covered by water or ice.

Watermanship Skills. Capabilities that include swimming, surface diving, treading water, and staying afloat with a reasonable degree of comfort appropriate to the required task.

7-2 Awareness.

7-2.1 Organizations operating at the awareness level shall meet all the requirements in Section 7-2. All members of organizations at the awareness level shall meet the requirements of "competent person" as defined in Section 1-3 of this standard.

7-2.2 Awareness level functions at water incidents shall include the development and implementation of the following:

(a)* Procedures for implementing the assessment phase.

(b)* Procedures for size-up of existing and potential conditions

(c)* Procedures for the identification of the resources necessary to conduct safe and effective water operations.

(d)* Procedures for implementing the emergency response system for water incidents

(e)* Procedures for implementing site control and scene management

(f)* Procedures for recognition of general hazards associated with water incidents and the procedures necessary to mitigate these hazards within the general rescue area

(g) Procedures to determine rescue vs. body recovery

7-3 Operations.

7-3.1 Organizations operating at the operations level shall meet all the requirements specified in Section 7-2.

7-3.2 For the purposes of this standard, there shall be four separate water-related disciplines for the operations level: dive, ice, surf, and swiftwater.

7-3.3* Organizations operating at the operations level shall meet all the requirements specified in 7-3.1 through 7-3.5. Organizations operating at the operations level of one or more specific disciplines shall meet the requirements of 7-3.1 through 7-3.5 as they relate to the specific discipline as well as the specific requirements (given in 7-3.6, 7-3.7, 7-3.8, or 7-3.9) of that discipline.

7-3.4* For personnel operating in the hazard zone, the minimum personal protective equipment (PPE) provided shall include the following:

(a) Personal flotation device (PFD)

(b) Thermal protection

(c)* Helmet appropriate for water rescue

(d) Cutting device

(e) Whistle

(f) Contamination protection (as needed)

7-3.5 Operations level functions at all water incidents shall include the development and implementation of the following:

(a)* Procedures to insure personal safety at water operations

(b)* Procedures to assess water conditions in terms of hazards to the victim and rescuer

(c) Procedures to separate, isolate, secure, and interview witnesses

(d)* Procedures to determine the method of victim entrapment

(e)* Procedures to evaluate the progress of the planned response to ensure the objectives are being met safely, effectively, and efficiently

(f)* Procedures to safely and effectively conduct shore-based rescue operations

(g)* Procedures using throw bags

(h)* Procedures to supply assistance with rigging and mechanical advantage systems to technician level personnel

(i) Procedures to deploy, operate, and recover any watercraft used by the organization

(j)* Procedures for survival swimming and self rescue

(k)* Procedures for identifying and managing heat and cold stress to the rescuer while utilizing PPE

(l) Procedures for the safe and effective use of victim packaging devices that could be employed by the organization for water rescue

(m)* Procedures for the transfer of victim information including location, surroundings, condition when found, present condition, and other information pertinent to Emergency Medical Services (EMS)

(n)* Procedures for boat-assisted and boat-based operations if boats are used by the organization

(o) A plan to meet operational objectives

(p)* Procedures for rapid extrication of accessible victims

(q) Procedures for surface water-based search operations

7-3.6 Dive. Operations level functions at dive incidents shall include the development and implementation of the following:

(a)* Procedures for the recognition of the unique hazards associated with dive operations

(b)* Procedures for serving as surface support personnel

(c) Procedures for the identification of water characteristics

(d)* Procedures for the operation of surface support equipment used in water operations

(e) Procedures for procuring the necessary equipment to perform dive operations

(f) Procedures for the safe entry and recovery of divers from the water

(g)* Procedures for participating in safe dive operations in any climate the organization may encounter

7-3.7 Ice. Operations level functions at ice rescue incidents shall include the development and implementation of the following:

(a)* Procedures for the recognition of the unique hazards associated with ice rescue operations

(b)* Procedures for the identification of water and ice characteristics

(c)* Procedures for the operation of surface support equipment used in water/ice rescue operations

(d) Procedures for procuring the necessary equipment to perform ice rescue operations

(e)* Procedures to recognize and deal with a victim's hypothermia

(f) Procedures for the safe entry of divers into the water through an ice hole, if ice diving is performed by the organization

7-3.8 Surf. Operations level functions at surf rescue incidents shall include the development and implementation of the following:

(a)* Procedures for the recognition of the unique hazards associated with surf rescue operations

(b) Procedures for the operation of surface support equipment used in surf rescue operations

(c) Procedures for procuring the necessary equipment to perform surf rescue operations

(d)* Procedures for self rescue and survival swimming in surf

7-3.9 Swift Water.

7-3.9.1 Organizations operating at the Operations Level shall meet all the Operations level requirements specified in Section 4-3 of this standard.

7-3.9.2 Operations level functions at swift water rescue incidents shall include the development and implementation of the following:

(a)* Procedures to assess moving water conditions, characteristics, and features in terms of hazards to the victim and rescuer

(b) Procedures to determine the method of victim entrapment

(c)* Procedures for using tag lines and tension diagonals (zip lines)

(d)* Procedures for self rescue and survival swimming in swift water

7-4 Technician.

7-4.1 Organizations operating at the technician level shall meet all the requirements specified in 7-3.1 through 7-3.5.

7-4.2 For the purposes of this standard, there shall be four separate water-related disciplines for the technician level: dive, ice, surf, and swiftwater.

7-4.3 Organizations operating at the technician level shall meet all the requirements specified in 7-4.1 through 7-4.6. Organizations operating at the technician level of one or more specific disciplines shall meet the requirements of 7-4.1 through 7-4.6 as they relate to the specific discipline as well as the specific requirements (given in 7-4.7, 7-4.8, 7-4.9, or 7-4.10) of that discipline.

7-4.4 Organizations operating at the technician level shall meet all the awareness level requirements specified in NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*.

7-4.5 Personnel operating within an organization at the technician level shall possess a level of watermanship skill and comfort appropriate to the required task.

7-4.6 Technician level functions at all water rescues shall include the development and implementation of the following:

(a) Procedures required to plan a response within the capabilities of available resources

(b) Procedures to implement a planned response consistent with the organization's capabilities

(c)* Procedures for conducting both boat-assisted and boat-based rescues

(d)* Procedures to conduct a "go" rescue

7-4.7 Dive.

7-4.7.1* At the entry level and for any specialties utilized by an organization at the technician level, the AHJ shall provide certification by a nationally recognized agency. The curriculum for such certification shall be oriented toward the needs and operational requirements of public safety diving as defined herein.

7-4.7.2 Annual fundamental SCUBA skill reviews shall be conducted to maintain public safety diver capability.

7-4.7.3 Technician level functions at dive incidents shall include the development and implementation of the following:

(a)* Procedures for skin and SCUBA diving, including the use of any associated equipment

(b) Procedures for the application of physics and physiology as it relates to the underwater environment

(c)* Procedures for the safe use of dive tables

(d) Procedures for dealing with the various underwater environments with which the rescue diver could come into contact

(e) Procedures for avoiding and dealing with underwater plants and animals

(f) Procedures for the safe conduct and supervision of dive operations

(g) Procedures for the use of relevant search theory and techniques

(h)* Procedures for the identification and management of dive-related maladies including air embolism and decompression sickness

(i) Procedures for recognizing and managing the impact of near-drowning in cold water

(j)* Procedures for effective underwater communication

7-4.8 Ice.

7-4.8.1 Technician level functions at ice rescue incidents shall include the development and implementation of the following:

(a)* Procedures for self-rescue unique to ice rescue

(b) Procedures for reach, throw, row, and go technique rescues unique to ice rescue

(c) Procedures for the use of watercraft, specialty craft, and specialty equipment unique to ice rescue

7-4.9 Surf.

7-4.9.1 Technician level functions at surf rescue incidents shall include the development and implementation of the following:

(a) Procedures for reach, throw, row, and go technique rescues unique to surf rescue

(b) Procedures for the use of watercraft, specialty craft, and specialty equipment unique to surf rescue

7-4.10 Swift Water.

7-4.10.1 Organizations operating at the Technician level shall meet all the Technician Level requirements specified in section 4-4 of this standard.

7-4.10.2 Technician level functions at swift water rescues shall include the development and implementation of procedures for the application of rope rescue techniques in the swift water environment.

Chapter 8 Wilderness Search and Rescue

8-1 General Requirements.

8-1.1 Organizations operating at wilderness search and rescue incidents shall meet all the requirements specified in Chapter 2 of this standard.

8-1.2* The AHJ shall evaluate the effects of severe weather, extreme heights, difficult terrain, high altitude operations, and other difficult conditions to determine whether their present training program has prepared the organization to operate safely.

8-1.3 Special Definitions.

Avalanche. A mass of snow — sometimes containing ice, water, and debris — that slides down a mountainside. A small, and often harmless, avalanche is called a "sluff."

Compass. A device that uses the earth's magnetic field to indicate relative direction.

Environment. A collection of characteristics such as weather, altitude, and terrain contained in an area that are unique to a location. Examples include desert, alpine/mountain, arctic, rain forest, sea shore, and so forth.

SAR. Search and rescue.

Terrain. Specific natural and topographical features within an environment. Examples include cliffs, steep slopes, rivers, streams, valleys, fields, mountainside, beach, and so forth.

Terrain Hazard. Specific terrain feature, or feature-related condition, that exposes one to danger and the potential for injury and/or death. Examples include cliffs, caves, wells, mines, avalanche, rock slides, and so forth.

Topographical Map. A graphical representation of the earth's surface, drawn to scale and reproduced in two dimensions, which reflects the topographical features of the area depicted.

Wilderness. An uncultivated, uninhabited and natural area usually, but not necessarily, far from human civilization and trappings. The wilderness often includes a collection of various environments such as forests, mountains, deserts, natural parks, animal refuges, rain forests, and so forth. Depending on terrain and environmental factors, the wilderness can be as little as a few minutes into the backcountry or less than a few feet off the roadway. Incidents with only a short access time could require an extended evacuation and thus qualify as a wilderness incident.

8-2 Awareness.

8-2.1 Organizations operating at the awareness level shall meet the requirements of Section 8-2.

8-2.2 Members of organizations at the awareness level shall be permitted to assist in support functions on a wilderness search/rescue operation but shall not be deployed into the wilderness.

8-2.3 Awareness level functions at a wilderness incident shall include the following:

(a)* Conducting a size-up of existing and potential conditions

(b)* Developing and implementing procedures for implementing the emergency response system for wilderness SAR

(c)* Implementing site control and scene management

(d)* Recognition of the general hazards associated with wilderness search and rescue incidents

(e) Recognition of the type of terrain involved in wilderness search and rescue incidents

(f)* Recognition of the limitations of conventional emergency response skills and equipment in various wilderness environments

(g)* Initiating the collection and recording of information necessary to assist operational personnel in a wilderness search and rescue

(h)* Identification and isolation of the reporting party(s) and witnesses

8-3 Operations.

8-3.1 Organizations operating at the operations level shall meet the requirements of Section 8-2. In addition, organizations operating at the operations level shall meet all the requirements specified in Section 4-3.

8-3.2* Operations level functions performed in the wilderness shall be under the supervision of personnel from technician level organizations. The AHJ shall establish standard operating procedures that identify the specific environments in which operations level personnel can safely operate. Outside of these specific environments, personnel from technician level organizations or special resources shall be utilized.

8-3.3 Operations level functions at a wilderness incident shall include the following:

(a)* Requesting and interfacing with wilderness search and rescue resources

(b)* Providing the specialized medical care that is unique to the wilderness environment

(c)* Personal survival, body management, and preparedness for the specific wilderness environments in which the rescuer could become involved

(d) Recognition of the need for, and procedures and equipment for the provision of, environmental protection through clothing systems appropriate for the specific wilderness environments in which the rescuer could become involved

(e)* Selection, care, and use of appropriately packed and carried personal medical and support equipment

(f)* The ability to travel safely through various wilderness environments in which the rescuer could become involved

(g) Land navigation techniques using map and compass as well as any methods of navigation and position reporting utilized by the responding organizations with which the rescuer could become involved

(h) Procurement of any necessary maps and navigational and topographical information

(i) Modifying actions and urgency appropriately for a rescue versus a body recovery

(j) Acquiring information on current and forecast weather including temperature, precipitation, and winds

(k)* Participating in and supporting wilderness search operations intended to locate victims whose exact location is unknown

(l) Accessing, as well as extricating, victims in any specific wilderness environments and terrain encountered in the response area

(m) Utilization, recognition, and identification of all rescue hardware and software used by the responding organizations with which the rescuer could become involved

(n) Ability to work safely in and around any aircraft, watercraft, and special vehicles used for SAR operations

(o)* Recognition of the team's limitations regarding accessing and/or evacuating a victim

8-4 Technician.

8-4.1 Organizations operating at the technician level shall meet the requirements of Sections 8-2 and 8-3. In addition, organizations operating at the technician level shall meet the requirements of Sections 4-4 and 7-2.

8-4.2 Organizations operating at the technician level shall be capable of performing and supervising wilderness technical rescue incidents that involve both search and rescue operations.

8-4.3 Wilderness rescue organizations at the technician level shall not be required to specialize in all aspects of wilderness rescue. The ability of the team to respond at the technician level in one aspect shall not imply the ability to respond at the technician level in all aspects of wilderness rescue.

8-4.4 Technician level functions at a wilderness incident shall include the following:

(a) Acquisition, utilization, and coordination of search and rescue resources with which the rescuer could become involved

(b) Developing or providing input to necessary standard operating procedures for anticipated wilderness responses

(c)* Performing search and rescue operations in the wilderness

(d)* Developing and implementing an operational plan for search and rescue

Chapter 9 Trench and Excavation

9-1 General Requirements.

9-1.1 Organizations operating at trench and excavation incidents shall meet all the requirements specified in Chapter 2 of this standard.

9-1.2* The AHJ shall evaluate the effects of severe weather, extremely hazardous trench or excavation situations, and other difficult conditions to determine whether their present training program has prepared the organization to operate safely.

9-1.3 Special Definitions.

Accepted Engineering Practices. Those requirements that are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring. Pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such a system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

Angle of Repose. The greatest angle above the horizontal plane at which loose material (such as soil) will lie without sliding.

Bell-Bottom Pier Hole. A type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a bell shape.

Benching or Benching System. A method of protecting employees from cave-ins by excavating the side of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-In. The separation of a mass of soil or rock material from the side of an excavation or trench, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Collapse Zone. See Rescue Area.

Cross Braces (or Struts). The individual horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales. *(See also Shoring.)*

Excavation. Any man-made cut, cavity, trench, or depression in an earth surface, formed by the removal of earth.

Face(s). The vertical or inclined earth surface formed as a result of excavation work.

Failure. The breakage, displacement, or permanent deformation of a structural member or connection that reduces its structural integrity and its supportive capabilities.

Grade Pole. A wood or fiberglass pole, either cut to a certain length or provided with markings, used by workers when setting pipes on grade.

Isolation System (or Isolation Devices). An arrangement of devices, applied with specific techniques, that collectively serve to isolate a victim of a trench or excavation emergency from the surrounding product (e.g., soil, gravel, sand, etc.). Examples of isolation devices include concrete or steel pipe, corrugated pipe, concrete vaults, or other pre-engineered structures that sufficiently isolate and protect the victim.

Laser Target. A square or rectangular plastic device used in conjunction with a laser instrument to set the line and grade of pipe.

One-Call Utility Location Service. A service from which contractors, emergency service personnel, and others can obtain information on the location of underground utilities in any area.

Panel. See Traditional Sheeting.

Panel Team. The group of individuals, with established communications and leadership, assigned to construct (if necessary), move, place, and manage panels (traditional sheeting panels) both inside and outside the space, trench, or excavation.

Pier Hole (or Bell-Bottom). A type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a bell shape.

Protective System. A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Sheeting. The members of a shoring system who support the sides of an excavation and are in turn supported by other members of the shoring system.

Shield (or Shield System). A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structures. Shields can be permanent structures of can be designed to be portable and moved along. Shields can be either manufactured or job-built in accordance with 29 CFR 1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (or Shoring System). A structure such as a metal hydraulic, pneumatic/mechanical, or timber shoring system that supports the sides of an excavation and is designed to prevent cave-ins.

Shoring Team. The group of individuals, with established communications and leadership, assigned to construct, move, place, and manage the shoring or shoring system inside the space, trench, or excavation.

Sides. See Faces.

Sloping system. A protecting system that uses inclined excavating to form sides that are inclined away from the excavation so as to prevent cave-in. The angle of incline required to prevent a cave-in varies with the differences in such factors as soil type, environmental conditions of exposure, and application of surcharge loads. *(See also Angle of Repose.)*

Support System. A structure — such as underpinning, bracing, or shoring — that provides support to an adjacent structure, underground installation, or the sides of an excavation.

Strongback. See Uprights.

Surcharge Loads. Any weight near the lip of the trench that increases the likelihood of instability or secondary cave-in.

Tabulated Data. Any set of site-specific design data used by a professional engineer to design a protective system at a particular location. Also, the term is applied to six tables found in Appendix C of 29 CFR 1926, Subpart P.

Testing. The process by which the hazards that could confront entrants of a trench or excavation are identified and evaluated. Testing includes specifying tests that are to be performed in a trench or excavation.

Traditional Sheeting and Shoring. The use of 4 ft × 8 ft (1.2 mm × 2.4 mm) sheet panels, with a strongback attachment, supplemented by a variety of conventional shoring options such as hydraulic, screw, and/or pneumatic shores. Some newer style sheeting and shoring might not require a strongback attachment (refer to manufacturer recommendations).

Trench (or Trench Excavation). A narrow (in relation to its length) excavation made below the surface of the earth. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is no greater than 15 ft (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 ft (4.6 m) or less, the excavation is also considered a trench.

Trench Box (or Trench Shield). A manufactured protection system unit made from steel, fiberglass, or aluminum that is placed in a trench to protect workers from cave-in and that can be moved as a unit. *(See also Shield.)*

Trench Emergency. Any failure of hazard control or monitoring equipment or other event(s) inside or outside a trench or excavation that could endanger entrants within the trench or excavation.

Supplemental Sheeting and Shoring. Sheeting and shoring operations that involve the use of commercial sheeting/shoring systems and/or isolation devices or that involve cutting and placement of sheeting and shoring when greater than two feet of shoring exists below the bottom of the strongback. Supplemental sheeting and shoring requires additional training beyond that of traditional sheeting and shoring.

Uprights (or Strongback). The vertical members of a trench shoring system placed in contact with the earth, usually held in place against sections of sheeting with shores, and positioned so that individual members do not contact each other. Uprights placed so that the individual members are closely spaced, in contact with, or interconnected to each other are considered "sheeting."

Wales (or Walers or Stringers). Horizontal members of a shoring system placed parallel to the excavation face and whose sides bear against the vertical members of a shoring system or earth.

9-2 Awareness.

9-2.1 Organizations operating at the awareness level shall meet all requirements specified in Section 5-2 within this standard, the requirements in Chapter 2 of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*, and the definition of "competent person."

9-2.2 Awareness level functions at trench and excavation emergencies shall include the following:

(a)* Size-up of existing and potential conditions

(b)* Identification of the resources necessary to conduct safe and effective trench and excavation emergency operations

(c)* Develop and implement procedures for carrying out the emergency response system for trench and excavation emergency incidents

(d)* Develop and implement procedures for carrying out site control and scene management

(e)* Recognition of general hazards associated with trench and excavation emergency incidents and the procedures necessary to mitigate these hazards within the general rescue area

(f)* Recognition of typical trench and excavation collapse patterns, the reasons trenches and excavations collapse, and the potential for secondary collapse

(g)* Develop and implement procedures for making a rapid, non-entry extrication of non- or minimally-injured victim(s)

(h)* Recognition of the unique hazards associated with the weight of soil and its associated entrapping characteristics

9-3 Operations.

9-3.1* Organizations operating at the operations level shall meet all requirements specified in Section 9-2. In addition, members shall be capable of hazard recognition, equipment use, and techniques necessary to operate safely and effectively at trench and excavation emergencies, including the collapse or failure of individual, nonintersecting trenches with an initial depth of 8 ft or less where no severe environmental conditions exist, digging operations do not involve supplemental sheeting and shoring, and only traditional sheeting and shoring are used.

9-3.2 Organizations operating at the operations level shall meet all requirements specified in Sections 4-3, 5-3, and 6-3.

9-3.3 Operations level functions at trench and excavation emergencies shall include the following:

(a) Develop and implement procedures to make an entry into a trench or excavation rescue area

(b)* Recognition of unstable areas associated with trench and excavation emergencies and adjacent structures

(c)* Develop and implement procedures to identify probable victim locations and survivability

(d)* Develop and implement procedures for making the rescue area safe, including the identification, construction, application, limitations, and removal of traditional sheeting and shoring using tabulated data and approved engineering practices

(e)* Develop and implement procedures for initiating a "one call" utility locating system

(f)* Identification of soil types using accepted visual or manual tests

(g) Develop and implement procedures to ventilate the trench or excavation space

(h) Identification and recognition of a bell-bottom excavation (pier hole) and its associated unique hazards

(i) Develop and implement procedures for placing ground pads and protecting the "lip" of a trench or excavation

(j)* Develop and implement procedures to provide entry and egress paths for entry personnel

(k)* Develop and implement procedures for conducting a pre-entry briefing

(l)* Develop and implement procedures for record keeping and documentation during entry operations

(m)* Develop and implement procedures for implementing and utilizing a rapid intervention team (RIT) as specified in Section 6-5 of NFPA 1500, *Fire Department Occupational Safety and Health Program.*

(n) Develop and implement procedures for the selection, utilization, and application of shield systems

(o)* Develop and implement procedures for the selection, utilization, and application of sloping and benching systems

(p) Identification of the duties of panel teams, entry teams, and shoring teams

(q) Develop and implement procedures for assessing the mechanism of entrapment and the method of victim removal

(r)* Develop and implement procedures for performing extrication

9-4 Technician.

