Protecting Workers in Industrial Confined Spaces:

California's emergency response requirements are ambiguous and less protective than the federal standard.

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The company experienced a confined space fatality several weeks ago. One of the factors contributing to the fatality was the absence of a rescue team, both on-site and off-site. We would be willing to share our knowledge and perspectives on this matter.

Industry survey respondent
January 2007

About the Center for Occupational and Environmental Health

The California Legislature established the Center for Occupational and Environmental Health (COEH) in 1978 (AB 3414) to improve understanding of occupational and environmental health problems in California and work toward their resolution through research, teaching, and service. The Northern California COEH consists of researchers and practitioners at UC Berkeley, UC San Francisco, and UC Davis.

About the authors

Heather Madison, MPH, is an environmental health consultant. She conducted research for this report as a graduate student researcher in industrial hygiene at the School of Public Health, University of California, Berkeley.

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External review

Four external reviewers provided comments on this report; the report, however, is not a consensus document. Final responsibility for the report rests with the authors, not with the reviewers, individually or collectively, or with COEH, the School of Public Health, UC Berkeley, or the Regents of the University of California.

About the report

This report was produced as part of a settlement involving the deaths of two workers in an industrial confined space in California. The employer in this case had a written confined space program that relied on the public 911 system for rescue services in the event of an emergency. When the emergency occurred in this case, fire department units responding to the incident did not have the technical capacity to rescue the workers in a timely manner. The settlement agreement resulting from the incident provided funding for this report.

The report analyzes the emergency planning and response aspects of California's confined space standard for general industry. Based on this analysis, the report recommends that California clarify and strengthen its emergency planning and response requirements by adopting language of the federal confined space standard, including Appendix F.

External reviewers

- Barbara Materna, Ph.D, CIH, Chief, Occupational Health Branch, California Department of Public Health

- Kim Nibarger, Health, Safety & Environment, United Steelworkers, Pittsburgh, Pennsylvania

- Robert Harrison, MD, MPH, Professor, Clinical Professor of Occupational and Environmental Medicine, University of California, San Francisco

- Kevin White, Director of Health and Safety, California Professional Firefighters

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Executive Summary

Workers continue to die and be injured in confined spaces each year in the U.S. despite implementation in 1993 of a federal Occupational Safety and Health Administration (OSHA) confined space standard for general industry. Twenty-five U.S. states have their own state OSHA plans, and by law, these plans must include confined space standards that meet or exceed the requirements of the federal standard. California is among these states, where a confined space standard for general industry has been in place since 1978.

California adopted most aspects of the federal standard in 1993; however, key differences remained in the area of emergency planning and response. California concluded that the emergency planning and response requirements of its existing 1978 standard were *more protective* than those of the new federal standard, and it therefore chose to retain key language from its existing standard when the federal standard was published.[1] California continued to maintain this position when the emergency response language in the federal standard was amended in 1998.

This report describes important differences in the emergency response language of the California and federal standards. The report points out that the 1998 amendments to the federal standard require the employer, through a rigorous evaluation and selection process, to "match" the timeliness and capacity of emergency rescue services to the nature and degree of hazard(s) posed by the entry operations. The most dangerous entry conditions (those most likely to develop atmospheres that are Immediately Dangerous to Life and Health (IDLH)) require the employer to post a technically capable rescue service at the entrance to the space. Such a "matching" scheme is less explicit in the California standard; in fact, this report illustrates that California's emergency planning and response requirements are in many respects ambiguous and confusing.

The report presents the results of a small survey of California employers, which suggest that even large employers may be relying on the public 911 system as their *primary* rescue strategy in the event of a confined space emergency. The report analyzes the limitations of the public 911 system and concludes that the California confined space standard is less protective than the federal standard in the area of emergency planning and response requirements.

The report recommends that California clarify and strengthen the emergency planning and response requirements of its confined space standard by adopting language of the federal standard, including Appendix F.

[1] California Department of Industrial Relations, Division of Occupational Safety and Health. Updated Informative Digest of Proposed Action, CCR8, Chapter 4, Subchapter 7, General Industry Safety Orders, Section 5156-5159, Confined Spaces, p.3 (1993)

Methods

We used the following data sources and methods in preparing this report: the Census of Fatal Occupational Injuries of the U.S. Bureau of Labor Statistics (BLS) for the period 1992–2005; California Division of Occupational Safety and Health (DOSH) incident investigation reports involving citations of the California confined space standard for the period July 1993–December 2003; a literature review; survey responses from 21large California companies; comprehensive fire department response time data for two major metropolitan areas in California; aggregated fire department response time data for six California municipalities; discussions with California employers; discussions with California DOSH industrial hygienists; and site visits.

Scope

This report pertains to the emergency planning and response aspects of the California confined space standard of 1978, revised in 1993, as it compares to the existing federal, as revised in 1998. Fatal and non-fatal injuries are evaluated only for confined space incidents that resulted from oxygen deficient and/or toxic atmospheres.

Key Findings

Confined space rescues involving hazardous atmospheres are uniquely dangerous.

Removing an incapacitated worker from a confined space that contains an IDLH atmosphere is both time-sensitive and technically complicated. A worker who becomes incapacitated in these conditions will likely die if he or she is not removed from the space and resuscitated in a matter of minutes. Rescues made under IDLH conditions require the most careful planning and the most time and expertise to safely perform. Requirements and guidelines for emergency planning and response – to protect both entrants and rescuers – therefore figure prominently in both the federal and California confined space standards.

After declining during the period 1992–1996, U.S. fatalities in confined spaces have claimed about 25 to 30 workers per year since 1996.

A total of 431 confined space incidents involving oxygen-deficient or toxic atmospheres resulted in 530 deaths in U.S. workplaces between 1992 and 2003, including 39 deaths during 29 incidents in California. 10% of U.S. and 17% of California incidents involved the death of at least one rescuer.

Non-fatal injuries comprise nearly two-thirds of all confined space injuries.

In addition to fatalities, significant underlying morbidity is associated with confined space incidents. For every confined space fatality in California, two workers were injured, one of which required hospitalization.

The federal standard requires the employer to "match" the response time and capacity of a rescue service with the nature of the hazard(s) posed by the space.

The federal standard requires the employer to post a technically trained and equipped rescue team at the entrance to the confined space if the space contains (or could contain) an IDLH atmosphere; however, the standard also allows the employer to rely on rescue services with longer response times (including an off-site fire department) if the space contains only minor physical hazards. The federal approach requires the employer to "match" or "scale" the emergency response time (and technical capacity) to the nature of the hazard(s) that exist in the space.

The California standard does not require the employer to "match" the response time and capacity of a rescue service with the nature of the hazard(s) posed by the space.

The California standard contains ambiguous language regarding employer emergency response requirements, and it does not differentiate between high and lower-hazard entries. In fact, in our assessment, the California standard signals to the employer that it is permissible to rely wholly on off-site rescue services (that is, fire departments) for confined space operations, even under IDLH conditions. The confined space guidance document of the California DOSH Consultation Service reinforces these ambiguities and provides no substantive guidance for employers in evaluating the capacity and timeliness of off-site rescue services, or in matching rescue services with entry conditions.

Confined space emergency response practices appear to vary considerably among California employers; reliance on off-site fire departments figures prominently.

In a survey of 21 large California companies, 26% of respondents reported that they "contracted out" confined space entry work to a private firm, which provided its own entry personnel, equipment, and rescue team. 17% of respondents reported having an employee-led rescue team on-site. 53% of respondents reported that they relied on the 911 system in the event of a confined space emergency. Many companies cited lack of resources for training and equipment as a reason for not maintaining an employee-based, on-site rescue team.

A worker who becomes incapacitated in an IDLH atmosphere will likely die if the employer relies on the 911 system for confined space rescue.

The first-responding units of a municipal fire department are not able to safely perform a confined space entry rescue under IDLH conditions; fire department technical rescue and hazardous materials units that are able to do so will be delayed. Technical rescue units are generally staffed only in large urban areas and on average arrive between 8 and 11 minutes after the time of dispatch. In addition to the response time, a fire department confined space rescue operation requires a team of firefighters to assess and secure the safety of the scene, don personal protective equipment, assemble the rescue platform, access and package the victim, extricate the victim, and initiate advanced life support.

We estimate that in a "best-case scenario," the total time required to complete this evolution (from the time of call to initiation of advanced life support) is about 48

minutes. In contrast, life support must be initiated within five minutes if a worker experiencing an emergency under IDLH conditions is to have a chance of survival.

The California standard is presently less protective than the federal standard.

The 1998 amendments to the 1993 federal OSHA confined space standard require employers to *evaluate* the timeliness and capacity of rescue services, as noted above. The amended standard includes an Appendix F to guide the employer in conducting the evaluation. Through this mechanism, the federal standard prohibits employers from relying on the public 911 system for rescue services when a worker enters a confined space that is at risk of developing IDLH conditions.

Following the introduction of the federal standard in 1993, California concluded that its own standard was at least as protective as the new federal standard because it contained language requiring *on-site* rescue capability in the form of a "stand-by" employee. California retained this position following the 1998 federal amendments.

This report concludes that the California standard is less protective than the federal standard because:

- the emergency planning and response language in the California standard is ambiguous;
- the California standard does not explicitly require the employer to "match" the response time and capacity of the rescue service with the degree of hazard posed by the space.

California should adopt the emergency planning and response language of the federal standard, including Appendix F.

In meeting its obligation to maintain standards "at least as protective" as those of federal OSHA, California faces two choices: (1) clarify the roles and responsibilities of the "attendant" and "stand-by" person, and clarify the employer's responsibility to provide on-site rescue for IDLH conditions, or (2) adopt the language of the federal standard.

We conclude that it is not possible to ensure that the first choice will produce a California standard "at least as protective" as the federal standard; it also introduces a number of complications regarding the training and equipping of employees as rescuers. We therefore recommend that California adopt the language of the federal standard, including its Appendix F. The emergency planning and response sections of the confined space guidance document of the Cal/OSHA Consultation Service should be re-drafted to reflect these changes.

If properly enforced, the evaluation requirement of the federal standard more explicitly meets the spirit of California's on-site rescue language, which is intended to minimize risks to workers and rescuers under the most dangerous entry conditions; it would therefore provide a greater degree of protection to California workers than what currently exists.

1. Background

1.1 Methodology

We used the following data sources and methods in preparing this report: the Census of Fatal Occupational Injuries of the U.S. Bureau of Labor Statistics (BLS) for the period 1992–2005; California Division of Occupational Safety and Health (DOSH) incident investigation reports involving citations of the California confined space standard for the period July 1993–December 2003; a literature review; survey responses from 21 California companies; aggregated fire department response time data for two major metropolitan areas in California; summarized fire department response time data for six additional California municipalities; discussions with California employers; discussions with California DOSH industrial hygienists; and site visits.

1.2 Scope

This report pertains to the emergency planning and response aspects of the California confined space standard of 1978, revised in 1993, as it compares to the federal standard of 1993, revised in 1998. The report evaluates fatal and non-fatal injuries for confined space incidents that resulted from oxygen deficient and/or toxic atmospheres. The report evaluates the unique problems inherent in confined space emergency planning and response and makes recommendations to clarify employer responsibilities in this area of the California standard.

1.3 Report Overview

Workers continue to die and be injured in confined spaces each year in the U.S. despite implementation in 1993 of a federal Occupational Safety and Health Administration (OSHA) confined space standard for general industry. Twenty-five U.S. states have their own state OSHA plans. Under the federal Occupational Safety and Health Act, these plans must include standards that meet or exceed federal OSHA standards, including in confined space operations. California is among these states, where a confined space standard for general industry has been in place since 1978.

California adopted most aspects of the federal standard in 1993; however, key differences remained in the area of emergency planning and response. California concluded that the emergency planning and response requirements of its existing 1978 standard were *more protective* than those of the new federal standard, and it therefore chose to retain key language from its existing standard when the federal standard was published.[2] California continued to maintain this position when the federal standard's emergency planning and response requirements were amended in 1998.

[2] California Department of Industrial Relations, Division of Occupational Safety and Health. Updated Informative Digest of Proposed Action, CCR8, Chapter 4, Subchapter 7, General Industry Safety Orders, Section 5156-5159, Confined Spaces, p.3 (1993).

This report presents trends in confined space injuries in California and the United States (Section 2); the rulemaking history of the federal and California confined space standards (Section 3); uncertainties in the present California standard (Section 4); ambiguities in California's confined space "guidance document" (Section 5); survey data from a small group of California employers (Section 6); limitations of the 911 system in responding to confined space emergencies (Section 7); recommendations to clarify employer responsibilities in the area of emergency response in the California standard (Section 8); and a conclusion (Section 9).

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2. Confined Space Injury Trends

2.1 Introduction

This section presents descriptive data on fatal and non-fatal injuries that resulted from oxygen-deficient and/or toxic atmospheres in confined spaces in the U.S. and California. We analyzed two data sources: (1) confidential U.S. and California data compiled by the U.S. Bureau of Labor Statistics' Census of Fatal Occupational Injuries (CFOI); and (2) California-specific data for fatal and non-fatal confined space incidents reported as part of investigations by the California Division of Occupational Safety and Health (DOSH). Together, these datasets provide a reasonably complete illustration of national and California trends with respect to occupational confined space incidents related to oxygen-deficient and/or toxic atmospheres.

2.2 Scope

We restricted our analysis to confined space incidents related to oxygen-deficient and toxic atmospheres for the period 1992–2005 (using the CFOI database) and from 1990–2003 (using the DOSH investigation reports). We analyzed the two data sources separately. We included drownings that occurred in confined spaces and were attributable to a toxic or oxygen-deficient atmosphere; we omitted apparent suicides.

