

Confined Space Fatalities in Water Facilities

Lessons Learned/Future Prevention

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Worker Deaths in Confined Spaces (Publication 94-103)

www.niosh.cdc.gov

1-800-35 NIOSH

Selected 70 representative incidents of 423
in 10 year period....

Water Dept Incidents

- ◆ Water meter Vault-Methane
1 fatality 
- ◆ Water Valve Pit-Oxygen
Deficiency-2 fatalities 
- ◆ Water Valve Vault-Oxygen
Deficiency-2 fatalities 
- ◆ Water Well-Oxygen
Deficiency-1 fatality 
- ◆ Water Valve Manhole-Oxygen
Deficiency-3 fatalities 
- ◆ Water valve manhole-Oxygen
Deficiency-1 fatality 
- ◆ Water Valve Vault-Solvents
1 fatality 
- ◆ Well- Carbon Monoxide-
3 fatalities 
- ◆ Municipal Water Tank-Fall-
1 fatality 
- ◆ Municipal Water Tank-Fall-
1 fatality 



NIOSH Fatality Report 85-40

- ◆ City Water Dept employee, Industrial Meter Reader
- ◆ Entered Meter Vault to read meter at 7:30 AM
- ◆ End of day did not return. Found face down in manhole dead at 6:45 PM
- ◆ Later found natural gas leak in line located outside the vault ~ 1 yard away.

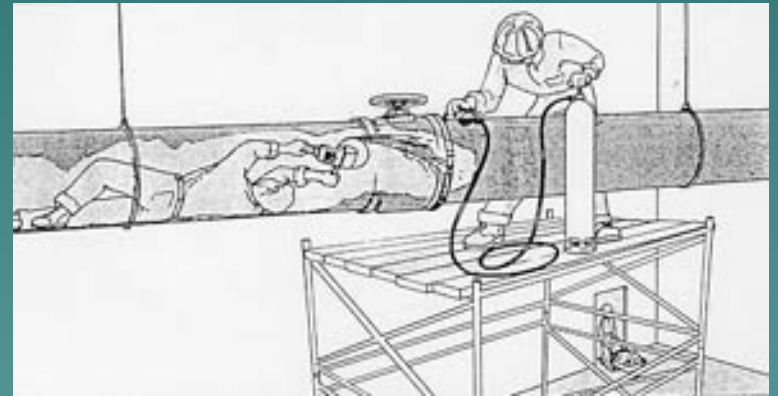
NIOSH Fatality Report 86-37

- ◆ Three man crew of municipal water dept shutting down water main
- ◆ One worker entered 10 foot valve pit through 22 inch manhole
- ◆ Called for help
- ◆ Second worker entered to help
- ◆ Third started in but stopped, exited and called for help. Two workers died
- ◆ Oxygen levels tested later 17-18%



OSHA FACE Accident Report 25

- ◆ Installing water line
- ◆ Welder entered line to grind bad weld 30 feet in
- ◆ Crew added oxygen to pipe
- ◆ Grinding weld for 5 minutes
- ◆ Fire enveloped worker
- ◆ Died of burns



Massachusetts Fatality

MA Face Report 92MA018

- ◆ Public Works foreman entered underground valve chamber while purging air from inactive waterline scheduled for restoration
- ◆ Normally open valve from street level. Thought there was a problem with valve so entered and immediately overcome and collapsed.
- ◆ Co-worker entered to rescue, also collapsed
- ◆ Third worker ran to summon help
- ◆ Police officer arrived-lowered head first –overcome and suffered concussion during extrication
- ◆ Fire Dept rescued using SCBAs. Co-worker and police officer died. First victim died
- ◆ Oxygen Level later tested 13%

If you cannot eliminate or adequately control all hazards must go to full permit entry

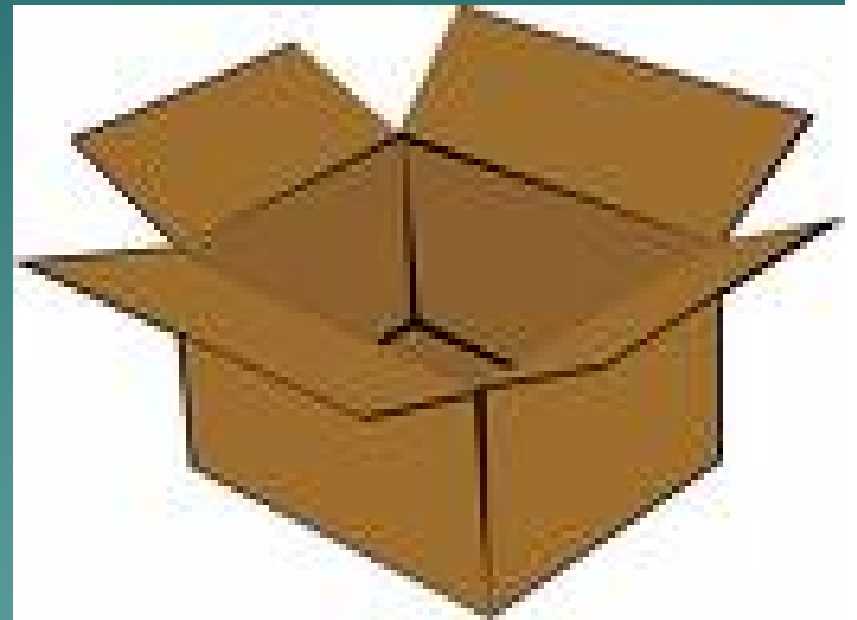
- ◆ Full Permit
- ◆ Rescue-non entry with tripod, harness, winch or rescue team
- ◆ Gas monitoring prior to and during entry
- ◆ Ventilation Blower
- ◆ Three persons involved in entry
 - Entry Supervisor
 - Attendant
 - Entrant



NONE of the fatalities would have occurred if followed OSHA Confined Space Entry Procedures

- ◆ No atmospheric testing
- ◆ No tripod harness winch retrieval
- ◆ No Permit

Its time to....!