9-4.1* Organizations operating at the technician level shall meet all requirements specified in Sections 9-2 and 9-3. In addition, members shall be capable of hazard recognition, equipment use, and techniques necessary to operate safely and effectively at trench and excavation emergencies, including the collapse or failure of individual or intersecting trenches with an initial depth of more than 8 ft (2.4 m) or where severe environmental conditions exist, digging operations involve supplemental sheeting and shoring, or manufactured trench boxes and/or isolation devices would be used.

9-4.2 Organizations operating at the technician level shall meet all requirements specified in Sections 5-4 and 6-4.

9-4.3 Technician level functions at trench and excavation emergencies shall include the development and implementation of the following:

(a)* Procedures for the identification, construction, application, limitations, and removal of manufactured protective systems using tabulated data and approved engineering practices

(b)* Procedures to continuously, or at frequent intervals, monitor the atmosphere in all parts of the trench to be entered. This shall be done, in the following order, for (1) oxygen content, (2) flammability (LEL/LFL), and (3) toxicity

(c) Procedures for the identification, construction, application, limitations, and removal of supplemental sheeting and shoring systems designed to create approved protective systems

(d) Procedures for the adjustment of protective systems based on digging operations and environmental conditions

(e)* Procedures for rigging and placement of isolation systems

Chapter 10 Referenced Publications

10-1 The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix C.

10-1.1 **NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*, 1997 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 1997 edition.

NFPA 1521, *Standard for Fire Department Safety Officer*, 1997 edition.

NFPA 1561, *Standard on Fire Department Incident Management System*, 1995 edition.

NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components*, 1995 edition.

10-1.2 Other Publications.

10-1.2.1 Superintendent of Documents Publication. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

29, *Code of Federal Regulations*, 1926 Subpart P, Appendix A, B and C.

29, *Code of Federal Regulations*, 1926.652 (c)(3) and (c)(4) (Shield Systems)

FEMA USAR Response System, Appendix C (Task Force Building Marking System)

U.S. Dept. of Transportation, First Responder Guidelines

10-1.2.2 American Hospital Association

AHA Health Care Provider CPR

10-1.2.3

ARC CPR for Professional Rescuer

National Safety Council equivalent to ARC CPR for Professional Rescuer

10-1.2.4 Incident Command System, ISBN 0-87939-051-4, First Edition 10/83, Fire Protection Publications, Oklahoma State University, Stillwater, OK 74078)

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

A-1-1.1 This standard was developed to define levels of preparation and operational capability that should be achieved by any AHJ that has responsibility for technical rescue operations. These defined levels provide an outline for a system to manage an incident efficiently and effectively in order to maximize personnel safety, the successful rescue of victims, and the eventual termination of the event.

The system should be followed to increase the capabilities of the AHJ to deal successfully with even the most complex incident. The system progresses from the simple basic awareness level, to the operations level, and finally to the technician level. It should be understood that, as the system expands, the requirements for training, operational skills, management ability, and types and amounts of equipment also expand.

A-1-1.2 These include rescue, fire suppression, and emergency services including agencies such as fire departments, law enforcement, emergency medical services, utility, public works, and rescue organizations.

A-1-2 An organization may achieve its desired level of operational capability through the use of external resources that operate at the desired level of operational capability.

A-1-3 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A-1-3 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A-1-3 Federal Response Plan. To facilitate the provision of Federal assistance, the Federal Response Plan breaks Federal response into twelve functions which are called Emergency Support Functions or ESFs (ESF#9 is Urban Search and Rescue). The Plan is applicable to natural disasters such as earth quakes, hurricanes, typhoons, tornadoes, and volcanic eruptions; technological emergencies involving radiological or hazardous material releases; and other incidents requiring Federal assistance under the Stafford Act.

A-2-1.5 BLS is the minimum level of medical care required; advanced life support (ALS) is recommended. The AHJ should consider the development of an advanced capability in medical response to reflect the needs of the technical rescue environment.

The AHJ, in addition to BLS training, should provide training in the treatment of the following medical conditions:

(a) *Cervical/Spinal Immobilization.* Training should be integrated with systems for vertical and horizontal patient evacuations (e.g., patient packaged onto a stokes stretcher and secured to provide spinal immobilization).

(b) *Crush Injury Syndrome.* Training should include recognition, evaluation, and treatment, prior to extrication, of victims with symptoms or mechanism of injury potential.

(c) *Amputation.* Amputation should be considered as a last resort, but rescuers should be aware of the possibility. Incident managers also should be aware of the proper procedures to be followed in their community, including interaction with local medical doctors.

(d) *Infection Control.* Training should include education in protective equipment (e.g., gloves, masks, PPE, etc.), protective procedures (e.g., avoiding contaminants and pollutants), and appropriate decontamination following possible exposures, as specified in NFPA 1581, *Standard on Fire Department Infection Control Program*, or in OSHA's "Blood-Borne Pathogens" standard (29 CFR 1910.1030).

(e) *Critical Incident Stress.* Training should include information on personal well-being, with emphasis on preconditioning, pacing of effort, proper diet and rest, and emotional and psychological diversions during long-term operations. Personnel should be trained to recognize the signs and symptoms of critical incident stress. Scene managers should be trained in the value of rehabilitation efforts during extended operations for the safety and continued efficiency of their personnel.

A-2-1.6.2 This documentation shall contain each recipients name, the signatures or initials of the trainers, the dates of training, an outline of the training conducted, and resource materials used to develop the training.

A-2-1.9 Legal considerations impact on many phases of a technical rescue incident (e.g., confined space regulations, use/maintenance of SCBA, Right of Entry laws during a search, Right to Privacy laws during an investigation, etc.). Whatever the capacity in which a rescuer functions (public or private), it is important that the rescuer be informed regarding all relevant legal restrictions, requirements, obligations, standards, and duties. Failure to do so could jeopardize the reliability of any investigation or operation and could subject the rescuer to civil liability or criminal prosecution.

A-2-2.1 A hazard and risk assessment is an evaluation and analysis of the environment and physical factors influencing the scope, frequency, and magnitude of technical rescue incidents and the impact and influence they can have on the ability of the AHJ to respond to and safely operate at these incidents.

The goal and terminal objectives of the hazard and risk assessment are to increase the awareness of the AHJ and to provide a focus toward conditions and factors associated with potential technical rescue responses.

The hazard and risk assessment can be associated closely with similar functional and format methodology, as might be incorporated in a master plan or strategic deployment study. It is not the intent of this standard to encumber the AHJ in its undertaking of a detailed and extensive analysis of each technical rescue environment within the jurisdiction, but this standard is meant to be a document that provides means for a deliberate and objective examination of common or unique factors that can be identified, correlated, or highlighted to aid in the development of technical rescue capabilities and to determine their necessary level of expertise in order to provide risk reduction.

A-2-2.3 As part of the risk assessment, the AHJ should identify the types of internal resources immediately available, within the operational structure of the organization, that could be utilized for technical rescue incident response. The resources should include the availability of personnel; training levels of personnel; professional specialty or trade skills; and type, quantity, and location of equipment, appliances, and tools applicable to technical rescue incident response.

A-2-2.4 The research and documentation of available external resources that can augment the internal capabilities of the AHJ form a crucial component in its overall ability to respond and operate at technical rescue incidents.

Due to the potential complexity of related technical rescue incidents and the variety of conditions and factors that can exist at site-specific or large-scale incidents, external resource allocation

and deployment becomes a necessity in order to support the search and rescue function. The AHJ can develop a comprehensive list of those resources that can aid the responding agency by first identifying those factors that currently can limit its overall response capability by using the hazard and risk assessment evaluation. Once limitations or resource deficiencies are identified, the AHJ can develop a resource database by reviewing those firms or businesses that are located within the jurisdiction. The telephone directory for the jurisdiction is an excellent reference that provides general categories and listing headings for companies, firms, and agencies that can become sources for resource allocation.

The identification of area needs can be associated with four general categories. These include, but are not limited to the following:

(a) Technical services
(b) Equipment
(c) Supplies
(d) Services

In addition, the AHJ should identify and contact local professional societies, associations, and trade groups that can become excellent sources for technical support and resource development.

Such professional groups could include the following:

(a) American Institute of Architects (AIA)
(b) American Society of Consulting Engineers (ASCE)
(c) Association of Building Contractors (ABC)
(d) Local or Regional Builders Exchange
(e) Construction Specification Institute (CSI)
(f) American Society of Safety Engineers (ASSE)
(g) American Public Works Association (APWA)
(h) Association of General Contractors (AGC)
(i) International Association of Bridge, Structural and Ornamental Iron Workers
(j) National Association of Demolition Contractors.

The development of a community resource directory based upon these contacts, documents and makes readily available the variety of resources that might be needed in the event of a technical rescue incident. The community resource directory should include information on each firm, company, or agency appearing in the directory. A profile of the specialized resource(s) available, along with contact person(s) information, including telephone numbers for both home and work, also should be included.

Although the compiled data can be entered and stored on a computer database, a binder or book-formatted system should be used to adapt easily for field use. The use of lap-top computer notebooks with disk-formatted data can also prove useful, and consideration should be given to the longevity and portability provided by battery packs.

Memorandums of Agreement (MOA) should be developed that outline specifications for equipment and resource allocation, availability of services and procedures for procurement, and subsequent financial reimbursement for services or equipment supplied.

In addition to the types of resources previously identified, the AHJ also should consider the development of a resource guide for the procurement of technical services from individuals associated with specific groups or agencies. This resource guide could include profiles of personnel, such as canine handlers, search dogs, technical rescue specialists, industrial hygienists, riggers, and so forth, who, on an on-call basis, could respond and augment on-scene resources.

The AHJ should not disregard resource acquisition requests to agencies and groups outside the immediate boundaries of the jurisdiction. Regional, statewide, and national resource identification could be developed based on the overall projected needs identified by evaluation of the hazard and risk assessment.

Depending on the size and magnitude of the on-scene incident, resource availability might not be adequate for incident logistical needs, or the resources might be affected by whatever caused the incident, especially where a large area within the jurisdiction is part of the overall incident conditions. Such could be the case in an earthquake, hurricane, flooding, or other large-scale natural disaster.

Regional, multistate, or national deployment of specialized rescue teams or task forces should be considered in the development of the overall resource directory in order to provide additional capabilities as incident conditions and incident magnitude necessitate.

A-2-2.5 The intent of this provision is to establish procedures to enable the incident commander to obtain the necessary resources to augment the internal capabilities of the AHJ. These resources can include, but are not limited to, the following:

(a) Mutual aid agreements

(b) Agreements with the private sector, including the following:

1. Organizations specializing in the specific skills and/or equipment required to resolve the incident
2. Special equipment supply companies
3. Related technical specialists
4. Communications
5. Food service
6. Sanitation

(c) Memorandums of Agreement (MOA) with other public, state, or federal agencies

A-2-4.1.1 Specific specialized equipment that might be required for safe technical rescue operations includes the following:

(a) Supplied line breathing apparatus (SLBA), supplied air breathing apparatus (SABA), and supplied air respirator (SAR), all of which should meet the requirements of 29 CFR 1910.146, "Confined Space Operations"

(b) Personal alert safety system (PASS), which should meet the requirements of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and NFPA 1982, *Standard on Personal Alert Safety Systems (PASS) for Fire Fighters*

(c) Life safety ropes and system components, which should meet the requirements of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components*

(d) Communications equipment, which should meet the requirements of 29 CFR 1910.146, "Confined Space Operations"

(e) Lighting equipment (e.g., flashlights, helmet-mounted lamps), which should be, depending on the situation, intrinsically safe or explosion proof as defined by 29 CFR 1910.146, "Confined Space Operations"

The AHJ should evaluate the appropriateness of the equipment at an emergency incident with regard to the existing hazards.

A-2-4.2.4 Depending on local conditions, divers should consider the use of CGA Grade E air.

A-2-5.1.4 BLS is the minimum level required; ALS is recommended.

A-2-5.2.2 Some organizations use helmets, helmet appliques, or vests with fluorescent retro reflective material to identify the safety officer(s) readily.

A-2-5.3.1 The incident management system utilized at all technical rescue incidents should be structured to address the unique groups, divisions, or branches that may be necessary to effectively manage the specific type of incident (e.g., structural collapse, trench/excavation cave-in, etc.).

Managing external influences such as family, news media, and political entities includes instructing subordinates in how to deal with them should they be encountered.

NFPA 1561, *Standard on Fire Department Incident Management System*, in 3-2.2.1, describes the use of an information officer (a member of the command staff) to address these types of influences. Where encounters with family, news media, or political

influences are likely, such a function should be filled as soon as possible.

A-2-5.4 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, etc.) that may impair their ability to perform rescue in a specific environment.

A-3-1.2 In all types of structural collapse rescue incidents, the potential exists for extenuating circumstances that would require expertise beyond the normal capability of the organization to safely operate. Examples of these situations may include, but are not limited to, multiple collapse sites, large number of victims, numerous deeply buried victims, multiple complications (e.g., both deeply buried victims and multiple sites), involvement of hazardous/toxic substances, or severe environmental conditions (e.g., snow and rain). These conditions should be evaluated during the initial risk assessment and on an incident-by-incident basis.

A-3-1.3 FEMA Task Force Structure Marking System, Structure Identification Within a Geographic Area. See FEMA US&R Response System, Appendix C, "Task Force Building Marking System."

A-3-1.3 FEMA Task Force Search and Rescue Marking System. See FEMA US&R Response System, Appendix C, "Task Force Building Marking System."

A-3-1.3 FEMA Task Force Structure/Hazard Evaluation Marking System. See FEMA US&R Response System, Appendix C, "Task Force Building Marking System."

A-3-1.3 General Area. Sometimes it is generally defined as the area 300 ft (90 m) in all directions from the incident site.

A-3-1.3 Rescue Area. Sometimes it is generally defined as an area 50 ft (15 m) in all directions from the incident site, or a distance in all directions equal to the height, plus a third, of the structure involved in the collapse.

A-3-2.2(a) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(a) Scope and magnitude of the incident
(b) Risk and benefit analysis
(c) Number and size of structures affected
(d) Integrity and stability of structures affected
(e) Occupancy types (i.e., residential, mercantile, etc.)
(f) Number of known and potential victims
(g) Access to the scene
(h) Environmental factors
(i) Available and necessary resources

A-3-2.2(b) The intent of this provision is to establish procedures to enable the incident commander to obtain the necessary resources to augment the internal capabilities of the AHJ. These resources can include, but are not limited to, the following:

(a) Mutual aid agreements

(b) Agreements with the private sector, including the following:

1. Construction industry
2. Demolition industry
3. Heavy equipment operators
4. Special equipment supply companies
5. Hardware, lumber, and construction suppliers
6. Consulting engineers and architects
7. Related technical specialists
8. Communications
9. Food service
10. Sanitation

(c) Memorandums of Agreement (MOA) with other public, state, or federal agencies

A-3-2.2(c) The emergency response system includes, but is not limited to operations and technician level personnel, as well as local, state, and federal resources.

A-3-2.2(d) 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-3-2.2(e) General hazards associated with search and rescue operations at structural collapses can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members.

(a) *Utilities.* Control of the utilities in and around a structural collapse 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 in order to provide a safe environment in which to operate and to ensure the safety of victims. The following utilities should be considered when providing training:

1. Electrical services (primary and secondary)
2. Gas, propane, fuel oil, or other alternative energy sources (primary systems)
3. Water
4. Sanitary systems
5. Communications
6. Secondary service systems (i.e., compressed, medical, or industrial gases)

(b) *Hazardous Materials.* Collapsed structures might include various materials unique to an occupancy that, when released during a structural collapse, could pose a hazard to victims and responders. The AHJ should provide members with training in the recognition of potential hazardous materials releases, the determination of an existing hazard, and the methods used to contain, confine, or divert hazardous materials in order to conduct operations safely and effectively.

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

(d) *Confined Space.* Some structural collapses 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 members in confined space rescue.

(e) *Other Hazards.* There are numerous other hazards associated with structural collapses. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide members with training and awareness of these other hazards in order to perform rescue operations safely and effectively.

Hazard recognition training should include the following as a minimum:

(a) Recognition of building materials and structural components associated with light-frame ordinary construction

(b) Recognition of unstable collapse and failure zones of light-frame ordinary construction

(c) Recognition of collapse patterns and probable victim locations associated with light-frame ordinary construction

Four Categories of Building Construction. The construction categories, types, and occupancy usage of various structures might necessitate the utilization of a variety of different techniques and material. The four construction categories that the rescuer most likely will encounter in collapse situations are light-frame, heavy wall, heavy floor, and precast concrete construction. These four categories usually comprise the majority of structures affected by a collapse.

(a) *Light-Frame Construction.*

1. Materials used for light-frame construction are generally lightweight and provide a high degree of structural flexibility in

response to forces such as earthquakes, hurricanes, tornados, and so forth.

2. These structures typically are constructed with skeletal structural frame systems of wood or light-gauge steel components, which provide support to the floor and roof assemblies.

3. Examples of this construction type include wood frame structures used for residential, multiple low-rise, and light commercial occupancies up to four stories in height. Light-gauge steel frame buildings include commercial, business, and light manufacturing occupancies and facilities.

(b) *Heavy Wall Construction.*

1. Materials used for heavy wall construction are generally heavy and utilize an interdependent structural or monolithic system. These types of materials and their assemblies tend to produce a structural system that is inherently rigid.

2. This construction type usually is built without a skeletal structural frame. It utilizes a heavy wall support and assembly system that provides support for the floors and roof areas.

3. Occupancies utilizing tilt-up concrete construction are typically one to three stories in height and consist of multiple, monolithic concrete wall panel assemblies. They also use an interdependent girder, column, and beam system for providing lateral wall support of floor and roof assemblies. Such occupancies typically include commercial, mercantile, and industrial usage. Materials other than concrete now are being utilized in tilt-up construction.

4. Examples of this type of construction include reinforced and unreinforced masonry buildings typically of low-rise construction, one to six stories in height, and of any occupancy type.

(c) *Heavy Floor Construction.*

1. Structures of heavy floor construction are built utilizing cast-in-place concrete construction consisting of flat slab panel, waffle, or two-way concrete slab assemblies. Pretensioned or post-tensioned reinforcing steel rebar or cable systems are common components used for structural integrity. The vertical structural supports include integrated concrete columns, concrete enclosed steel frame, or steel frame, which carry the load of all floor and roof assemblies. This type of structure includes heavy timber construction that might use steel rods for reinforcement.

2. The reinforcing steel, along with the varying thicknesses of concrete structural slab and girder supports utilized in this construction assembly, poses significant concerns with respect to breaching and void penetration.

3. The loss of reinforcement capability and the integrity of structural loading capacity of the floor and wall assemblies create significant safety and operational considerations during collapse operations.

4. Structural steel frame construction utilizes a skeletal framing system consisting of large-load-carrying girders, beams, and columns for structural support. These components represent a substantial weight factor for individual and assembly components. Floor systems consist of cast-in-place concrete slabs of varying thicknesses poured onto metal pan or structural metal floor decks and also might include precast and post-tensioned concrete plank systems. These concrete/metal pan floor assemblies are supported by the structural steel framing system.

5. The exterior construction might consist of metal or masonry veneer, curtain wall, or composite material panel systems. Additionally, precast concrete or stone-clad panel systems might be present.

6. Multiple assembly or component failures might be present in a collapse situation where isolated or multiple collapse conditions or collapse configurations exist.

7. Examples of this type of construction include offices, schools, apartments, hospitals, parking structures, and multipurpose facilities. Heights vary from single-story to high-rise structures.

(d) *Precast Construction.*

1. Structures of precast construction are built utilizing modular precast concrete components that include floors, walls, columns, and other subcomponents that are field-connected at the site.

2. Individual concrete components utilize imbedded steel reinforcing rods and welded wire mesh for structural integrity and might utilize either steel beam and column or concrete framing systems for the overall structural assembly and building enclosure.

3. These structures rely on single or multipoint connections for floor and wall enclosure assembly and are a safety and operational concern during collapse operations.

4. Examples of this type of construction include commercial, mercantile, office, and multi-use or multifunction structures, including parking structures and large occupancy facilities.

Table A-3-2.2(e) lists the four model construction codes and standards commonly adopted within the United States and is provided to aid the AHJ in identifying the relationship of NFPA 1670 construction/collapse types to their applicable code. These model codes are referenced to classification Types I through V as specified in NFPA 220, *Standard on Types of Building Construction.*

Table A-3-2.2(e)

Reference	Fire-Resistive[1]		Noncombustible[1]			Ordinary[1]		Heavy Timber[1]	Wood[1]	
NFPA 220[2,3]	Type I		Type II			Type III		Type IV	Type V	
	443	332	222	111	000	211	200	2HH	111	000
BOCA[4]	Type I		Type II			Type III		Type IV	Type V	
	1A	1B	2A	2B	2C	3A	3B	4	5A	5B
UBC[5]	Type I		Type II			Type III		Type IV	Type V	
	P		P	P	NP	P	NP		P	NP
SBC[6]	Type I	Type II	Type IV			Type V		Type III	Type VI	
	433	332	P	NP		P	NP	2HH	P	NP

[1]The table headings for fire-resistive, noncombustible, ordinary, heavy timber, and wood construction do not represent any special construction code classification but are meant to provide an easily recognizable general construction type reference.
[2]See NFPA 220, *Standard on Types of Building Construction,* for common definitions of construction Types I through V.
[3]The three-digit arabic numbers that appear beneath each construction type heading designate the fire resistance rating requirements for certain structural elements specified in NFPA 220, *Standard on Types of Building Construction.* They are provided in this table as a reference and to indicate their relationship to each type of construction.
[4]Construction types are referenced to the BOCA National Building Code for correlation with fire-resistive rating requirements for each construction type.
[5]Construction types are referenced to UBC, Uniform Building Code. The designations P and NP stand for "protected" and "not protected," respectively, as used within the UBC.
[6]Construction types are referenced to SBC, *Standard Building Code.* The designations P (protected) and NP (not protected) are used in order to provide correlation with *Uniform Building Code* information.

