NIOSH Comments to DOL

COMMENTS OF THE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ON THE
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION'S
NOTICE OF PROPOSED RULEMAKING
ON
PERMIT REQUIRED CONFINED SPACES

29 CFR Part 1910
Docket No. S-019

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

10/4/89

In December of 1979, the National Institute for Occupational Safety and Health (NIOSH) published a document entitled, Criteria for a Recommended Standard....Working in Confined Spaces (NIOSH 1979). NIOSH continues to endorse the recommendations of that criteria document.

NIOSH has continued to evaluate confined space hazards since 1979. In 1986, NIOSH published an alert entitled, Request for Assistance in Preventing Occupational Fatalities in Confined Spaces (NIOSH 1986) and in 1987, a document entitled, A Guide to Safety in Confined Spaces (NIOSH 1987). The Fatal Accident Circumstances and Epidemiology (FACE) project has evaluated selected confined space deaths since January 1984 (Attachment 1). A summary of the results of the FACE confined space reports has been accepted for publication in the Journal of Safety Research (Conroy et al. 1989) and is attached.

FREQUENCY OF INJURIES AND FATALITIES

OSHA's estimate of 39.1 fatalities per year due to confined space incidents appears to be extremely low. The NIOSH FACE program has investigated 44 incidents resulting in 70 fatalities in five years (an average of 14 fatalities per year). FACE is a passive surveillance system that relies on reports from a limited number of reporting States and, therefore, represents a limited percentage of the total occurrence of confined space deaths in the United States. A maximum of 11 States have participated in the FACE project at any one time, and the average annual number of fatalities investigated by FACE is theoretically more consistent with the NTOF-based estimate of 127 annual fatalities than with the OSHA estimate of 39.1 fatalities.

There is a lack of definitive data on the frequency of confined space injuries and fatalities. NIOSH has reviewed the Bureau of Labor Statistics (BLS) Supplementary Data System (SDS) for potential confined space claims, and the National Traumatic Occupational Fatalities (NTOF) data base for potential confined space fatalities. The results of these analyses are attached (Attachment 2) with an explanation of their limitations. Based on these data, NIOSH estimates that a minimum of 763 confined space fatalities occurred between 1980 and 1985 (approximately 127 fatalities per year).

FACE RESULTS

NIOSH has found that confined space fatalities involve a failure to post a warning on the confined space, a failure of the victim to recognize the space as a confined space hazard, a failure to monitor and ventilate the atmosphere before entry, and well-intentioned but ill-conceived rescue attempts (Conroy et al. 1989). Based on our

experience in investigating confined space fatalities through the FACE project and in evaluating other reports of confined space fatalities, NIOSH continues to recommend that there be a minimum of three classes of confined spaces, that all confined spaces require permits and monitoring, and that ventilation is the preferred engineering control method (NIOSH 1979).

The proposed definition for "permit required confined space" in 1910.146 (b)(23) includes the qualifying language in (23)(iv)(A), "contains or has a known potential to contain a hazardous atmosphere." NIOSH is concerned with the use of the term "known potential" in this definition. The available data indicate that failing to recognize the potentially hazardous condition or entering a confined space where the hazards are not "known" are the leading contributing factors to confined space fatalities. Twenty-five (36 percent) of the seventy deaths resulting from the 44 incidents investigated by the FACE project through December of 1988 were supervisors; in 37 of the 44 incidents, failure to recognize the operation as involving a confined space was a contributing factor (Conroy et al. 1989). NIOSH recommends that the word "known" be deleted from the language used in the definition of permit required space.

OSHA comments in the preamble to the proposed rule that the data indicate there are low-risk and high-risk confined spaces (page 24088). OSHA further suggests that they have not adequately distinguished between these spaces. NIOSH concurs. The FACE data indicate that the frequency of fatalities due to confined spaces is greatest in municipal (25 percent), manufacturing and production (20.5 percent), plumbing and sewage (15.9 percent), and construction (15.9 percent) industries. Sewage was present in 35 percent of the confined spaces investigated, water in 25 percent, chemicals in 20 percent, and petroleum products in 11 percent. The high-risk confined spaces according to the FACE reports are tanks (38.6 percent), utility vaults (18.1 percent) and sewers (18.1 percent) (Conroy et al. 1989).

