

OSHA Issues Hazard Alert in Wake of Amoco Explosion

To prevent further tragedies like the October, 1980 fire and explosion at the Amoco, New Castle Delaware polypropylene plant which leveled the plant, killed six people and injured 28 others, the OSHA Philadelphia Regional Office sent out a hazard alert to OSHA compliance officers and others in the chemical process and oil industries.

The alert addresses the underlying cause of the Amoco explosion—failure to train craftsmen that removing attachments to block valves will cause the valve itself to fall apart as the attachments—in this case a pneumatic controller—are an integral part of the valve as shown in the sketch on this page.

The following is excerpted from the Alert sent out by OSHA Regional Administrator David Rhone. It should be studied carefully by all OCAW members in the oil and chemical process industries.

"The employers' responsibilities with regard to this hazard include but are not necessarily limited to the following items:

1. Mechanics or operators whose job it is to assemble, adjust or disassemble valves or attachments to valves shall be trained in the safe assembly, disassembly, or adjustment of each type of valve-attachment assembly.

2. Mechanics or operators who have not been so trained shall not be assigned to perform such duties without supervision by those foremen or operators who have been trained.
3. Attachments to valves which regulate hazardous materials shall not be connected to the valves with the same bolts which preserve the integrity of the valve, without assurance that such attachments would not be removed while the valve is in service.

Background: A recent investigation of an explosion and fire at a chemical plant revealed that when workers removed the pneumatic controller from a block valve, the valve itself fell apart. The reason for this was that the bracket which connected the controller to the valve was attached to the valve with the same four bolts which held the bonnet of the valve to the body (see sketch).

On October 21, 1980 four mechanics were assigned to perform a slurry line cleanout for a ten thousand gallon polypropylene reactor. The slurry line ran from the bottom of the reactor through a pump, a slurry cooler (heat exchanger) and then back to the top of the reactor through a four inch line.

The slurry line had been isolated from the system by the closing of the two block valves, one at the top and one at the bottom of the reactor. Each block valve had a pneumatic controller attached but the connecting mechanisms were different. The valve at the top was a plug valve. The controller was attached to a bracket which was in turn

attached to the valve bonnet by the same bolts which held the bonnet in place.

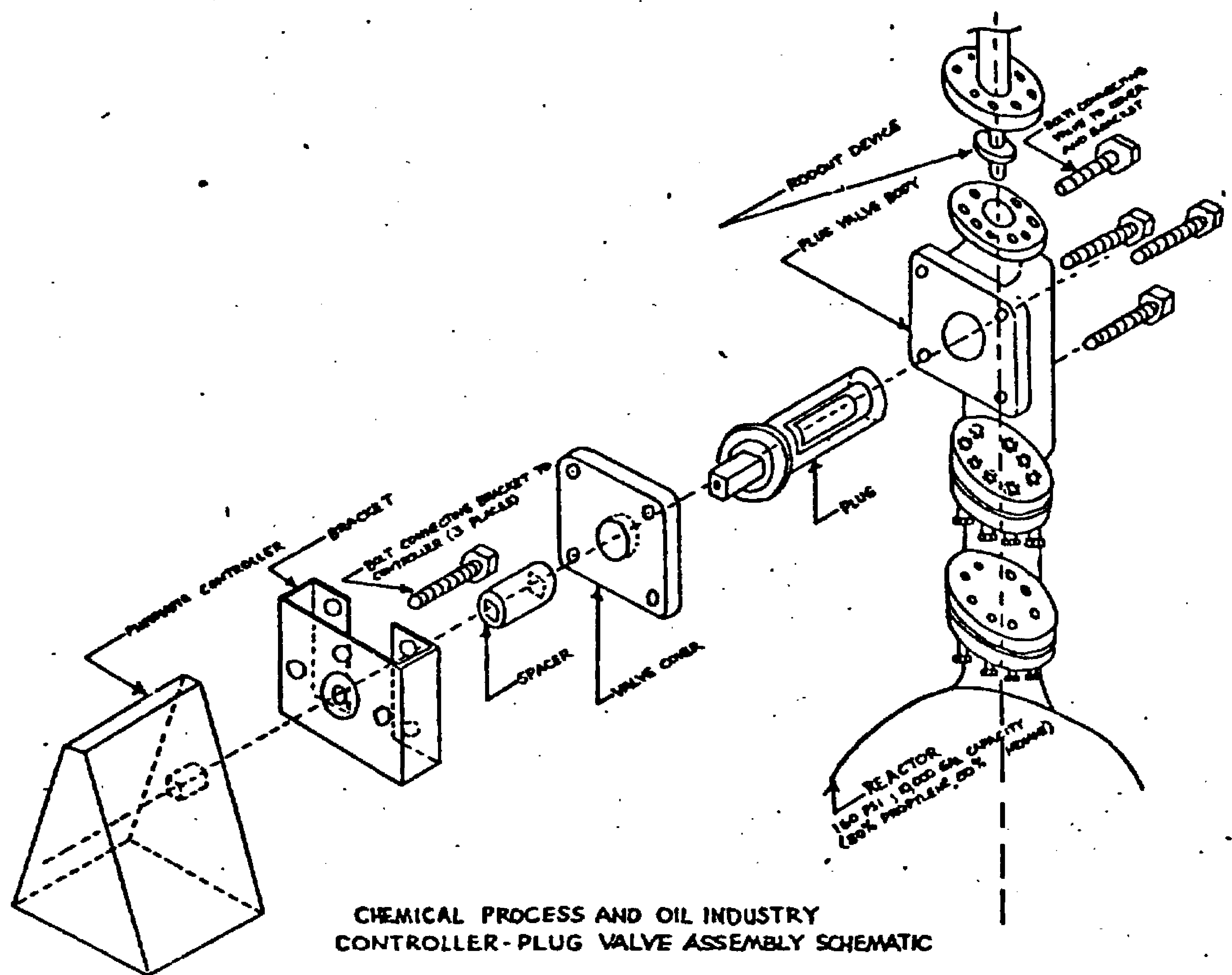
The valve at the bottom was a ball valve. Because of its configuration the same type of bracket connection could not be used. The controller on this valve was connected to a bracket which in turn was held in place by two large "U" bolts which attached around the top and bottom flanges of the valve.