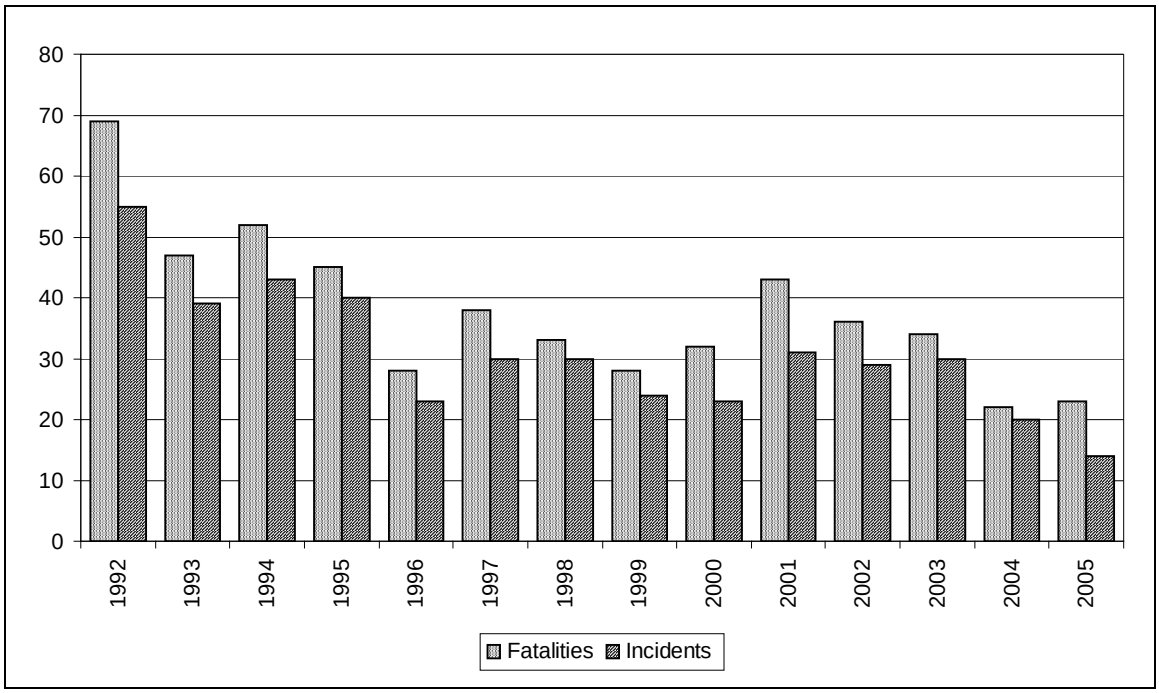
2.3 The federal CFOI database

Between 1992 and 2005 in the U.S., 530 occupational confined space fatalities occurred as a consequence of oxygen-deficient and/or toxic atmospheres. These fatalities occurred during 431 separate incidents, resulting in an overall fatality-to-incident ratio of 1.23. The data show a decline in the number of U.S. fatalities from 1992 to 1996, followed by a roughly continuous rate of about 25-30 fatalities per year from 1996 to 2005 (Figure A).

Thirty-nine (7.4%) of U.S. confined space fatalities took place in California during this period. These fatalities occurred during 29 separate incidents (6.7% of U.S. incidents), resulting in a fatality-to-incident ratio of 1.34. The number of *fatalities* per year in California ranged from zero to six, with a mean of 2.8; the number of *incidents* per year ranged from zero to five, with a mean of 2.1.[3]

[3] To protect confidentiality, detailed annual fatality data for California are not provided.

Figure A. Annual U.S. occupational confined space fatalities (n=530) and incidents (n=431) due to oxygen-deficient and/or toxic atmospheres, 1992–2005 (CFOI dataset).



2.3.1 Multiple-fatality incidents

The fatality-to-incident ratios for the U.S. and California imply that, on average, more than one worker dies per confined space incident. We found that about one-fifth of confined space incidents resulted in multiple fatalities. In the U.S., eighty-seven (20%) of 431 incidents produced multiple fatalities; 181 deaths were associated with these incidents (Table 1). Seventy-seven (89%) of these incidents involved the deaths of two workers; nine (10%) involved three or more deaths. In California, eight (28%) of 29 incidents resulted in multiple fatalities, for a total of 18 deaths.

Table 1. Multiple fatalities in confined space incidents resulting from an oxygen-deficient and/or toxic atmosphere, 1992–2005 (CFOI dataset).

Region	Total number of incidents	Multi-fatality incidents	Percent
U.S.	431	87	20
California	29	8	28

2.3.2 Rescuer fatalities and incidents

Rescuer deaths in confined space incidents provided impetus for the promulgation of both state and federal confined space standards. Case studies illustrate that would-be rescuers often die alongside victims; in some cases rescuers save the life of a victim but are subsequently overcome by a toxic or oxygen-depleted atmosphere.

In the U.S., forty-three (10%) of 431 incidents involved the death of at least one rescuer during the period 1992–2005 (Table 2). Of the 530 total fatalities at these incidents, forty-seven (9%) were rescuers. Five (17%) of the 29 California incidents involved the death of at least one rescuer. Of the thirty-nine total fatalities at these incidents, five (13%) were rescuers.

Table 2. Rescuer fatalities in confined space incidents resulting from an oxygen-deficient and/or toxic atmosphere, 1992–2005 (CFOI dataset).

Region	Total number of incidents	Incidents involving death of a rescuer	Percent
U.S.	431	43	10
California	29	5	17

2.3.3 Incident characteristics

The CFOI database provided details about the nature of fatal confined space incidents. Of the 530 U.S. fatalities occurring during the period 1992–2005 that met the research definition, and for which information on the nature of the fatality was available (n=514), 75% involved inhalation of a substance, 18% involved oxygen deficiency, and 4% were drownings.

Of the 39 California fatalities during this period for which information on the nature of the fatality was available (n=38), 56% were caused by inhalation of a substance, 26% involved oxygen-deficiency, and 16% were drownings.

In the U.S., carbon monoxide was the most common identifiable agent associated with confined space fatalities. Hydrogen sulfide and methane were the second and third most commonly identified agents, respectively. Similarly, in California, carbon monoxide and hydrogen sulfide were the leading identifiable agents; other sources were either unspecified or unclassified.

Repair & maintenance, cleaning, and inspection activities accounted for 127 (24%) of U.S. confined space fatalities during the period 1992–2005 (Table 3), and 10 (26%) of California fatalities during this period (Table 4). Over a third of U.S. confined space fatalities occurred in the South (Table 5).

Table 3. Confined space fatalities by worker activity, U.S., 1992–2005 (n=530) (CFOI dataset).

Activity	Number of fatalities	Percent
Repair, maintenance	127	24
Cleaning	64	12
Inspecting	57	11

Table 4. Confined space fatalities by worker activity, California, 1992–2005 (n=39) (CFOI dataset).

Activity	Number of fatalities	Percent
Repair, maintenance	10	26
Cleaning	6	15

Table 5. Confined space fatalities by region, 1992–2005 (n=530) (CFOI dataset).

Region	Number of fatalities	Percent
South	207	39
Midwest	170	32
West	90	17
Northeast	64	12

The months of August and September ranked in the top three months for confined space fatalities for both the U.S. and California, and incidents tended to occur toward the middle of the week, with Thursday, Wednesday, and Tuesday (in that order, for both the U.S. and California) being the most likely days of the week for a confined space fatality to occur.

2.3.4 Fatality demographics

The CFOI database showed that 99% of workers who died in confined space incidents involving toxic or oxygen-deficient atmospheres were male; in the California subset, 97% were male. For both the U.S. (Table 6) and California (Table 7), the age group 35-44 years experienced the most fatalities, followed by the 25-34 age group.

Table 6. U.S. confined space fatalities by age group, 1992–2005 (n=530) (CFOI dataset).

Age group	Number of fatalities	Percent
35-44	157	30
25-34	147	28
45-54	94	18
20-24	57	11
55-64	44	8
16-19	15	3
65 and older	14	3

Table 7. California confined space fatalities by age group, 1992–2005 (n=39) (CFOI dataset).

Age group	Number of fatalities[4]	Percent
35-44	14	37
25-34	8	21
20-24	6	16
45-54	5	13

In the U.S., four occupational groups accounted for about 50% of confined space fatalities (Table 8). With some variability, this was similar to the experience in California. The percentage of agriculturally related confined space fatalities in California was about twice that of the U.S.

Table 8. Confined space fatalities by occupational group for the U.S. (n=530) and California (n=39), 1992–2005 (CFOI dataset).

Occupational group	U.S. fatalities	Percent	CA fatalities[4]	Percent
Handlers, cleaners, laborers	85	16	7	18
Construction trades	69	13	5	13
Mechanics and repairers	69	13	5	13
Transportation, material moving	48	9	7	19
Machine operators, assemblers	37	7	5	13
Farm operators, manager	32	6	*	*
Other agriculture occupations	32	6	5	13
Precision production occupations	27	5	*	*
Executive, managerial	27	5	*	*
Other, or not reported	106	20	*	*

2.3.5 Industry demographics

Construction and manufacturing industries experienced the most occupational confined space fatalities in the U.S., at 21% and 19%, respectively. In California, these industries also comprised the top two sectors, with manufacturing at 31% and construction, 23%. Industry demographics in the U.S. and California were roughly similar (Table 9).

[4] To protect confidentiality, detailed annual fatality data are not provided for fatality numbers below five in California.

Table 9. Confined space fatalities by industry group, 1992–2005 for the U.S. (n=530) and California (n=39) (CFOI dataset).

Industry group	U.S. fatalities	Percent	CA fatalities[4]	Percent
Construction	106	20	9	23
Manufacturing	101	19	12	30
Trans/commun/utilities/sanitary	80	15	5	13
Agriculture, forestry, fishing	74	14	5	13
Services	74	14	*	*
Mining	27	5	*	*
Public Administration	21	4	*	*
Wholesale trade	16	3	*	*
Retail trade	11	2	*	*
Other	21	4	*	*

The great majority of companies that experienced fatal confined space incidents were privately owned (91% for the U.S., 92% for California). U.S. companies with 10 employees or fewer comprised 33% of all fatalities; companies with 100 employees or more comprised 20% of fatalities.

2.4 The California DOSH database

The DOSH investigation dataset provided information on California-specific confined space incidents. Unlike the federal CFOI dataset, the DOSH data included information on both fatal and non-fatal injuries; however, we found that the details surrounding fatalities were not as extensive as those provided in the CFOI dataset.

2.4.1 Number of incidents and injuries

Seventy-six injuries occurred at 47 confined space incidents in California during the period 1990–2003. Twenty-six (34%) of these injuries were fatal, and 50 (66%) were non-fatal (Table 10). Of the non-fatal injuries, 27 (54%) required hospitalization.

Table 10. California fatal and non-fatal injuries in confined space incidents due to oxygen-deficient or toxic atmospheres, 1990–2003 (DOSH dataset).

Total Incidents	Total injuries	Fatal injuries (%)	Non-fatal injuries (%)	Hospitalization for non-fatal injuries (%)
47	76	26 (34)	50 (66)	27 (54)

Twenty-six (55%) of the 47 incidents involved a single injury to an entrant; in no case was a rescuer injured in these cases. Nine (35%) of these 26 incidents resulted in a

fatality; nine (35%) resulted in injuries that required hospitalization; and eight (31%) resulted in injuries that did not require hospitalization.

Twenty-one (45%) of the 47 California incidents in the DOSH dataset involved injuries to multiple persons and accounted for 50 of the total 76 injuries. Seventeen (34%) of these injuries were fatal; of these, thirteen (76%) were entrants and four (24%) were rescuers (Table 11).

Table 11. Entrant and rescuer fatalities at California multi-injury confined space incidents due to oxygen-deficient or toxic atmospheres, 1990–2003 (DOSH dataset).

Multi-injury incidents	Total injuries (% of total CA injuries)	Fatal injuries (% of total CA injuries)	Entrant fatality (% of fatal)	Rescuer fatality (% of fatal)
21	50 (66)	17 (34)	13 (76)	4 (24)

Fifteen (71%) of the 21 multi-injury incidents involved two persons, five involved three persons, and one involved five persons.

2.4.2 Rescuer versus entrant injuries

Overall, 56 (74%) of the 76 injured persons analyzed in the DOSH dataset were entrants; of these, 22 (39%) died, 17 (30%) required hospitalization, and 17 (30%) required no hospitalization.

Twenty (26%) of the 76 injured persons were rescuers; of these, four (20%) died, 10 (50%) required hospitalization, and 6 (30%) required no hospitalization.

2.5 Conclusion

The federal CFOI dataset illustrates that since 1996, the U.S. has experienced between 25 and 35 confined space fatalities each year related to oxygen-deficient and/or toxic atmospheres. The relatively small number of confined space incidents in California makes comparisons with the federal dataset problematic. However, the California data indicate that non-fatal injuries contribute to the personal and economic burden of confined space incidents in the U.S.; that is, for every fatal injury, two non-fatal injuries occur, one of which requires hospitalization. Applying the California DOSH data to the U.S. experience suggests that in addition to the 32 fatal confined space injuries each year, an additional 66 non-fatal injuries occur at these events, 33 of which require hospitalization.

The CFOI data illustrate that confined space incidents often result in more than one fatality, and that about 10% of fatalities and 20% of injured persons are rescuers. The California DOSH dataset reveals that 40% of entrant injuries were fatal, versus 20% for rescuers; however, the percentage of injuries that required hospitalization was 30% for

entrants and 50% for rescuers. Non-hospitalization was the same for both entrants and rescuers.

The CFOI dataset shows a 78/22 ratio (3.5/1) for single versus multiple-fatality incidents. In California, rescuers represent 26% of total *injuries* in confined space incidents but only 13% of total fatalities.

