V. TRAINING GUIDELINES

The very nature of the hazards encountered in a confined space is of paramount importance in structuring an effective training program which will provide for safe work practices and techniques. The training program should be based on the specific hazards to be encountered, approved by a trained safety person and given to all individuals who will perform the work or may be assigned as standby or rescue persons.

(a) Qualifications of Training Personnel

It is essential that the person in charge of training know the relevant aspects of safety as they relate to confined spaces. The instructor(s) must have a thorough working knowledge of the following:

(1) Type(s) of confined spaces associated with the industrial activity.

(2) Hazards involved

(A) Chemical

(B) Physical

(3) Work practices and techniques

(4) Testing requirements, PEL's, etc.

(5) Safety equipment

(A) Respirators

(B) Clothing

(C) Other protection (shields, helmets, etc)

(6) Rescue procedures

(7) Knowledge of applicable Federal, state, and local regulations

(8) Evaluation and test methods

(b) Training methods

The method and approach of training will be determined by the previous experience and skills of the employee, with the exception of a newly hired person who should receive a complete and thorough safety orientation. Basic types of training prescribed are:

(1) Orientation of all new employees. This type of training would consist of classroom sessions along with a walk-through of the physical plant layout to give the trainee a basic understanding of the industrial activity.

(2) On-the-job training. This would be a second phase of training. After classroom sessions and after the trainee has gained a basic understanding of the operation and hazards involved, on-the-job instruction should include observation and closely supervised participation in actual work practices or simulated conditions.

(3) Retraining. This should be performed periodically and as frequently as needed. Many industrial activities are quite complex and operations are frequently updated to keep up with modern innovations. It is necessary, therefore, for a formal retraining program to be planned so that all personnel concerned may be kept abreast of changes. Retraining should also be considered necessary if a supervisor notices a weakness in employee performance.

(c) Training Evaluation

The effectiveness of the training program can be determined by observation of the employee by the qualified person to see if safe work practices are being followed, testing the employee for knowledge of the operations and hazards, and a reduction in the accident rate due to safe work practices and techniques which have been learned and are being practiced.

(d) Training Program

The work practices section presented in Chapter I was designed to set a formalized standard that could, when complied with, eliminate or minimize accidents and injuries occurring in confined spaces. The standard would not be sufficient without a formal written training program and job planning to convey safe work practices and their relationship to the entire operation.

The employer is responsible for ensuring that each employee is adequately trained and given refresher courses in assigned duties, and that the employee understands and applies safe work practices. The following are recommended areas that should be covered thoroughly in training:

(1) The types of confined spaces that are found in the industrial complex. This should cover physical location, size, and any pertinent information that would inform the worker of its function.

(2) Physical and chemical hazards involved. The physical hazards would include structural members within a confined space, equipment that will be used, eg, scaffolding or ladders, size of openings, flooring, and other. Chemical hazards discussed will cover the product which has been stored, chemical cleaners used, and air contaminants which can be liberated due to the work practices.

(3) Atmospheric testing of the confined space. This phase of the instruction should emphasize the contaminants which should be tested for and the safe levels for entry.

(4) Cleaning and purging. Cleaning methods to be discussed should include steaming, water rinses, chemical cleaners, or other specific processes used.

(5) Ventilation of the space by mechanical methods to reduce or eliminate toxic airborne contaminants. This category should be covered sufficiently to alert the employee of potential hazards, and the need for warning devices to signal when there is a ventilation failure.

(6) Isolation and lockout of the confined space. The worker should be able to recognize a hazard by visual observation of the connecting lines to a confined space. The lockout of electrical circuits and mechanical disconnects to complete confined space isolation should be explained as should the employees' responsibilities in this area.

(7) Safety equipment and clothing. The worker should be aware of the proper use and care required for his personal protective equipment. This should include the type of protective shoes, gloves, face protection, protective clothing, head protection, and safety belts and harnesses that are to be worn as well as the rationale for their use. A major area in this section will be the use of respirators: the types required, their use, quantitative fit (test), respirator cleaning procedures, and proper storage. It should be emphasized that different type respirators are required for different atmospheres and the dangers involved when the wrong type is used [39]. The mandatory wearing of safety belts should be stressed. The use of safety belts and harnesses should be demonstrated so that each individual understands the importance of having the rescue system available, and operative, and is constantly aware of the necessity of keeping life lines clear to the point of exit.