Construction/Code Classifications (CCC)		Fire Resistive	Non-combustible	Ordinary	Heavy Timber	Wood
NFPA 220 classifications		I	II	III	IV	V
NFPA 1470 Construction/Collapse Types (CCT)	Light frame					■
	Heavy wall	■	■	■	■	
	Heavy floor	▒	▒			
	Precast concrete	■	■			

Figure A-3-2.2(e) is intended to identify construction/collapse types according to the classifications of NFPA 220 and is not part of any fire-resistive or fire rating/assembly requirement. In this table, the NFPA 1670 construction/collapse types (CCT) are referenced to NFPA 220, *Standard on Types of Building Construction*, to allow rapid correlation of construction code classification (CCC) with the associated construction/collapse type. Depending upon occupancy, usage, and actual size of the structure, some construction code classifications can exhibit characteristics of other than specifically correlated construction/collapse types.

A-3-2.2(f) Collapse patterns and potential victim locations include the following:

(a) *Lean-To.* A lean-to is formed when one or more of the supporting walls or floor joists breaks or separates at one end, causing one end of the floor(s) to rest on the lower floor(s) or collapse debris. Potential areas where victims might be located are under the suspended floor and on top of the floor at the lowest level.

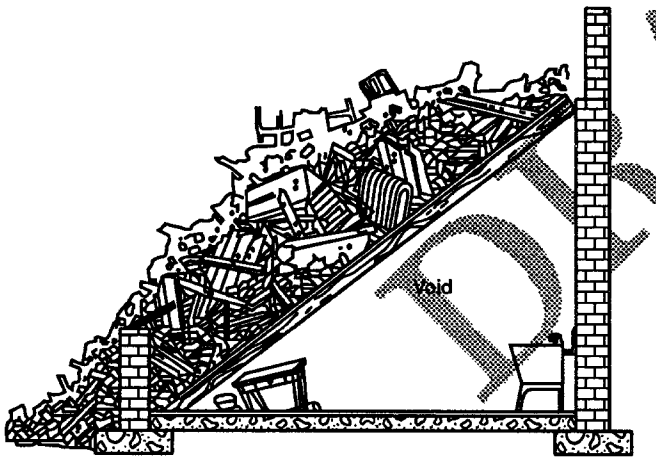


Figure A-3-2.2(f)(a) Lean-to floor collapse.
(Illustration courtesy of U.S. Department of Civil Defense)

(b) *V.* A "V" is formed when heavy loads cause the floor(s) to collapse near the center. Potential areas where victims might be located are under the two suspended floor pieces and on top of the floor in the middle of the V.

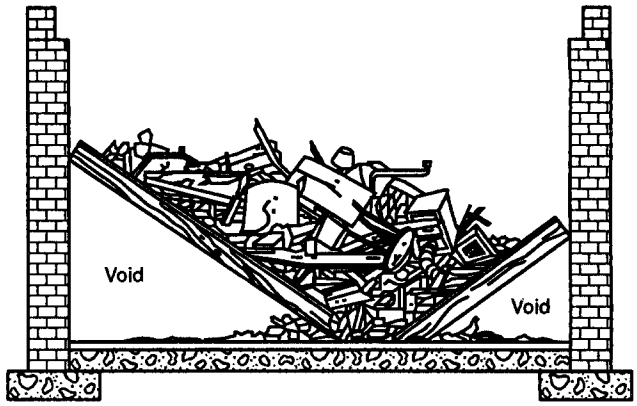


Figure A-3-2.2(f)(b) V-shape floor collapse.
(Illustration courtesy of U.S. Department of Civil Defense)

(c) *Pancake.* A pancake is formed when the bearing wall(s) or column(s) fails completely and an upper floor(s) drops onto a lower floor(s), causing it to collapse in a similar manner. Potential areas where victims might be located are under the floors and in voids formed by building contents and debris wedged between the floors.

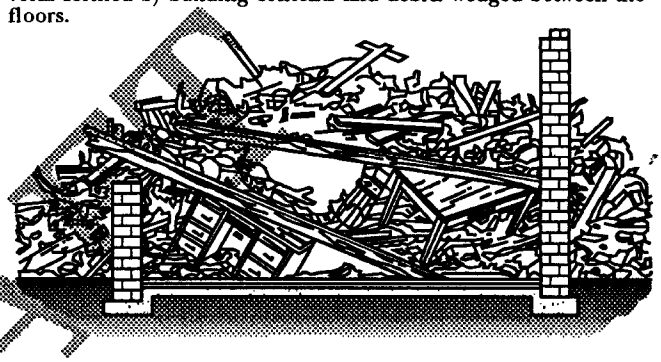


Figure A-3-2.2(f)(c) Pancake floor collapse.
(Illustration courtesy of U.S. Department of Civil Defense)

(d) *Cantilever.* A cantilever is formed when one end of the floor(s) hangs free because one or more walls have failed and the other end of the floor(s) is still attached to the wall(s). Potential areas where victims might be located are on top of or under the floors.

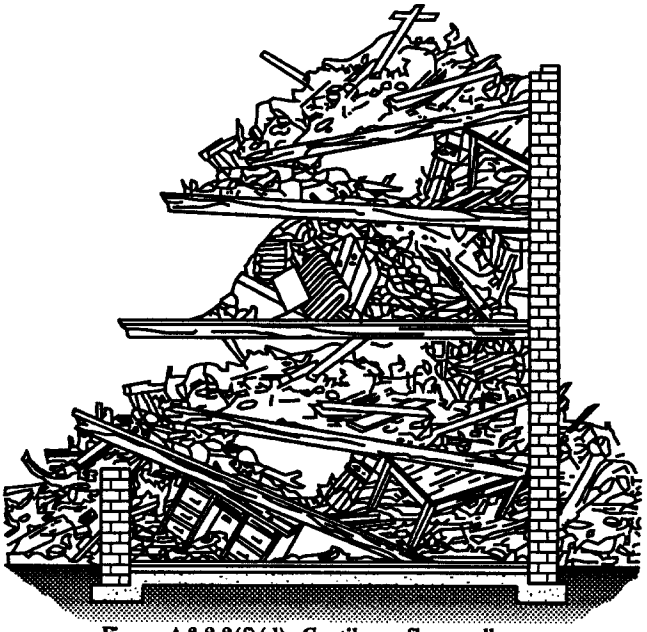


Figure A-3-2.2(f)(d) Cantilever floor collapse.
(Illustration courtesy of U.S. Department of Civil Defense)

(e) *A-Frame.* An A-Frame occurs when flooring separates from the exterior bearing walls but still is supported by one or more interior bearing walls or non-bearing partitions. The highest survival rate for trapped victims will be near these interior partitioning. Other victims will be located in the debris near both exterior walls.

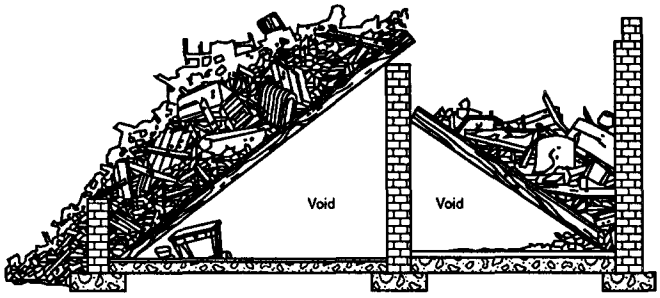


Figure A-3-2.2(f)(e) A-Frame floor collapse.

A-3-2.2(g) Indications of potential for secondary collapse include the following:

(a) Leaning walls

(b) Smoke or water seeping through joints

(c) Unusual sounds (e.g., creaking, groaning, etc.)

(d) Recurring after shocks

(e) Sagging floor or roof assemblies

(f) Missing, strained, or damaged points of connection of structural elements

(g) Excessive loading of structural elements

(h) Sliding plaster and airborne dust

(i) Separating walls

(j) Lack of water runoff

(k) Structure is racked or twisted

(l) Building vibration

A-3-2.2(h) Procedures for conducting searches should include, at a minimum, visual and verbal methods.

Search and rescue operations in the structural collapse environment should include close interaction of all incident management system elements for safe and effective victim extrications. Search operations for locating victims should be initiated early at a structural collapse incident. Structural collapse search operations should conform to an accepted system for victim search strategy and tactics in order to achieve optimum performance and effectiveness. The following recommendations provide current tactical capabilities and general strategies that can assist personnel in productive search operations.

Structural collapse operations are one of the most difficult rescue situations likely to be encountered. Depending on the complexity of the search and rescue activity, personnel might need to spend large amounts of precious time on small numbers of difficult rescues. It is important to establish whether or not rescue personnel are involved with a live victim, since time should not be wasted in such unproductive missions as the removal of dead bodies while live victims might be saved.

A-3-2.2(i) Structure/hazards evaluation and search assessment procedures are designed to identify specific information pertinent to each affected building. Either of these analyses can be completed independently of the other, although the structure/hazards evaluation normally is completed first. Symbols should be drawn conspicuously with orange spray paint. *(See FEMA US&R Response System, Appendix C, "Task Force Building Marking System.")*

One of the initial strategic concerns for personnel is the need to analyze the structure(s) involved in any collapse situation. This is especially true where there is more than one structure involved, as in cases of devastating earthquakes, hurricanes, or other natural or man-made disasters. The determination of the condition of the structure, hazards, and occupancy prior to the event will affect the overall search and rescue strategy.

It is imperative that the information derived from a coordinated building triage and marking system be consolidated by the AHJ at any structural collapse event. This information should be used not only to identify operational priorities but should be forwarded to the incident commander to assist in the overall assessment of the event.

(a) *FEMA Task Force Search and Rescue Marking System.* Distinct markings should be made within the four quadrants of an "X" to denote clearly the search status and findings during the search. Figure A-3-2.2(i)(a) illustrates the search marking system.

An "X" measuring 2 ft × 2 ft (0.6 m × 0.6 m) should be spray-painted in the color orange. The information for each quadrant should be written in the quadrant using carpenter's chalk or a lumber crayon.

In addition, search personnel should mark the exact location of a victim(s) with orange spray paint. Surveyor's tape can be used as a flag to identify the appropriate area in conjunction with the spray paint. To reduce needless duplication of search efforts, markings should be made at each point of entry or separate area of the structure. Where updated information of previously searched structures is needed, the old information should be crossed out and the most recent information should be indicated below or next to the old, using the marking system.

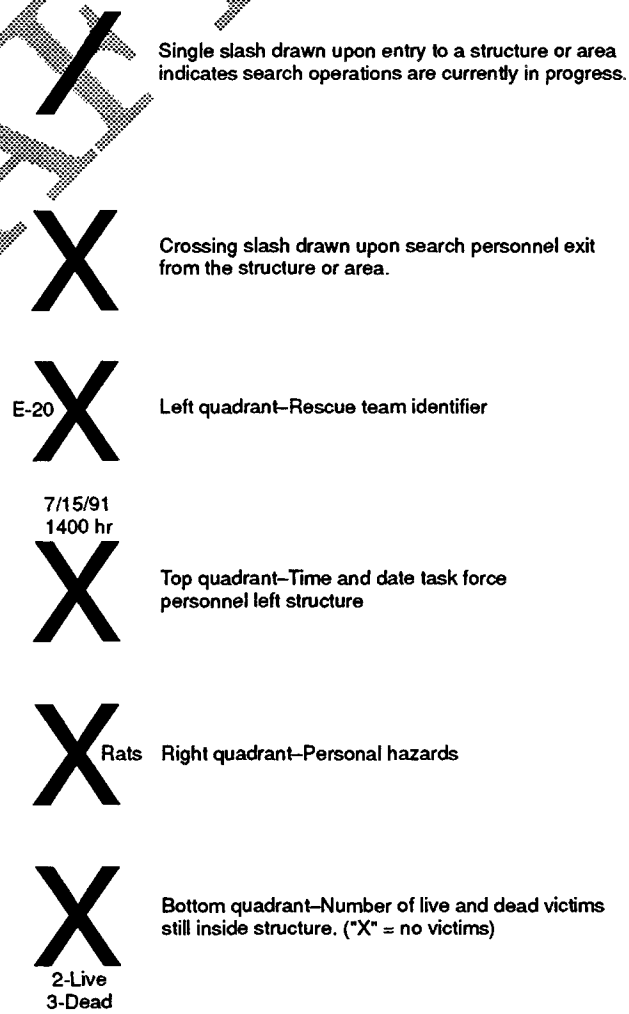


Figure A-3-2.2(i)(a).

(b) *FEMA Task Force Building Marking System (Structure/Hazard Evaluation).* This system is designed to identify specific hazards associated with any collapsed structure. Personnel should be cognizant of the nationally accepted marking system and should be proficient in the use of the system. *(See FEMA US&R Response System, Appendix D, "Structure Triage, Assessment & Marking System.")*

After performing a building hazard assessment, the responder uses international orange spray paint to make a 2 ft × 2 ft square box on the building adjacent to the most accessible point of entry. Figure A-3-2.2(i)(b) illustrates the search marking system.

An empty box indicates the building is relatively safe for search and rescue operations and that damage is such that there is little danger of further collapse. One diagonal line in the box indicates the structure is significantly damaged and that some areas may need shoring, bracing, or removal of hazards in spite of the fact that some areas may be safe. Two diagonal lines in the box (an "X") indicate that the building is not safe for search and rescue operations and may be subject to sudden collapse. An arrow next to the marking box indicates the direction of safest entry to the structure. To the right of the marking box, text is used to indicate the time and date of the search, the team designation, and hazard(s) found. The letters "HM" to the right of the box (in the text area) indicate a hazmat condition in or adjacent to the structure. When "HM" is used, search and rescue operations normally will not be allowed until the condition is better defined or eliminated.

Structural specialist makes a 2 ft x 2 ft box on building adjacent to most accessible entry. This is done after doing hazards assessment and filling out hazards assessment form. Box is spray painted with international orange and marked as follows:

Structure is relatively safe for SAR operations. Damage is such that there is little danger of further collapse. (May be pancaked building)

Structure is significantly damaged. Some areas may be relatively safe, but other areas may need shoring, bracing, or removal of hazards.

Structure is NOT safe for rescue operations and may be subject to sudden collapse. Remote search operations may proceed at significant risk. If rescue operations are undertaken, safe haven areas and rapid evacuations routes should be created.

Arrow located next to the marking box indicates the direction of safest entry to the structure.

HM — Indicates HazMat condition in or adjacent to structure. SAR operations normally will not be allowed until condition is better defined or eliminated.

Example:

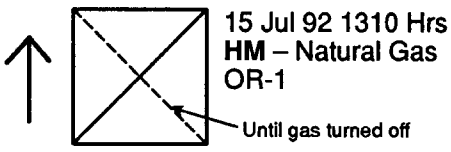


Figure A-3-2.2(i)(b) Task force building marking system structure/hazard evaluation.

(c) *FEMA Task Force Structure Marking System (Structure Identification Within a Geographical Area).* Structure identification within a geographic area is used to differentiate buildings by groups, such as by block(s) or jurisdictional area. This geographic area identification should be consolidated at the command post of the AHJ and used to deploy search and rescue personnel.

International orange spray paint is used to mark buildings with their street number so that personnel can differentiate one building from another. Existing numbers should be used to fill in any unknown numbers. If all numbers are unknown, arbitrary numbers can be used (odd and even used on opposite sides of the street). The primary method of identification should include the existing street name, hundred block, and building number. Such identification is not always possible due to post-disaster conditions. *(See FEMA US&R Response System, Appendix D, "Structure Triage, Assessment & Marking System.")*

A standard approach to describing each building's layout is also used. The street side of the building is side one. Subsequent sides (2, 3, 4) are labeled in a clockwise direction around the building. Internally, quadrants are described starting with the front left corner (while standing at the front, street side of the building) and labeled with letters starting with "A." Subsequent quadrants (B, C, D, E) are labeled in a clockwise direction around the interior of the building with the core (center) being labeled "E." Stories are labeled 1, 2, 3, etc., and basements are designated B1, B2, B3, etc.

It is imperative that personnel clearly identify each structure within a geographic area. This identification will assist both in the specific ongoing search and rescue effort and the long-term, post-disaster identification of the site.

A-3-3.3(b) Operations personnel should be capable of obtaining and utilizing one or more of the following resources:

(a) Structural collapse search dogs

(b) Search cameras

(c) Acoustic/seismic instruments (listening devices)

(d) Thermal imaging (infrared) devices

(e) Other technical search devices

Search operations should incorporate a variety of technical and nontechnical methods that might provide personnel with the only viable method to locate victims and determine their status.

The AHJ should identify as many forms of technical and nontechnical search capabilities available at the local, regional, state, or national level that are commensurate with their needs. In addition to the basic operational level of capability, search methods should include, but not be limited to, the following:

(a) *Structural Collapse Search Dogs.* This involves the use of air-scent dog and handler teams trained and equipped to specifically search collapsed structures. The dog and handler work as a team to identify the location and status of victims buried beneath rubble or structural components. It is important that the AHJ differentiate between structural collapse search dogs and other "air-scenting" dogs such as those used to search for drugs and explosives, cadaver dogs, and police K-9.

(b) *Electronic Search.* This involves the use of acoustic/seismic devices and includes the deployment of an array of two or more pickup probes around the perimeter of a collapsed structure or void area.

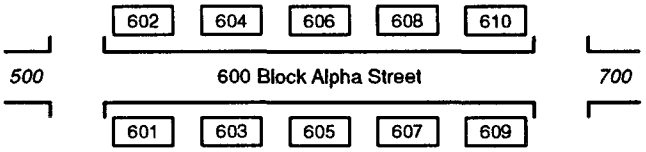
An important duty of a structure triage team is to clearly differentiate buildings in groupings such as by block(s) or jurisdictional areas/sectors. This geographic (area/sector) identification of buildings would be consolidated at the Command Post and used to deploy search and rescue personnel and/or track Structure/Hazard Evaluation and Search Assessment information.

It is imperative that each structure within a geographic area is clearly defined. This identification will assist both in the specific ongoing search and rescue effort and in the long term post-disaster identification of the site. This identification is important from a technical documentation perspective regarding the specific events which took place at a given site. Structure identification has a significant impact on overall scene safety and the safety of task force personnel.

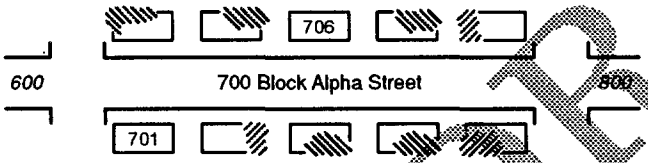
It is important to clearly identify each separate structure within a geographic area when information is being disseminated to other operational entities. The primary method of identification should be the existing street name, hundred block and building number. Obviously, such identification is not always possible due to post-disaster site conditions. In these situations, it is important that the task force personnel implement the following system for structure identification.

This system builds upon the normal pre-disaster street name, hundred block and building number. As task force personnel establish a need to identify a structure within a given block they will:

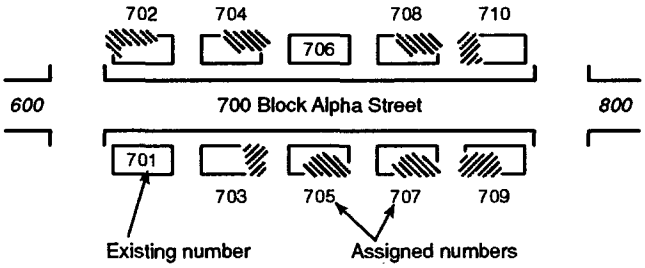
1. Identify each structure by existing street name and building number



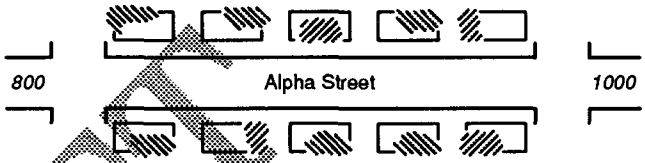
2. If some previously existing numbers have been obliterated, an attempt should be made to reestablish the numbering system based upon one or more structures that still display an existing number.



3. The damaged building(s) would be assigned numbers to separately identify them as indicated. The front of the structure(s) is question should be clearly marked using International Orange spray paint with the new numbers being assigned.



4. If no number is identifiable in a given block then task force personnel will identify the street name and the hundred block for the area in question on other structures in proximity to the site in question.



5. In this case, structures will be assigned the appropriate numbers to designate and differentiate them. The front of the structure(s) in question should be clearly marked using International Orange spray paint with the new number being assigned.

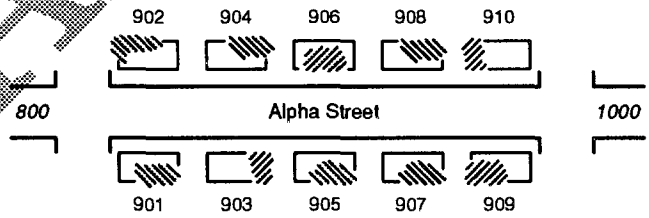


Figure A-3-2.2(i)(c) Task force structure marking system structure identification within a geographic area.

(c) *Search Cameras.* This involves the placement of a search camera device within a void area to search "visually" a previously nonvisible collapse zone. To use this device, ancillary tools such as rotary hammers, drills, or breakers are needed to create an opening through which the camera can be passed.

(d) *Air Sampling.* Identification of high concentrations of CO_2, for example, might indicate the presence of a live victim.

Once the AHJ has identified the location and the availability of these search options, a system should be developed to place them into operation at a structural collapse incident.

In conjunction with the capability of the AHJ to place into operation one or more of the previously described search methods, personnel should implement a strategic and tactical plan for the use of these devices as quickly as possible. Personnel should coordinate all available and viable tactical capabilities into a logical plan of operation.

It is essential that the AHJ employ every possible search method to ensure that its members are able to locate viable victims before committing rescue resources to any prolonged (although well-intentioned) operation.