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3. Rulemaking History

3.1 The 1978 California standard

The rulemaking history illustrates how the California confined space standard came to differ from the federal standard in the area of emergency planning and response. California's standard, published in 1978, pre-dated the federal standard by fifteen years. Notably, California's definition of a confined space differed from the federal definition that would appear in 1993. According to California's original standard from 1978, a confined space was defined by the presence of the following two conditions:

- *Existing ventilation is insufficient to remove dangerous air contamination and/or oxygen deficiency which may exist or develop.*

- *Ready access or egress for the removal of a suddenly disabled employee is difficult due to the location and/or size of the opening(s).*[5]

California essentially focused its regulation of confined spaces to the most dangerous – those associated with IDLH atmospheres. Because an emergency in such a space would require immediate action on the part of rescuers, precautions were mandated in California's original confined space standard. The standard included three primary elements:

- First, the standard called for a "standby" employee for every entry into a confined space, wherein the employer was required to station an individual immediately outside the opening to the space. The standard required that this individual be equipped with respiratory protection and trained to perform an *entry rescue* in the event of an emergency inside the space.

- Second, at least one other employee *within sight or call* of the "standby" employee was required. In the event of an emergency, the "standby" employee was expected to first notify this second employee (who presumably would summon aid) and would then initiate rescue procedures.

- Third, if a confined space entry required the entrant(s) to use respiratory protection, the employer was required to have at least one employee trained in first aid and CPR immediately available.

[5] California Code of Regulations, Title 8, Chapter 4, Subchapter 7, Article 108, General Industry Safety Orders, Section 5156-5159, Confined Spaces (repealed) (1978).

3.2 The 1993 federal confined space standard

The 1993 federal OSHA standard was written to protect workers and rescuers in a *range* of confined spaces, and its definition of a confined space reflected this broader focus. The new federal regulation defined a confined space as one that:

- *Is large enough and so configured that an employee can bodily enter and perform assigned work; and,*
- *Has limited or restricted means for entry or exit; and,*
- *Is not designed for continuous employee occupancy.*[6]

However, to distinguish spaces that pose *unique* hazards to entrants and rescuers, noted below, the federal standard introduced the concept of a "permit-required confined space," which was defined as a confined space with one or more of the following characteristics:

- *Contains or has a potential to contain a hazardous atmosphere;*
- *Contains a material that has the potential for engulfing an entrant;*
- *Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or,*
- *Contains any other recognized serious safety or health hazard.*[7]

Only "permit-required" confined spaces are regulated under the federal standard.

The federal standard was more comprehensive than California's standard at the time: employer requirements under the new federal standard included a written confined space program, a "permit" system that introduced broader, standardized safeguards for confined space entry, and more extensive duties and training of personnel.

With respect to emergency planning and response, the federal standard required the following elements:

- The "permit" system, which required employers to develop and implement procedures for summoning rescue services and rescuing entrants;

[6] Federal Register, Vol. 58, No. 9, January 14, 1993, 29 CFR Parts 1910.146, Permit-Required Confined Spaces for General Industry; Final Rule.
[7] Federal Register, Vol. 58, No. 9, January 14, 1993, *supra* note.

- The designation of key personnel responsible for protecting employees working inside the space, as follows:

    - The "entry supervisor," who ensures that the permit requirements are satisfied and verifies that rescue services are available, and;

    - The "attendant," who monitors the confined space at the entry point and summons rescue services if an emergency arises.

In the area of emergency planning and response, these elements represented a departure from the then-existing California standard in three important ways:

- First, the federal standard used the term "rescue service" to describe rescue capability and defined it as "the personnel designated to rescue employees from permit spaces." While California's original standard designated a "properly equipped standby employee" with entry rescue capability, the federal standard described a "summoning of rescue services" in the event of an emergency; significantly, there was no explicit requirement in the federal standard that employers maintain *on-site* rescue capability.

- Second, the federal standard required the presence of an "attendant," whose role resembled that of the 1978 California standard's "standby person," except that the "attendant" was not required to be outfitted with respiratory protection, nor was the attendant necessarily trained and expected to perform *entry rescue* in the space.

- Third, under the federal standard, overall responsibility for entry fell to the entry supervisor, whose duties were outlined in a separate subsection. Among these duties was ensuring that a rescue service was available, and that the means for summoning these services was operable. The California standard at the time did not include mention of an entry supervisor.

3.3 California's response to the 1993 federal standard

Upon publication of the federal standard in 1993, California faced the choice of either revising its 1978 standard to be "at least as protective" as the federal standard or adopting the new federal language outright. As the new federal standard was more extensive and broader in scope, California initially chose to adopt the entirety of the federal standard, without modification.

When California announced its intention of repealing its confined space standard and replacing it with the new federal standard, critics pointed out that the federal standard could jeopardize California's more explicit requirement that employers provide *on-site* rescue capability. Even under the broader definitions stipulated in the new federal standard (which included non-IDLH hazards) it was argued that California's standard was more protective than the new federal standard. California subsequently chose to

adopt the federal language but retain the original California language that required the employer to provide on-site rescue capability, in the form of a "standby person."

3.4 The 1998 federal amendments

Federal OSHA amended *subsection (k) Rescue and Emergency Services* in 1998 to address unresolved issues in the original rulemaking of 1993. Notably, the United Steelworkers of America, (USWA) AFL-CIO sought judicial review of the 1993 standard on the grounds that *subsection (k)* did not adequately address the timeliness or the technical capacity of emergency responders.

Federal OSHA responded to the USWA petition by "clarifying" its original intent regarding emergency planning and response. The agency amended *subsection (k)* to explicitly require the employer to "match" the *timeliness* and *capacity* of the emergency response with the nature of the hazards present in the space. For example, if workers were to enter a space at risk of potentially developing IDLH conditions, the employer would be required to provide a technically capable rescue team *at the entry site* to the space; i.e., one that could respond to an emergency in a timely manner. The employer could meet this requirement using an employee-based team or a contracted team. The employer would be permitted to rely on the public 911 system for rescue services *only* if the space posed non-IDLH hazards, such as physical hazards that might only result in an abrasion or broken bone.

This "systematic review process" removed the distinction between (and confusion surrounding) "on-site" and "off-site" rescue services, and it ensured that workers operating in the most dangerous conditions were afforded the highest degree of protection in the event of an emergency. As long as the employer could demonstrate that a rescue service could safely perform a rescue in a time frame appropriate to the nature of the hazards present, the employer would be in compliance with *subsection (k).*

The 1998 amendments included a new *Appendix F* to guide employers in evaluating the timeliness and capacity of rescue services. Appendix F points out explicitly that the employer must provide an on-site rescue team fully trained and equipped to immediately enter the space if workers are operating under potential IDLH conditions, and it states that relying on the 911 system for rescue services would be prohibited in this case (see Appendix B, attached).

3.5 California's response to the 1998 federal amendments

Following the federal amendments to *subsection (k),* California performed a mandatory review of its own standard to determine whether it was "as least as protective" as the new federal language. California concluded that its post-1993 standard was *more protective* because it contained language that, in California's view, required the employer to provide on-site rescue services, *regardless* of the hazards in the space, whereas the federal language only required the employer to "match" the timeliness and capacity of rescue

services to the nature and degree of entry hazards.[8] California therefore adopted neither the federal amendments to *subsection (k)* nor Appendix F.

However, as described below, ambiguities in the resulting language of the California standard weaken its on-site rescue requirement. These ambiguities are reinforced in the DOSH Consultation Service guidance document, which is intended to interpret the confined space standard for California employers. The ambiguities are substantive enough that we believe California was incorrect in concluding that its emergency response requirements were "at least as protective" as the amended 1998 federal standard.

3.6 Language differences between the federal and California standards

The California language is a somewhat awkward merging of the old (California 1978 standard) with the new (1993 federal standard). Throughout the standard, California reiterates its concept of employer-based, on-site rescue by inserting the word "additional" and other terms whenever the term *rescue services* appears in the text, and by introducing *subsection (k)* with the phrase, "The employer shall ensure that at least one standby person at the site is trained and immediately available to perform rescue and emergency services."

In addition to *subsection (k)*, important differences appear in the following subsections of the California standard (Tables 12-16):

A. Permit required confined space program (subsection (d)) (see Table 12)
B. Entry permit (subsection (f)) (see Table 13)
C. Attendant duties (subsection (i)) (see Tables 14 &15)
D. Entry supervisor duties (subsection (j)) (see Table 16)

[8] California Department of Industrial Relations, Division of Safety and Health. Public Hearing Summary, CCR8 Chapter 4, Subchapter 7, Article 108, Section 5157, Permit-Required Confined Spaces, p. 13. (May 20,1999).

Table 12. California uses the term "additional" when it refers to rescue and emergency services.

Permit required confined space program, subsection (d):	
1993 federal subsection (d)(9)	California subsection (d)(9)
(The employer shall*)* develop and implement procedures for summoning rescue and emergency services, for rescuing entrants from permit spaces, for providing necessary emergency services to rescued employees, and for preventing unauthorized personnel from attempting a rescue;	(The employer shall*)* develop and implement procedures for rescuing entrants from permit spaces, for providing necessary emergency services to rescued employees, for summoning ***additional*** rescue and emergency services, and for preventing unauthorized personnel from attempting a rescue;

Table 13. California differentiates on-site rescue from "additional" rescue and emergency services.

Entry permit, subsection (f):	
1993 federal subsection (f)(11)	California subsection (f)(11)
(The entry permit shall identify*)* the rescue and emergency services that can be summoned and the means (such as the equipment to use and the numbers to call) for summoning those services;	(The entry permit shall identify*)* the rescue and emergency services that can be ***provided on-site*** and ***additional service*** that can be summoned and the means (such as the equipment to use and the numbers to call) for summoning those services;

Table 14. California differentiates on-site rescue from "additional" rescue services.

Attendant duties, subsection (i):	
1993 federal subsection (i)(7)	California subsection (i)(7)
(The employer shall ensure that each attendant) summon rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;	(The employer shall ensure that each attendant) ***initiate on-site rescue procedures and, if necessary***, summon ***additional*** rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;

Table 15. California introduces the term "other rescue services" as part of the responsibilities of the attendant.

Attendant duties, subsection (i):	
1993 federal subsection (i)(9)	California subsection (i)(9)
(The employer shall ensure that each attendant) performs non-entry rescues as specified by the employer's rescue procedure;	(The employer shall ensure that each attendant) performs non-entry rescues ***or other rescue services*** as part of the employer's ***on-site rescue*** procedure;

Table 16. California differentiates rescue services from "additional rescue services" in describing supervisor responsibilities.

Entry supervisor duties, subsection (j):	
1993 federal subsection (j)(4) (The employer shall ensure that each entry supervisor) verifies that rescue services are available and that the means for summoning them are operable;	California subsection (j)(4) (The employer shall ensure that each entry supervisor) verifies that rescue services are available and that the means for summoning ***additional*** services are operable;

4. Uncertainties in the California standard

The rulemaking history illustrates that when the federal standard was adopted in 1993, California adopted the new federal language while retaining the concept (from its original 1978 standard) that the employer is responsible for providing on-site rescue services (regardless of the hazards in the space) and that off-site rescue services are "additional" and should serve as a "back-up" only. The ambiguities in California's resulting standard, however, undermine this important concept in four main areas:

1) the role of the "standby person"
2) the role of the "attendant"
3) the term "additional rescue services" and
4) the term "off-site rescue capabilities."

4.1 The role of the "standby person" is unclear.

When California opted to reassert its on-site rescue requirement in 1993, it used the same term it had used in 1978: "standby person." In the 1978 standard, however, the standby person's role was well defined and occurred in a clear context; that is, when a confined space operation involved entry into a space *under IDLH conditions*. The 1978 standard required the employer to provide a standby person equipped with respiratory protection and trained to perform a rescue, including *entry* rescue, in the event an emergency occurred.

In California's subsequent 1993 standard, the standby person (in *subsection (k)*) is described as "trained and immediately available to perform rescue and emergency services;" however, *which* "rescue and emergency services" this individual is "trained and immediately available to perform" are not stipulated. In particular, it is not clear if this includes *entry* rescue (a hazardous and technically challenging operation) or *non-entry* rescue (extracting the entrant using a tripod or other mechanical advantage system from outside the space). This contrasts with the 1978 standard, which stated that the standby person's responsibilities included entry rescue.

It is worth noting that the rulemaking history shows that when California re-drafted its standard in 1993, the state did *not* want to mandate that employers provide entry rescue services by the employer's own employees.

4.2 The role of the "attendant" is unclear.

The respective roles of the "standby person" and the "attendant" in the California standard are also unclear. California's original 1978 standard did not use the word "attendant;" rather, the notion of a person standing by the entrance of the confined space, ready to give assistance in the event of an emergency, was embodied by the term "standby person." As previously mentioned, this individual performed a very specific role: ongoing monitoring of the entrant, and if necessary, entry rescue.

The federal standard, however, introduced the term “attendant,” defined as follows:

> "*Attendant" means an individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employer's permit space program*.[9]

The attendant has a range of duties under the federal standard that are focused on ensuring the safety of entrants. These include:

- Training on the hazards of the entry and the signs of overexposure in entrants;
- Maintaining a count of entrants;
- Keeping unauthorized entrants out of the space;
- Maintaining communication with the entrants;
- Monitoring activities inside and outside of the space, and ordering entrants to evacuate if dangerous circumstances arise.