(8) Buddy system and use of a standby person.

(9) Communication systems and emergency signals.

(10) Rescue procedures. All employees working in or around a confined space should be fully trained in emergency entry and exit procedures and be trained in first aid and CPR. This should include on-site entry and rescue drills.

(11) Permit system used by the employer. Information covered on the permit should include: purpose of the permit; location where permit will be posted; responsible persons; emergency information, and hazards to be encountered.

(12) Documentation of Training. Satisfactory completion of this safety training, and refresher courses, should be entered into the employee's permanent record.

VI. RESEARCH NEEDS

The primary research need in the area of confined spaces is the development of a data system that would have the capability of recording injury and mortality information specific to the causative factor eg, confined space and be readily accessible. It is now impossible to retrieve data directly related to confined space injuries and mortality, since data are currently collected by general classifications, such as SIC codes. Feasibility studies are being done by NIOSH on a system that could correct this weakness in data recording and retrieval and provide a more accurate picture in areas such as confined space hazards. These data are essential to the proper evaluation of the causes of injuries and deaths. Specific data will provide a base for establishing training programs and standards aimed toward the more hazardous areas and permit the evaluation of current standards. These data would also provide a background for analyzing unusual accidents to establish causal factors and prevent recurrence.

A final step that would be accomplished by an approved data base on confined spaces would be to standardize the degree of hazards throughout industry and provide justification for a uniform standard. This uniform standard would serve as the basis for a training program, which could be tailored to meet the needs of large as well as small industries.

The second area of research needed is development of more adequate methods for preventing and detecting gas leaks into confined spaces. Many accidents have occurred because the atmosphere in a confined space, which was presumed to be safe by the nature of the contents or obvious safe history of the confined space, had suddenly become lethal. Historical cases reported have shown that faulty seals in storage or processing vessels may allow seepage from an external source, which could be naturally lethal or could form a lethal substance when combined with residual material in the tank.

A third area for research is the analytical devices used in confined spaces, such as intrinsically safe continuous monitors for gases as well as explosive dusts, personal dosimeters, and test meters designed to withstand rugged field use and maintain their integrity. It becomes difficult to calibrate a gas detection meter after continued field use and to be sure of its accuracy. The instrument, for field use, should be of the internal calibration type that will allow for more accurate testing.

A fourth area of research is the need to define and evaluate the stresses on employees who are required to work in confined spaces. This evaluation should include physical stressors (eg heat stress, cold stress) and sensory deprivation with respect to the work practice and length of work period.

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VIII. APPENDIX I

CROSS REFERENCE - NIOSH RECOMMENDED STANDARD FOR WORKING IN CONFINED SPACES TO THE OSHA STANDARD

NIOSH Recommended Standard	OSHA Standard
Confined Space Definition	1926.21(b)(6)(ii) 1915.2(n) 1916.2(n) 1917.2(n) Standards Notice 20
Training of Personnel	1926.21(b)(6)(i)
Isolation, Lockout, and Tagging	1910.252(d)(3)(i) 1910.261(b)(5) 1910.261(e)(12)(iii) 1910.261(f)(6)(i) 1910.261(g)(4)(ii) 1910.261(g)(15) 1910.261(j)(5)(iii) 1910.261(j)(6)(i) 1910.262(p) and (g) 1910.263(d)(6)(ii) 1910.263(l)(3)(iii)
Cleaning	1910.252(d)(2)(vi)(c) 1910.261(g)(4)(i)
Testing	1910.94(d)(11)(iii) 1915.11 1917.11 1915.33(c) 1916.33(c) 1917.33(c) 1915.33(d) 1916.33(d) 1915.33(e) 1916.33(e) 1926.651(v) 1926.850(e) 1926.956(a)(3)(i) 1926.956(a)(3)(ii) 1926.956(b)(3)