The highest risk for confined space fatalities are those spaces where the potential to contain a hazardous atmosphere is not known or recognized. Utility vaults, sewers, water sumps, and silos accounted for 19 of the 44 incidents investigated by FACE from January 1984 through December 1988 (Conroy et al. 1989).

The high frequency of confined space fatalities involving sewers and utility vaults, and the fact that these confined spaces tend to be widely dispersed rather than centrally located, as are the confined spaces in many manufacturing and chemical processing operations, should be carefully considered by OSHA in determining if a single standard can adequately address confined space entry for both manufacturing/processing hazards and utility/sewage hazards.

NIOSH RECOMMENDATIONS

For spaces with limited openings for entry and exit and unfavorable natural ventilation, NIOSH continues to recommend that the worker be made aware of the dangers involved in entering such a confined space through training and posting of the space. NIOSH continues to recommend that confined spaces be categorized into at least 3 classifications to determine appropriate work practices (NIOSH 1979). NIOSH recommends that purging and ventilation be required environmental controls for class A and class B confined spaces, and that environmental monitoring always be required to insure the effectiveness of the ventilation in class A confined spaces.

NIOSH also recommends that OSHA consider regulating as a separate class of confined space, those spaces where the potential atmospheric hazard is oxygen deficiency. NIOSH makes this recommendation because of the frequent occurrence of such confined spaces in nonmanufacturing areas, the frequent number of fatalities in them, and the relative effectiveness of a simple air monitoring procedure in preventing fatalities in these spaces. Entry into oxygen-deficient spaces is extremely dangerous because oxygen deficiency does not have adequate warning properties. The onset of hypoxia is characterized by a lack of coordination and poor judgement (Barron 1970). Because of these dangers, oxygen-deficient spaces will frequently cause multiple fatalities (Conroy et al. 1989). Simple, portable, direct-reading oxygen meters are available and are certified for use in harsh environments by the Mine Safety and Health Administration.

NIOSH has reviewed the American National Standards Institute's consensus standard ANSI Z117.1-1988 on "safety requirements for confined spaces." Based on our extensive experience in analyzing confined space fatalities, NIOSH contends that the recommendations in our 1979 criteria document, Working in Confined Spaces (NIOSH 1979) and our 1987 Guide to Safety in Confined Spaces (NIOSH 1987) are more protective of worker safety and offer more flexibility to employers.

CONCLUSION

It is important to recognize that NIOSH does not recommend the entry of workers into confined spaces where unknown atmospheres, hazardous atmospheres, or immediately dangerous to life and health (IDLH) atmospheres exist at the time of entry. NIOSH recommends that, where possible, confined spaces be purged and ventilated so that safe atmospheric conditions are obtained before worker entry. The precautions and work practices contained in the criteria document are based on this premise.

NIOSH is aware that there are certain circumstances where purging and ventilating confined spaces may not render a safe atmosphere, or may

even create a more hazardous situation. If it is absolutely necessary to enter a confined space that contains an unknown hazardous or IDLH atmosphere at the time of entry, special precautions must be taken. NIOSH does not endorse entry into such a dangerous environment under the generic criteria specified in either the OSHA proposed rule or the NIOSH criteria document for Class A confined spaces. Entry into a confined space under IDLH conditions requires the careful consideration of several factors in addition to those set forth for Class A confined spaces:

- Is the shape and size of the space such that it will interfere with the wearing or operation of the appropriate respiratory protection?

- Is the size and shape of the opening into the confined space compatible with the entry of workers and rescue personnel in appropriate respiratory protective equipment, and with the removal of an injured worker wearing respiratory protective equipment?

- Will a worker be able to escape from the space in an emergency situation with the respiratory equipment selected?

- Is the worker furnished with an appropriate escape device in case of a failure of the primary means of respiratory protection?

- Is it possible to maintain two-way communication between the workers in the space and attendants outside the space while respirators are being worn?

OSHA should address the entry of confined spaces with IDLH or hazardous atmospheres in a separate section of the standard that clearly provides for the conditions under which such an entry may be allowed, and provides detailed specifications on the procedures and work practices to be followed.

NIOSH recommends that OSHA specify in the final standard the type of respiratory protection required for workers entering confined spaces and for attendants at confined spaces. The determination of the appropriate respiratory protection, in addition to addressing the nature and geometry of the confined space as addressed above, must also require that the atmospheric conditions in the confined space be evaluated for:

1) oxygen content,

2) types and concentrations of contaminations, and

3) the NIOSH Respirator Decision Logic (RDL) selection recommendations (NIOSH 1987).