The attendant under the federal standard also has duties concerning emergency rescue; it is these duties that present potential confusion with respect to California’s “standby” person, as described in *subsection (i)* of the California standard:

> *(i) Duties of attendants. The employer shall ensure that each attendant:*
> *…*
> *(4) Remains outside the permit space during entry operations until relieved by another attendant;*
>
> *Note: When the employer's permit entry program allows attendant entry for rescue, attendants may enter a permit space to attempt a rescue if they have been trained and equipped for rescue operations as required by subsection (k)(1) and if they have been relieved as required by subsection (i)(4).*
> *…*
> *(7) Initiate on-site rescue procedures and, if necessary, summon additional rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;*
> *…*
> *(9) Performs non-entry rescues or other rescue services as part of the employer's on-site rescue procedure; …* [10]

From these paragraphs, it is clear that the attendant in the California standard can have both entry and non-entry rescue responsibilities and is expected to use them in an emergency. Paragraph (9) states that the attendant is expected to perform non-entry

[9] Federal Register, Vol. 58, No. 9, January 14, 1993, *supra* note.
[10] California Code of Regulations, Chapter 4, Subchapter 7, Article 108, Section 5157, Permit-Required Confined Spaces (1993).

rescue or "other rescue services," while paragraph (4) states that an attendant may perform entry rescue, if an employer allows, but only if the attendant is "relieved."

This leaves open the question of what role a "standby" person plays in the presence of an "attendant." In a letter of interpretation on the confined space standard, California has stated that an "attendant" can fulfill the role of the "standby" person, as long as he or she is relieved.[11] In the present California standard, it is unclear whether and to what extent the attendant and the stand-by person are responsible for performing emergency rescue.

4.3 The term "additional rescue services" is unclear.

The presence of the standby person sets the context, although unclearly, for all other mentions of rescue services in the California standard, which are referred to as "additional rescue services," as noted above. The meaning of the term "additional" in this context is unclear. When additional rescue services are mentioned, the role of these services is not stated, nor is it clear what these services are *in addition to.*

The rulemaking history illustrates that when California inserted the word "additional," it meant to convey "in addition to the standby person," although this is not explicit in the standard.[12] In using this terminology, the California standard has essentially set up a system of *primary* rescue service ("on-site rescue procedures"), and *back-up* rescue services ("additional rescue services"). Although these specific terms are not used in the standard, the term "back-up" appears in the rulemaking record to characterize "additional" rescue services.

4.4 The employer's responsibilities regarding on-site rescue are unclear.

When California revised its standard in 1993, the only difference at that time between the federal and California versions of *subsection (k) Rescue and emergency services* was the following sentence inserted by California at the beginning of the subsection:

> *The employer shall ensure that at least one standby person at the site is trained and immediately available to perform rescue and emergency services.*

California made no other changes to this subsection of the federal standard, nor did it adopt the subsequent federal amendments made to this subsection in 1998. This sentence, however, is inconsistent with the remainder of the subsection, which contains seemingly contradictory requirements. Paragraph (2) of *subsection (k)* appears to relieve the employer of the standby person requirement, as follows:

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[11] Letter of interpretation sent to Mr. Richard Hirsh of Rohm and Haas Company from California DOSH Research & Standards Health Unit (November 2005).

[12] California Department of Industrial Relations, Division of Safety and Health. Public Hearing Summary, CCR8 Chapter 4, Subchapter 7, Article 108, Section 5157, Permit-Required Confined Spaces, p. 13 (May 20, 1999).

(2) When an employer (host employer) arranges to have persons other than the host employer's employees perform permit space rescue, the host employer shall…

This sentence could be interpreted to mean that an employer has the option of relying on an *off-site* entity (presumably the 911 system) to perform rescue services, at the exclusion of rescue services provided on-site by the employer.[13]

4.5 Conclusion

California's attempt to "merge" its 1978 standard with the 1993 federal standard has resulted in confusing language in the present standard. This has important implications for worker safety in California: as described in Section 6, some employers appear to be interpreting the standard to mean that the 911 system can serve as a permissible alternative to providing on-site rescue services during confined space operations, even during operations in spaces at risk of developing IDLH conditions.[14] As described in the following section, the lack of clarity in the California standard is reflected in the confined space "guidance document" produced by the DOSH Consultation Service, which encourages employers to "arrange with the local fire department" in planning for confined space emergencies.[15]

* * * * * * * *

[13] This could also be interpreted to mean that the employer could employ the services of an "off-site" private contractor, who enters the employers site and provides confined space rescue services during confined space entry operations. This interpretation of the California standard would meet the intent of the federal language.

[14] Personal communication with DOSH research and standards staff (July 2005) and with corporate health and safety staff and industry consultants (July–September 2005).

[15] California Department of Industrial Relations, Cal/OSHA Consultation Service, Education and Training Unit. *Is it Safe to Enter a Confined Space?* California Department of Education, Sacramento, California, p.10 (1998).

5. California's Guidance Document

In evaluating California's confined space standard and its provisions for emergency planning and response, it is useful to consider guidance materials produced by California's Division of Occupational Safety and Health (DOSH) to assist employers in complying with the standard. The DOSH Education and Training Unit has produced such a document, entitled "Is it Safe to Enter a Confined Space?"[16] This document contains useful information for employers on *evaluating* confined space hazards, *controlling* those hazards, and *complying* with requirements under the standard.

Although the document states clearly that it is *not* intended to be a legal interpretation of the standard, it is nonetheless a key document to guide California employers in interpreting and implementing the standard. Not unexpectedly, principal ambiguities in the California confined space standard pertaining to emergency planning and response are reflected in the guidance document.

5.1 The role of the 911 system is unclear.

The guidance document addresses salient questions likely to be raised by employers in the area of emergency planning and response. The document approaches the issue of on-site rescue capability, for example, as follows:

> *Q: How can the facility owner prepare for an emergency?*
> *A: As an employer, you must have on-site rescue ability; however, you can also supplement your rescue operation with an off-site rescue team.*[17]

Here the language appears to require that the employer provide on-site rescue services; following a discussion of on-site rescue team training, however, the document presents an *Off-Site Rescue* section that begins on a confusing note:

> *If off-site rescue cannot be provided quickly enough, it is not a real option!* [18]

Like the standard itself, this statement could be interpreted to mean that off-site rescue services (i.e., the 911 system) can serve as the employer's *primary* option for emergency response, but that if such a service cannot be provided "quickly enough," it should not be considered as a primary option. The document then neglects to provide guidance on *how* an employer might assess the timeliness or capacity of the 911 system to perform a confined space rescue.

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[16] California Department of Industrial Relations, Cal/OSHA Consultation Service, Education and Training Unit. *Is it Safe to Enter a Confined Space?* California Department of Education, Sacramento, CA. (1998).

[17] California Department of Industrial Relations, *supra* note, p. 9

[18] California Department of Industrial Relations, *supra* note, p. 10.

The document recommends that the employer:

> *Arrange for the local rescue/fire departments to provide rescue services.*

It then advises the employer to develop a rescue plan with local rescue/fire departments, including disclosing known hazards and granting access to confined spaces in order for:

> *…off-site rescuers to familiarize themselves with the spaces and to practice rescue operations.*

These phrases suggest that relying on the "local rescue/fire department" for rescue services is a permissible option; i.e., that the 911 system can serve as the employer's primary rescue service, including in spaces where IDLH conditions might develop.

Ambiguity with respect to rescue services also appears in the role of the entry supervisor in verifying the "availability of off-site rescue services." Under subsection (j)(4) of the California standard, the entry supervisor must:

> *…(verify) that rescue services are available and that the means for summoning additional services are operable.*

The guidance document states:

> *If the off-site rescue service indicates for any reason that it would be unable to respond to a rescue summons, entry must not be authorized unless and until an adequate back-up rescue service is arranged and confirmed.* [19]

The use of the phrase *back-up rescue service* reinforces the impression that the "off-site rescue service" (i.e. the 911 system) can serve as the employer's *primary* rescue service for confined space emergency planning and response. Together, these phrases leave the reader with the impression that the 911 system is a reasonable and permissible option for rescue services during confined space operations, including those at risk of developing IDLH conditions.

5.2 Staffing requirements are unclear.

The guidance document provides attachments that include a decision flow chart for setting up a permit-system, atmospheric testing protocols, and a sample confined space entry permit. The sample permit contains the phrase,

> *Safety Standby Person is Required for all Confined Space Work.*[20]

A space for listing the "safety standby person(s)" is included, but there is no mention of the "attendant," which figures prominently in the standard. This lack of precision in the

[19] California Department of Industrial Relations, *supra* note, p. 10.
[20] California Department of Industrial Relations, *supra* note, p. 57.

guidance document contributes to the confusion about the roles of the "attendant" and the "standby" person that occur in the standard.

5.3 The concepts of "timeliness" and "capacity" in emergency response planning are not adequately addressed.

As noted above, when federal OSHA amended its subsection on emergency response in 1998, California elected not to follow suit, concluding that its own standard was at least as protective. In addition to amending its standard to reflect the need to *evaluate* rescue services, federal OSHA added a non-mandatory Appendix F, which guides the employer in "evaluating and selecting" rescue services. California concluded that it would be unnecessary to adopt Appendix F because the state already provided a guidance document for employers "with similar information."[21]

As described above, however, California's guidance document discusses rescue issues but reinforces ambiguities in the standard and provides no guidance for employers in "evaluating and selecting" rescue services that are appropriate to the hazards that may occur during the entry; e.g., IDLH conditions. Conducting an evaluation of the timeliness and capacity of rescue services would reveal to an employer that the 911 system is unable to respond in a timely manner to a confined space emergency that occurs as a result of IDLH conditions.

5.4 Conclusion

Although California's document is useful in many respects, the federal Appendix F contains critical information for evaluating rescue services that is lacking in the analogous California document. Ambiguities in the California standard pertaining to emergency planning and response are reinforced in the guidance document.

The following section provides a "snap-shot" of emergency response practices among a small sample of California employers. It illustrates the challenge of confined space emergency planning for employers, and it suggests that some employers may be unclear about their emergency planning and response requirements in California.

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[21] California Department of Industrial Relations, Division of Occupational Safety and Health. Side-by-side comparison and Title 8 equivalence to the federal Permit-required Confined Space Standard Final Rule, p.6 (February 5, 1999)

6. Employer Practices

This section presents initial findings suggesting that the ambiguities in California's standard may be causing California employers to believe they can reliably (and permissibly) depend on the public 911 system during a confined space emergency, at the exclusion of their own *on-site* rescue capability. Presumably, this would include when an IDLH atmosphere could develop in the space.

6.1 Confined space survey

In 2006, we administered a small survey in cooperation with a California trade group and an industry consulting firm.[22] The survey pertained specifically to confined space emergency planning and response. Twenty-one large companies from various industry sectors responded to the questionnaire (Table 18). The number of permit-required confined spaces among responding companies ranged from one to thirty, with a mean of twelve. One company reported hundreds of permit-required spaces at sites nationwide.

To capture the broadest set of scenarios, the survey used the term "confined space emergency," rather than the terms "IDLH" and "non-IDLH."

Table 18. Number of respondents by industry sector (n=21).

Industry sector	# of survey respondents
Oil refining	1
Electronics	6
Aerospace	1
Energy	1
Food processing	1
Diversified manufacturing	2
Declined to state	9

Though limited in size, the survey suggests that confined space emergency planning practices vary considerable among companies. Twelve companies (57%) reported that they relied on the fire department for confined space emergencies (Question 1), but only four companies (19%) reported that the fire department had performed an assessment of the confined spaces at their site (Question 2). Four companies (19%) reported that the fire department had conducted actual training in confined space rescue on-site (Question 2). Six respondents (29%) indicated that they used an off-site contractor for confined space work; four companies (19%) reported that they maintained their own on-site rescue team (Question 1).

Question 1. What is your company's protocol in the event of a confined space emergency? Please select the most appropriate statement (n=21).

[22] Silicon Valley Leadership Group, San Jose, California; and ORC Global, Washington, D.C., respectively.

Response	Number of respondents*	Percent
We call 911 if there is a confined space emergency.	9	43%
A contracted, professional rescue team would be on-site and would respond to the emergency.	6	29%
An employee-led rescue team is on-site and would respond to the emergency.	4	19%
We call the local fire department directly if there is a confined space emergency.	3	14%
No response.	1	5%

***** n=23 because two respondents selected two answers.

Question 2. Has your facility made arrangements with the local fire department for response to a confined space emergency? Please select all statements that apply.

Response	Number of respondents	Percent
We have provided our emergency response plan to the fire department.	9	43%
We have communicated with the fire department about our need for confined space rescue service.	9	43%
We have no arrangement with the fire department concerning confined space rescue.	5	24%
We notify the fire department when we make confined space entries and confirm they are available to provide rescue services should an emergency arise.	5	24%
The fire department has performed a survey of the confined spaces at our workplace	4	19%

Fourteen of the 21 respondents provided comments to a question pertaining to the company's rationale for relying on the fire department or hiring a contractor rather than maintaining an employee-based rescue team (Question 3). In general, the comments reflected the company's concern about the cost, liability, and training requirements necessary for maintaining an on-site rescue team. In an open-ended question, three respondents expressed concern about the emergency response practices of confined space

contractors and the ability of fire departments to perform a confined space rescue (Question 4).

Question 3. If an off-site rescue service is involved in confined space emergency planning and response, why did your facility select this approach as opposed to maintaining an in-house rescue team?

A. "Cost associated with maintaining proficiency."

B. "Technical skills necessary to confirm competency."

C. "Cost, liability, maintaining equipment."

D. "An in-house rescue team requires continuous training and tools, and resources need to be provided. The possibility of an injury increases. Off-site services eliminate these complications."

E. "Multiple sites working on short-term entries make on-site resources impractical. Also the issue of experience. On-site teams are unlikely to be able to exercise as much as off-site teams."

F. "Need for expertise that we do not have on hand."

G. "We rely on calling 911 and depend on whoever shows up. We are staffed very lean and do not want our employees risking their lives to enter permit-required confined spaces in emergencies. However, they are trained in non-entry rescue. Most of our plants in this region do not have the money to invest in training and maintaining an in-house rescue team."