APPENDIX I (CONTINUED)
CROSS REFERENCE - NIOSH RECOMMENDED STANDARD FOR WORKING IN CONFINED SPACES TO THE OSHA STANDARD

NIOSH Recommended Standard	OSHA Standard
Ventilation and Purging	1910.94(d)(11)(iv) 1910.252(e)(4)(ii) 1910.252(f)(2)(i) 1910.252(f)(2)(ii) 1910.252(f)(3)(i) 1910.252(f)(3)(ii) 1910.252(f)(4)(i) 1910.252(f)(4)(ii) 1910.252(f)(5)(ii) 1910.261(g)(4)(i) 1910.261(g)(6) 1910.261(g)(15) 1910.261(g)(22) 1910.265(f)(4) 1915.31(b) 1916.31(b) 1917.31(b) 1918.93 1926.154(a)(2) 1926.353(b)(1) 1926.353(b)(2) 1926.353(c)(1) 1926.353(c)(2) 1926.651 (v) 1926.850 (e) 1926.956(a)(3)(i) 1926.956(a)(3)(ii) 1926.956(a)(3)(iii) 1926.956(b)(2)
Equipment and Tools	1910.252(a)(1)(ii) 1910.252(e)(4)(iii) 1910.261(g)(15) 1910.261(j)(6)(iii) 1910.263(d)(6)(iii) 1910.265(f)(4) 1915.35(b)(4) 1916.35(b)(4) 1917.35(b)(4) 1915.32(g) 1916.32(g) 1917.32(a) 1926.350(b)(4) 1926.352(g)

APPENDIX I (CONTINUED)
CROSS REFERENCE - NIOSH RECOMMENDED STANDARD FOR WORKING IN CONFINED SPACES TO THE OSHA STANDARD

NIOSH Recommended Standard	OSHA Standard
Personal Protective Equipment	1910.94(a)(5) 1910.94(d)(9)(vi) 1910.94(d)(11)(v) 1910.134(e)(3) 1910.134(e)(3)(iii) 1910.252(e)(4)(iv) 1910.252(f)(4)(ii) 1910.252(f)(4)(iii) 1910.252(f)(4)(iv) 1910.261(b)(5) 1910.261(g)(2)(iii) 1910.261(g)(4)(i) 1910.261(g)(6) 1910.261(g)(8) 1910.261(g)(15) 1910.261(j)(5)(ii) 1915.23(a)(4) 1916.23(a)(4) 1915.23(b) 1916.23(b) 1917.23(b) 1915.24(a) 1916.24(a) 1916.82 1917.82 1918.82 1926.21(b)(6)(i) 1926.103(b)(3) 1926.104(a) 1926.104(b) 1926.104(d) 1926.104(f) 1926.250(b)(2) 1926.353(b)(2) 1926.353(c)(2) 1926.354(c) 1926.651(v) 1926.957(h)(2)
Standby Person and Rescue	1910.134(e)(3) 1910.134(e)(3)(i) 1910.134(e)(3)(ii) 1910.134(e)(3)(iii) 1910.252(e)(4)(iv) 1910.252(f)(4)(iv) 1910.261(b)(5) 1910.261(f)(6)(ii)

APPENDIX I (CONTINUED)
CROSS REFERENCE - NIOSH RECOMMENDED STANDARD FOR WORKING IN CONFINED SPACES TO THE OSHA STANDARD

NIOSH Recommended Standard	OSHA Standard
Standby Person and Rescue	1910.261(g)(4)(ii) 1910.261(g)(8) 1910.261(j)(5)(ii) 1910.268(o)(1)(i) 1910.268(o)(1)(ii) 1910.268(o)(2)(i) 1910.268(o)(2)(ii) 1910.268(o)(2)(iii) 1910.268(o)(3) 1910.268(o)(4) 1910.268(o)(5)(i) 1910.268(o)(5)(ii) 1915.46(b) 1916.46(b) 1917.46(b) 1915.54 1916.54 1917.54 1926.353(b)(2) 1926.956(b)(1)