According to the RDL, the most protective types of respiratory protection* should be worn under the following conditions:

1) the ambient atmosphere is oxygen-deficient (less than 19.5%);

2) atmospheric conditions of the ambient environment are greater than immediately dangerous to life and health (IDLH) values;

3) emergency situations where the atmospheric conditions are unknown;

4) contaminants in the environment are carcinogens; or

5) firefighting conditions.

In confined space circumstances where none of these conditions exist, other, less protective classes of respirators can be used. These respirators include, but are not limited to, air-purifying and powered air-purifying respirators with half-mask or full facepiece). If these less protective respirators are worn and the atmospheric conditions can become IDLH or oxygen deficient, then an escape SCBA must be carried by the worker for emergency/escape use.

If none of the five conditions listed above exist, and the appropriate recommended exposure limit(s) (RELs) or permissible exposure limit(s) (PELs) are not exceeded, then no respiratory protection is required. However, an emergency/escape respirator must be carried by the worker and this escape device can be either air-purifying or air-supplied depending on whether the atmospheric conditions can become oxygen deficient or IDLH. The type of escape device is also dependent on other selection and use criteria which are outlined in the NIOSH RDL.

For all confined space entries where an attendant is required and where the atmospheric conditions are or can become oxygen deficient or IDLH, the attendant must carry the most protective respirator for emergency use. Where atmospheric conditions either are not or cannot become oxygen deficient or IDLH, then the attendant must still carry a respirator for emergency use but that respirator may be air-purifying.

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* Self-contained breathing apparatus in pressure-demand (PD) or other positive-pressure (PP) mode, or Type C supplied-air respirator operated in a PD or PP mode with auxiliary SCBA.

REFERENCES CITED AND SENT TO OSHA WITH THIS SUBMISSION

Barron CI (1970). The relationship of the physiology of disease to flight safety. Arch Environ Health 21:206-210.

Conroy C, Manwaring JC, Sharifpour SP (1989). Occupational confined space-related fatalities: surveillance and prevention. Accepted for publication in Journal of Safety Research.

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NIOSH (1987). Respirator decision logic. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 87-108.

REFERENCES CITED AND ALREADY IN THE DOCKET

NIOSH (1979). Criteria for a recommended standard: working in confined spaces. Morgantown, WV: U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, DHEW (NIOSH) Publication No. 80-106.

NIOSH (1986). Request for assistance in preventing occupational fatalities in confined spaces. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 86-110.

Attachment 1

LIST OF FATAL ACCIDENT CIRCUMSTANCES
AND EPIDEMIOLOGY (FACE) REPORTS SUBMITTED TO OSHA DOCKET S-019

FACE REPORT #	SUBJECT	DATE
89-28	Two Maintenance Workers Die After Inhaling Hydrogen Sulfide in Manhole	07/30/89
88-44	Construction Sub-contractor Asphyxiated in Manhole	12/21/88
88-36	Three Construction Supervisors Die from Asphyxiation in Manhole	12/15/88
88-01	Two Supervisors Die in Manhole in South Carolina	04/05/88
87-67	Two Construction Workers Die Inside Sewer Manhole in Indiana	04/05/88
87-64	Mechanic Asphyxiated Within Steam Service Passageway	11/08/88
87-59	73 Year-Old Self-Employed Pump Service Contractor Dies in Well in Maryland	08/06/87
87-57	Parks and Recreation Director Dies in Oxygen Deficient Atmosphere in West Virginia	07/28/87
87-50	Tractor-Trailer Repairman Dies while Welding Interior Wall of a Tanker in Indiana	07/21/87
87-49	Farmer Dies in Indiana	07/20/87
87-47	Worker Dies Inside Filtration Tank in Michigan	07/07/87
87-46	Confined Space Fatality at a Wastewater Treatment Plant in Indiana	06/25/87
87-45	One Dead, One Near Miss in Sewer in Kentucky	06/30/87
87-39	Farm Worker Asphyxiated in Grain Silo in Indiana	05/11/87
87-33	Digester Explosion Kills Two Workers at Wastewater Treatment Plant in Pennsylvania	03/06/87
87-27	Truck Driver Dies While Cleaning Out Inside of Tanker in South Carolina	04/07/87
87-26	Worker Dies After Lifting Access Cover on Acid Reclaim Storage Tank in Virginia	03/10/87