A-3-3.3(c) Access training shall include, but shall not be limited to the following:

(a) Techniques to lift safely and effectively structural components of walls, floors, or roofs

(b) Shoring techniques to construct safely and effectively temporary structures needed to stabilize and support structural components to prevent movement of walls, floors, or roofs

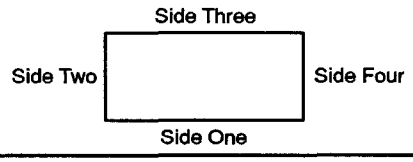
(c) Breaching techniques to create safely and effectively openings in structural components of walls, floors, or roofs

(d) Operation of appropriate tools and equipment to accomplish the above tasks safely and effectively

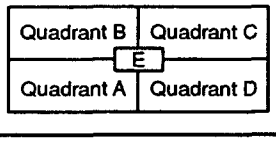
A-3-3.3(d) Extrication operations at a structural collapse incident necessitate a coordinated effort that includes search, rescue, and medical capabilities. Personnel should have a working knowledge of general extrication tactics and procedures. These tactics and procedures should be flexible enough to address the specific situation and problems encountered. The AHJ should provide the appropriate training and equipment necessary to complete an extrication operation safely and effectively. These should include the following:

It is also important to identify locations within a single structure.

1. The address side of the structure shall be defined as SIDE 1. Other sides of the structure shall be assigned numerically in a clockwise manner from SIDE 1.



2. The interior of the structure will be divided into QUADRANTS. The quadrants shall be identified alphabetically in a clockwise manner starting from where the side 1 and side 2 perimeter meet. The center core, where all four quadrants meet will be identified as Quadrant E (i.e., central core lobby, etc.).



3. Multistory buildings must have each floor clearly identified. If not clearly discernible, the floors should be numbered as referenced from the exterior. The grade level floor would be designated floor 1 and, moving upward the second floor would be floor 2, etc. Conversely, the first floor below grade level would be B-1, the second B-2, etc.

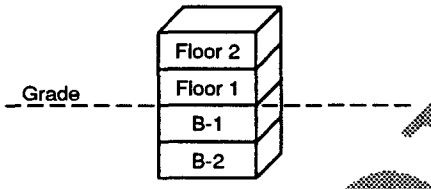


Figure A-3-2.2.(i)(d) Task force structure marking system structure identificaiton within a geogrphaic area — single structure.

(a) *Manual.* Training should be provided in safe lifting techniques necessary to move manageable sections of debris and interior contents displaced by partial or complete structural collapse.

(b) *Hand Tools.* Tools and training necessary to move debris, room contents, and structural components displaced by partial or complete structural collapse should be provided. Hand tools should include, but not be limited to, pry bars, bolt cutters, jacks, and sledge hammers. Training requirements should be coordinated with the hand tool inventory.

Extrication training should include the following, as a minimum:

(a) Packaging victims within confined areas

(b) Removing victims from elevated or below-grade areas

(c) Providing initial medical treatment to victims

(d) Operating appropriate tools and equipment to accomplish the above tasks safely and effectively

A-3-4.3(b) See A-3-3.3(b).

A-3-4.3(c) Generally in concrete tilt-up, reinforced concrete, and steel construction, locating and extricating victims is more complicated than in light-frame, ordinary construction, or reinforced and unreinforced masonry construction. As structural components, materials, and weights increase, the ability to breach, stabilize, and operate within such a structural collapse becomes more hazardous, complicated, and time consuming.

The overall ability of the AHJ to function safely and effectively is greatly dependent upon the prompt availability of appropriate tools, equipment, and supplies to accomplish operations.

In concrete tilt-up, reinforced concrete, and steel construction, personnel should understand that the tools needed change, depending on the type of structure involved. Structural collapse incidents involving these categories of construction necessitate the use of tools and equipment specifically designed for these materials, including the following:

(a) Masonry saws and blades
(b) Rotary hammers and breakers
(c) Airbags
(d) Dump trucks and front-end loaders
(e) Concrete saws and blades
(f) Pneumatic and hydraulic drills, hammers, and breakers
(g) Cranes
(h) Burning and cutting equipment such as oxyacetylene and exothermic or plasma cutters
(i) Bolting and anchoring systems

Power tools (e.g., air bags, hydraulic spreaders and rams, and power saws) and training necessary to breach, cut, bore, and lift structural components displaced by partial or total structural collapse should be provided.

A-3-4.3(d) See A-3-3.3(d).

A-4-1.2 In all types of technical rescue incidents, the potential exists for extenuating circumstances that would require expertise beyond the normal capability of the organization to safely operate. Examples of these situations may include lowering and raising operations requiring significant obstacle negotiation, descending or ascending operations from extreme heights, or severe environmental conditions (e.g., snow and rain). These conditions should be evaluated during the initial risk assessment and on an incident-by-incident basis.

A-4-1.3 Mechanical Advantage. This is usually expressed in terms of a ratio of output force to input force. For example, a rope mechanical advantage system that requires only 10 pounds of input force to produce 30 pounds of output force has a 3:1 mechanical advantage (30 force pounds to 10 force pounds, 3:1). Likewise, a system that requires 30 pounds of input force to produce 30 pounds of output force has a 1:1 mechanical advantage. There is no such thing as zero mechanical advantage. Other factors may effect the efficiency of a M/A system including friction and drag created by the equipment. For purposes of this document, these factors are not considered and so the mechanical advantage is theoretical rather than actual. Although others exist, rope-based mechanical advantage systems are most practically classified as simple or compound.

A-4-1.3 Load Distributing/Load Sharing Anchor Systems (Multi-Point Anchor Systems). Both should be configured so as to limit the resulting drop occurring as the result of an anchor point failure.

A-4-1.3 Raising System. Raising systems should incorporate a mechanical means to prevent the load from falling should the primary control mechanism be released during the raising operation.

A-4-1.3 System Safety Check. This system should have three components:

(a) *Physical/Visual Check.* Personnel should carefully review all system components to ensure proper assembly.

(b) *Load Test.* Personnel should pre-load the system in a safe manner (e.g. Standing away from edges while pre-loading).

(c) *Audible/Visual Confirmation.* A signal issued by the person performing the system safety check following the first two steps confirming their completion. The signal should address other rescuers utilizing the system and should be acknowledged by one or more of them.

A-4-2.2(a) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(a) Scope, magnitude, and nature of the incident
(b) Location and number of victims
(c) Risk versus benefit analysis (body recovery versus rescue)
(d) Access to the scene
(e) Environmental factors
(f) Available/necessary resources
(g) Patient contact when it can be performed without endangering either responders or victims

A-4-2.2(b) See A-3-2.2(b).

A-4-2.2(c) The emergency response system includes, but is not limited to operations and technician level personnel, as well as local, state, and federal resources.

A-4-2.2(d) 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 non-emergency personnel and establishment of operational zones and site security.

A-4-2.2(e) General hazards associated with rope rescue operations can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members.

(a) *Fall Hazards.* Rope rescue incidents are often required in areas where elevation differential exists. Therefore, the possibility of someone falling, or something falling on someone, should always be considered and mitgated.

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

The "general area" around a rope rescue scene is the entire area within 300 ft (or more, as established by the incident commander). Making the general area safe includes, but is not necessarily limited to, the following:

(a) Controlling/limiting traffic and sources of vibration in the area including shutting down all vehicles and equipment
(b) Controlling/limiting access to the area by unnecessary personnel
(c) Identifying hazards and removing and/or reducing their impact

A-4-2.2(f) Other than that described in 2-4.2, specific PPE necessary for safe rope rescue operations may include, but not be limited to, the following:

(a) Harnesses
(b) Gloves appropriate for rope rescue work
(c) Helmets designed for climbing and rope rescue work

A-4-3.2(c) An "anchor system" includes, if necessary, an appropriate and proper backup.
Anchor systems may include, but are not limited to, the use of portable anchor systems (either improvised or commercial) such as A-frames, bi-pods, tri-pods, pickets, and gin poles.

A-4-3.2(e) The skills and procedures required to select, construct, and use a lowering system vary greatly depending on environmental factors and elevation differential (height). Therefore, rescuers should be trained to perform these procedures under the environmental (e.g., snow, darkness, wind, etc.) and elevation (e.g., potential height) conditions.

A-4-3.2(f) Rescuers shall be able to identify a tied knot. Specific knots, hitches, and bends that may be useful include the following:

(a) Bowline
(b) Figure-eight family of knots and bends
(c) Grapevine or Double Fisherman's knot
(d) Water knot
(e) Barrel knot
(f) Any knots, hitches, or bends used by the organization

A-4-3.2(g) Safety procedures should include, as a minimum, the following:

(a) Edge protection
(b) Belays
(c) Critical angles in rope systems
(d) System stresses
(e) Safety checks
(f) Other safety assurances

A-4-3.2(j) A counter-balance system is a type of raising system (see definitions).

A-4-4.2(c) See A-4-3.2(j).

A-5-1.2 In all types of confined space rescue incidents, the potential exists for extenuating circumstances that would require expertise beyond the normal capability of the organization to safely operate. Examples of these situations may include, but are not limited to, deep or isolated spaces, multiple complicating hazards (e.g., water, chemicals, and extreme height in a space), failure of essential equipment, or severe environmental conditions (e.g., snow and rain). These conditions should be evaluated during the initial risk assessment and on an incident-by-incident basis.

A-5-1.3 While much of this chapter applies to CSR in industrial settings, it is intended for all incidents involving confined spaces as defined within this standard.

A-5-1.4 Authorized Entrant. This term can also be used to designate rescue personnel assigned to perform the task of entry during rescue operations. In this case the term "rescue entrant" is used.

A-5-1.4 Confined Space. For purposes of this chapter, this definition excludes mines and caves or other natural formations, all of which must be addressed by other specialized training and equipment.

A-5-1.4 Confined Space Rescue Team. While six personnel provide the recommended minimum for most entry-type confined space rescues, the committee recognizes that some of these will not require this number of personnel. The number of personnel required to perform these rescues should be based on 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-5-1.4 Entry Permit. In certain industries, U.S Federal law does not require a permit system even though spaces meeting the characteristics of confined spaces as defined within this standard may be present. In these cases, as well as cases of unauthorized or nonregulated entry into confined spaces, a permit may not be available for reference by the rescue team. The space must be completely assessed before entry can be safely made. U.S. Federal law does not require rescuers to have a permit to rescue although it is advisable for the rescue team to follow similar procedures to ensure safety.

A-5-1.4 Hazardous Atmosphere for Confined Space (b). This can be estimated by observing the density of the concentration. In general, if the concentration of dust obscures vision at a distance of 5 feet or less, it could be within it's flammable range.

A-5-1.4 Rescue Service (e). 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 may be used to determine how quickly the rescue service should be able to respond in order to deliver the patient to the appropriate treatment facility within an hour of onset of injuries. The rescue service should have a goal of responding to these emergencies within 15 minutes of the time they receive notification.

A-5-2.2(a) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

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

(b) Location, number, and condition of victims

(c) Risk versus benefit analysis (body recovery versus rescue)

(d) Access to the scene

(e) Environmental factors

(f) Available/necessary resources

(g) Establishment of control perimeter

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

(a) Rescue team notification

(b) Acceptable entry conditions for rescue

(c) Hazard analysis

(d) Risk analysis of hazards

(e) Site map

(f) Hazard abatement (including control zones, ventilation, lock out/tag out procedures, etc.)

(g) Use of buddy system (when applicable)

(h) Communications (site, rescue attendant to rescue entrant, etc.)

(i) Command post

(j) Incident management organizational chart

(k) Standard operating guidelines

(l) Safe work practices

(m) Medical assistance

(n) Pre-entry safety briefings

(o) Pre-/post-entry physicals (if indicated)

A-5-2.2(c) Hazards can include, but are not limited to, the following:

(a) Hazardous atmospheres

(b) Hazardous chemicals

(c) Temperature extremes

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

(a) Assessment of the perimeter surrounding the confined space incident to determine the presence of or potential for a hazardous condition that could pose a risk to rescuers during approach

(b) Recognition of the need for decontamination of a patient or responder who may have been exposed to a hazardous material as per NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents*; NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*; and U.S. Federal OSHA 29 CFR 1910.120 regulation on Hazardous Waste

(c) Recognition of the need for a confined space rescue service or additional resources when non-entry retrieval is not possible

(d) Notification of the designated rescue service and other resources necessary for initiation of confined space rescue

(e) The recognition of hazardous atmospheres or materials through visual assessment and information received from on-site personnel.

A-5-2.2(d) The term "confined space" as defined within this standard is synonymous with the term "permit-required confined space" or "permit space" used by many U.S. federally regulated agencies.

A-5-2.2(e) Retrieval includes the operation of common non-entry retrieval systems. Examples include simple winch and block devices used in conjunction with tripods, quadpods, or other manufactured portable anchor systems. A non-entry retrieval may simply involve operating the crank on a winch/tripod system when anchors and protection systems are already in place.

A-5-2.2(f) The emergency response system includes, but is not limited to operations and technician level personnel, as well as necessary local, state, and federal resources. In addition, the system includes procurement of on-site information resources such as witnesses, industrial entry supervisors, industrial facility managers, engineers, or other responsible persons. Printed on-site information resources available at many U.S. federally regulated industrial facilities may include, but is not limited to, the following:

(a) Entry permit

(b) Material Safety Data Sheets (MSDS)

(c) Other site work permits

A-5-2.2(g) 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 non-emergency personnel and establishment of operational zones and site security. The organization should also assure through written standard operating guidelines that the scene is rendered safe at the termination of the incident.

A-5-3.3(a) Specific procedures for mitigating hazards at confined space rescue may include, but are certainly not limited to, consideration of the following:

(a) PPE

(b) Fall protection

(c) Harnesses

(d) Lock out/tag out procedures

(e) Hazard assessment

(f) Scene assessment

Procedures to perform a confined space hazard assessment include, but are not limited to, the following:

(a) Identification of the important industrial documentation, where available, useful in hazard assessment. This includes entry permits, lock-out/tag-out procedures and checklists, and hot work permits.

(b) Selection of all applicable information necessary for emergency responders from a Material Safety Data Sheet (MSDS)

(c) Selection of the proper personal protective equipment (PPE) for the hazard as per NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*, and U.S. Federal OSHA 29 CFR 1910.120 regulation on Hazardous Waste.

Procedures to perform a scene assessment in order to determine the magnitude of the problem in terms of life safety may include, but are not limited to, the following:

(a) The type, size, access, and internal configuration of the confined space

(b) Information regarding current and potential hazards that threaten victims and rescuers

(c) A risk-benefit analysis concerning the threat to rescuers in relation to the viability of victims

A-5-3.3(b) The assessment at this level should include, but not be limited to, the initial and continuous evaluation of the following:

(a) Hazards such as engulfment potential, environmental (i.e., chemical, atmospheric, temperature, etc.), harmful forms of energy (i.e., electrical, mechanical, movement due to gravity, hydraulic, etc.), configuration hazards (i.e., diverging walls, entrapment, obstructions, trip/fall hazards), and so forth

(b) Risk versus benefit analysis (body recovery versus rescue)

(c) Available/necessary additional resources

(d) Establishment of control zones

The following are predefined "types" of confined spaces normally found in an industrial setting. Classifying spaces by "types" can be used to prepare a rescue training plan to include representative permit spaces for practicing rescue operations as specified by OSHA. These types focus mainly on the OSHA specified criteria of opening size, configuration, and accessibility. Another important factor to consider is the internal configuration (congested or non-congested) of the permit required confined space.

CS TYPE 1 / 1E – elevated
Portal Size: Less than 24-inches
Configuration: Round / Oval
Accessibility: Horizontal Entry (vertical portal)

CS TYPE 2 / 2E – elevated
Portal Size: 24-inches or larger
Configuration: Round / Oval
Accessibility: Horizontal Entry (vertical portal)

CS TYPE 3 / 3E – elevated
Portal Size: Less than 24-inches
Configuration: Square / Rectangle
Accessibility: Horizontal Entry (vertical portal)

CS TYPE 4 / 4E – elevated
Portal Size: 24-inches or larger
Configuration: Square / Rectangle
Accessibility: Horizontal Entry (vertical portal)

***CS TYPE 5 / 5E – elevated**
Portal Size: Less than 24-inches
Configuration: Round / Oval
Accessibility: Vertical Top Entry (horizontal portal)

***CS TYPE 6 / 6E – elevated**
Portal Size: 24-inches or larger
Configuration: Round / Oval
Accessibility: Vertical Top Entry (horizontal portal)

***CS TYPE 7 / 7E – elevated**
Portal Size: Less than 24-inches
Configuration: Square / Rectangle
Accessibility: Vertical Top Entry (horizontal portal)

***CS TYPE 8 / 8E – elevated**
Portal Size: 24-inches or larger
Configuration: Square / Rectangle
Accessibility: Vertical Top Entry (horizontal portal)

CS TYPE 9 / 9E – elevated
Portal Size: Less than 24-inches
Configuration: Round / Oval
Accessibility: Vertical Bottom Entry (horizontal portal)

CS TYPE 10 / 10E – elevated
Portal Size: 24-inches or larger
Configuration: Round / Oval
Accessibility: Vertical Bottom Entry (horizontal portal)

CS TYPE 11 / 11E – elevated
Portal Size: Less than 24-inches
Configuration: Square / Rectangle
Accessibility: Vertical Bottom Entry (horizontal portal)

CS TYPE 12 / 12E – elevated
Portal Size: 24-inches or larger
Configuration: Square / Rectangle
Accessibility: Vertical Bottom Entry (horizontal portal)

** Could include open sumps, pits, tanks trenches, etc.*

Definitons:

1. Diagonal Portal – Plane of manway or portal is at an angle (between perpendicular and parallel to the ground). To be considered as a vertical entry/horizontal portal.
2. Elevated Portal – Bottom of passageway is 4-feet or higher from ground level.
3. Horizontal Entry – Access passageway is entered traveling parallel to ground level through a vertical portal.
4. Manway or Portal – An internal or external opening large enough for a person to pass through.
5. Rectangular/Square Portal – A four-sided opening with four right angles. Opening size is determined by measuring the shortest side of the opening.
6. Round/Oval Portal – A circular or elliptical opening; also any polygon not having exactly four sides. Opening size is determined by measuring the smallest inside diameter.
7. Vertical Entry – Access passageway is entered traveling perpendicular to ground level through a horizontal portal.

Figure A-5-3.3(a) Confined space types for rescue training purposes.

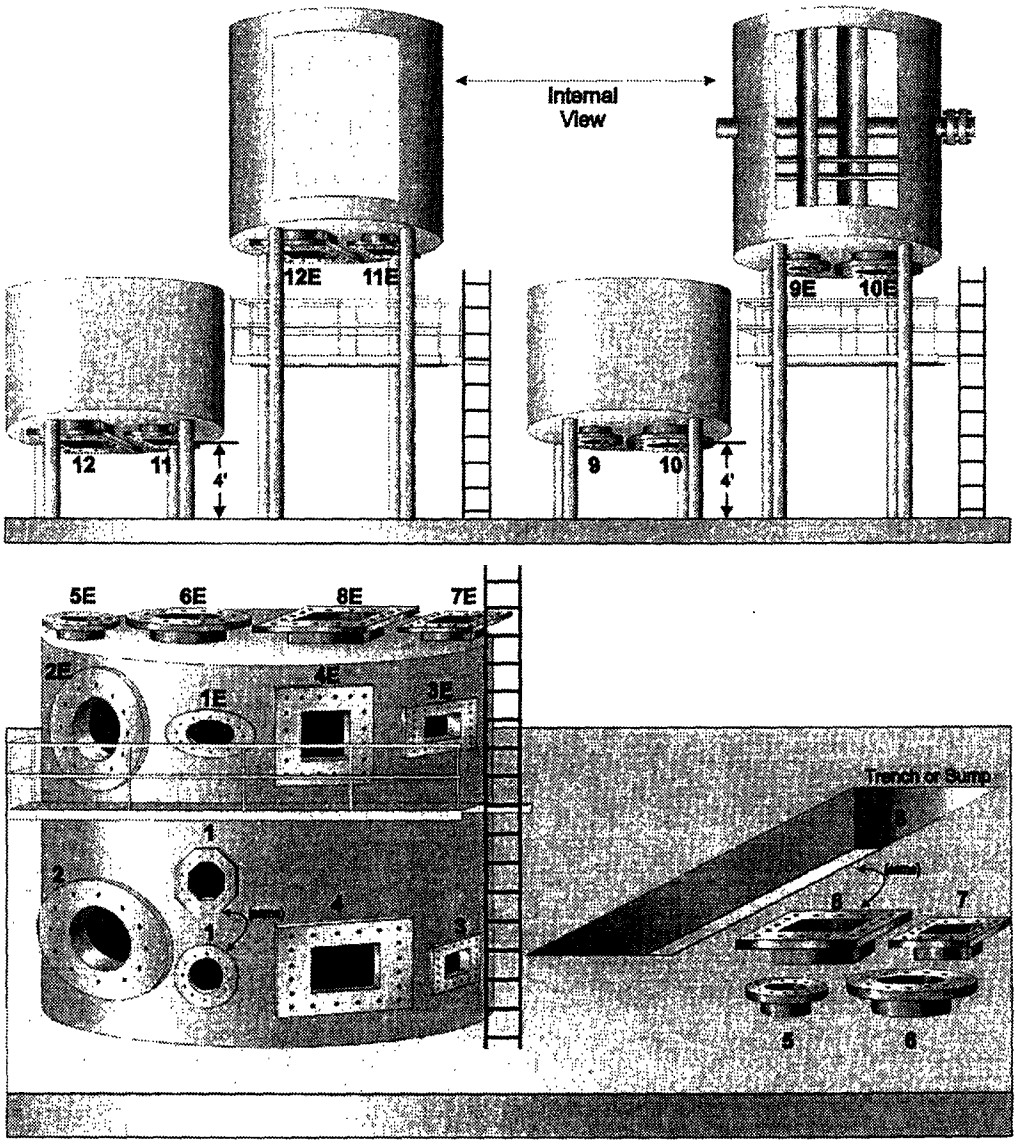


Figure A-5-3.3(a) (cont'd) Confined space types for rescue training purposes.