H. "More cost effective."

I. "Only if there are highly hazardous entries do we utilize an off-site service. We cannot support a rescue team with the limited number of entries we do at this site."

J. "Had a team until about 1996. Team captain left company. Management declined to fund the team after that. No budget for maintaining team on 24-hour basis and keep up training requirements."

K. "We do a limited number of entries (about 2 per year) and our level of entry is limited to non-hazardous atmospheres only. In addition, our facility is situated in a large city with USAR (Urban Search and Rescue) teams just minutes away. Therefore, it was decided to not maintain an emergency response team on site for such rescues."

L. "Employees were unwilling to participate on such a team."

M. "We have an on-site ERT trained in hazmat, confined space rescue and heavy search and rescue. Our team is trained by members of the local FEMA team."

N. "Any confined space work is contracted out. We do not allow our employees to enter confined spaces."

Question 4. Are there other matters pertaining to confined space emergency planning and response that you would like to communicate to our research team?

A. "Invitation has been extended but local fire department has never practiced on our site. Assume they are capable? Don't know."

B. "We have discovered some smaller fire departments do not have equipment for confined space rescue, so we donated equipment to them."

C. "Eight out of the ten plants in my region are partnership plants (limited budgets and staff). The majority of confined space entries are during outages and we hire contractors to do the work. There are times when our employees enter permit required confined spaces, but we rely heavily on their expertise and knowledge of procedures to perform the work safely, which doesn't always happen. In the 2 ½ years I have been in this region, we have not had any confined space emergencies involving 911 emergency response."

D. "The company experienced a confined space fatality several weeks ago. One of the factors contributing to the fatality was the absence of a rescue team, both on-site and off-site. We would be willing to share our knowledge and perspectives on this matter."

E. "Contractors don't always arrange for emergency response services as required in regulations. We make sure we provide back-up to them while they are on our site. I have concerns about whether all fire departments have the skills and equipment available to provide confined space rescues. Seems like these regulations have been out for a long time and it appears as if the fire departments are just lately improving their training in this area."

F. "Our policy is to use confined entry procedures only to prove that a space can be downgraded to a non-permit space (enter to confirm no hazardous atmosphere). The situation has arisen only once in my 15 years here where we were unable to remove all hazards which make the space subject to the more stringent levels of the rule requiring rescue service availability. It involved tank cleaning and we simply got longer handles for the scoops and brushes to avoid fully entering the space. I know even partially entering can trigger the rules but it is easier to rescue someone who is only sticking their upper body in a space than to rescue someone crawling fully inside. The tank has since been decommissioned."

6.2 Conclusion

The survey presents various approaches used by a small set of large California employers to address the challenge of confined space emergency response. The results suggest that the great majority of companies (about 80%) have decided that the risks of maintaining an employee-based, on-site rescue team for confined space emergencies exceed the benefits. At the same time, while most employers (about 57%) appear to be relying on local fire departments for rescue services, some employers express little confidence in the ability of fire departments to meet this challenge. The diversity of employer practices (and what appears to be general reliance on the 911 system) could reflect ambiguities in the emergency response requirements of the California confined space standard. Finally,

the survey represents practices among large businesses; it is likely that small and medium-sized businesses would rely more heavily on the 911 system in the event of a confined space emergency.

7. Limitations of the 911 system

The success of a response to an emergency hinges on both the *timeliness* of the response and the technical *capacity* of the responders. This is particularly true in the case of confined space emergencies. A confined space rescue carried out under IDLH conditions is a highly time-sensitive and technically challenging emergency. The difference between life and death can be a matter of minutes for the entrant, yet a *hastily* executed rescue increases the likelihood of multiple fatalities, where the rescuers themselves could become victims.

This section addresses the question, "Is it reasonable for an employer to rely on the 911 system for rescue services during confined space operations?" As previously described, ambiguities in the California confined space standard (and the standard's guidance document) could lead an employer to believe that the 911 system is indeed a practical and permissible means of addressing the challenge of confined space emergency planning. The survey results presented in Section 6 suggest that some portion of California employers may be following this practice.

This section presents evidence to illustrate that the 911 system is unable to respond quickly enough to save the life of an entrant who becomes incapacitated in a confined space under IDLH conditions. In a best case scenario, we estimate that a fire department rescue under these conditions will take about 48 minutes from the time the call is placed to 911 to the initiation of advanced life support (ALS) by paramedics at the scene.

The section illustrates that when there is the potential for IDLH conditions to develop, rescuers must be stationed at the entrance to the space if they are to have a chance of successfully rescuing an entrant in the event of an emergency. The section proposes an appropriate role for the 911 system in the employer's confined space emergency response plan.

7.1 Confined space entry rescue is a highly technical operation, especially under IDLH conditions.

There are two ways to extricate an incapacitated entrant from a confined space: non-entry rescue and entry rescue. In a *non-entry* rescue, rescuers situated outside the space remove the entrant using a tripod hoist or other means of mechanical advantage. In an *entry* rescue, at least two rescuers enter the space and remove the worker using specialized extrication equipment. A *non-entry* rescue is feasible only when the mechanical advantage system (rated for life safety purposes) is in place prior to the entry and the entrant is outfitted with an appropriate harness. The entrant must be clearly visible (from the entry point) and the rescue path must be free of obstructions, such as piping, valves, equipment, tools, ladders, and so forth, any of which will preclude a *non-entry* rescue if they could entangle the entrant during the extrication process.

For purposes of emergency planning, it is therefore reasonable for employers to assume that *entry rescue* could be needed in the event an entrant becomes incapacitated, especially under IDLH conditions.

A confined space *entry rescue* under IDLH conditions is inherently challenging in part because it is a very low frequency, high-risk event. Extricating an entrant from a confined space (while also protecting the safety of the rescue team) requires a carefully planned process that only a properly trained and equipped team can execute. Such a team requires members who are able to:

- assess physical hazards, both inside and outside the space
- evaluate explosive, toxic, and oxygen-deficient conditions
- operate portable hoists and other mechanical advantage systems
- use self-contained breathing apparatus (SCBA) or fixed air-line systems
- use specialized personal protective clothing
- use continuous air monitoring equipment
- use specialized communication devices
- use emergency medical equipment at the *basic life support* (BLS) level
- use patient packaging and extrication equipment.

Given the high degree of competency and specialized equipment required to perform a confined space rescue (particularly under IDLH conditions), it is reasonable that employers would be tempted to rely on the public 911 system to meet their emergency planning needs.

7.2 The technical capacity of fire department personnel and equipment varies considerably.

Urban fire departments consist primarily of fire engines, ladder trucks, and ambulances; large departments also operate a small number of technical rescue units, hazardous materials units, lighting units, and other specialized equipment.[23]

Fire engines are considered the "work horses" of the fire service. In most cities, the engine is the first unit to respond to 911 calls, a high percentage of which (up to 80%) are for medical emergencies, including trauma. Engines carry hoses, hand ladders, basic life support (BLS) or advanced life support (ALS) medical equipment (see below), hand tools, and an on-board water pump for pressurizing water from a hydrant for use in firefighting. Engines are normally staffed by three to five firefighters who are trained to perform medical intervention at levels ranging from *first responder* to *paramedic* (see below) and who are responsible for pumping water and handling hose lines during firefighting; performing extrication and rescue at vehicle crash sites; and conducting other work as needed at the emergency scene. First-responding engine companies typically arrive at the emergency scene within four to six minutes from the time of

[23] See National Fire Protection Agency (NFPA) 1710. *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. NFPA, Quincy, MA. (2004 Edition).

receiving a call; however, they are not trained or equipped to perform a confined space entry rescue, especially under IDLH conditions.

Ladder trucks carry a large hydraulically powered ladder or "bucket" and various types of rescue equipment. They are usually dispatched as part of a larger assignment; that is, they are not often first-response units. They typically carry four to six firefighters who are responsible at structural fires for securing utilities, gaining entry into the building, rescuing victims, and making ventilation openings in the building. Compared to engines, ladder trucks often carry heavier extrication equipment, which in some cities might include confined space rescue equipment; in general, however, ladder truck companies are not trained or equipped to perform a confined space entry rescue if it could involve IDLH conditions.

Ambulances that respond to 911 calls in California (as compared to those that provide medical transport services only) carry one or two paramedics trained at the level of advanced life support (ALS).[24] Ambulances are operated by fire departments or by a private ambulance company under contract with the county emergency medical services authority. Paramedics provide the highest level of field emergency care generally available by ground ambulance in California. Paramedics are licensed by the California Emergency Medical Services Authority and are accredited in their county. They perform advanced interventions that include cardiac monitoring and defibrillation, administration of emergency medications by intravenous (IV) access, airway management by endotracheal intubation, and other ALS skills. Many urban fire departments have engine and truck companies staffed with one or more "dual-trained" firefighter-paramedics; most firefighters, however, are trained at the level of emergency medical technician (EMT) I. An EMT I in California is able to perform basic life support (BLS) services, which include skills such as cardiopulmonary resuscitation (CPR), use of oxygen, and advanced first aid.

In a confined space emergency, advanced life support (ALS) services provided by a paramedic are essential to the rescue process. Basic life support (BLS) intervention might be appropriate at the point of contact with the entrant inside the space, but ALS will nearly always be needed at the scene after an entrant is extricated. Fire department engine and ambulance crews are therefore an essential part of an employer's confined space emergency response plan, even when the employer has arranged for a contracted (or employee-based) *on-site* rescue team to be present during the entry. Confined space contractors who provide rescue personnel at the site are *not* able to perform ALS intervention, and they are not able to transport an injured person to an acute care hospital; it is very likely they will be trained at the level of CPR and basic first aid only. It is therefore essential that the employer's confined space plan include an efficient means of contacting the 911 system and guiding responders to the scene, *including* when the employer has an on-site rescue team stationed at the space.

[24] A paramedic in California is technically known as an "Emergency Medical Technician–Paramedic" by the California Emergency Medical Services Authority.

Technical rescue units consist of four to six firefighters with specialized training and equipment in technical rescue operations, including confined space entry rescue. If their staffing level is augmented by firefighters from a first alarm assignment (see below), these units are capable of safely performing a confined space rescue. Most U.S. cities, however, operate only a small number of such units. The City and County of San Francisco, for example, with a population of over 700,000 residents, operates two technical rescue units on a 24-hour basis. As a consequence, rescue units are responsible for large geographic regions and therefore have longer travel times to the emergency scene. While they are capable of performing a rescue in a confined space, they typically arrive *later* than the first-responding engine company and ambulance.

Hazardous materials units consist of four to six firefighters trained at the level of Hazardous Materials Technician or Specialist. Most "HAZMAT" teams are trained and equipped to evaluate a hazardous materials emergency, enter a contaminated area, control the source of the contamination, and mitigate the emergency. Doing so requires that staffing levels be augmented by firefighters from a first alarm assignment to conduct decontamination, monitor the entry crews, and perform other tasks. Like technical rescue units, HAZMAT teams respond to a small number of calls each year and are therefore responsible for large geographic areas. Most medium and smaller-sized cities and counties are unable to staff full-time HAZMAT units; rather, they assemble a team when necessary from on-duty firefighters who are trained as hazardous materials technicians but who normally staff engine or truck companies.

A fire department response to a confined space incident that involves hazardous materials (such as IDLH conditions) will include a HAZMAT unit; in fact, when hazardous materials are present, the confined space rescue will very likely *not go forward* without first obtaining clearance from the HAZMAT team. This, of course, increases the total time to reach and extricate the entrant.

7.3 Under IDLH conditions, a confined space emergency will likely require a first alarm assignment, with support from technical rescue and hazardous materials units.

Fire departments respond to 911 calls in a tiered manner. Medical emergencies are usually assigned one engine company and one ambulance. For structural fires, complicated rescues, and other incidents that require more than a single engine company and ambulance, fire department equipment is dispatched in groups, or "assignments," that consist primarily of engines and a smaller number of ladder trucks. A "first alarm assignment," for example, typically consists of three engines, a ladder truck, a rescue unit (in large urban areas) and a supervising battalion chief; a second alarm assignment adds two or three engines and one or more ladder trucks. Third, fourth, and greater alarm assignments bring additional groups of engines, trucks, and other specialized equipment to the scene.

A confined space emergency would likely trigger a first alarm assignment, including a technical rescue unit and a HAZMAT unit. Without the support of these units, firefighters in first and greater alarm assignments would not be expected to have the training or

equipment necessarily to safely perform a confined space entry rescue, especially under IDLH conditions.

7.4 Many time-consuming steps are required to perform a confined space entry rescue.

Immediate intervention is needed if an entrant experiences an emergency under IDLH conditions in a confined space. If the entrant suffers respiratory arrest, for example, ALS intervention is needed within five minutes. Fire departments are unable to meet this time frame, given the many steps involved in an entry rescue operation (Table 19).[25]

Table 19. Steps involved in a fire department response to a confined space emergency.

Time period	*Activity*
Reaction time:	An emergency occurs in the space and is recognized as such by the attendant.
Contact time:	The company accesses the 911 system.
Response time:	The first alarm assignment (with a technical rescue unit) is dispatched and arrives at the scene.
Assessment time:	The rescue team assesses potential hazards and determines a rescue strategy.
Preparation time:	The rescue team dons personal protective equipment, controls visible hazards, and establishes a rescue platform.
Rescue time:	The rescue team accesses, provides BLS intervention, packages, and extricates the victim.
ALS time:	Advanced life support (ALS) is initiated outside the space by paramedics.
Acute care transport time:	The victim is loaded and transported by paramedics to an acute care hospital.
Tertiary care transport time:	The victim is transported to a trauma center, burn center, or other specialized facility as needed.

[25] For background, see CMC Rescue, Inc. *Confined Space Rescue*. In: Confined Space Entry and Rescue: A Training Manual. Approved by the California State Fire Marshall and the California State Board of Fire Services. CMC Rescue, Inc. Santa Barbara, CA. pp. 8-1 to 8-19 (1996).