Attachment 1 (continued)

LIST OF FATAL ACCIDENT CIRCUMSTANCES
AND EPIDEMIOLOGY (FACE) REPORTS SUBMITTED TO OSHA DOCKET S-019

FACE REPORT #	SUBJECT	DATE
87-25	Worker Dies While Repairing a Vacuum Evaporator in Virginia	02/24/87
87-23	General Maintenance Person Asphyxiated Attempting to Repair Water Leak	02/10/87
87-20	Two Workers Die in Digester Unit in New Mexico	01/26/87
87-17	Worker Dies While Cleaning Freon 113 Degreasing Tank in Virginia	12/11/86
87-06	Two Dead, Five Injured in Confined Space Incident in Oregon	11/18/86
87-05	Owner/Foreman of Construction Company Dies in 15 Foot-Deep Manhole in California	11/25/86
86-54	Insufficient Oxygen Level in Sewer Claims the Life of Plumbing Contractor in Georgia	09/29/86
86-48	28 Year-Old Dies in Rescue Attempt in Drainage Pit in Illinois	09/19/86
86-38	Three Dead, One Critical in Industrial Septic Tank in Georgia	08/04/86
86-37	Two Workers Die in Underground Valve Pit in Oklahoma	08/06/86
86-34	Three Dead in Confined Space Incident in New York	07/20/86
86-23	Foundry Worker Dies in Indiana	05/13/86
86-19	Truck Driver Suffocates in Sawdust Bin in Pennsylvania	03/06/86
86-15	Steel Worker Dies in an Industrial Waste Pit in Pennsylvania	03/18/86
86-13	Worker Dies in Fermentation Tank in Montana	03/17/86
85-49	Three Fire Fighters Killed Fighting Silo Fire In Ohio	09/27/85
85-45	Worker Killed in Cave-In at Ohio Excavation Site	09/18/85
85-44	Two Sanitation Employees Die in Confined Space in Kentucky	08/30/85

LIST OF FATAL ACCIDENT CIRCUMSTANCES AND EPIDEMIOLOGY (FACE) REPORTS SUBMITTED TO OSHA DOCKET S-019

FACE REPORT 3	SUBJECT	DATE
85-40	City Water Worker Dies as a Result of Being Overcome by Natural Gas Vapors While Reading a Water Meter in a Confined Space in Ohio	08/12/85
85-33	Construction Worker Dies as a Result of Applying Coating Material in Confined Space in California	08/07/85
85-31	Three Sanitation Workers and One Policeman Die in an Underground Sewage Pumping Station in Kentucky	07/09/85
85-27	Rescue Effort Results in Fatality for a Wire Manufacturing Plant Worker in Illinois	06/17/85
85-26	27 Year-Old Dies Inside of 6 Million Gallon Storage Tank	06/14/85
85-23	Use of Sulfuric Acid in Septic Tank Leaves One Dead and One Critical in Pennsylvania	05/15/85
85-12	One Dead, One Injured in Elevator Fall at Construction Site in Missouri	03/20/85
85-09	Worker Dies in 20,000 Gallon Gasoline Bulk Tank While Wearing Closed Circuit SBCA in Vermont	03/19/85
85-05	Confined Space Incident Kills Two Workers - Company Employee and Rescuing Fireman	02/06/85
85-02	Two Rescuers Die in Fracturing Tank in West Virginia Gas Field	12/14/84
84-013	Two Confined Space Fatalities During Construction of a Sewer Line	03/08/84
84-011	Fire at a Wastewater Treatment Plant	12/29/83

Attachment 2

CONFINED SPACE INJURY AND FATALITY STATISTICS

Nonfatal Injury

A major shortcoming of the data sources used by NIOSH/DSR is the lack of any single code, or series of codes, to denote if an injury or fatality occurred in a confined space. While NIOSH has developed criteria and definitions for confined spaces, they have not been extended to develop standard data classifications for making confined spaces a codable hazard. A further complication is that many injuries that are typical in confined spaces occur in other work areas as well. For example, a fatality occurring in a service station garage because of carbon monoxide poisoning would be very difficult to separate from a similar death occurring in a sewage service manhole passageway.