IX. APPENDIX II

RECOMMENDED RESPIRATORY SELECTION GUIDE

Hazard	Concentration* Less Than or Equal To	Respirator**
particulate	5 x PEL	single use respirator***
particulate	10 x PEL	any dust respirator***
particulate	50 x PEL	full facepiece respirator with high efficiency filter(s) or self-contained breathing apparatus with full facepiece operated in the demand mode
particulate	2000 x PEL	supplied-air respirator with full facepiece operated in any positive pressure mode
particulate	greater than 2000 x PEL	self-contained breathing apparatus with full facepiece operated in the pressure demand mode or a supplied-air respirator with full facepiece operated in any positive pressure mode with an auxiliary self-contained breathing apparatus
known gas or vapor contaminant****	50 x PEL	chemical cartridge respirator with full facepiece and cartridges approved for the specific contaminant(s) or a full facepiece self-contained breathing apparatus operated in the demand mode

APPENDIX II (CONTINUED)

Hazard	Concentration* Less Than or Equal To	Respirator**
known gas or vapor contaminant***	2000 x PEL	Supplied-air respirator with full facepiece operated in any positive pressure mode
	greater than 2000 x PEL	Self-contained breathing apparatus with full facepiece operated in the pressure-demand mode or combination supplied-air respirator with full facepiece operated in any positive pressure mode with an auxillary self-contained breathing apparatus
combination of particulates and gases or vapors****	50 x PEL	a full facepiece combination respirator approved for dusts and mists and the specific contaminant(s) (gases or vapors)
	1000 x PEL	powered air-purifying full facepiece combination respirator with high efficiency filter and chemical cartridge approved for the specific gas or vapor
	2000 x PEL	supplied-air respirator with full facepiece operated in any positive pressure mode
	greater than 2000 x PEL	self contained breathing apparatus with full facepiece operated in the pressure-demand mode or combination supplied-air respirator with full facepiece operated in any positive pressure mode with an auxilary self-contained breathing apparatus

APPENDIX II (CONTINUED)

Hazard	Concentration* Less Than or Equal To	Respirator**
unknown contaminant	undetermined	self-contained breathing apparatus with full facepiece operated in the positive pressure mode or a supplied-air respirator with full facepiece operated in any positive pressure mode with an auxilary self-contained breathing apparatus
inert and other atmospheres where the oxygen level is below 17%		self-contained breathing apparatus with full facepiece operated in the pressure demand mode or a combination supplied air respirator with full facepiece operated in any positive pressure mode with an auxillary self-contained breathing apparatus
emergency entry	unknown	self-contained breathing apparatus with full facepiece operated in the pressure demand mode or a combination supplied-air respirator with full facepiece operated in any positive pressure mode with an auxilary self-contained breathing apparatus

*If the concentration forms a flammable atmosphere only the self-contained breathing apparatus with full facepiece operated in the pressure-demand mode may be used.
**Any respirator recommended for a higher concentration may be used at a lower concentration.
***These respirators may not be used if the toxic material is carcinogenic.
****If the concentration forms an atmosphere which is immediately dangerous to life then only the self-contained breathing apparatus operated in the pressure mode or the combination supplied-air respirator with full facepiece operated in any positive mode with an auxilary self-contained breathing apparatus may be used.

X. APPENDIX III

SAMPLE PERMIT

CONFINED SPACE ENTRY

CLASS ____

Location of Work: _____
Description of Work (Trades): _____
Employees Assigned: _____
Entry Date: _____ Entry Time: _____
Outside Contractors: _____

Isolation Checklist:

- Blanking and/or Disconnecting
- Electrical
- Mechanical
- Other

Hazardous Work:

- Burning
- Welding
- Brazing
- Open Flame
- Other

Hazards Expected:

- Corrosive Materials
- Hot Equipment
- Flammable Materials
- Toxic Materials
- Drains Open
- Cleaning (Ex: chemical or water lance)
- Spark Producing Operations
- Spilled Liquids
- Pressure Systems
- Other