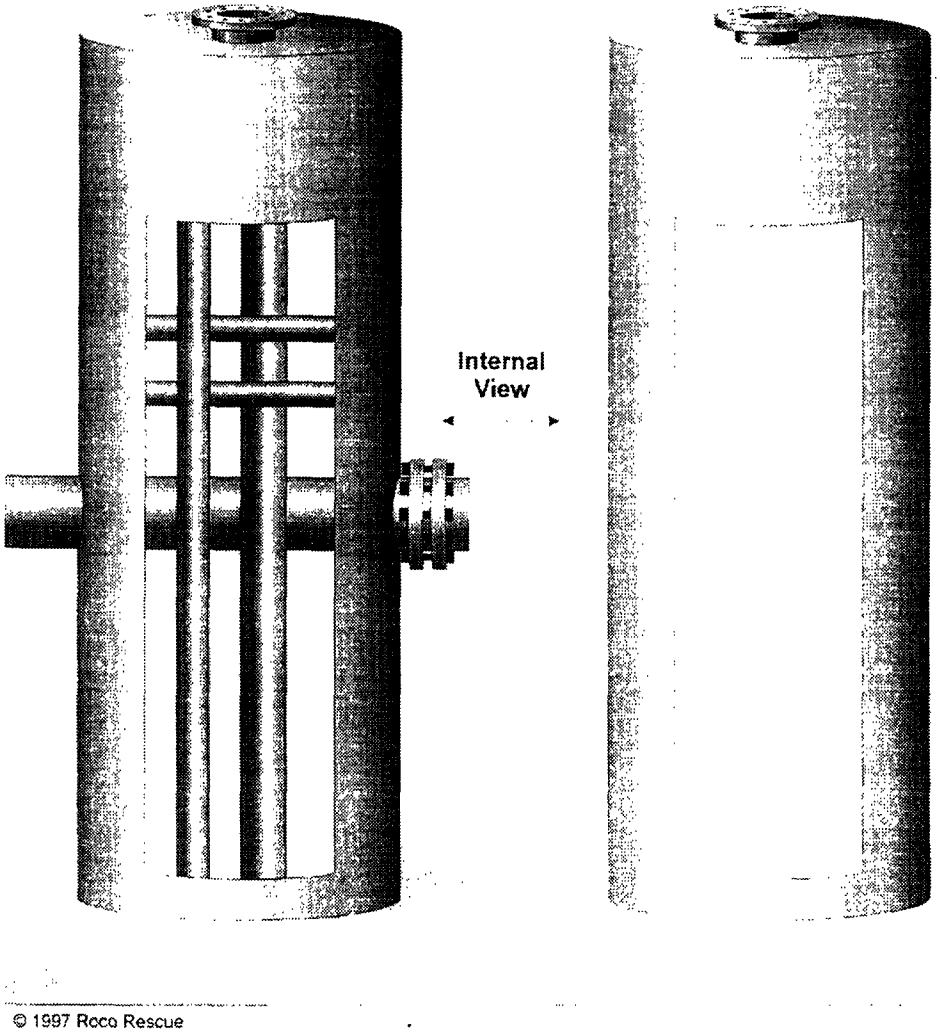


Figure A-5-3.3(a) (cont'd) Confined space types for rescue training purposes.

(e) Magnitude of the hazard and isolation procedures

(f) Effectiveness of the non-entry, or qualifying entry-type, rescue

(g) Overall safety of rescue operations

(h) Level of rescue response (appropriate for the type of rescue being attempted?)

(i) Current and projected status of the planned response

(j) Personnel accountability

A-5-3.3(c) 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, etc.) that could impair their ability to perform rescue in confined spaces.

A-5-3.3(d) Roles, functions, and responsibilities for these team positions should be consistent with the organization's standard operating guidelines for confined space rescue.

A-5-3.3(e) Personnel meeting the requirements of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*, shall perform the monitoring procedures even if such personnel are not part of the rescue team. *(See also A-5-4.2.)*

Monitoring the atmosphere may include the following considerations:

1. Acceptable limits for oxygen concentration in air shall be within 19.5% and 23.5%. An oxygen enriched atmosphere is considered to be greater than 23.5% and poses a flammability hazard. An oxygen deficient atmosphere is considered to be lower than 19.5% and may lead to asphyxiation without fresh-air breathing apparatus.

2. Flammability is measured as a percentage of a material's lower explosive limit (LEL) or lower flammable limit (LFL). Rescuers should not enter confined spaces containing atmospheres greater than 10% of a material's LEL regardless of the personal protective equipment worn. There is no adequate protection for an explosion within a confined space.

3. Acceptable toxicity levels are specific to the hazardous material involved, and chemical properties should be assessed to determine the level of the hazard for a given environment and time frame.

The confined space rescue team at the operations level should have available resources capable of understanding the assessment tools necessary for analysis and identification of hazardous conditions within confined spaces and interpretation of that data. This capability should include at least the following:

(a) Identifying the hazards found within confined spaces and understanding how those hazards influence victim viability and rescue/recovery operations

(b) Selection and use of monitoring equipment to assess the following hazards:

1. Oxygen deficient atmospheres

2. Oxygen enriched atmospheres

3. Flammable environments

4. Toxic exposures

5. Radioactive exposures

6. Corrosive exposures

(c) Understand the limiting factors associated with the selection and use of the atmospheric and chemical monitoring equipment provided by the AHJ for confined space emergencies. This equipment could include, but is not limited to, the following:

1. Calorimetric tubes

2. Oxygen concentration monitor (continuous reading, remote sampling)

3. Combustible gas monitor (continuous reading, remote sampling)

4. Specific toxicity monitor (continuous reading, remote sampling)

5. Multi-gas atmospheric monitors (continuous reading, remote sampling)

6. Passive dosimeter

7. PH papers, PH meters, and PH strips

8. Radiation detection instruments

NOTE: These factors include, but are not limited to, calibration, proper operation, response time, detection range, relative response, sensitivity, selectivity, inherent safety, environmental conditions, and nature of hazard.

(d) Utilization and evaluation of reference terms and resources to include, but not be limited to, the following:

1. Lethal concentration-50 (LC-50)

2. Lethal dose-50 (LD-50)

3. Permissible exposure limit (PEL)

4. Threshold limit value (TLV)

5. Threshold limit value-short term exposure limit (TLV-STEL)

6. Threshold limit value-time weighted average (TLV-TWA)

7. Immediately dangerous to life and health (IDLH)

8. Material Safety Data Sheets

9. Reference manuals

10. Computerized reference data bases

11. Technical information centers

12. Technical information specialists

13. Monitoring equipment

A-5-3.3 (f) The intent of this paragraph 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-5-3.3 (f)(1) If entries require the use of fresh-air breathing apparatus, there will be more difficulty operating within the space because of additional bulk of the apparatus and greater potential for entanglement.

A-5-3.3 (f)(2) The intention is to limit the danger of entanglement.

A-5-3.3 (f)(3) The intention is to ensure that the attendant can maintain direct observation of the entrants at all times, making recognition of problems more rapid.

A-5-3.3 (f)(4) The intention 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 personal protective equipment.

A-5-3.3 (f)(5) The intention is to allow a "buddy system" to be employed providing potentially faster response to a problem with one of the rescue entrants.

A-5-3.3(f)(6) The intention is to ensure that hazards to rescuers in organizations at this level are kept to an absolute minimum.

A-5-3.3(g) Packaging devices that can be used in confined spaces include, but are not limited to, the following:

(a) Full spine immobilization devices

(b) Short spine immobilization devices

(c) Cervical spine immobilization devices

(d) Litters

(e) Prefabricated full-body harnesses

(f) Tied full-body harnesses

(g) Wrist loops (wristlets)

A-5-3.3(i) Guidelines for initial response planning within the quantity and capability of available personnel and equipment should include, but is not limited to, the following:

(a) Response objectives for confined space emergencies

(b) Non-entry rescue options

(c) Entry-type rescue options

(d) Whether rescuer and equipment capabilities are appropriate for available rescue options

(e) Needs analysis and procedures for providing emergency decontamination to victims suspected of being contaminated with a hazardous material

Confined Space Rescue Preplan

Date:				
Space Designation: *(Unit / Vessel Name & ID#)*	**Space Location:**			
Staging Area:				
Space Category: ❑ Category I – Rescue Available (RA) ❑ Category II – Rescue Stand-by (RS)	**Space Type (1–12):** _____ Elevated: Y N Congested Y N			
Means to Summons Rescue Service: ❑ Phone ❑ Pager ❑ Radio ❑ Audible signal ❑ Intercom ❑ Other: _____				
Method of Rescue: ❑ *Confirm that attendant has been trained in emergency response procedures.*				
❑ External (Retrieval):	❑ Internal: _____ (Congested: _____)			
❑ Hauling System Required	❑ Victim-Lowering System Required / Lowering Area: _____			
❑ Anchorage: Overhead: _____	Pre-rigging Required? ❑ Yes ❑ No			
Anchorage: ❑ Beam ❑ Welded Steel Handrail ❑ Support Strut ❑ Other: _____ ❑ Stairwell ❑ Anchored Steel Pipe ❑ Support Column				
Suggested CSR Preplanned Technique: **CSR#_____ (1–5)**	**Rescue Equipment Requirements:** *(Indicate quantity needed)*			
	❑ Hauling Systems	❑ Carabiners	❑ Pulleys	
	❑ Ascenders	❑ Prusiks	❑ Shock Absorbers	
	❑ Anchor Straps	❑ Webbing	❑ Rigging Bags	
Rescue Ropes Needed: *(Indicate quantity needed)*				
❑ Main Line(s)	❑ Hauling Systems	❑ Lowering Line(s)		
❑ Safety Line(s)	❑ Line-Transfer System(s)			
Medical & Packaging Equipment Needed: *(Indicate quantity needed)*				
❑ Spinal Immobilization Device:	❑ Stretcher Device:			
❑ C-Collar:	❑ Medical Kit:			
Additional PPE: *(See Permit / MSDS)*				
Designation of Rescue Personnel: *(Last name, First initial)* • First Responder(s): _____ • Team Leader: _____ • Safety Line(s): _____ • Back-up Rescuer: _____	• Rigger: _____ • Attendant: _____ • Air Watch: _____			
Space Description:				
Sketch or Diagram of Space: *(Use back of page if needed)*				
Entry Supervisor:	Phone:	Date:		
Report Completed By:				

Figure A-5-3.3.(i) Confined space rescue preplan.

Operational procedures for response implementation should include, but are not limited to, the following:

(a) Scene control procedures including control zones and communication

(b) Incident management system consistent with the organizations standard operating procedure

(c) Non-entry retrieval

(d) Qualifying entry-type rescues

(e) Emergency decontamination as needed

(f) Technical level rescue service assistance

A-5-3.3(j) Organizations at the operations level are expected to safely apply lowering and raising systems (rope or non-rope based) as appropriate during confined space emergencies. These applications may involve the use of rope rescue systems in the high-angle environment to both lower rescuers into and remove rescuers and victims from confined spaces. The determination of what systems are most appropriate to accomplish these tasks should be dictated by the circumstances surrounding the incident.

A-5-4.2 Requirements should be met based on the circumstances of the rescue operation undertaken. For example, rescue operations undertaken in a hazardous atmosphere may require an operations level of hazardous material competency rather than an awareness level of competency.

A-5-4.3(a) The size-up/assessment at this level should include, but not be limited to, the initial and continuous evaluation of the following:

(a) Available/necessary additional resources

(b) Hazard isolation and control requirements.

A-5-4.3(b) Procedures should be consistent with local, state, and federal guidelines such as those found in 29 CFR 1910.120, *U.S. Federal OSHA Standard on Hazardous Waste Operations and Emergency Response* (HAZWOPER).

A-5-4.3(c) Planning response for entry-type rescues with hazards should consider the following issues:

(a) Options for entry-type confined space rescues beyond the capability of operations level personnel

(b) Selection, use, maintenance, and training relative to personal protective clothing and equipment provided by the AHJ for operating in and around confined space emergencies

(c) Determination of response objectives based on circumstances of the confined space emergency. The response objective may involve any one of the following:

1. Victim rescue
2. Victim recovery
3. Remote extrication
4. Non-intervention

(d) Verify the need for emergency decontamination

(e) Develop a plan of action, including safety considerations, consistent with the organizations standard operating guidelines, for entry-type confined space rescue. Components of a typical action plan might include the following:

1. Site assessment
2. Confined space assessment
3. Resource organization and accountability (IMS)
4. Perimeters and control zones
5. Hazard evaluation
6. A comprehensive risk/benefit analysis that evaluates the viability of the victim
7. Personal protective equipment
8. Chemical protective clothing
9. Specialized rescue equipment
10. Rescue/recovery objectives
11. On-scene work assignments
12. Communications procedures
13. Emergency decontamination procedures (victim)
14. Decontamination procedures (rescuers)
15. On-scene safety and health procedures including personnel health monitoring, on-scene rehabilitation, emergency medical care procedures, and the designation of a safety officer
16. Scene termination procedures

(f) Implement the planned response to successfully rescue or recover victims from confined spaces by completing the following tasks:

1. Perform the duties of an assigned position within the local incident management system (IMS)
2. Perform entry-type rescues from Confined spaces
3. Perform support functions for entry-type rescues from confined spaces
4. Don, safely operate, and doff appropriate personal protective clothing including, but not limited to, liquid splash protection and vapor protective clothing, which might be required when operating around the scene of confined space emergencies involving hazardous materials

(g) Develop procedures that include required equipment and safety precautions for the following entry-type confined space rescues:

1. Vertical rescue
2. Horizontal rescue
3. Suspended victim rescue
4. Entrapped or engulfed victim (collapse, particulate matter, etc.)

A-5-4.3(d) See 5-4.3(c).

A-6-1.1 It is the intent of this provision that the AHJ, as part of the hazard analysis and risk assessment, identify the types of vehicles and machinery within their response area. These types may include, but are not be limited to, cars, trucks, buses, trains, mass transit systems, aircraft, watercraft, agriculture implements, industrial/construction machinery and elevators/escalators. The AHJ should develop procedures and provide training to personnel that is commensurate with the potential for rescue situations involving the above mentioned vehicles and machinery.

A-6-1.2 In all types of vehicle and machinery rescue incidents, the potential exists for extenuating circumstances that would require expertise beyond the normal capability of the organization to safely operate. Examples of these situations may include, but are not limited to, complex and/or unusual machinery, unusual vehicles, unusual locations of either machinery or vehicles, multiple complicating hazards (e.g., water, chemicals, and extreme height), failure of essential equipment, or severe environmental conditions (e.g., snow and rain). These conditions should be evaluated during the initial risk assessment and on an incident-by-incident basis.

A-6-2.2(a) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(a) Scope and magnitude of the incident
(b) Risk/Benefit analysis (body recovery versus rescue)
(c) Number/size of vehicles and/or machines affected
(d) Integrity and stability of vehicles and/or machines affected
(e) Number of known/potential victims
(f) Access to the scene
(g) Hazards such as disrupted or exposed utilities, standing or flowing water, mechanical, hazardous materials, electrical, and explosives
(h) Exposure to traffic
(i) Environmental factors
(j) Available/necessary resources

A-6-2.2(b) See A-2-2.5.

A-6-2.2(c) The emergency response system includes, but is not limited to, operations and technician level personnel, as well as local, state, and federal resources.

A-6-2.2(d) 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-6-2.2(e) General hazards associated with rescue operations at vehicle and/or machinery rescue incidents can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members.

(a) *Utilities.* Control of the utilities in and around a vehicle and/or machinery rescue 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 in order to provide a safe environment in which to operate and to ensure the safety of victims. The following utilities should be considered when providing training:

1. Electrical services (primary and secondary)
2. Gas, propane, fuel oil, or other alternative energy sources (primary systems)
3. Water
4. Sanitary systems
5. Communications
6. Secondary service systems (such as compressed, medical or industrial gases)

(b) *Hazardous Materials.* Vehicle and/or machinery rescue incidents might include various materials that, when released during an incident, could pose a hazard to victims and responders. The AHJ should provide 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 in order to conduct operations safely and effectively.

(c) *Personal Hazards.* At the site of any vehicle and/or machinery rescue incident, there are many dangers that pose personal injury hazards to the responders. The AHJ should train members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards in order to help ensure their safety. Every member should be made aware of hazards such as trips, falls, blows, cuts, abrasions, punctures, impalement, and so forth.

(d) *Movement of Vehicle(s) and/or Machinery.* Uncontrolled movement of vehicle(s) and/or machinery components can cause extremely hazardous and potentially fatal situations. Responding personnel should be familiar with and trained in techniques for stabilizing and removing the potential for movement of vehicle(s) and/or machinery components.

(e) *Release of High Pressure Systems.* Vehicles and machinery often include high pressure systems (e.g., hydraulic, pneumatic, etc.) that can fail without warning. Such failure can cause extremely hazardous conditions, injury, and death of victims and responders. The AHJ should provide members with training in the recognition of potential high pressure system hazards, the determination of an existing hazard, and the methods used to contain, confine, or divert such hazards in order to conduct operations safely and effectively.

(f) *Other Hazards.* There are numerous other hazards associated with vehicle and/or machinery rescue incidents. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide members with training and awareness of these other hazards in order to perform rescue operations safely and effectively.

A-6-3.3(b) The rescue area is that area immediately surrounding (within a 20-ft, or so, radius) the vehicle and/or machinery. Making the rescue area safe includes, but is not limited to, the following actions; however, specific actions should be based on the vehicle/machinery type and specific situation:

(a) Establishing operational zones (i.e., hot, warm, cold) and site security
(b) Utilizing specific techniques and tools (including cribbing, chocks, and wedges) to stabilize the vehicle
(c) Utilizing specific techniques and tools (i.e., lock out and tag out) to isolate the involved equipment
(d) Making the rescue area (i.e., hot zone) safe for entry
(e) Safely undertaking disentanglement and/or extrication operations using hand tools
(f) When necessary, ventilating the rescue area and monitoring its atmosphere
(g) Supporting any unbroken utilities
(h) Providing protective equipment for any victims, if possible, when necessary
(i) Prohibiting entry into an unsafe vehicle and/or machinery rescue area
(j) Preventing the touching or operating of equipment or machinery involved until its safety has been established

A-6-3.3(g) In order to perform a safe disentanglement and/or extrication operation, the AHJ shall provide training on the following topics:

(a) Types of passenger restraint systems
(b) The frame and construction features of vehicles
(c) Types of suspension systems in vehicles
(d) Types and classification of impacts
(e) Categories of mechanical injury
(f) Various stabilization techniques
(g) Center of gravity and its relationship to rollover
(h) Use of cribbing and chocks
(i) Building a crib box
(j) Types and examples of levers for mechanical advantage
(k) Proper and effective use of hand tools including a hammer, pry bar, hack saw, glass punch, Halligan, knife/belt cutter, cable cutter, and come-a-long
(l) Disentanglement through primary access points
(m) Patient packaging prior to removal from a vehicle and/or machine
(n) Protecting the victim during extrication and/or disentanglement operations

A-6-3.3(h) These procedures refer to the mitigation and management of the hazards identified in A-6-2.2(e).

A-6-4.2(a) In order to perform a safe disentanglement and/or extrication operation from large/heavy vehicles and/or machines, the AHJ shall provide training on the following topics:

(a) Frame and construction features of heavy/large vehicles and machinery
(b) Use and components of a rescue chain assembly
(c) Pneumatic high, medium, and low pressure lifting bags
(d) Use, care, and maintenance of wire rope and its associated equipment
(e) Large and heavy object weight estimation
(f) Steps necessary to lift and/or move large objects
(g) Use of cribbing and chocks with large and heavy objects
(h) Use of commercial heavy wreckers and recovery services to assist at incidents involving large transportation vehicles
(i) Use, care, and maintenance of both manual and power winches
(j) Types and examples of lifting devices that use mechanical advantage principles
(k) Proper and effective use of power tools including hydraulic, pneumatic, and electrical spreading, cutting, lifting, and ram-type tools
(l) Disentanglement through both primary and secondary access points through the use of available power tools

(m) Protecting the victim during this type of extrication and/or disentanglement operations
(n) Lock out/tag out of machinery
(o) Identification and use of various sling configurations

A-6-4.2(b) "Unusual" situations include, but are not limited to, extrication and/or disentanglement operations at incidents involving cars on their tops, cars on their side, and cars on top of other cars, trucks, and large commercial vehicles.

"Advanced stabilization" includes techniques using chains, cables, jack devices, and cribbing/shoring to stabilize vehicles of any size.

A-6-4.2(c) Power tools (e.g., air bags, hydraulic spreaders and rams, hand tools, and power tools) and training necessary to remove, cut, and move components displaced at a vehicle and/or machinery rescue incident should be provided.

"Specialized rescue equipment" may 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-7-1.2 In all types of water incidents, the potential exists for extenuating circumstances that would require expertise beyond the normal capability of the organization to safely operate. Examples of these situations may include, but are not limited to, depth, current, water movement, water temperature extremes, or severe environmental conditions (e.g., snow and rain). These conditions should be evaluated during the initial risk assessment and on an incident-by-incident basis.

A-7-2.2(a) The assessment phase includes size-up *[see A-7-2.2(b)]* as well as an evaluation of the subject's condition and his or her ability to assist in their own rescue.

Consideration should be given to the need for dive rescue early in the size-up/assessment phase. The best intended surface rescue may eventually require dive capability.

A-7-2.2(b) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(a) Scope, magnitude, and nature of the incident
(b) Location and number of victims
(c) Risk/benefit analysis
(d) Separating, isolating, securing, and interviewing witnesses
(e) Hazards such as disrupted or exposed utilities, standing or flowing water, mechanical, hazmat, and explosives
(f) Access to the scene
(g) Environmental factors
(h) Resource assessment, internal and external
(i) Rescue verses recovery

A-7-2.2(c) See A-2-2.5.

A-7-2.2(d) The emergency response system includes, but is not limited to, operations and technician level personnel, as well as local, state, and federal resources.

A-7-2.2(e) 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 non-emergency personnel and establishment of operational zones and site security.

A-7-2.2(f) 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.