The mechanics split into two groups. Two men began opening lines at the top of the reactor while the other two broke the lines at the bottom. They cleaned out the slurry lines and broke for dinner. When they returned they were asked by the chief operator to rod-out the block valve at the top of the reactor. That valve still had the controller attached.

The company operating procedure required that the controller be removed prior to the opening of any lines to determine the position of the valve, but since this had been overlooked, the mechanics decided to remove it even though the valve was obviously closed.

It was at this juncture that the two mechanics made the fatal error. They removed the four bolts which attached the bracket to the valve. Those same four bolts held the valve together.

Upon removal, the plug and bonnet shot out and contents of the reactor, ten thousand gallons of propylene and hexane at 150 psi, poured out through the four inch opening. An enormous gas cloud formed and within three minutes an explosion occurred which could be heard over ten miles away.



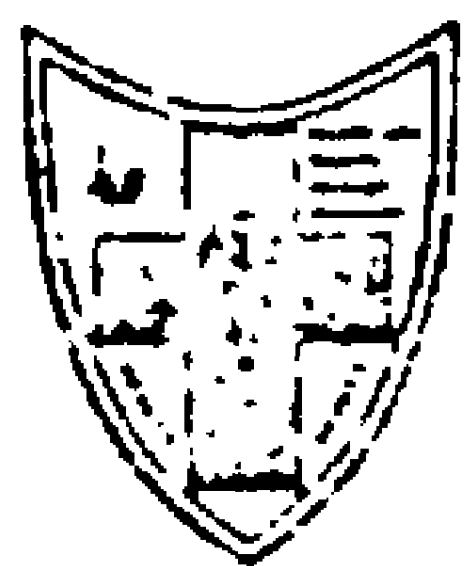
LIFELINES OCAW HEALTH AND SAFETY NEWS

Vol. 8, Nos. 1, 2

April 1981

Published in cooperation
with the OCAW Union News,
1636 Champa St., Denver,
Colo. 80202.

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Items of Interest for the May issue
will be sent in by April 20.

Subscription price for non-members
is \$5 per year.

Small Reactor Safety Survey

Question No. 1: Most Important Safety Considerations

What are some of the most important safety considerations that you would investigate to evaluate the overall plant safety status?