With these factors in mind, the Bureau of Labor Statistics (BLS) Supplementary Data System (SDS) was examined to identify compensation claims that were potential confined space incidents. The data are for the year 1986. This was done by selecting SDS "Type of Accident" codes that exhibited outcomes that would be expected due to hazards created by confined spaces. These accident types are environmental heat, contact with radiation or toxic materials, and explosions. Contact with radiation or toxic materials includes contact by inhalation, contact by absorption, and contact by means not elsewhere classified (NEC). These specific accident types accounted for 33,836 claims in the 1986 SDS. The frequency breakdowns by industrial division, nature of injury, body part injured, source of injury, and occupation for each accident type are presented in Tables 1 through 5.

In reviewing these data, it must be remembered that the frequencies are not national values but rather claims filed in 1986 from only 27 States. Furthermore, because the States have different compensation laws, comparisons between States are not possible. Finally, because no information is available to determine whether a confined space was actually involved in the incident, these data only indicate that injuries typical of confined space exposure exist.

Fatal Injury

As with the BLS SDS data, determining the exact number of fatalities resulting from hazards in confined spaces is difficult. Fatalities were assessed by using the NIOSH/DSR National Traumatic Occupational Fatalities (NTOF) data base. The process was similar to that used for the nonfatal cases pulled from the SDS. First, the type of deaths that would be expected to occur in confined spaces was selected from the

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NTOF files using the International Classification of Diseases, 9th Revision, External Cause of Death Codes (E-codes). Approximately 90 percent of the NTOF records have E-codes.

To identify potential confined space-related fatalities, each NTOF record with a selected E-code was hand searched to determine whether the fatality was a confined space-related death. The subset of E-codes examined was accidental poisonings by other solid and liquid substances, gases and vapors (E861, E862, E866, and E869), excessive heat (E900), accidental drowning and submersion (E910), accidental mechanical suffocation (E913), accidents caused by explosive materials (E923), and accidents caused by hot substances or objects, caustic or corrosive materials, and steam (E924). It is not known if other E-codes should have been included in this subset to identify other types of confined space fatalities.

Between 1980 and 1985, a total of 2,640 fatalities were found in the NTOF files that were coded with one of the specified E-codes, representing approximately 7 percent of the death certificates in the NTOF data base that included E-codes. Upon examining the injury description fields of these records, 763 fatalities were determined to very likely be confined space deaths. Many of the remaining records were not specific enough to determine whether the death occurred in a confined space. Still, these 763 cases represent approximately 2 percent of the E-coded deaths in the NTOF system.

As with the SDS data, caution should be used in evaluating these counts. First, they should be considered minimum values for the number of confined space deaths that occurred in the United States between 1980 and 1985. Furthermore, when reading the injury description fields, care was taken not to include a case, regardless of how suspicious it appeared, unless evidence existed that a confined space was involved. Those cases which involved poisonous fumes were only selected if evidence showed the worker was in a confined space such as a bin, vat, or other structure. It is likely that some of these poisoning cases are confined space incidents, but were not clearly stated as such.

Finally, because only a subset of the cases in the NTOF were searched, it is possible that other E-codes not screened here do have confined space fatalities associated with them. Again, this brings to light the problems in determining confined space deaths because a confined space incident involves not only how the worker died, but also where he died.

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15. Supplementary Notes

16. Abstract (Limit: 200 words) This testimony concerned the activities of NIOSH as they relate to the prevention of fatalities in confined spaces. The NIOSH Fatal Accident Circumstances and Epidemiology (FACE) program has investigated 44 incidents resulting in 70 fatalities in 5 years. FACE, a passive surveillance system, relies on reports from a limited number of reporting states and, therefore, represents only a limited percentage of the total concurrence of confined space deaths in the United States. These fatalities appeared to often involve a failure to post a warning on the confined space, a failure of the victim to recognize the space as a confined space hazard, a failure to monitor and ventilate the atmosphere before entry, and well intentioned but ill conceived rescue attempts. The highest risk for confined space fatalities were those spaces where the potential to contain a hazardous atmosphere was not known or recognized. NIOSH recommended that workers be made aware of the dangers involved in entering a confined space through proper training and posting of the space, that confined spaces be classified in at least three classifications to determine appropriate work practices, that purging and ventilation be required, and that those spaces where the potential atmospheric hazard is oxygen deficiency be regulated as a separate class.

17. Document Analysis a. Descriptors

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