(a) *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 in order to provide a safe environment in which to operate and to ensure the safety of victims. The following utilities should be considered when providing training:

1. Electrical services (primary and secondary)
2. Gas, propane, fuel oil, or other alternative energy sources (primary systems)
3. Water/steam
4. Sanitary systems
5. Communications
6. Secondary service systems (such as compressed, medical, or industrial gases)

(b) *Hazardous Materials.* Water incident sites might include various materials unique to a site that, when released during a rescue, could pose a hazard to victims and responders. The AHJ should provide 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 in order to conduct operations safely and effectively.

(c) *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 members to recognize the personal hazards they encounter and to use the methods needed to mitigate these hazards in order to help ensure their safety. Every member should be made aware of hazards such as trips, falls, blows, punctures, impalement, and so forth.

(d) *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 members in confined space rescue.

(e) *Hazards that Are Immediately Dangerous to Life and Health.* Swiftwater with currents exceeding that which a person or watercraft can safely and effectively operate.

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

(g) *General Area.* The general area around a water incident site is the entire area around a rescue site. Any member operating within the vicinity of the water's edge may 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 and/or reducing their impact
3. Utilizing PFD's and other PPE

A-7-3.3 Certain jurisdictions may not need to achieve operational capability in one or more specialties. The organization should have the option of selecting those specialties relevant to needs identified in the risk assessment and hazard analysis.

A-7-3.4 Further requirements of PPE are included in Section 2-4.2 of this standard. This requirement applies to all the described disciplines.

A-7-3.4(c) It is important to note that fire-related PPE such as fire helmets and boots are not typically appropriate for water rescue work and in some cases actually pose a hazard.

A-7-3.5(a) These procedures may include, but are not limited to, assuring the wearing of proper PPE, procedural checklists, site security (keep 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, proper attire for the potential weather, reviewing procedures for equipment handling, assuring proper rest and attitude for the operation.
Water rescue requires a combination of knowledge, skills, abilities, physical fitness, and judgement to expect positive outcomes. These things are to be gained through a combination of training and experience.

A-7-3.5(b) Hazards to both victim and rescuer may include, but are not limited to, the following:

(a) Holes
(b) Strainers
(c) Hydraulics

(d) Low head dams
(e) Debris
(f) Cold water
(g) Currents
(h) Undercuts
(i) Backwash
(j) Outwash
(k) Contamination
(l) Obstructions
(m) Turbidity

A-7-3.5(d) Mechanisms of entrapment include, but are not limited to, the following:

(a) Undercuts
(b) Underwater hazards
(c) Strainers
(d) Hydraulics

A-7-3.5(e) It is important for the organization to have the capability to continuously evaluate 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-7-3.5(f) Shore-based rescues include, but are not limited to, reaching to a victim, throwing something to a victim (e.g., rope, buoy, etc.), and talking a victim into self rescue.

Many readily available items found 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 (e.g., throw bag, PFD, ring buoy, manufactured floatation or rope throwing devices) found on shore can be thrown to a victim and used as either flotation or used to pull the victim to shore.

A-7-3.5(g) 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, etc.).

A-7-3.5(h) 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-7-3.5(j) Procedures for survival swimming and self rescue are important because a rescuer might find him- or herself unintentionally in the water. These procedures should include, but are not limited to, the ability to float and swim with and without floatation, the ability to conserve body heat while immersed in water (heat escape lessening position), the ability to use one's clothing for floatation, and the ability to remove one's self from the water by climbing into a boat, exiting at shore, or exiting from a pool's edge.

A-7-3.5(k) Environmental conditions like 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 effected by cold. Therefore, thermal protection from the elements is essential for safe operations in cold and wet environments.

It is also very important to note that all environments can lead to heat stress as well. For example, much of the apparel designed for rescue operations serves to protect the rescuer from heat loss and wet by being waterproof and insulating its wearer from the ambient environment. Unfortunately, a side effect of such garments is the serious impairment of the body's most effective means of thermal regulation: the evaporation of perspiration from the skin. In all environments and conditions, rescuers wearing proper PPE will require great attention to the substantial potential 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-7-3.5(m) The regular use of an approved form for the collection and transfer of this information is recommended.

A-7-3.5(n) 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).

A-7-3.5(p) Accessible victims are those who can be retrieved without venturing out onto the ice or into the water.

A-7-3.6(a) Hazards associated with dive operations include, but are not limited to, the following:

(a) Barotrauma (decompression sickness, nitrogen narcosis, oxygen toxicity, etc.)
(b) Drowning
(c) Hyperventilation, hypercarbia, and other respiratory problems
(d) Anxiety reactions
(e) Fatigue and exhaustion
(f) Dehydration (electrolyte imbalances)
(g) Heat stress (i.e., heat exhaustion, stroke, and cramps)
(h) The combination of prescription medication or smoking and diving
(i) Pre-existing medical conditions or injuries
(j) Hypothermia

A-7-3.6(b) Surface support personnel are called upon to assist technicians in preparing to dive, dress, and equip divers; provide search pattern control and direction; monitor divers time, depth, dive profile, and air supply; and provide a communication link to the surface via electronic communication equipment or manual rope pull signals.

A-7-3.6(d) Surface support personnel should be capable of recognizing, maintaining, and operating all surface support equipment used by the organization.

A-7-3.6(g) Unusual or extreme environmental conditions may require very specialized dive and/or surface support training specific to the situation(s) encountered. *(See A-7-4.7.1 for some specialty examples.)*

A-7-3.7(a) Hazards associated with ice rescue may include, but are not limited to, the following:

(a) Hypothermia
(b) Localized cold injuries (i.e., frostbite, frostnip, etc.)
(c) Thermal burns from heating devices

A-7-3.7(b) Rescuers should be able to recognize, and describe the implication of, the following ice and water characteristics:

(a) New (frazil) ice
(b) Candle ice
(c) Old (rotten) ice
(d) Clear (hard) ice
(e) Milk ice
(f) The depth of ice and how it relates to carrying capacity
(g) Water currents and how they relate to ice thickness
(h) Obstacles and how they relate to current and ice formation
(i) Salt water and ice formation (i.e., sea ice)

A-7-3.7(c) Surface support personnel should be capable of recognizing, maintaining, and operating all surface support equipment used by the organization.

A-7-3.7(e) One component of hypothermia that should be emphasized to cold weather rescuers is the effects of cold weather/water on a victim's ability to help themselves, respond to instructions from rescuers, or assist in their rescue.

A-7-3.8(a) Surf hazards may include, but are not limited to, the following:

(a) Riptides
(b) Undertows
(c) Currents
(d) Tides
(e) Obstructions
(f) Debris
(g) Cold Water
(h) Contamination

A-7-3.8(d) See A-7-3.5(j).

A-7-3.9(a) The ability to assess moving water is important for safe operations. Examples of water characteristics and features that should be identifiable include eddies, downstream/upstream "V"s, standing waves, laminar/helical flows, confluence, cushion/pillows, and swift water classifications.

A-7-3.9(c) A tag line is a line stretched across a river and brought to the level of a stationary victim. A floating tag line has a floatation device attached to the line to keep the rope on the surface of the water and to provide something for the victim to grasp. A snag line is a variation of the tag line which is weighted to reach an object beneath the surface of the water. A tension diagonal, or zip line, is a line positioned at an angle greater than 45 degrees diagonal to the water's flow and just above the surface of moving water, anchored at both ends and tensioned tightly. This type of taut, diagonal line can be used in a variety of ways as an operational rescue tool.

A-7-3.9(d) Swift water self rescue involves all capabilities discussed in A-7-3.5(j) as well as the capability to swim in current while defending against obstacles that are likely to be encountered.

A common technique used to safely swim in moving water is to swim face up with the feet downstream while using the hands to maneuver (swim). When obstacles such as rocks are encountered the feet can be used to push off. If strainers are encountered that cannot be circumnavigated, the swimmer should make every attempt to swim over (never under or through) them while maneuvering toward a safe shore.

Additional hazards may be found in A-7-3.5(b).

A-7-4.6(c) Boat-assisted operations involve the actual performance of rescue techniques through the use of one or more boats. *[See also A-7-3.5(n).]*

A-7-4.6(d) "Go" techniques include, but are not limited to, the following:

(a) Shallow water crossing

(b) In-water contact rescues with or without floating rescue devices, including rescue tubes, boards, and so forth

(c) Rescuer combat techniques (i.e., blocks/escapes) when conducting in-water contact rescues

(d) The use of specialized PPE (i.e., rescue release personal flotation devices) and other specialized equipment and techniques utilized by the AHJ

(e) Advanced rope rescue techniques including the use of high lines.

(f) Other "go" techniques, and more advanced options, utilized by the AHJ

A-7-4.7.1 Examples of specialty training include dry suit use, full face or light helmet use, underwater communications equipment, deep diving, night/limited visibility, current, polluted water, team operations, leadership, lifting equipment, cave/cavern diving, tidal diving, surface supply diving, ice diving, and underwater tools. Organizations at the technician level may gain knowledge, skills, and abilities necessary at a controlled training situation to extend their capabilities.

Additional areas that may need to be addressed include scene surveys, drowning accidents, operational planning, effective search patterns, electronic equipment (e.g., sonar, underwater video), safety procedures, handling of outside influences, rescue/recovery techniques and procedures, IMS, CISD, Risk/Benefit.

Nationally recognized agencies include, but are not limited to, the following:

(a) PADI (Professional Association of Dive Instructors)
(b) SSI (SCUBA Schools International)
(c) NAUI (National Association of Underwater Instructors)
(d) YMCA (Young Men's Christian Association)
(e) PDIC (Professional Diving Instructor's Corporation)
(f) DRI (Dive Rescue International)
(g) NASDS (National Association of SCUBA Diving Schools)
(h) MDEA (Multinational Diving Educators Association)
(i) IDEA (International Diving Educators Association)
(j) LACUI (Los Angeles County Underwater Instructors)

A-7-4.7.3(a) Training in skin and SCUBA diving should include, but not be limited to, the information conveyed in a nationally recognized skin/SCUBA diving program.

A-7-4.7.3(c) Safe use of dive table means precise use of nationally recognized dive tables specified for the type of dive operation undertaken.

A-7-4.7.3(h) The treatment of dive-related injuries and maladies is often beyond the capability of standard BLS providers. Therefore, the AHJ should assure that procedures are in place during any dive to provide appropriate emergency medical care for the treatment of dive-related injuries. This may include the training of selected personnel, as Dive Medics (a specialized emergency medical training program) or establishing an SOP to address the situation.

A-7-4.7.3(j) Effective underwater communication refers to the capability to communicate between divers and from a diver to the surface. Such communications may be achieved through the use of rope signals, a hard-wired communications system, a wireless communications system, or whatever system is in use by the organization.

A-7-4.8.1(a) Self rescue on ice includes, but is not limited to, the following capabilities:

(a) Roll, crawl, or swim away from an ice hole
(b) Utilize any personal ice rescue equipment used by the organization such as ice awls, crampons, and so forth
(c) Practical methods of weight distribution

A-8-1.2 In all types of wilderness rescue incidents, the potential exists for extenuating circumstances that would require expertise beyond the normal capability of the organization to safely operate. Examples of these situations may include lowering and raising operations requiring significant obstacle negotiation, descending or ascending operations from extreme heights, or severe environmental conditions (e.g., snow, rain, altitude). These conditions should be evaluated during the initial risk assessment and on an incident-by-incident basis.

A-8-2.3(a) The size up should include, but not be limited to, the initial and continuous evaluation of the following:

(a) Scope and magnitude of the incident including whether it is a search, rescue, or body recovery
(b) Assessment of time required
(c) Assessment of manpower needs
(d) Specific environmental factors involved
(e) Integrity and stability of the environment involved
(f) Number of known/potential victims
(g) Weather (current and forecast)
(h) Urgency (based on the type of known/potential victims)
(i) Available/necessary resources

A-8-2.3(b) The emergency response system includes, but is not limited to, operations and technician level personnel, as well as local, state, and federal resources.

A-8-2.3(c) Training should address 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-8-2.3(d) General hazards associated with search and rescue operations in the wilderness can present the AHJ with uniquely

challenging situations. The AHJ should consider the following potential hazards and, in order to help ensure their safety, assure members have the ability to recognize potential hazards that they may encounter:

(a) *Personal Hazards.* In the wilderness environment, there are many dangers that pose personal injury and physiological hazards to the responders. Personnel should be made aware of hazards including, but not limited to, blisters, scrapes, scratches, falls, blows, bruises, dehydration, and so forth.

(b) *Environmental Hazards.* Depending on the specific environment, there are many dangers that pose hazards to the responders. Personnel should be made aware of hazards including, but not limited to, insect bites and stings, poisonous plants, exposure injuries (cold and heat), snow blindness, altitude illness, lightning, sun burn, dangerous wildlife, and so forth.

(c) *Terrain Hazards.* Specific features in an environment can pose hazards to responders. Personnel should be made aware of hazards including, but not limited to, cliffs, avalanches, standing water (e.g., ponds, lakes), flat ice (e.g., ponds, lakes), moving water (e,g, rivers, streams), caves, mines, wells, high winds, snow (blowing and fallen), coastal white water surf, and so forth.

(d) *Man-made Hazards.* Humans, whether intentionally or accidentally, can also cause unsafe conditions in the wilderness. Personnel should be made aware of hazards including, but not limited to, booby-trapped stills and labs (covert ethanol and drug production), hazardous materials dumps, trained attack dogs (drug labs), and so forth.

A-8-2.3(f) Conventional emergency response PPE and equipment (especially fire-related equipment) is often inappropriate for use in a wilderness setting. For instance, fire helmets and boots can increase one's potential for injury in the wilderness.

Conventional emergency response skills such as using a sphygmomanometer and using an ambulance cot have very little application in the wilderness. Therefore, such skills and equipment will require modification to achieve their desired goals in the wilderness.

A-8-2.3(g) Documents for the collection and recording of information may include the following:

(a) Information regarding the lost person or persons
(b) Information needed to determine search urgency
(c) Information required by the AHJ
(d) Information required by the IMS
(e) Information required to identify a subject's track (i.e., foot print)
(f) Information for development of search strategy

A-8-2.3(h) Isolation includes keeping the reporting party handy 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-8-3.2 In some cases, where minimum exposure to wilderness hazards exists, it may be appropriate for the AHJ to establish SOP's that permit operations level personnel to conduct certain rescues without supervision of technician level personnel.

A-8-3.3(a) Resources may include but are not limited to the following:

(a) Search dogs
(b) Trackers
(c) Aircraft
(d) Ground/air search specialists
(e) Rope rescue specialists
(f) Water search and rescue specialists
(g) Trench rescue specialists
(h) Vehicle/machinery rescue specialists
(i) Collapse building search and/or rescue specialists
(j) Emergency incident management (overhead) teams
(k) Avalanche rescue specialists
(l) Cave rescue specialists
(m) Mine rescue specialists
(n) Other technical search and/or rescue providers and managers

A-8-3.3(b) The AHJ shall establish wilderness medical care protocols.

A-8-3.3(c) Body management refers to the skills and knowledge involved in maintaining personal nutrition, hydration, rest, and other physiological requirements of the human body.

A-8-3.3(e) Personal support equipment should include that which is necessary to address the following needs, or potential needs, of a rescuer in a wilderness setting:

(a) Personal medical (first aid) supplies
(b) Additional clothing appropriate for anticipated environment/weather
(c) Fluids and food appropriate for mission duration
(d) Personal safety and comfort gear (i.e., flashlight, sunglasses, sunscreen, etc.)
(e) Navigation (i.e., compass, map, etc.)
(f) General marking and documentation tools (i.e., flagging tape, paper/pencil, etc.)
(g) Improvisational tools (i.e., wire, twine, leaf bag, safety pin, etc.)
(h) Emergency shelter, bivouac, and/or body protection
(i) Emergency communications (i.e., whistle, radio, flare)
(j) Pack for contents (i.e., belt pack, ruck sack, etc.)

A-8-3.3 (f) The AHJ should establish procedures for negotiating, and/or avoiding, conditions and hazards specific to the wilderness environments and terrains in which rescuers may 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 more highly trained resources should be procured. *(See also 8-1.2 and A-8-1.2.)*

A-8-3.3(k) Skills involved in supporting and participating in a search should include, but not be limited to, the following:

(a) Hasty, efficient, and thorough search techniques
(b) Principles of confinement and segmentation of the search area
(c) Principles and importance of clue awareness
(d) Basic search probability theory application and terminology
(e) Principles of lost person behavior
(f) Procedures for serving as an air observer (e.g., searching from an aircraft).
(g) Procedures for handling, processing, and documenting evidence.

A 8-3.3(o) The ability to discern limitations in accessing and/or evacuating should be based on the following:

(a) Individual and team expertise
(b) Qualified personnel available
(c) Ability to communicate from the patient scene
(d) Anticipated manpower and time

A-8-4.4(c) 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 wilderness skills, travel, and operations in the wilderness setting.

A-8-4.4(d) Such an operational plan should be based on the hazard analysis and risk assessment performed according to Section 2-2 of this standard, available resources, environmental influences and conditions, and the urgency of the situation. Specifically with regard to a search, the implemented plan should involve proper search management techniques including, but not necessarily limited to, the following:

(a) Determining the urgency of the search
(b) Development of a lost subject profile
(c) Properly establishing and segmenting the search area
(d) Conducting an appropriate investigation and interviews
(e) Application of the concept of search probability theory
(f) Design, development, and establishment of appropriate search strategy and tactics
(g) Appropriate base camp establishment and management
(h) Proper and thorough briefing and debriefing of operational personnel

(i) Appropriate consideration given to suspension of the search
(j) Demobilizing personnel and facilities
(k) Properly documenting the incident

A-9-1.2 In all types of trench and excavation rescue incidents, the potential exists for extenuating circumstances that would require expertise beyond the normal capability of the organization to safely operate. Examples of these situations may include, but are not limited to, very deep trenches, unusually shaped excavations, multiple complications (e.g., deep excavation and fluid soil), involvement of hazardous/toxic substances, completely buried subjects, or severe environmental conditions (e.g., snow and rain). These conditions should be evaluated during the initial risk assessment and on an incident-by-incident basis.

A-9-2.2(a) The size-up should include, but not be limited to, the initial and continuous evaluation of the following:

(a) Scope, magnitude, and nature of the incident
(b) Location and number of victims
(c) Risk versus benefit analysis (body recovery versus rescue)
(d) Exposure to traffic and sources of vibration
(e) Hazards such as disrupted or exposed utilities, standing or flowing water, secondary collapse, mechanical, hazmat, and explosives
(f) Trench/excavation dimensions
(g) Access to the scene
(h) Environmental factors
(i) Available/necessary resources

A-9-2.2(b) See A-3.2.2(b).

A-9-2.2(c) The emergency response system includes, but is not limited to, operations and technician level personnel, as well as local, state, and federal resources.

A-9-2.2(d) 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 non-emergency personnel and establishment of operational zones and site security.

A-9-2.2(e) General hazards associated with search and rescue operations at trench and excavation collapses can present the AHJ with uniquely challenging situations. The AHJ should consider the following potential hazards when providing training to its members.

(a) *Utilities.* Control of the utilities in and around a trench or excavation emergency 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 in order to provide a safe environment in which to operate and to ensure the safety of victims. The following utilities should be considered when providing training:

1. Electrical services (primary and secondary)
2. Gas, propane, fuel oil, or other alternative energy sources (primary systems)
3. Water/steam
4. Sanitary systems
5. Communications
6. Secondary service systems (such as compressed, medical or industrial gases)

(b) *Hazardous Materials.* Excavations might include various materials unique to a site that, when released during a collapse, could pose a hazard to victims and responders. The AHJ should provide 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 in order to conduct operations safely and effectively.

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

(d) *Confined Space.* All trench, and many excavation, collapses 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 members in confined space rescue.

(e) *Other Hazards.* There are numerous other hazards associated with trench and excavation collapses. The AHJ should make every effort to identify the hazards that might be encountered within the jurisdiction and should provide members with training and awareness of these other hazards in order to perform rescue operations safely and effectively.

The "general area" around a trench or excavation emergency is the entire area within 300 feet (or more, as established by the incident commander). Making the general area safe includes, but is not necessarily limited to, the following:

(a) Controlling/limiting traffic and sources of vibration in the area including shutting down all vehicles and equipment
(b) Controlling/limiting access to the area by unnecessary personnel
(c) Identifying hazards and removing and/or reducing their impact

A-9-2.2(f) The types of collapse normally encountered at an excavation or trench incident include the following:

(a) Spoil pile collapse — where the excavated earth piled on the side of the trench slides into the trench
(b) Shear wall collapse — where one side of the trench shears away from the wall of the trench
(c) Slough collapse — where a below-grade section collapses, leaving the potential for the collapse of an overhanging ledge

The reasons and indicators of initial and secondary collapse of trenches and excavations are usually related to one or more of the following site characteristics:

(a) Unprotected trench (lack of protection systems)
(b) Static loads
(c) Standing water or water seeping into trench
(d) Intersecting trenches
(e) Vibrations (from vehicles, nearby roads, airports, etc.)
(f) Previously disturbed soil
(g) Exterior cracking of trench walls

A-9-2.2(g) Rapid, non-entry rescues may include placing a ladder to allow a victim to perform a self-rescue or allowing non-injured persons in the trench to remove a victim.

A-9-2.2(h) As a rule of thumb, a cubic foot of soil weighs 100 pounds and a cubic yard of soil weighs 1.5 tons.

The weight and movement of soil alone can cause crush injuries, and the characteristics of the soil (e.g., wet, hard, sandy, etc.) will dictate how the soil will entrap (e.g., flow around, drown, etc.) a victim.

A-9-3.1 Severe environmental conditions include operations involving frozen soil, running soil (e.g., gravel, sand, liquid), severe weather (e.g., heavy rain, wind, or flooding), or night (dark) operations.

Supplemental sheeting and shoring includes operations that involve the use of commercial sheeting/shoring systems and/or isolation devices, or cutting and placement of sheeting and shoring when greater than two feet of shoring exists below the bottom of the strongback. Supplemental sheeting and shoring requires additional training beyond that of traditional sheeting and shoring. Traditional sheeting and shoring involves the use of 4 ft × 8 ft sheet panels with a strongback attachment supplemented by a variety of conventional shoring options such as hydraulic, pneumatic, and/or screw shores.