	Number of Replies
(a) Containment of vinyl chloride	
1. Relief valve and rupture disk system and condition	(6)
2. Emergency relief containment capacity and recovery system	(3)
3. Cooling and electrical backup for reactors	(3)
4. Reactor controls	(2)
5. Unloading and storage and handling of VCM	(2)
6. Reactor S/S system	(2)
7. Control of reactor bottom valve	(1)
8. Emergency shutdown systems	(1)
9. Agitator alarms	(1)
10. Reactor area manned at all times	(1)
11. Maintenance records for vessels in VCM service	(1)
12. Vessel integrity program	(1)
(b) Contingency - preventing fires and explosions in the event of V.C. escape	
1. Fire protection system	(6)
2. Plant layout	(4)
3. Presence of safety equipment	(2)
4. Plant emergency plan	(1)
5. Electrical equipment properly grounded	(1)
6. Use of fire safe valves	(1)
7. Ability to handle large quantities of V.C. gas	(1)
(c) Good safety and operational management	
1. Up to date procedures - complete operating manual - plant follows procedures	(11)
2. Training and education of all personnel	(10)
3. Maintenance status - P.M. program	(7)
4. Housekeeping	(6)
5. Attitude of management and personnel	(5)
6. Safety organization	(2)
7. Operator involvement in safety	(1)
8. Inspection system	(1)
9. Engineering standards - design criteria being followed	(1)
10. Proper raw material storage	(1)
11. Regular safety sessions	(1)
12. Inter-action between Production and Maintenance	(1)
(d) Indicators	
1. Past Records - frequency and severity records	(4)
2. Monitoring and emission records	(2)
3. Most recent systems safety analysis review	(1)

Question No. 2: Reactor Discharge Valve Control

How do you prevent the wrong reactor from being opened?

	Number of Replies
1. Operator training and procedures	(8)
2. Clear identification of reactors	(6)
3. Mechanical locking system - two people to open	(4)
4. Discharge port is covered with a locked cover	(4)
5. Fixed discharge piping - batch always contained	(4)
6. Reactor discharge valve interlocked with reactor pressure	(3)
7. Two valves	(2)
8. Software interlocks	(2)
9. Warning light system - indicates safe to open	(2)
10. Electrical interlocks	(1)
11. Communications	(1)
12. Pressure gauge mounted beside valve	(1)
13. Slow opening valves - time to discover mistake	(1)
14. Drop valve actuated from reactor top - hear pressure gauge and sight glass	(1)
15. Working on a locking device	(1)

Question No. 3: Charge Volume Control

(a) How do you measure water, VCM, catalyst, suspending agents?

	Weight	Meter	Volume
Water	0	15	1
VCM	7	10	1
Catalyst	9	0	3
Suspending Agents	8	2	1

(b) How do you prevent over or under charging?

1. Visual checks on levels	(7)
2. Operator training, procedures, signing charge sheet	(6)
3. Calibrating meters - maintenance	(3)
4. No independent mechanism to prevent over/under charging	(2)
5. N/A	(2)
6. Dual meters	(1)
7. Computer controlled	(1)

(c) How do you control charging sequence?

1. Operator training and procedures	(12)
2. Computer	(3)
3. Sequence controlled by mechanical stepper switch	(1)
4. N/A	(2)
5. No answer	(2)

Question No. 4: Gasket Replacement Control

(a) Do you replace gasket --				Number of Replies
	<u>Yes</u>	<u>No</u>	<u>No Answer</u>	<u>N/A</u>
1. After each opening	7	5	7	1
2. After major maintenance	15	0	4	1
3. Once per year	3	1	14	2

(b) Pressure of the pressure test --	
1. After each opening	psig - 50, 200, 90, 30, Vacuum, 80% of R/D rating, 15" Hg vacuum
2. After major maintenance	psig - 100, 140, 150, 85, 120, 150, 135, 120, 180, 60, reaction pressure, rating - 10%
3. Once per year	psig - 170, 175, 180

(c) How often is a manway gasket re-used?	
1. Inspected visually and re-used if passes inspection	(8)
2. Never re-used	(3)
3. 10 - 15 times	(3)
4. 10 - 20 charges	(1)
5. 50 charges	(1)
6. 100 - 150 charges	(1)
7. No answer	(2)

(d) Are your manway gaskets O-rings or flat gaskets?		
<u>O-Rings</u>	<u>Flat</u>	<u>N/A</u>
10	8	2

Question No. 5: Safety Valve Control on Reactors

(a) How often do you inspect your safety valve nozzle?	
1. Each time the reactor is entered or opened	(7)
2. After every charge	(4)
3. Approximately every 3 days	(1)
4. Once per week	(1)
5. Once per month	(1)
6. Once every 30 - 50 batches	(1)
7. Two parallel relief nozzles - each with 2 rupture discs and no pop safety valves	(1)
8. Do not use safety valves on reactors - use double rupture discs	(1)
9. No answer	(4)

Question No. 5: Safety Valve Control on ReactorsNumber of
Replies

(b) How often do you test your safety valves?