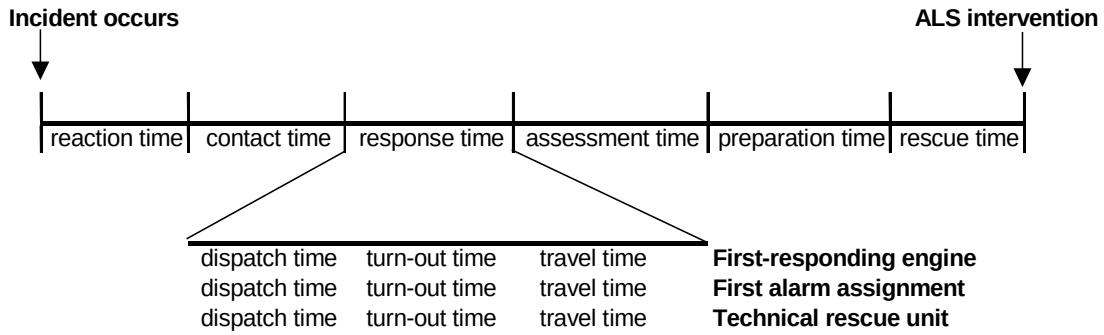
The fire department *response time* interval can be further broken down into subintervals (Table 20).

Table 20. Break-down of the fire department response time.

Time period	*Activity*
Dispatch time:	The dispatcher receives the call, records key information, and dispatches fire department units.
Turnout time:	Fire department units receive the information and initiate the response.
Travel time:	The first responding engine, first alarm assignment, rescue unit, and HAZMAT unit travel to the scene and access the rescue site.

The intervals and subintervals involved in a fire department response to a confined space emergency are summarized in Figure B:

Figure B. Timeline of a confined space emergency response, from the time of incident to advanced life support (ALS) intervention by paramedics on the scene.



7.5 Fire departments are not able to respond quickly enough to rescue entrants who become incapacitated under IDLH conditions.

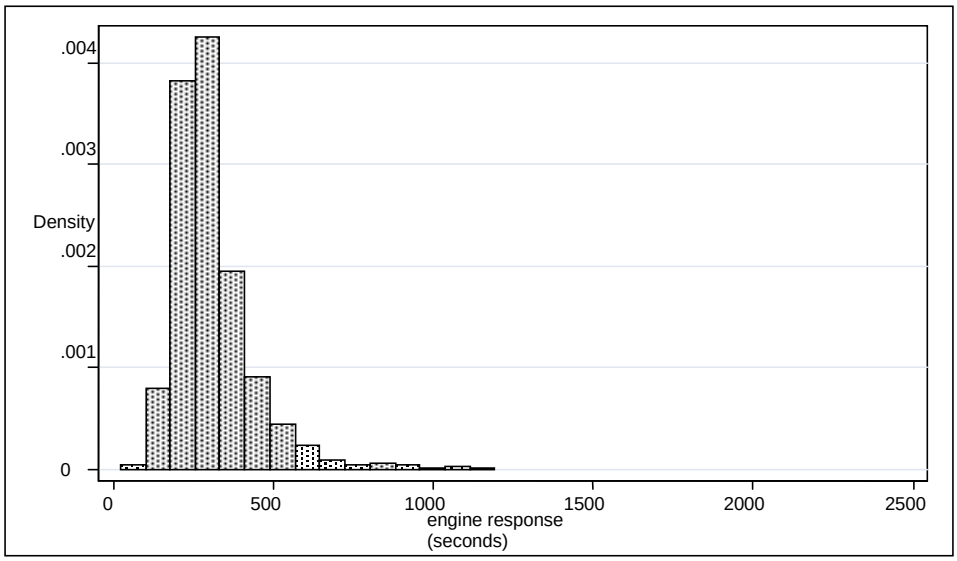
A fire department's *capacity* to perform a confined space rescue depends on the presence of a technical rescue unit (and a HAZMAT unit), supported by firefighters in a first alarm assignment. The department's ability to respond in a *timely* manner is influenced by many factors, including fire station locations, the population density of the area served, layout of streets, traffic patterns, weather conditions, and so forth. To better understand fire department response times in California, we gathered comprehensive fire department response time data for first responding engine companies and rescue units from two urban counties in California (Counties A and B), and aggregated response time data for

the first responding engine company for six additional municipalities in California (Cities C-G).

7.5.1 County A

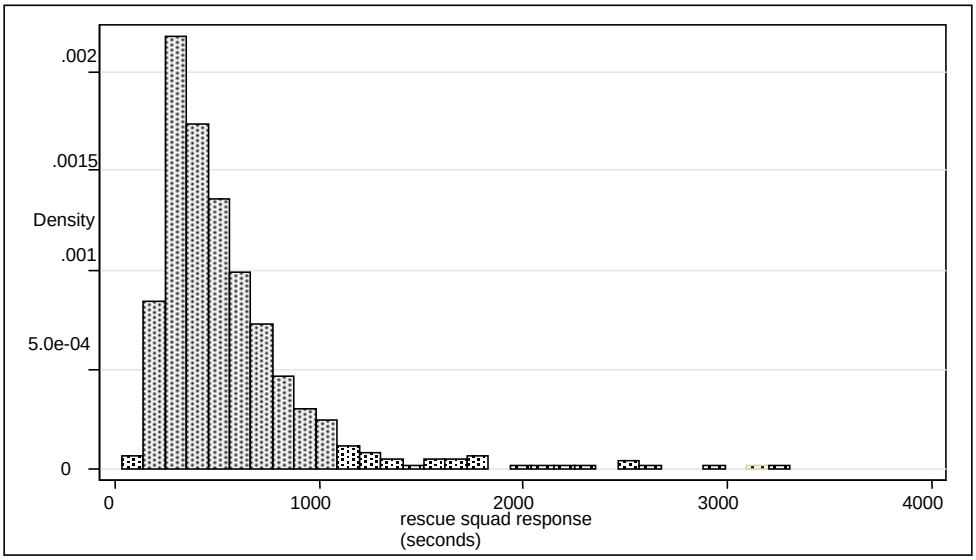
County A is a densely populated urban county with a well-funded fire department that trains personnel in confined space rescue. We constructed the response time distribution for this county using data from 1,495 first alarm dispatches that occurred between January 1, 2003 and February 28, 2005 and included a technical rescue unit. Two distributions are presented: the response time for the first responding engine company (Figure C) and the response time for the technical rescue unit (Figure D). We defined the response time as the interval from the time of dispatch to the time of arrival on scene.

Figure C. County A, response time distribution for the first arriving engine company (in seconds).



Summary statistics:	Minutes	Seconds
Mean engine response (geometric):	04:51	291
Standard deviation:	02:35	155
90th percentile:	07:37	457
Range:	0:20 – 40:42	20 – 2,442

Figure D. County A, response time distribution for arrival of the rescue unit (in seconds).



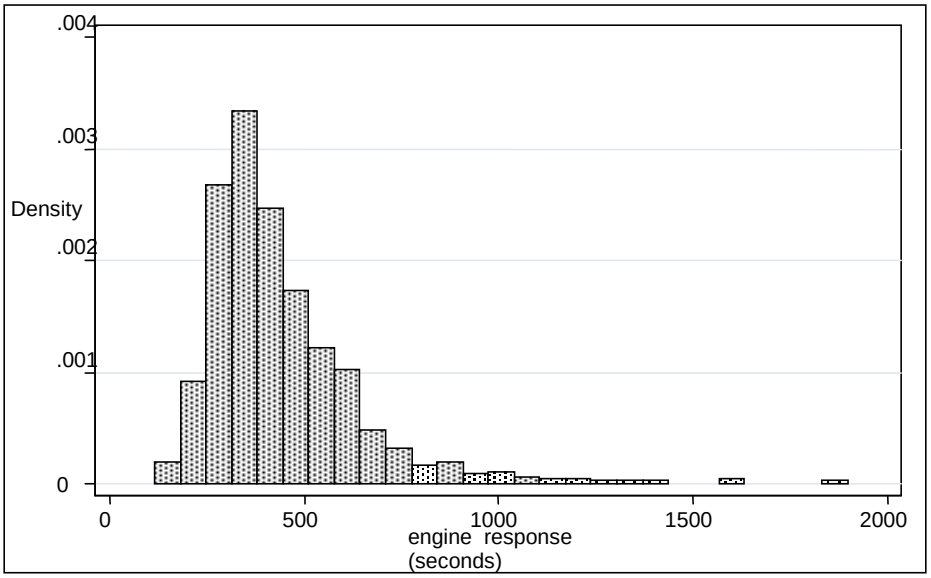
Summary statistics:	Minutes	Seconds
Mean rescue squad response (geometric):	07:48	468
Standard deviation:	06:31	391
90th percentile:	15:44	944
Range:	0:33 – 55:09	33 – 3,309

7.5.2 County B

County B is a major metropolitan center and its outlying suburbs. The fire department in this county trains and equips personnel for confined space rescue operations.

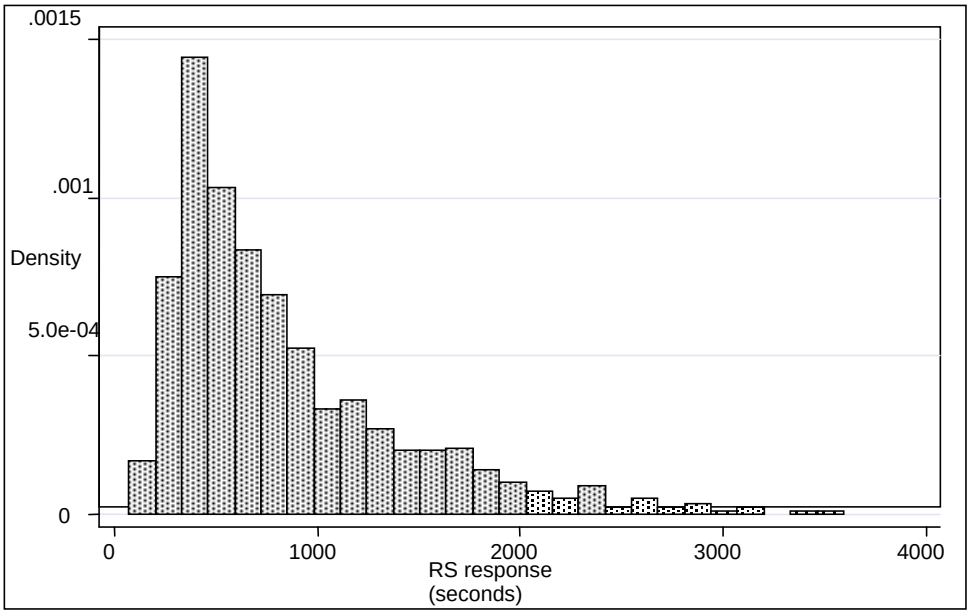
We constructed the response time distribution for this county using data from 762 first alarm dispatches that occurred between January 4, 2003 through December 31, 2005. As with county A, two distributions are presented: the response time for the first responding engine company (Figure E) and the response time for the technical rescue squad (Figure F).

Figure E. County B, response time distribution for the first arriving engine company (in seconds).



Summary statistics :	Minutes	Seconds
Mean engine response (geometric):	06:44	404
Standard deviation:	03:15	195
90th percentile:	10:53	653
Range:	1:15 – 31:39	75 – 1,899

Figure F. County B, response time distribution for arrival of the rescue unit (in seconds).



Summary statistics, in minutes:	Minutes	Seconds
Mean engine response (geometric):	11:19	679
Standard deviation:	09:38	578
90th percentile:	27:47	1,667
Range:	1:09 – 59:56	69 – 3,596

The distributions for counties A and B illustrate that, on average, an employer would wait about 5-7 minutes for the arrival of the first responding engine and about 8-11 minutes for the arrival of a rescue unit.

57% of county A's first-responding engines arrived on scene in five minutes or less, while 92% arrived in 8 minutes or less. 22% of county B's first engines arrived in 5 minutes or less, while 70% arrived in 8 minutes or less. The 90th percentile for first engine arrivals was about 7 minutes for County A and 11 minutes for County B.

In both counties, rescue unit arrival times lagged behind those of the first arriving engine, as expected, though again the lag time was greater for county B. The variability of first engine arrivals was markedly lower than that of rescue unit arrivals in both counties – standard deviations were between two and three times higher for rescue units compared to first arriving engine companies. This reflects the fact that a small number of rescue units is responsible for large geographic areas, compared to fire engines, which are more numerous and distributed evenly throughout a department's jurisdiction.