Commercial sheeting/shoring systems and devices include trench boxes, sheet piles, plate steel, and the like. Isolation devices include concrete pipes, concrete vaults, steel pipe, or anything that serves to separate the victim(s) from the surrounding soil.

A-9-3.3(b) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when one of the following occurs:

(a) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure.

(b) The excavation is in stable rock.

(c) A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity.

(d) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

Sidewalks, pavements, and appurtenant structure should not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

A-9-3.3(c) Procedures to identify probable victim locations include the following:

(a) Visualization of the victim
(b) Presence of drink cups or food containers, work tools, laser targets, buckets, grade poles, grease and brush, engineers hubs, or anything that may indicate the victim's last probable physical location
(c) Information from bystanders
(d) End of pipe string
(e) Sounds in pipes
(f) "Cat" or tire tracks

A-9-3.3(d) The rescue area is that area immediately surrounding the trench and/or excavation site. Making the rescue area safe includes, but is not limited to, the following actions, however specific actions should be based on both the type of collapse and the soil type.

(a) Utilizing sheeting and shoring to stabilize trench/excavation walls
(b) Making the trench/excavation safe for entry
(c) Safely undertaking disentanglement operations in the trench/excavation
(d) Placing ground pads at the lip of the trench/excavation
(e) Ventilating the trench and monitoring its atmosphere
(f) Dewatering
(g) Supporting any unbroken utilities.
(h) Providing a helmet and goggles for a victim, if possible
(i) Prohibiting entry into an unsafe trench/excavation
(j) Preventing the touching or operating of heavy equipment until its safety has been established
The term "tabulated data" usually refers to the six (6) tables found in Appendix C of 29 CFR 1926 Subpart P.

Traditional sheeting and shoring should not be used in situations that exceed the tabulated data for timber trench shoring presented in 29 CFR 1926, Subpart P. Also, these systems should not be used where they would be submerged in water.

A-9-3.3(e) In many parts of the United States, a "one-call" underground utility location service is available to contractors and residents who are preparing to excavate. By making one telephone call (usually a toll free number), excavators can learn the location of all underground utility installations in the area of the planned excavation. This service quickly notifies all possible utility providers in the area who, in turn, either indicate that there is no utility in the area or have someone go to the site to mark the utilities. Such a service can be invaluable to emergency responders at the site of a trench or excavation emergency incident.

Where no "one-call" system exists, all utility companies who might have underground equipment at or near the excavation site must be notified so they can have a representative respond to mark underground utility locations.

A-9-3.3(f) The following is excerpted from 29 CFR 1926.651 (Specific Excavation Requirements) and specifies soil types.

"Cemented soil" means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

"Cohesive soil" means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

"Dry soil" means soil that does not exhibit visible signs of moisture content.

"Fissured" means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

"Granular soil" means gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

"Layered system" means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

"Moist soil" means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

"Plastic" means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

"Saturated soil" means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

"Soil classification system" means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the characteristics of the deposits and the environmental conditions of exposure.

"Stable rock" means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

"Submerged soil" means soil which is underwater or is free seeping.

"Type A" means cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or
(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
(iii) The soil has been previously disturbed; or
(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

"Type B" means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or
(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.
(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
(v) Dry rock that is not stable; or
(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

"Type C" means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or
(ii) Granular soils including gravel, sand, and loamy sand; or
(iii) Submerged soil or soil from which water is freely seeping; or
(iv) Submerged rock that is not stable, or
(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

"Unconfined compressive strength" means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

"Wet soil" means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

The classification of soil shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in 29 CFR 1926 Subpart P Appendix A (Soil Classification), or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

The visual and manual analyses, such as those specified in 29 CFR 1926 Subpart P Appendix A (Soil Classification), shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the soil.

A-9-3.3(j) A ladder or engineered ramp may be required for entry or egress from a trench. For instance, 29 CFR 1926.651(c)(1)(v) requires, "A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet or more in depth so as to require no more than 25 feet of lateral travel for employees."

A-9-3.3(k) The pre-entry briefing shall include, but not limited to, information regarding the following:

(a) Tactical assignments with explicit instructions
(b) General hazards and safety instructions
(c) Communications protocols, procedures, and details
(d) Anticipated environmental concerns
(e) Time frames for operations
(f) Emergency procedures
(g) Specific equipment needs
(h) Debriefing procedures
(i) Anticipated logistical needs

A-9-3.3(l) Documentation for entry operations, as a minimum, should include the following:

(a) Development of some type of representation of IMS command structure
(b) Time of incident
(c) Total time of operation
(d) Environmental conditions
(e) Location of victim
(f) Creation of a tactical check list that includes entry times, exit times, personal accountability reports, atmospheric readings, rehabilitation information, injuries sustained, and incident number

A-9-3.3(m) RIT members should be at or above the capability level at which the incident is operating.

A-9-3.3(o) The following describes and defines sloping and benching as used in this standard and is excerpted from 29 CFR 1926 Subpart P Appendix B (Excavation Sloping and Benching).

(a) Scope and application. This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in 1926.652(b)(2).

(b) Definitions.

"Actual slope" means the slope to which an excavation face is excavated.

"Distress" means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, e.g., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

"Maximum allowable slope" means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

"Short term exposure" means a period of time less than or equal to 24 hours that an excavation is open.

(c) Requirements.

(1) Soil classification. Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.
(2) Maximum allowable slope. The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.
(3) Actual slope.
(i) The actual slope shall not be steeper than the maximum allowable slope.
(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least 1/2 horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope.
(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with 1926.651(i).
(4) Configurations. Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1 - MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)(1) FOR EXCAVATIONS LESS THAN 20 FEET DEEP(3)
STABLE ROCK	VERTICAL (90 Deg.)
TYPE A (2)	3/4:1 (53 Deg.)
TYPE B	1:1 (45 Deg.)
TYPE C	1 1/2:1 (34 Deg.)

Footnote(1) Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
Footnote(2) A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feed (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53 degrees).
Footnote(3) Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

FIGURE B-1 (See appendix D for these diagrams) Slope Configurations (All slopes stated below are in the horizontal to vertical ratio)

B-1.1 Excavations Made in Type A Soil 1.

All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 3/4:1. (See Figure B-1.1a)

SIMPLE SLOPE - GENERAL Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of 1/2:1. (See Figure B-1.1b)

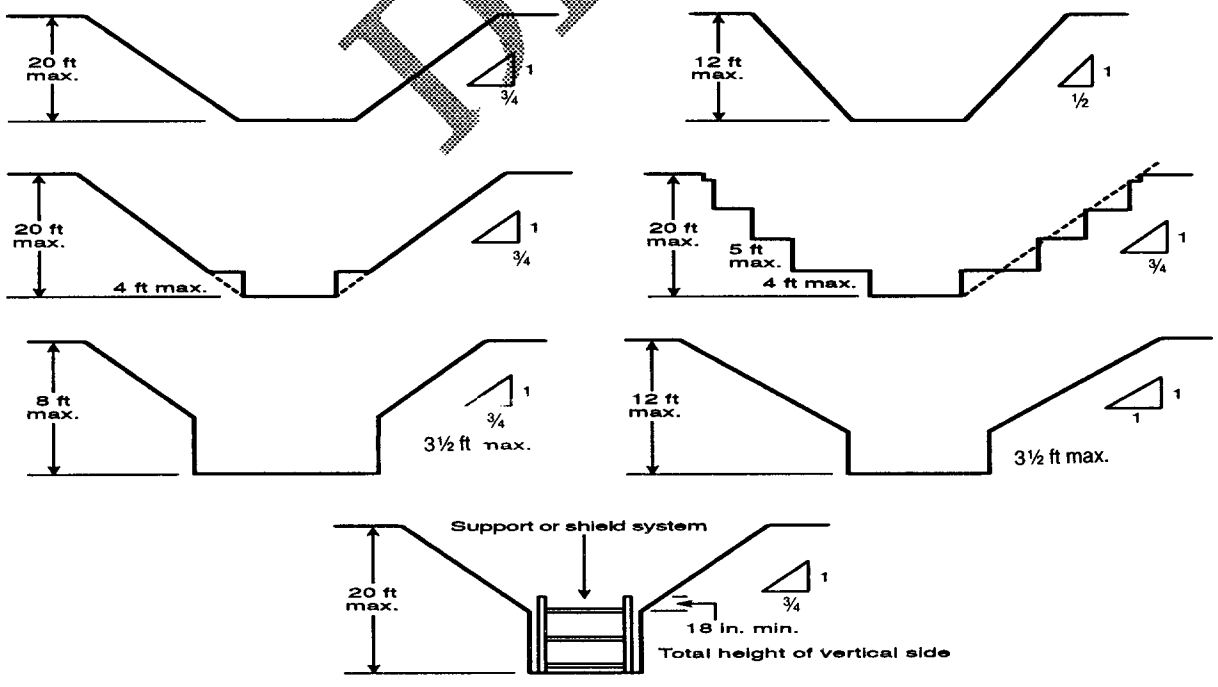
SIMPLE SLOPE - SHORT TERM 2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows: (See Figure B-1.1c)

SIMPLE BENCH; MULTIPLE BENCH 3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3 1/2 feet. (See Figure B-1.1d)

UNSUPPORTED VERTICALLY SIDED LOWER PORTION - MAXIMUM 8 FEET IN DEPTH) All excavations more than 8 feet but not more than 12 feet in depth with unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3 1/2 feet. (See Figure B-1.1e)

UNSUPPORTED VERTICALLY SIDED LOWER PORTION - MAXIMUM 12 FEET IN DEPTH) All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of 3/4:1. The support or shield system must extend at least 18 inches above the top of the vertical side. (See Figure B-1.1f)

SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION) 4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under 1926.652(b). (See Figure B-1.1g)



B-1.2 Excavations Made in Type B Soil 1.

All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1. (See Figure B-1.2a)

SIMPLE SLOPE 2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows: (See Figure B-1.2b)

SINGLE BENCH AND MULTIPLE BENCH (These benches allowed in cohesive soil only). 3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1. (See Figure B-1.2c)

VERTICALLY SIDED LOWER PORTION 4. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b). (See Figure B-1.2d)

VERTICAL SIDED LOWER PORTION 3. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b). B - 1.4 Excavations Made in Layered Soils 1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below. (See Figure B-1.4a)

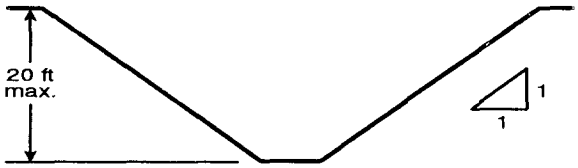
B OVER A (See Figure B-1.4b)

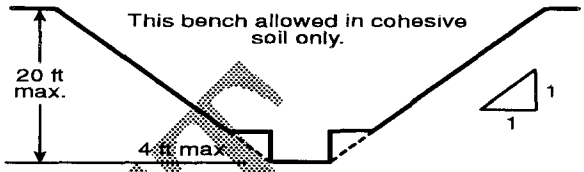
C OVER A (See Figure B-1.4c)

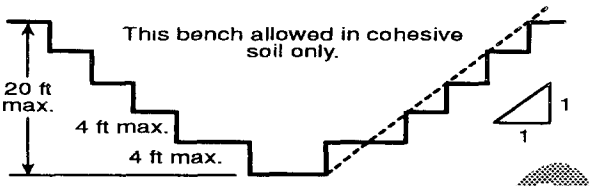
C OVER B (See Figure B-1.4d)

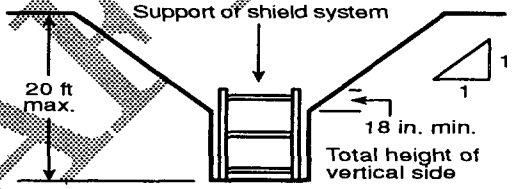
A OVER B (See Figure B-1.4e)

A OVER C (See Figure B-1.4f)





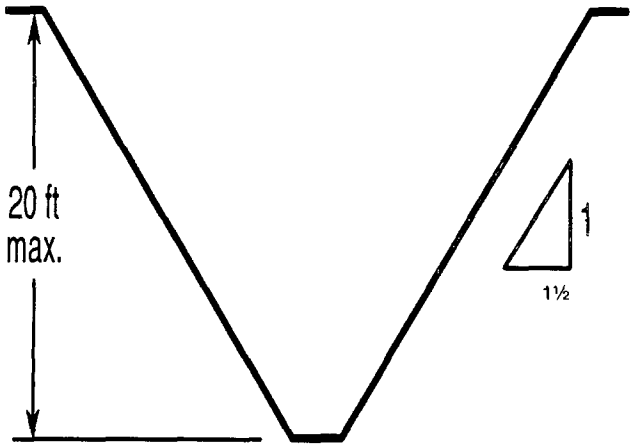


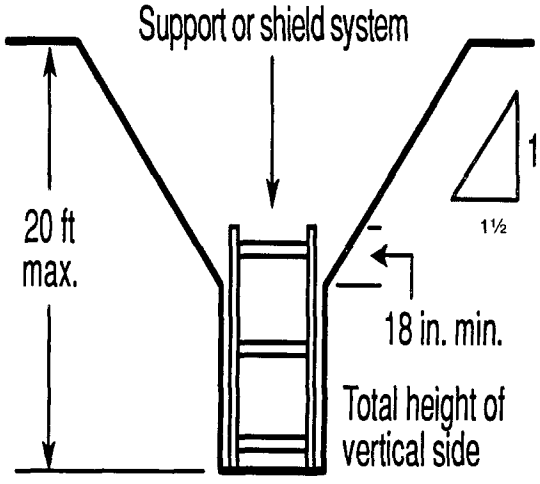


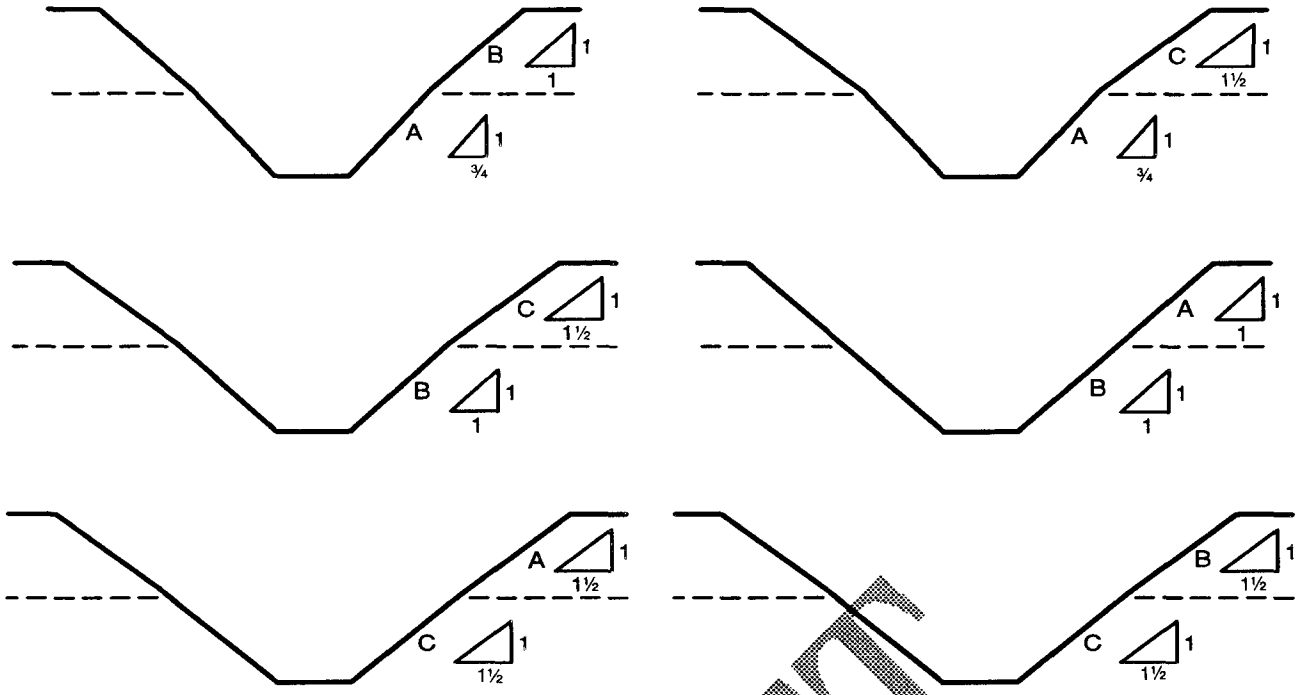
B-1.3 Excavations Made in Type C Soil 1.

All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1. (See Figure B-1.3a)

SIMPLE SLOPE 2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1 1/2:1. (See Figure B-1.3b)







B OVER C 2. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

A-9-3.3(r) Procedures for disentanglement and removing the entrapment mechanism may include but are not be limited to the following:

(a) Hand digging
(b) Lifting using air bags, pneumatic, or other mechanical advantage devices
(c) Suctioning
(d) Cutting using air knives, saws, or other power tools
(e) Dewatering
(f) Heavy equipment

Procedures and equipment involved in removal systems should comply with NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components.*

Heavy or mechanical equipment and/or mechanical winches, of any kind, should not be used to physically lift, pull, or extricate victims from a trench. However, there may be circumstances when heavy equipment may be appropriate for accessing victims of trench and evacuation emergencies with the appropriate level of supervision and after careful consideration is given to the negative impact of such actions on the victim including the effects of extreme superimposed loads and vibration adjacent to the trench. For example, heavy equipment might be used to dig an adjacent trench or hole for access, but the excessive loading and vibration of the area adjacent to the trench may cause a rapid deterioration in the condition of, and in the immediate environment surrounding, the victim. In any case, to best establish viable options and available capabilities, the advice of experienced and knowledgeable on-site personnel should be sought in order to make the best decisions possible.

A-9-4.1 See A-9-3.1.

A-9-4.3(a) Manufactured protection systems include trench boxes, rabbit boxes, "coffins," rigging and placement of sheetpiles, rigging placement of plate steel, or other similar commercial systems. *[See also 9-3.3(d).]*

A-9-4.3(b) Personnel meeting the requirements of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incident*, should perform the monitoring procedures even if such personnel are not part of the rescue team. Important information regarding these procedures include, but are not limited to, the following:

(a) Acceptable limits for oxygen concentration in air should be within 19.5% and 23.5%. An oxygen enriched atmosphere is considered to be greater than 23.5% and poses a flammability hazard. An oxygen deficient atmosphere is considered to be lower than 19.5% and may lead to asphyxiation without fresh-air breathing apparatus.

(b) Flammability is measured as a percentage of a material's lower explosive limit (LEL) or lower flammable limit (LFL). Rescuers should not enter confined spaces containing atmospheres greater than 10% of a material's LEL regardless of the personal protective equipment worn. There is no adequate protection for an explosion within a confined space.

(c) Acceptable toxicity levels are specific to the hazardous material involved and chemical properties should be assessed to determine the level of the hazard for a given environment and time frame.

A-9-4.3(e) In certain soil and environmental conditions, it may be necessary to isolate the victim in order to effectively disentangle them. For instance, in sand, grain, pea gravel, coal slag, or any type of running product, it may be necessary to physically isolate the victim from the surrounding product in order to free them. Examples of isolation devices include concrete or steel pipe, corrugated pipe, concrete vaults, or other pre-engineered structures that sufficiently isolate and protect the victim.

Appendix B

This appendix is not a part of the requirements of this NFPA document, but is included for informational purposes only.

NOTE: Appendix B is extracted from FEMA Earthquake Hazards Reduction Series 41, Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook.

Table B-1 Combinations of Materials in Structural Types (after ATC, 1987)

Structural Type Identifier	General Description
W	Wood buildings of all types
S1	Steel moment-resisting frames
S2	Braced steel frames
S3	Light metal buildings
S4	Steel frames with cast-in-place concrete shearwalls
C1	Concrete moment-resisting frames
C2	Concrete shearwall buildings
C3/C5	Concrete or steel frame buildings with unreinforced masonry in-fill walls
TU	Tilt-up buildings
PC2	Precast concrete frame buildings
RM	Reinforced masonry
URM	Unreinforced masonry

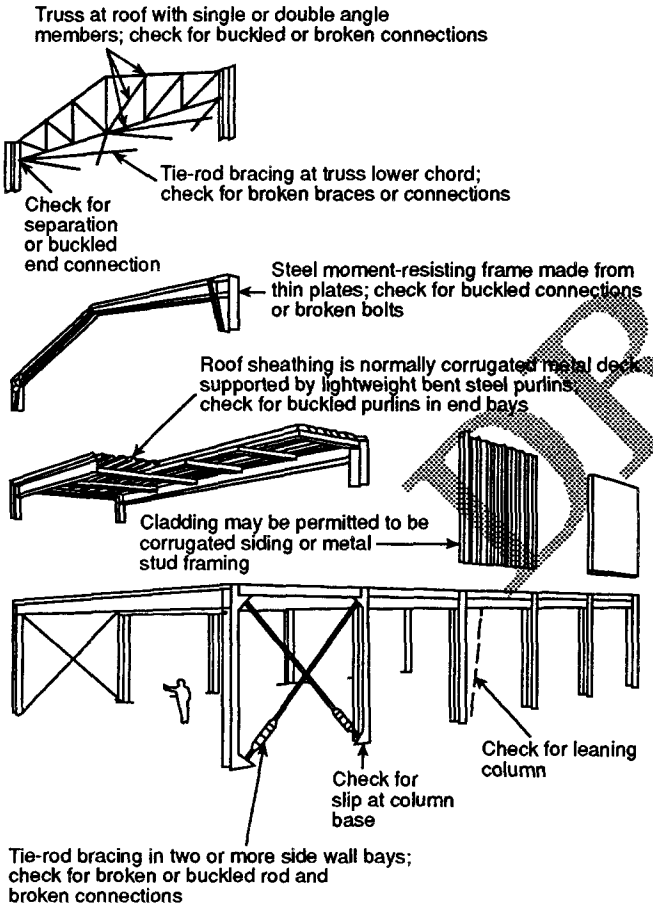


Figure B-1 Light metal buildings (S3).