Vessel Cleaned:

- Deposits _____
- Method _____
- Inspection _____
- Neutralized with _____ _____

Fire Safety Precautions: _____
_____

Personal Safety:

Ventilation Requirements
Respirators
Clothing
Head, Hand, and Foot Protection
Shields
Life Lines and Harness
Lighting
Communications
Employee Qualified
Buddy System
Standby Person
Emergency Egress Procedures
Training Sign Off (Supervisor or Qualified Person)_____
Remarks: _____

Atmospheric Gas Tests

	Tests Performed	- Location	- Reading
Example:	(Oxygen)	_____	(19.5%)
Example:	(Flammability)	_____	(Less than 10% LFL)
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

Remarks: _____

Test Performed By: _____
Signature

Time: _____

Authorizations:

Supervisor: _____
Prod Supervisor: _____
Line Supervisor: _____
Safety Supervisor: _____
Etc.: _____

Entry and Emergency Procedures Understood:

Standby Person _____
Rescue _____
Telephone _____

Permit Expires: _____

Classification: _____

XI. APPENDIX IV

CHARACTERISTICS OF CASES INCLUDED AS "CONFINED SPACE RELATED"

Ref. No.	Accident Type or Illness	Characteristics of Included Cases	Related, but Excluded, Cases
1	Atmospheric Condition in CS	Toxic levels in CS of substances: - contained in CS - from decomposition of substances in CS - from mixture of substances in CS - substances being used in CS, eg, cleaning solvents - catalytic heaters - vapors left from previously emptied CS - welding fumes Oxygen deficiency, due to: - fermentation - rust - use of other gases, eg, nitrogen to clear combustible gases - welding in CS Includes cases in which the employee was at the point of entry to the CS (eg, leaning into CS to measure) and was overcome. Includes allergic reactions to substances inhaled.	Falls or other types which are not the result of hazardous atmospheric conditions, eg, due to surface condition of CS, are covered under other Accident Types such as Ref. No. 8.

(*Note: all cases involving mining, tunneling are excluded.)

APPENDIX IV (CONTINUED)

CHARACTERISTICS OF CASES INCLUDED AS "CONFINED SPACE RELATED"

Ref. No.	Accident Type or Illness	Characteristics of Included Cases	Related, but Excluded, Cases
		Includes falls and other accident types even if the employee was outside the CS before he fell, if, and only if, they were the result of being overcome by atmospheric substances. Examples: employee was sitting on top of silo and was overcome by gas from fermenting corn and fell into silo; employee fell from ladder, when he was overcome by gas in CS; employee drowned when he was overcome by gas and fell into 12" deep water in CS.	
2	Explosion or Fire in CS	Only includes cases in which one or more victims were in the CS at the time. May be able to identify a spark - generating activity that occurred in CS, eg, - dip testing tank - welding - electrical tools - light bulbs - matches Usually the result of a combination of combustible gases in CS and spark from activity of employee in CS.	Cases in which a CS exploded but no victim was inside. Cases in which the CS exploded for "no apparent reason" or a reason not connected with the activities of those in the CS.

APPENDIX IV (CONTINUED)

CHARACTERISTICS OF CASES INCLUDED AS "CONFINED SPACE RELATED"

Ref. No.	Accident Type or Illness	Characteristics of Included Cases	Related, but Excluded, Cases
3	Explosion or Fire at Point-of-Entry of CS	Cases in which an employee was welding, using a power tool, or some other spark generating activity at the entry point to the CS.	Cases in which a CS exploded for "no apparent reason" or for a reason unconnected with the activity of the employee near the CS, eg, "just walking by and it blew up."
		Driving an automobile near to a CS containing combustible materials.	Cases in which the employee was welding (or performing some other spark-generating activity) on a CS which is too small for, and would almost certainly never be used to contain an employee, eg, 55 gal oil drums. Welding drums containing flammable liquids or left over vapors is an extremely common cause of fatalities, and has causal factors similar to CS-related cases were not typical of the problem NIOSH is addressing.
	Electrocution or Electrical Shock	Must appear to be result, at least in part, of the CS.	Cases in which an electrically "hot" source just happened to be in a CS eg, "I picked up a cable with a frayed wire".
		Frequently the result of the conductive walls of the CS.	