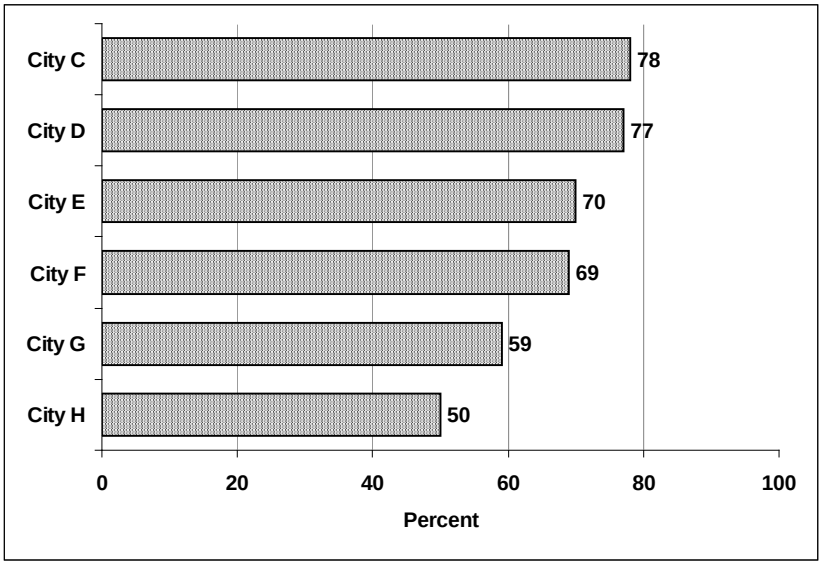
7.5.3 Aggregated data for six California municipalities

We analyzed aggregate response time data for six additional California municipalities (cities C, D, E, F, G, and H). We found that the response time performance for the first

arriving engine company varied markedly between these cities. Figure G presents these data as a percent of total 911 calls responded to within five minutes or less, as measured from the time of dispatch to the time of arrival of the first fire department unit on scene.[26]

The response times *within* each of the individual cities did not vary considerably over the time period 2001–2004. City G, for example, had a mean annual response time under five minutes 59% to 65% of the time during this period (Figure H).[15]

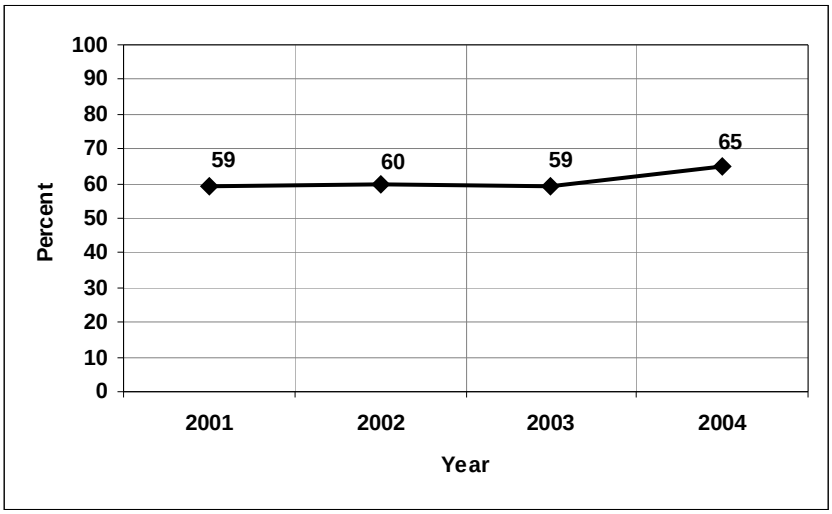
Figure G. Percent of 911 calls for six cities in which the first responding engine arrived on scene in five minutes or less.



City	*2003 population*	*Percent F.D. arriva in ≤5 mins*
C	400,000 – 500,000	78
D	50,000 – 100,000	77
E	50,000 – 100,000	70
F	400,000 – 500,000	69
G	> 500,000	59
H	100,000 – 200,000	50

[26] Comparative Performance Measurement Annual Report. The International City and County Manager's Association (2003).

Figure H. Percent of 911 calls for City G in which the first responding engine arrived on scene in five minutes or less, 2001-2004.



The aggregate data for the six California cities shows that between 50% and 78% of the time, first responding engines arrived in 5 minutes or less. The population of these cities ranged from less than 100,000 to greater than 500,000; the percent of arrival times under five minutes, however, did not correlate with the size of the population served.

Together, the data for counties A and B and cities C through H present a "real-world" picture of how quickly an employer in an urban California setting could expect the 911 system to respond to a confined space emergency.

7.6 Conclusion

Based on these data, together with interviews and review of the literature, we estimated the time frame for a fire department response for a confined space entry rescue, beginning with the point of "reaction" at the facility and terminating at the point of advanced life support (ALS) intervention in the field. We assumed a "best-case scenario".[27] Our estimate produced a total response time of 48 minutes (Table 21).

[27] Under a "best-case scenario," we assumed (1) immediate recognition of an emergency by a co-worker, (2) immediate contact to 911 by the employer, (3) a quick fire department response time (4) immediate access to the confined space by responders, (5) a minimum of rescuer hazards at the scene (explosive or toxic atmosphere, oxygen deficiency, physical hazards etc), (6) a well-trained and equipped fire department rescue team, (7) a minimum of complications during the rescue and extrication process, and (8) on-scene availability of advanced life support services.

Table 21. Estimated timeline for a fire department response to a confined space entry rescue, assuming a "best case scenario."

Step	*Event*	*Time, minutes*
1	Reaction	2
2	Contact	2
3	Rescue unit response	7
4	Assessment	10
5	Preparation & set-up	10
6	Rescue	15
7	ALS intervention	2
	Total	48

This estimate illustrates that an entrant who experiences a life-threatening emergency in a confined space under IDLH conditions will almost certainly die if the employer's emergency response plan depends on an off-site fire department for extricating the worker from the space. The data illustrate that it is not possible for a fire department to respond to a confined space emergency in a time frame that would allow firefighters to save the life of a worker who experiences an emergency under IDLH conditions.

Industry therefore faces a conundrum: confined space entry rescue under IDLH conditions requires the personnel and equipment of specialized fire department technical rescue and hazardous materials units, yet in cities throughout the U.S., these units will arrive at the scene of the emergency too late to save the life of an entrant. In addition, the fire department response time represents only one of many steps involved in a confined space entry rescue operation.

The appropriate role of the 911 system in confined space operations (when IDLH conditions are present or could develop) is therefore *not* to rescue the entrant from the space but to provide advanced life support (ALS) services once the entrant is extricated, and to transport the entrant from the rescue scene to the ambulance and to a hospital or trauma center.

When the space poses *only physical hazards* and is very unlikely to develop into IDLH conditions, the 911 system could reasonably be used for purposes of confined space emergency planning, assuming all other elements of the standard are properly implemented, as stipulated in the federal confined space standard.

In short, the California standard should make it clear that under no circumstances should an employer rely on the 911 system for rescue services when there is a chance that IDLH conditions could develop during the entry.

* * * * * * * *

8. Recommendations

Three factors point toward the need for California to clarify and strengthen the emergency response language in its confined space standard. First, there are ambiguities in the language regarding the employer's responsibilities to provide on-site rescue services, and there is no explicit recognition in the standard of the unique hazards posed by IDLH conditions. Second, limited evidence suggests that (perhaps as a consequence of these ambiguities) some portion of California employers may be relying on the 911 system for *first response* to a confined space emergency, even under potentially IDLH conditions. Third, fire department response time data indicate that the 911 system is unable to provide a timely response to a confined space emergency that occurs under IDLH conditions.

8.1 Goals

We propose two overarching goals for the *Rescue and Emergency Services* section of the California confined space standard:

Goal 1: Protect the safety of rescuers;

Goal 2: Safely rescue entrants in a timely manner.

To meet these goals, we considered three options for the California standard.

8.2 Options

Option A. Distinguish and define the role of the "standby person."

Under this option, California would adopt language changes to (1) distinguish the role of the "standby" person from that of the "attendant," and (2) clarify employer responsibilities regarding on-site and off-site rescue services.

Option B: Establish a requirement for a "back-up attendant" in lieu of the "standby" person.

Under this option, California would adopt language changes to (1) redefine the "standby" person as a "back-up" attendant, and (2) clarify employer responsibilities regarding on-site and off-site rescue services.

Option C: Adopt the language of the current federal standard.

Under this option, California would adopt the current federal standard 1910.146(k), *Rescue and Emergency Services*, including 1910.146 App F, Non-Mandatory Appendix F, *Rescue Team or Rescue Service Evaluation Criteria*.

8.2 Recommendation

We recommend Option C. We have prepared language changes that would implement options A and B but for brevity have not included them here. We are *not* confident that options A or B would meet (or exceed) the degree of worker protection provided by the language of the federal standard. More broadly, we believe Goals 1 and 2 are best met by language that would require the employer to provide rescue services that are appropriate in both response time and technical capacity to the degree of hazard posed by the entry conditions. This approach is embodied in the federal standard and its Appendix F.

If California adopts the federal standard, a California employer would be required to provide a trained and equipped rescue team *at the entry site* of the confined space if the entry could involve IDLH conditions. The federal standard stipulates as follows:

> *1910.146(k)(1). An employer who designates rescue and emergency services pursuant to paragraph (d)(9) of this section, shall:*
>
> *1910.146(k)(1)(iii). Select a rescue team or service from those evaluated that:*
>
> *1910.146(k)(1)(iii)(A). Has the capability to reach the victim(s) within a time frame that is appropriate for the permit space hazard(s) identified;*
>
> *1910.146(k)(1)(iii)(B). Is equipped for and proficient in performing the needed rescue services.*

Federal Appendix F clarifies this requirement as follows:

A. Initial Evaluation:

I. *The employer should meet with the prospective rescue service to facilitate the evaluations required by §1910.146(k)(1)(i) and §1910.146(k)(1)(ii). At a minimum, if an off-site rescue service is being considered, the employer must contact the service to plan and coordinate the evaluations required by the standard. Merely posting the service's number or planning to rely on the 911 emergency phone number to obtain these services at the time of a permit space emergency would not comply with paragraph (k)(1) of the standard.*

II. *The capabilities required of a rescue service vary with the type of permit spaces from which rescue may be necessary and the hazards likely to be encountered in those spaces. Answering the questions below will assist employers in determining whether the rescue service is capable of performing rescues in the permit spaces present at the employer's workplace.*

   1. *What are the needs of the employer with regard to response time (time for the rescue service to receive notification, arrive at the scene, and set up*

> *and be ready for entry)? For example, if entry is to be made into an IDLH atmosphere, or into a space that can quickly develop an IDLH atmosphere (if ventilation fails or for other reasons), the rescue team or service would need to be standing by at the permit space. On the other hand, if the danger to entrants is restricted to mechanical hazards that would cause injuries (e.g., broken bones, abrasions) a response time of 10 or 15 minutes might be adequate.*

Importantly, as previously noted, the California standard does not explicitly require the employer, through a systematic evaluation and selection process, to provide rescue services whose *response time* and *capacity* "match" the degree of hazard that workers could encounter in the space.

Furthermore, the ambiguities contained in the current California standard's emergency response section could leave the impression that employers may rely exclusively on the 911 system for primary emergency response.

For these reasons, we believe the emergency response section of the California standard is less protective than the federal standard and should be abandoned in favor of the federal language, including Appendix F. The emergency planning and response sections of the California confined space guidance document should be re-drafted to reflect these changes to make clear that under no circumstances should an employer rely on the 911 system for rescue services when IDLH conditions could occur during a confined space entry.

* * * * * * * *

9. Conclusion

California established a confined space standard in 1978 before it was legally required to do so. In the intervening years, the hazards of confined spaces have been recognized and subsequently regulated at the federal level, beginning in 1993. In amending its standard in 1998, federal OSHA clarified the employer's responsibilities regarding emergency planning and response. The revised federal language requires the employer to evaluate and select rescue services whose response time and technical capacity "match" the hazards posed by the entry conditions; spaces with potential IDLH conditions require a rescue team to be stationed at the entry point.

Following these changes, California concluded that its existing emergency response language contained requirements that were at least as (or more) protective than the federal standard because it described rescue services provided by the employer on-site, regardless of the degree of hazard posed by the space.

This report, however, finds that this language is imprecise and confusing. The report finds that:

- The emergency response section of California's confined space standard contains confusing language pertaining to the roles of "attendants" and "stand-by" persons, as well as language that seemingly would allow employers to rely on off-site 911 services without careful consideration of the service's response time and rescue capabilities.

- California's guidance document that is intended to translate the standard for employers is similarly confusing and reinforces the imprecision of California's standard.

- Some California employers, including large companies, may be confused by California's emergency planning and response requirements and may be relying on the 911 system as a primary response to a confined space emergency, in lieu of a dedicated on-site rescue team positioned at the entry to the space.

- The 911 system is unable to provide rescue services in a timely manner to a confined space emergency that occurs under IDLH conditions. In a best-case scenario, a fire department will need at least 48 minutes to arrive on scene, enter a confined space, extricate an incapacitated worker, and initiate advanced life support services.

Based on these findings, the report concludes that California's confined space standard is less protective than the federal standard. The report recommends that California adopt the emergency planning and response language of the federal standard contained in subsection (k), along with the federal non-mandatory Appendix F. The emergency

planning and response sections of the California confined space guidance document should be re-drafted to reflect these changes.

* * * * * * * *

Appendix A. Federal language, subsection k (1998)[28]

Regulations (Standards-29 CFR)

Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	J
• Subpart Title:	General Environmental Controls
• Standard Number:	1910.146
• Title:	Permit-required confined spaces

1910.146(k)

Rescue and emergency services.

1910.146(k)(1)

An employer who designates rescue and emergency services, pursuant to paragraph (d)(9) of this section, shall:

1910.146(k)(1)(i)

Evaluate a prospective rescuer's ability to respond to a rescue summons in a timely manner, considering the hazard(s) identified;

Note to paragraph (k)(l)(i): What will be considered timely will vary according to the specific hazards involved in each entry. For example, §1910.134, Respiratory Protection, requires that employers provide a standby person or persons capable of immediate action to rescue employee(s) wearing respiratory protection while in work areas defined as IDLH atmospheres.

1910.146(k)(1)(ii)

Evaluate a prospective rescue service's ability, in terms of proficiency with rescue-related tasks and equipment, to function appropriately while rescuing entrants from the particular permit space or types of permit spaces identified;

1910.146(k)(1)(iii)

[28] U.S. Dept. of Labor, Occupational Safety and Health Administration, Regulations (Standards 29 CFR) Permit Required Confined Spaced 1910.146 (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9797) (Accessed August 16, 2007).