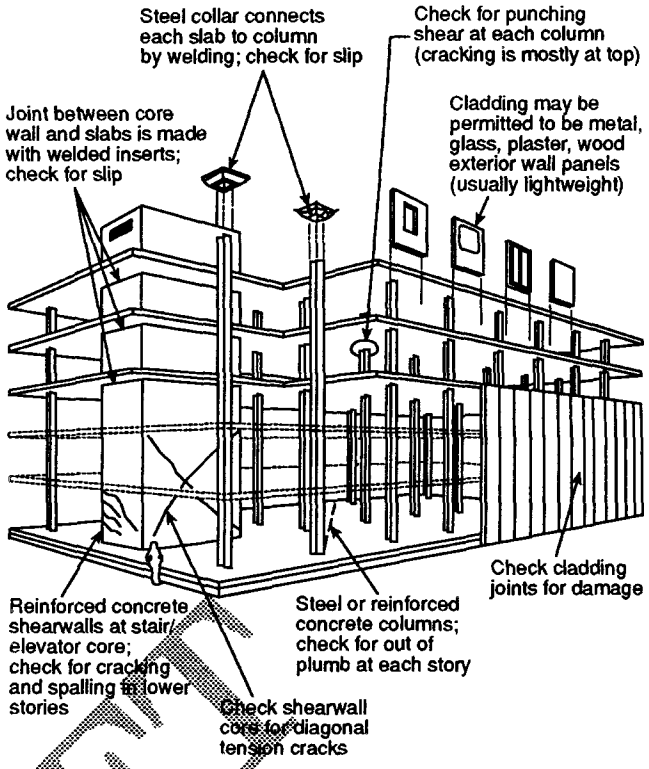


Figure B-2 Post-tensioned lift slab building.

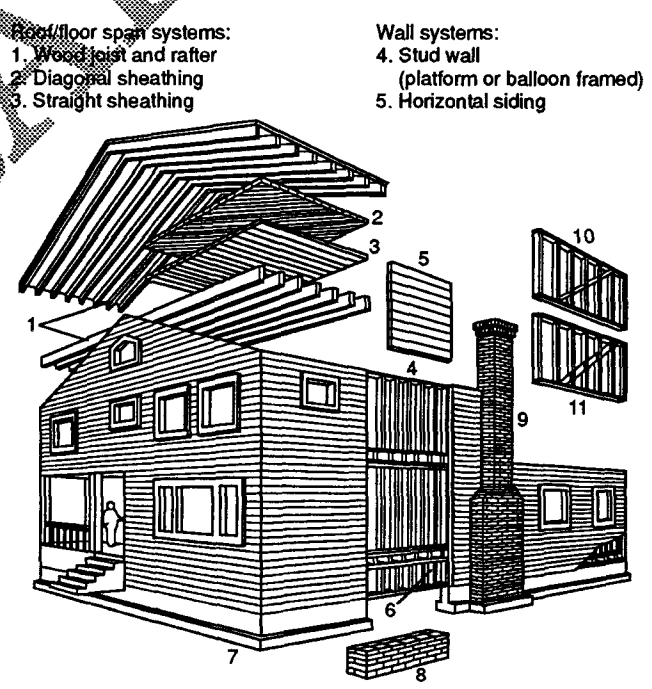


Figure B-3 Wood stud frame construction.

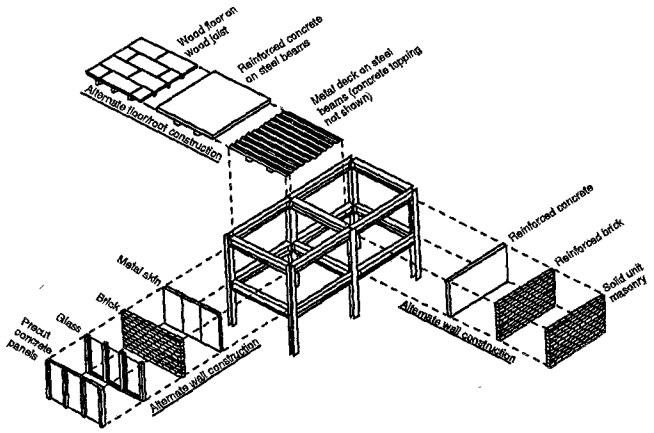


Figure B-4 Steel moment-resisting frame.

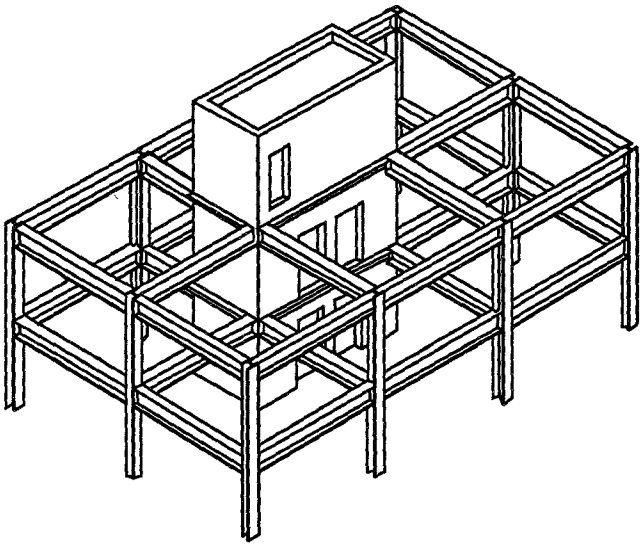


Figure B-6 Steel frame with shearwall.

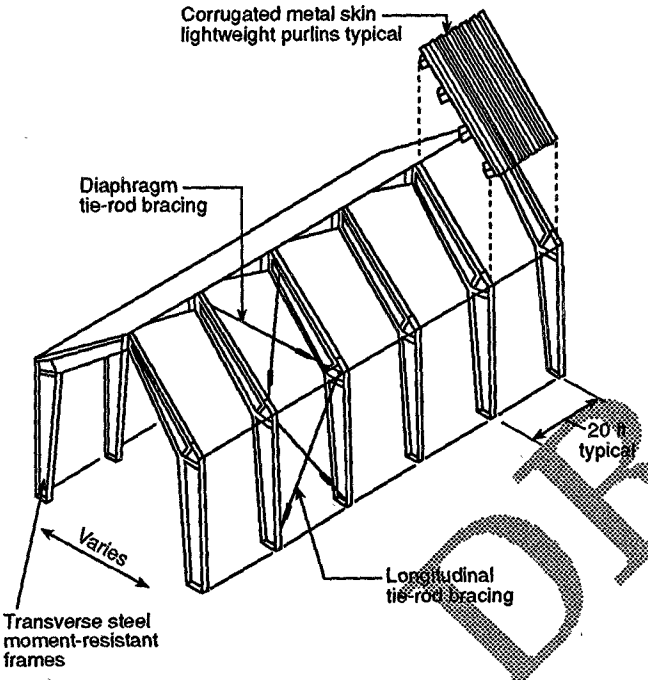


Figure B-5 Light metal construction.

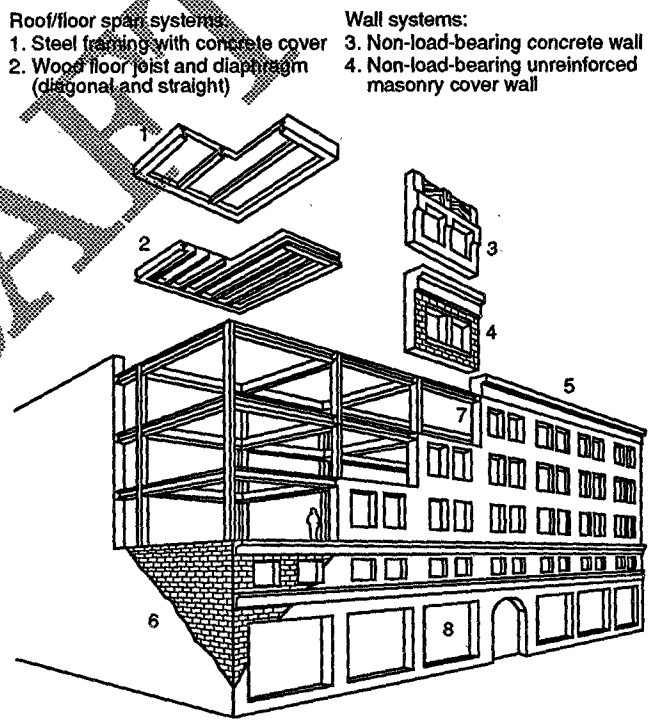
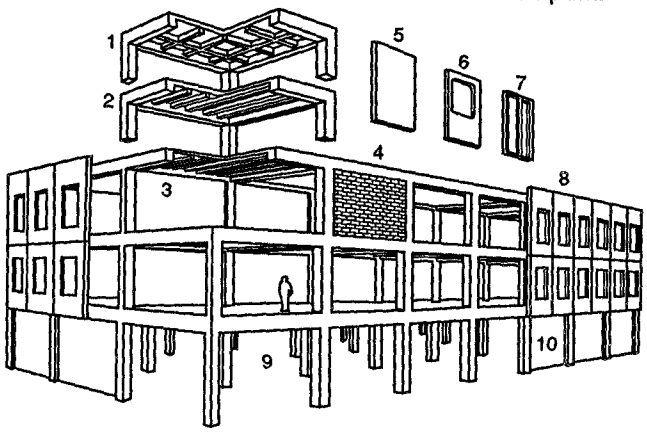


Figure B-7 Steel frame with URM in-fill.

Roof/floor diaphragms:
1. Concrete waffle slab
2. Concrete joist and slab
3. Steel decking with concrete topping

Curtain wall/nonstructural infill:
4. Masonry infill walls
5. Stone panels
6. Metal skin panels
7. Glass panels
8. Precast concrete panels



Structural system:
9. Distributed concrete frame

Details:
10. Typical tall first floor (soft story)

Figure B-8 Concrete moment-resisting frame.

Roof/floor span systems:
1. Heavy timber rafter roof
2. Concrete joist and slab
3. Concrete flat slab

Wall system:
4. Interior and exterior concrete beating walls
5. Large window penetrations of school and hospital buildings

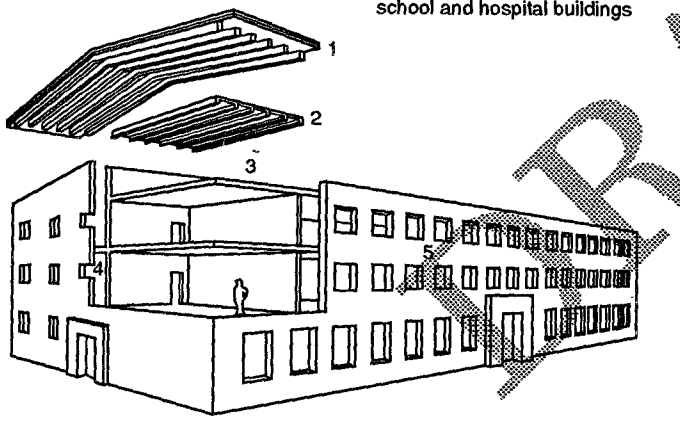
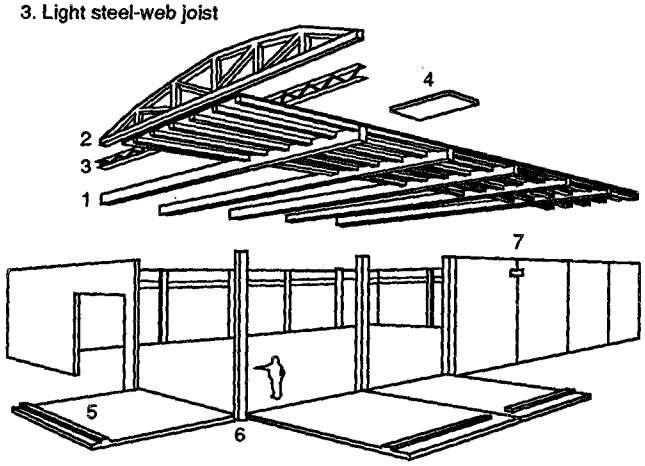


Figure B-9 Concrete shearwall.

Roof/floor span systems:
1. Glue laminated beam and joist
2. Wood truss
3. Light steel-web joist

Roof/floor diaphragms:
4. Plywood sheathing



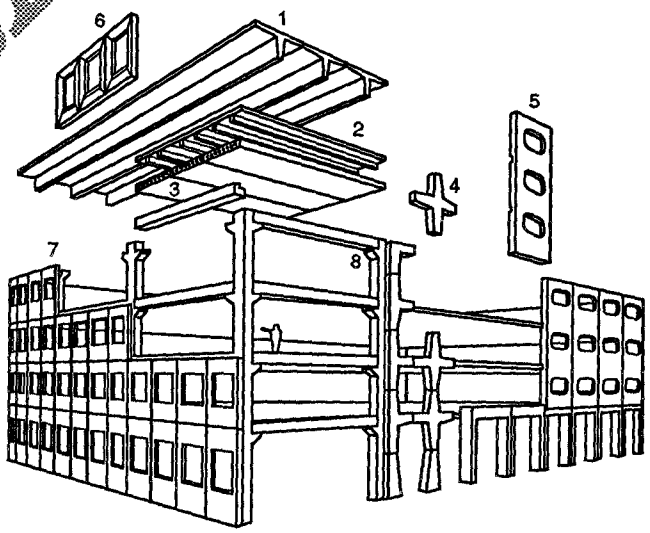
Details:
5. Anchor-bolted wooden ledger for roof/floor support

Wall systems:
6. Cast-in-place columns- square, "T"-shape, and "H"-shape
7. Welded steel plate-type panel connection

Figure B-10 Tilt-up construction typical of the western United States. Tilt-up construction in the eastern United States may incorporate a steel frame.

Roof/floor span systems:
1. Structural concrete "T" sections
2. Structural double "T" sections
3. Hollow-core concrete slab

Wall systems:
4. Load-bearing frame components (cross)
5. Multi-story load-bearing panels



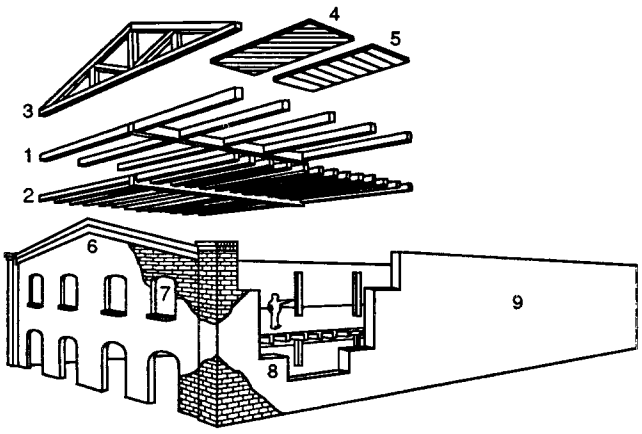
Curtain wall system:
6. Precast concrete panels
7. Metal, glass, or stone panels

Structural system:
8. Precast column and beams

Figure B-11 Precast concrete frame.

Roof/floor span systems:
1. Wood post and beam (heavy timber)
2. Wood post, beam, and joist (mill construction)
3. Wood truss-pitch and curve

Roof/floor diaphragms:
4. Diagonal sheathing
5. Straight sheathing



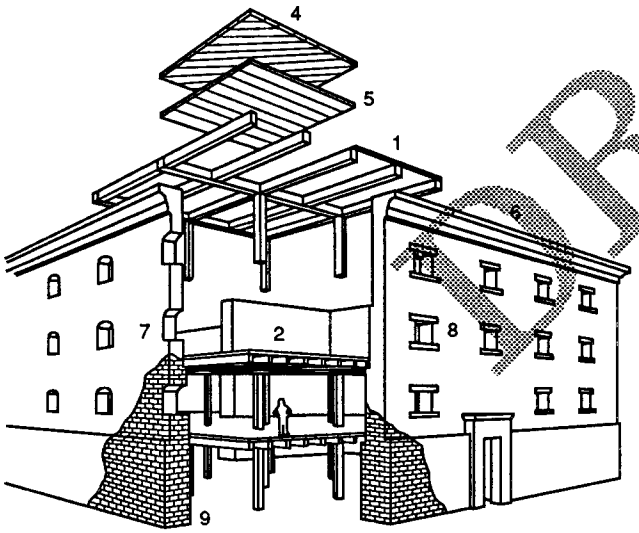
Details:
6. Typical unbraced parapet and cornice
7. Flat arch window openings

Wall systems:
8. Bearing wall-four or more wythes of brick
9. Typical long solid party wall

Figure B-12 Unreinforced masonry bearing wall.

Roof/floor span systems:
1. Wood post and beam (heavy timber)
2. Wood post, beam, and joist (mill construction)

Roof/floor diaphragms:
3. Diagonal sheathing
4. Straight sheathing



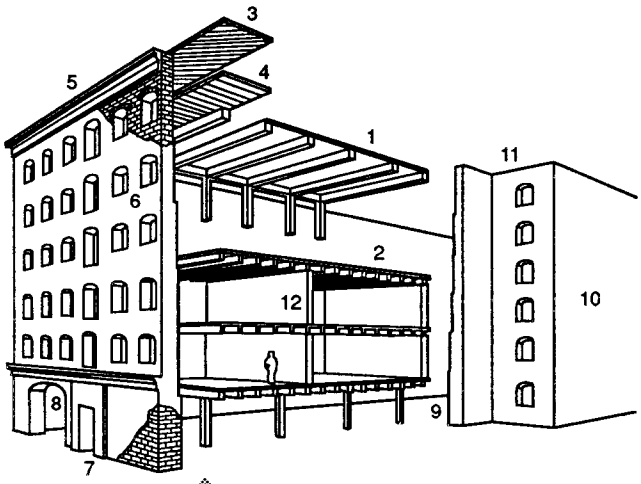
Details:
5. Typical unbraced parapet and cornice
6. Flat arch window openings
7. Small window penetrations (if bldg. is originally a warehouse)

Wall systems:
8. Bearing wall-four to eight wythes of brick

Figure B-13 Unreinforced masonry bearing wall.

Roof/floor span systems:
1. Wood post and beam (heavy timber)
2. Wood post, beam, and joist (mill construction)

Roof/floor diaphragms:
3. Diagonal sheathing
4. Straight sheathing



Details:
5. Typical unbraced parapet and cornice
6. Flat arch window openings
7. Typical penetrated facade of residential buildings
8. Large openings of ground floor shops

Wall systems:
9. Bearing wall-four to eight wythes of brick
10. Typical long solid party wall
11. Light/ventilation wells in residential bldg
12. Nonstructural wood stud partition walls

Figure B-14 Unreinforced masonry bearing wall.

Appendix C Referenced Publications

C-1 The following documents or portions thereof are referenced within this standard for informational purposes only and are thus not considered part of the requirements of this standard unless also listed in Chapter 10. The edition indicated here for each reference is the current edition as of the date of the NFPA issuance of this standard.

C-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 220, *Standard on Types of Building Construction*, 1995 edition.

NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*, 1997 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 1997 edition.

NFPA 1521, *Standard for Fire Department Safety Officer*, 1997 edition.

NFPA 1561, *Standard on Fire Department Incident Management System*, 1995 edition.

NFPA 1581, *Standard on Fire Department Infection Control Program*, 1995 edition.

NFPA 1982, *Standard on Personal Alert Safety Systems (PASS) for Fire Fighters*, 1993 edition.

NFPA 1983, *Standard on Fire Service Life Safety Rope and System Components*, 1995 edition.

C-1.2 Other Publications.

C-1.2.1 BOCA Publication. Building Officials and Code Administrators International, 4051 W. Flossmoor Rd., Country Club Hills, IL 60477.

National Building Code, 1990 edition.

C-1.2.2 FEMA Publications. Federal Emergency Management Agency, 500 C Street SW, Washington, DC 20472.

FEMA Earthquake Hazards Reduction Series 41, Rapid Visual Screening for Potential Seismic Hazards: A Handbook.

FEMA US&R Response System.

C-1.2.3 ICBO Publication. International Conference of Building Officials, 5360 S. Workman Mill Road, Whittier, CA 90601.

Uniform Building Code, 1991 edition.

C-1.2.4 SBCC Publication. Southern Building Code Congress, International, 900 Montclair Road, Birmingham, AL 35213.

Standard Building Code, 1991 edition.

C-1.2.5 Superintendent of Documents Publications. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402

Title 29, *Code of Federal Regulations*, 29 CFR 1910.1030 (OSHA), "Blood-Borne Pathogens," July 1, 1992.

Title 29, *Code of Federal Regulations*, 29 CFR 1910.146, "Permit-Required Confined Spaces," May 19, 1994.

Title 29, *Code of Federal Regulations*, 29 CFR 1910.120, U.S. Federal OSHA *Standard on Hazardous Waste Operations and Emergency Response* (HAZWOPER).

Title 29, *Code of Federal Regulations*, Part 1926.651 (29 CFR 1926.651), "Specific Excavation Requirements," August 9, 1994.

Title 29, *Code of Federal Regulations*, Part 1926 Subpart P Appendix B (29 CFR 1926 Subpart P, Appendix B), "Excavations, Sloping and Benching," August 9, 1994.

C-1.2.6 Recommended Reading.

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Auerbach, Paul S., Ed. *Wilderness Medicine: Management of Wilderness and Environmental Emergencies*, Third Edition, Mosby-Year Book, Inc., 1995.

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Drabek, Thomas E. *The Professional Emergency Manager*, University of Colorado, Institute of Behavioral Science, 1987.

Drabek, Thomas E., et. al. *Managing Multiorganizational Emergency Responses: Emergency Search and Rescue Networks in Natural Disaster and Remote Area Settings*, University of Colorado, Institute of Behavioral Science, 1981.

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NY: Charles Scribner's Sons; 1972.

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