APPENDIX IV (CONTINUED)

CHARACTERISTICS OF CASES INCLUDED AS "CONFINED SPACE RELATED"

Ref. No.	Accident Type or Illness	Characteristics of Included Cases	Related,but Excluded, Cases
5	Caught In/ Crushing of CS	Cases in which an employee entered a machine and failed to "lock-out". The machine is activated and the employee is crushed inside the machine. The victim must be <u>inside</u> a machine which it was <u>intended</u> that he should enter and he must have entered deliberately. Elevator shafts, or cases in which the employee was on top of an elevator and crushed in the "CS" when it was elevated. Examples of such machines include rock crushers.	Cases in which the machine is too small for the employee to ever place his entire body inside eg, caught in conveyor gear's. Cases in which the employee was <u>under</u> (not in) a machine or machine part. In particular, being trapped under a vehicle eg, when the jack slips or under a falling bed of a dump truck are <u>not</u> included. Cases in which the employee is drawn into the machine. Elevator injuries if person is inside the elevator. Falls into machines.
6	Trapped in Unstable Materials in CS	"Quicksand" effect of standing in silos containing fine grain or beans. Employee must have been in the CS <u>before</u> the surface gave way eg, unjamming blockage or <u>intentionally</u> stepped into CS with the unstable surface material.	Falls into CS containing such the result of atmospheric conditions (Ref. No. 1).

APPENDIX IV (CONTINUED)

CHARACTERISTICS OF CASES INCLUDED AS "CONFINED SPACE RELATED"

Ref. No.	Accident Type or Illness	Characteristics of Included Cases	Related, but Excluded, Cases
7	Struck by Falling Objects in CS	Employee is struck by objects falling from walls of CS or through point of entry of CS.	(Eye injuries are covered in Ref. No. 11.)
		Related in that employee is unable to maneuver to safety in a CS.	Does not include cave-ins of trenches as these have not been considered to be CS's.
		Includes being suffocated when a CS is accidentally filled while the employee is in it.	
8	Falls (while in CS)	Only to employees in CS due to surface condition eg, wet, oil; configuration eg, a rolling barrel; or other characteristics of the CS.	Falls into a CS eg, uncovered manhole. Atmospheric condition of CS
		Falls through holes in or breaking part of CS, eg, employee goes through weak part of ventilation duct as he crawls through it.	Falls in CS where no characteristic of the CS was involved.
		Falls over objects or tools, eg, holes, on floor of CS when it is not possible to locate elsewhere.	(Falls while leaving or entering the CS are covered in Ref. No. 9.)
		Falls due to poor lighting in CS.	
		Falls due to uneven surface of CS.	

CHARACTERISTICS OF CASES INCLUDED AS "CONFINED SPACE RELATED"

Ref. No.	Accident Type or Illness	Characteristics of Included Cases	Related, but Excluded, Cases
9	Ingress/Egress	Strains, bodily reactions, abrasions, or falls as the result of entering or leaving a cramped, sharp-edged, high-level, or otherwise hazardous point-of-entry to a CS.	(Must be a bonafide CS, eg, ingress/egress of vehicle cabs, though subject to similar hazards, are not included because they are not a CS.)
10	Insufficient Maneuver	Strains, bodily reactions, abrasions, contact with caustic substances, etc. when they are in part the result of attempting to maneuver in a CS. Includes striking self or being struck by fellow employee as the result of a CS. Low head room eg, striking head.	Cases of insufficient space when the employee is working under a machine (even though cramped), because these are not considered a CS.
11	Eye Injury in CS	From dust falling from walls of CS, generated by activity in CS, or from materials in CS. Welding arc when unable to use face shield because of CS.	
12	Contact with Temperature	Burns or scalds from hot steam discharged into CS. Heat exhaustion or frost bite from temperature of CS.	

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