1. Once per year
2. Every 6 months
3. N/A

(14)
(1)
(5)

(c) Are safety valves removed and cleaned after each release?

Yes 15

No 0

Yes was the only answer if the question was answered, except -- "no reactor releases - should be done - no policy."

Question No. 6: Reaction Shortstop

(a) Do you have a reaction shortstop system?

Yes 17

No 2

N/A 1

(b) Is the injection automatic or done by an operator?

Automatic 5

Operator 16

No answer 3

If automatic, what initiates the operation?

- Agitator RPM
- High reactor pressure
- Loss of power to agitators
- Over pressure or temperature or loss of agitation
- Loss of agitation, agitator motor, high water pressure, power failure

Question No. 6: Reaction ShortstopNumber of
Replies(c) Is this system independent for each reactor
or a common system for several reactors?

Independent 10

Common 6

Both systems 1

No answer 4

(d) How often was your system operated last
year?

Less than 10 6

10 to 100 times 4

Over 100 times 4

N/A 6

Many times the shortstop system was used in non-emergency situations.

(e) How often was your system tested last
year?

Daily 2

Weekly 1

Monthly 3

Yearly 1

N/A 13

Question No. 7: Reactor Pressure Control(a) How do you prevent pluggage in reactor
pressure transmitters?

- | | |
|-----------------------------------|------|
| 1. Water injection | (6) |
| 2. Inspection and manual cleaning | (10) |
| 3. Solvent cleaning system | (1) |
| 4. Dual pressure systems | (2) |
| 5. N/A | (1) |
| 6. Not a problem | (1) |

Question No. 7: Reactor Pressure ControlNumber of
Replies

(b) Do you have alarms for high pressure?

Yes 18

No answer 1

N/A 1

(c) Approximately what percent of normal
operating pressure is the alarm set for?

- | | |
|-----------------------|-----|
| 1. Less than 110% | (9) |
| 2. Between 110 - 120% | (5) |
| 3. Over 120% | (2) |
| 4. No answer | (4) |

Question No. 8: VCM Pump ControlWhat protection do you have to prevent remote
operated VCM pumps from starting with suction
and discharge valves closed?

- | | |
|---|-----|
| 1. Operator training, procedures, etc. | (5) |
| 2. Automatic valves interlocked with pump | (5) |
| 3. None | (6) |
| 4. No answer | (2) |
| 5. CRT display | (1) |
| 6. No remote pumps | (1) |

Question No. 9: VCM Storage Tanks(a) Do you have sprinkler protection for
your VCM storage tanks?

Yes 20

No 2

- { -- Use monitor nozzles on older installations.
-- No, for some larger tanks

Question No. 9: VCM Storage Tanks

(b) How often are these tanks opened for internal inspection:

Number of
Replies

- | | |
|--|-----|
| 1. Once per year | (3) |
| 2. 2 - 5 years | (8) |
| 3. 6 - 10 years | (3) |
| 4. Over 10 years | (2) |
| 5. No regular basis (many use ultrasonic inspection) | (3) |
| 6. No answer | (1) |

Virgin monomer tanks inspected infrequently. Day tanks inspected more frequently.

(c) Have you had any corrosion problems in VCM storage tanks?

Yes 4

No 16

Those indicating they have corrosion problems are in recovered VCM tanks or day tanks, not virgin VCM.

Question No. 10: Recovered VCM Handling

(a) Do you distill your recovered VCM?

Yes 3

No 17

N/A 1

(b) How do you control polyperoxide formation in your recovered VCM system?

- | | |
|-----------------------------------|-----|
| 1. Short retention time | (7) |
| 2. Add an inhibitor | (6) |
| 3. pH control - keep basic | (4) |
| 4. Keep O ₂ levels low | (3) |
| 5. No precautions taken | (3) |
| 6. No answer | (3) |

Question No. 11: Reactor Entry

Do you require:

	<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>No Answer</u>
1. All flanges blinded	13	6	1	
2. VCM flanges blinded only	3	12	1	5
3. Manway watch	16	4	1	
4. Mechanical manway watch	4	11	1	4
5. Safety belt only	6	11	1	3
6. Safety belt and wristlets only (3 answered - wristlets only)	2	11	1	3
7. Safety belt and wristlets with line attached (2 answered - safety belt with line attached)	2	12	1	3
8. Lab entry analysis VCM/O ₂	2	14	1	3
9. Portable analyzer entry analysis VCM/O ₂	17	2	1	
10. Respirator worn at all times	15	3	1	1
11. Respirator worn at certain jobs	6	6	2	6
12. Gloves to be worn	13	4	1	2