Select a rescue team or service from those evaluated that:

1910.146(k)(1)(iii)(A)

Has the capability to reach the victim(s) within a time frame that is appropriate for the permit space hazard(s) identified;

1910.146(k)(1)(iii)(B)

Is equipped for and proficient in performing the needed rescue services;

1910.146(k)(1)(iv)

Inform each rescue team or service of the hazards they may confront when called on to perform rescue at the site; and

1910.146(k)(1)(v)

Provide the rescue team or service selected with access to all permit spaces from which rescue may be necessary so that the rescue service can develop appropriate rescue plans and practice rescue operations.

Note to paragraph (k)(1): Non-mandatory Appendix F contains examples of criteria which employers can use in evaluating prospective rescuers as required by paragraph (k)(l) of this section.

1910.146(k)(2)

An employer whose employees have been designated to provide permit space rescue and emergency services shall take the following measures:

1910.146(k)(2)(i)

Provide affected employees with the personal protective equipment (PPE) needed to conduct permit space rescues safely and train affected employees so they are proficient in the use of that PPE, at no cost to those employees;

1910.146(k)(2)(ii)

Train affected employees to perform assigned rescue duties. The employer must ensure that such employees successfully complete the training required to establish proficiency as an authorized entrant, as provided by paragraphs (g) and (h) of this section;

1910.146(k)(2)(iii)

Train affected employees in basic first-aid and cardiopulmonary resuscitation (CPR). The employer shall ensure that at least one member of the rescue team or service holding a current certification in first aid and CPR is available; and

1910.146(k)(2)(iv)

Ensure that affected employees practice making permit space rescues at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces. Representative permit spaces shall, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.

1910.146(k)(3)

To facilitate non-entry rescue, retrieval systems or methods shall be used whenever an authorized entrant enters a permit space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Retrieval systems shall meet the following requirements.

1910.146(k)(3)(i)

Each authorized entrant shall use a chest or full body harness, with a retrieval line attached at the center of the entrant's back near shoulder level, above the entrant's head, or at another point which the employer can establish presents a profile small enough for the successful removal of the entrant. Wristlets may be used in lieu of the chest or full body harness if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

1910.146(k)(3)(ii)

The other end of the retrieval line shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device shall be available to retrieve personnel from vertical type permit spaces more than 5 feet (1.52 m) deep

1910.146(k)(4)

If an injured entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is required to be

kept at the worksite, that MSDS or written information shall be made available to the medical facility treating the exposed entrant.

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Appendix B. Federal Appendix F[29]

Regulations (Standards - 29 CFR)
Non-Mandatory Appendix F -- Rescue Team or Rescue Service Evaluation Criteria - 1910.146 App F [63 FR 66039, Dec. 1, 1998].

• Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	J
• Subpart Title:	General Environmental Controls
• Standard Number:	1910.146 App F
• Title:	Non-Mandatory Appendix F -- Rescue Team or Rescue Service Evaluation Criteria

Non-Mandatory Appendix F -- Rescue Team or Rescue Service Evaluation Criteria

(1) This appendix provides guidance to employers in choosing an appropriate rescue service. It contains criteria that may be used to evaluate the capabilities both of prospective and current rescue teams. Before a rescue team can be trained or chosen, however, a satisfactory permit program, including an analysis of all permit- required confined spaces to identify all potential hazards in those spaces, must be completed. OSHA believes that compliance with all the provisions of §1910.146 will enable employers to conduct permit space operations without recourse to rescue services in nearly all cases. However, experience indicates that circumstances will arise where entrants will need to be rescued from permit spaces. It is therefore important for employers to select rescue services or teams, either on-site or off-site, that are equipped and capable of minimizing harm to both entrants and rescuers if the need arises.

(2) For all rescue teams or services, the employer's evaluation should consist of two components: an initial evaluation, in which employers decide whether a potential rescue service or team is adequately trained and equipped to perform permit space rescues of the kind needed at the facility and whether such rescuers can respond in a timely manner, and a performance evaluation, in which employers measure the performance of the team or service during an actual or practice rescue. For example, based on the initial evaluation, an employer may determine that maintaining an on-site rescue team will be more expensive than obtaining the services of an off-site team, without being significantly more effective, and decide to hire a rescue service. During a performance evaluation, the employer could decide, after observing the rescue service perform a practice rescue, that the service's training or preparedness was not adequate to effect a timely or effective rescue at his or her facility and

[29] U.S. Dept. of Labor, Occupational Safety and Health Administration, Regulations (Standards 29 CFR) Permit Required Confined Spaced 1910.146 (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9803) (Accessed August 16, 2007).

decide to select another rescue service, or to form an internal rescue team.

A. Initial Evaluation

I. The employer should meet with the prospective rescue service to facilitate the evaluations required by §1910.146(k)(1)(i) and §1910.146(k)(1)(ii). At a minimum, if an off-site rescue service is being considered, the employer must contact the service to plan and coordinate the evaluations required by the standard. Merely posting the service's number or planning to rely on the 911 emergency phone number to obtain these services at the time of a permit space emergency would not comply with paragraph (k)(1) of the standard.

II. The capabilities required of a rescue service vary with the type of permit spaces from which rescue may be necessary and the hazards likely to be encountered in those spaces. Answering the questions below will assist employers in determining whether the rescue service is capable of performing rescues in the permit spaces present at the employer's workplace.

1. What are the needs of the employer with regard to response time (time for the rescue service to receive notification, arrive at the scene, and set up and be ready for entry)? For example, if entry is to be made into an IDLH atmosphere, or into a space that can quickly develop an IDLH atmosphere (if ventilation fails or for other reasons), the rescue team or service would need to be standing by at the permit space. On the other hand, if the danger to entrants is restricted to mechanical hazards that would cause injuries (e.g., broken bones, abrasions) a response time of 10 or 15 minutes might be adequate.

2. How quickly can the rescue team or service get from its location to the permit spaces from which rescue may be necessary? Relevant factors to consider would include: the location of the rescue team or service relative to the employer's workplace, the quality of roads and highways to be traveled, potential bottlenecks or traffic congestion that might be encountered in transit, the reliability of the rescuer's vehicles, and the training and skill of its drivers.

3. What is the availability of the rescue service? Is it unavailable at certain times of the day or in certain situations? What is the likelihood that key personnel of the rescue service might be unavailable at times? If the rescue service becomes unavailable while an entry is underway, does it have the capability of notifying the employer so that the employer can instruct the attendant to abort the entry immediately?

4. Does the rescue service meet all the requirements of paragraph (k)(2) of the standard? If not, has it developed a plan that will enable it to meet those requirements in the future? If so, how soon can the plan be implemented?

5. For off-site services, is the service willing to perform rescues at the employer's workplace? (An employer may not rely on a rescuer who declines, for whatever reason, to provide rescue services.)

6. Is an adequate method for communications between the attendant, employer and

prospective rescuer available so that a rescue request can be transmitted to the rescuer without delay? How soon after notification can a prospective rescuer dispatch a rescue team to the entry site?

7. For rescues into spaces that may pose significant atmospheric hazards and from which rescue entry, patient packaging and retrieval cannot be safely accomplished in a relatively short time (15-20 minutes), employers should consider using airline respirators (with escape bottles) for the rescuers and to supply rescue air to the patient. If the employer decides to use SCBA, does the prospective rescue service have an ample supply of replacement cylinders and procedures for rescuers to enter and exit (or be retrieved) well within the SCBA's air supply limits?

8. If the space has a vertical entry over 5 feet in depth, can the prospective rescue service properly perform entry rescues? Does the service have the technical knowledge and equipment to perform rope work or elevated rescue, if needed?

9. Does the rescue service have the necessary skills in medical evaluation, patient packaging and emergency response?

10. Does the rescue service have the necessary equipment to perform rescues, or must the equipment be provided by the employer or another source?

B. Performance Evaluation

Rescue services are required by paragraph (k)(2)(iv) of the standard to practice rescues at least once every 12 months, provided that the team or service has not successfully performed a permit space rescue within that time. As part of each practice session, the service should perform a critique of the practice rescue, or have another qualified party perform the critique, so that deficiencies in procedures, equipment, training, or number of personnel can be identified and corrected. The results of the critique, and the corrections made to respond to the deficiencies identified, should be given to the employer to enable it to determine whether the rescue service can quickly be upgraded to meet the employer's rescue needs or whether another service must be selected. The following questions will assist employers and rescue teams and services evaluate their performance.

1. Have all members of the service been trained as permit space entrants, at a minimum, including training in the potential hazards of all permit spaces, or of representative permit spaces, from which rescue may be needed? Can team members recognize the signs, symptoms, and consequences of exposure to any hazardous atmospheres that may be present in those permit spaces?

2. Is every team member provided with, and properly trained in, the use and need for PPE, such as SCBA or fall arrest equipment, which may be required to perform permit space rescues in the facility? Is every team member properly trained to perform his or her functions and make rescues, and to use any rescue equipment, such as ropes and backboards, that may

be needed in a rescue attempt?

3. Are team members trained in the first aid and medical skills needed to treat victims overcome or injured by the types of hazards that may be encountered in the permit spaces at the facility?

4. Do all team members perform their functions safely and efficiently? Do rescue service personnel focus on their own safety before considering the safety of the victim?

5. If necessary, can the rescue service properly test the atmosphere to determine if it is IDLH?

6. Can the rescue personnel identify information pertinent to the rescue from entry permits, hot work permits, and MSDSs?

7. Has the rescue service been informed of any hazards to personnel that may arise from outside the space, such as those that may be caused by future work near the space?

8. If necessary, can the rescue service properly package and retrieve victims from a permit space that has a limited size opening (less than 24 inches (60.9 cm) in diameter), limited internal space, or internal obstacles or hazards?

9. If necessary, can the rescue service safely perform an elevated (high angle) rescue?

10. Does the rescue service have a plan for each of the kinds of permit space rescue operations at the facility? Is the plan adequate for all types of rescue operations that may be needed at the facility? Teams may practice in representative spaces, or in spaces that are "worst-case" or most restrictive with respect to internal configuration, elevation, and portal size. The following characteristics of a practice space should be considered when deciding whether a space is truly representative of an actual permit space:

(1) Internal configuration.

(a) Open -- there are no obstacles, barriers, or obstructions within the space. One example is a water tank.

(b) Obstructed -- the permit space contains some type of obstruction that a rescuer would need to maneuver around. An example would be a baffle or mixing blade. Large equipment, such as a ladder or scaffold, brought into a space for work purposes would be considered an obstruction if the positioning or size of the equipment would make rescue more difficult.

(2) Elevation.

(a) Elevated -- a permit space where the entrance portal or opening is above grade by 4 feet or more. This type of space usually requires knowledge of high angle rescue procedures because of the difficulty in packaging and transporting a patient to the ground from the

portal.

(b) Non-elevated -- a permit space with the entrance portal located less than 4 feet above grade. This type of space will allow the rescue team to transport an injured employee normally.

(3) Portal size.

(a) Restricted -- A portal of 24 inches or less in the least dimension. Portals of this size are too small to allow a rescuer to simply enter the space while using SCBA. The portal size is also too small to allow normal spinal immobilization of an injured employee.

(b) Unrestricted -- A portal of greater than 24 inches in the least dimension. These portals allow relatively free movement into and out of the permit space.

(4) Space access.

(a) Horizontal -- The portal is located on the side of the permit space. Use of retrieval lines could be difficult.

(b) Vertical -- The portal is located on the top of the permit space, so that rescuers must climb down, or the bottom of the permit space, so that rescuers must climb up to enter the space. Vertical portals may require knowledge of rope techniques, or special patient packaging to safely retrieve a downed entrant.

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Appendix C. California language, subsection k[30]

(k) Rescue and emergency services. The employer shall ensure that at least one standby person at the site is trained and immediately available to perform rescue and emergency services.

(1) The following requirements apply to employers who have employees enter permit spaces to perform rescue services.

(A) The employer shall ensure that each member of the rescue service is provided with, and is trained to use properly, the personal protective equipment and rescue equipment necessary for making rescues from permit spaces.

(B) Each member of the rescue service shall be trained to perform the assigned rescue duties. Each member of the rescue service shall also receive the training required of authorized entrants under subsections (g) and (h).

(C) Each member of the rescue service shall practice making permit space rescues at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces. Representative permit spaces shall, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.

(D) Each member of the rescue service shall be trained in basic first-aid and in cardiopulmonary resuscitation (CPR). At least one member of the rescue service holding current certification in first aid and in CPR shall be available.

(2) When an employer (host employer) arranges to have persons other than the host employer's employees perform permit space rescue, the host employer shall:

(A) Inform the rescue service of the hazards they may confront when called on to perform rescue at the host employer's facility, and

(B) Provide the rescue service with access to all permit spaces from which rescue may be necessary so that the rescue service can develop appropriate rescue plans and practice rescue operations.

(3) To facilitate non-entry rescue, retrieval systems or methods shall be used whenever an authorized entrant enters a permit space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Retrieval

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30 Subchapter 7. General Industry Safety Orders, Group 16. Control of Hazardous Substances, Article 108. Confined Spaces, §5157. Permit-Required Confined Spaces (http://www.dir.ca.gov/title8/5157.html) (accessed August 16, 2007).

systems shall meet the following requirements.

(A) Each authorized entrant shall use a chest or full body harness, with a retrieval line attached at a suitable point so that when rescued, the entrant presents the smallest possible profile (for example at the center of the entrant's back near shoulder level, or above the entrant's head). Wristlets may be used in lieu of the chest of full body harness if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

(B) The other end of the retrieval line shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device shall be available to retrieve personnel from vertical type permit spaces more than 5 feet deep.

(4) If an injured entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or written information shall be made available to the medical facility treating the exposed entrant.

(l) Employee participation.

(1) Employers shall consult with affected employees and their authorized representatives on the development and implementation of all aspects of the permit space program required by subsection (c).

(2) Employers shall make available to affected employees and their authorized representatives all information required to be developed by this section.

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