Best Way to Prevent FATALITIES in Confined Spaces????



- ◆ Eliminate the confined spaces and the need to go into them in the first place!

(Or design in way to control hazards,
ventilate and if all else fails... to rescue)

- ◆ Need to get involved in design phase if possible
- ◆ Need to remember that workers are people too!
Mentality that “no one” enters the space leads to unsafe design-unguarded parts, exposed electrical equipment, etc.
- ◆ Look at reasons for entry-often cleaning, maintenance, checking for leaks, reading meters, etc.
- ◆ Look at how we could get employees out of space during rescue
- ◆ Look at costs associated with confined space entry and make business case for eliminating and redesigning these spaces

Eliminate the need to enter to perform work



- ◆ Put critical valves, controls **OUTSIDE** the confined space. Extend stems for shut off or control valves
- ◆ Install Remote Cameras/Viewing windows for inspection and monitoring
- ◆ Install equipment such as pumps on tracks that allow it to be mechanically moved **OUT** of the space for maintenance
- ◆ Install equipment that requires less maintenance or has a longer life expectancy

Eliminate need for entering spaces-Example-Use of Remote Monitoring

Town was entering manholes and vaults to read meters and look for leaks

- ◆ Switched to -RadioRead AMR
- ◆ Install in Vault or Pit
- ◆ Reads consumption
- ◆ Detects leaks
- ◆ Cost about \$200
 - Compare to cost of two person confined space entry???



Eliminate Restricted Means of Entry



**Spiral Staircase/Ladder
considered restricted**



Standard Staircase is not!

Eliminate spaces that are not designed for human occupancy

- ◆ Design space with ventilation/light
- ◆ Don't put anything below grade that does not need to be below grade.
- ◆ Minimize potential for rusting, infiltration of water, gases.
- ◆ Guard all moving parts. Eliminate exposed electrical. Design it or redesign it as though employees were in there all the time!

As a minimum design/redesign confined spaces to allow for rescue (PPE)

- ◆ If you must design a permit required confined space, be sure there is a way to rescue employees from the space.
- ◆ Many vaults and lift stations designed so no way to do non-entry rescue. Spiral staircases, no hatches or hatches against wall so no way to set up tripod or davit arm.
- ◆ What about horizontal rescue?? Frequent access points, openings, design in pulley system?

Safer Design for Valve Vaults

- ◆ Install standard staircases instead of ladders, spiral staircases, ships ladders, hatches, etc.
- ◆ Design specification courtesy of San Francisco Public Utilities Commission
- ◆ Not just “business as usual”

PLATFORM MUST PROVIDE ADEQUATE WORK SPACE TO OPERATE AND MAINTAIN EQUIPMENT— CONTACT OPERATING DIVISION FOR SPECIFIC REQUIREMENTS

RAILINGS REQUIRED, SEE GUIDELINE

OPERATING PLATFORM

STAIRWAY ACCESS REQUIRED TO WORKING PLATFORM LEVEL SEE STAIRWAY GUIDELINE FOR REQUIREMENTS

SEE HATCH GUIDELINE FOR REQUIREMENTS

HEIGHT < 30" OR PROVIDE GUARDRAILS OR TERRACE

HATCH

LIGHTS

NOTES:

1. LIGHTS AND VENTILATION TURN ON AUTOMATICALLY WHEN DOOR OR HATCH OPENED (PREFERRED) OR OPERABLE FROM EXTERIOR SWITCH BY DOOR
2. INCLUDE INSTRUMENTATION TO VERIFY VENTILATION IS WORKING
3. LOCATE LIGHTS IN EASILY ACCESSIBLE LOCATION FOR CHANGING BULBS.
4. HATCH MUST BE SIZED TO PROVIDE ADEQUATE HEAD CLEARANCE—7'0" RECOMMENDED, 6'6" MINIMUM.
5. PIPELINE RISERS AND OTHER INFREQUENTLY ACCESSED, SMALL CONFINED SPACES MAY HAVE LADDER ACCESS ONLY.

RECOMMEND STAIR ACCESS TO BOTTOM OF VAULT. LADDER ACCESS PERMITTED WHERE STAIRS NOT FEASIBLE.

VENTILATION PROVIDED AT MULTIPLE LEVELS FOR SUFFICIENT MIXING AND FRESH AIR SUPPLY. VENTILATION RATE DEPENDS ON MULTIPLE FACTORS— DISCUSS WITH PUC H&S

OTHER RELATED GUIDELINES:

- SDG-9 GUARDRAILS
- SDG-10 LADDERS
- SDG-11 HATCHES
- SDG-18 STAIRWAYS

CAL/OSHA REGULATION	GISO SECTION 3234
OTHER REGULATION	
SFPUC GUIDELINE	RECOMMENDED PRACTICE

CITY AND COUNTY OF SAN FRANCISCO PUBLIC UTILITIES COMMISSION HEALTH AND SAFETY PROGRAM	SAFE DESIGN GUIDELINES	FIGURE
	VALVE VAULTS (WATER SYSTEM ONLY)	SDG-1
		JAN. 2007

- ◆ Grant from AwwA Research Foundation. *“Integrating Worker Health and Safety into Water Utility Operation, Management, and Facility Design”*.
- ◆ Start to look at better/safer design templates for building water facilities

Questions??

Thank you!