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Date	To	Location and mail code
October 16, 1981	R. T. Kelly	Blue Bell #2126

Subject	From	Location and mail code
VINYL CHLORIDE SAFETY ASSOCIATION ANNUAL MEETING	C. A. Gellner/dap	Lake Charles #283

The Annual Vinyl Chloride Safety Association Meeting was held on September 24 and September 25, 1981, at Hilton Head, South Carolina. The meeting was held for two days with the first half of the first day concentrating on True Confessions.

The main action points to come out of this meeting are:

1. Check all process sewers to be sure they are separate and no VCM could back up.
2. Review vessel entry procedure when nitrogen has been present to determine the safety aspects.
3. Review initiator addition procedure.
4. Standardize radio communications.
5. Reemphasis of Maintenance Production Department's responsibilities on equipment repairs.
6. Teflon valve repair procedure, i.e. bonnet bolt versus actuator bolt removal.
7. Check control room pressure design.
8. Arcas system--air conditioner and/or remove transformers.
9. Review another safety level for polymerization, i.e. large recovery condensers, shortstop system, or another diesel pump for cooling water.

SECTION I

ITEM I. Furon Process Sewer Explosion. This explosion occurred at the Conoco VCM Plant at Lake Charles. Basically, they had a closed sewer system that collected chlorinated materials for recovery from the various process units. They had been cleaning down the EDC column and in the sewer when an above ground drum at 50-pound design top blew off. They basically felt the static could have caused a challenge. They did find that the vessel was not grounded properly and the line for the liquid came in the top and did not terminate below the normal liquid level. Also, there could have been traces of peroxide or copper alloys that could have been unsteady. The actions they took to resolve the situation was that they replaced the plastic drum with a solid steel drum. They provided a vent stack for nitrogen purging. They positioned the feed line below the liquid level, and they put on a PH controller for the liquid.

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ITEM II. Control Room/Laboratory Explosion. An explosion occurred in the Control Room/Laboratory Area of the Dow VCM Plant in Canada. Basically, the sewer from the recovery area particularly the caustic scrubbers had been inadvertently connected to the sewer from the Laboratory Building. A leaking valve apparently was on the bottom of the caustic scrubber column and allowed liquid VCM to leak into the line and come up into the Laboratory area. This then provided an explosion which destroyed the majority of the Control Room and the Laboratory area. No one was killed but there were five serious injuries. The actions taken as a result of this incident were they disconnected the lab sewer from the process sewer, and they did now blind all process connections.

ITEM III. Nitrogen Inhalation Incident. B. F. Goodrich Company at their Petro Town New Jersey bulk polymerization plant experienced a potential serious accident during last year. While performing routine maintenance of replacing a packing on the drive end of an autoclave, it was determined that the packing would not blow as it normally would to be replaced. They assumed that the latern ring somehow had become stuck; therefore, the mechancial department requested that the production department secure the vessel for entry so that they could somehow look at it from the inside and determine if it stuck or somehow push it out. The vessel was prepared for entry; but, it was not prepared properly with the checklists; it was not cleared of nitrogen; there was no lifeline, and no oxygen check. The first maintenance man in was overcome with nitrogen. At first, it was not realized what the problem was, but after a short time, it was realized, the man was pulled out, resuscitated, and taken to the emergency room. Fortunately, the man survived without any serious challenges. They summarized that the causes of the incident were the nitorgen was in the reactor; no oxygen check was taken; no lifelines were present on the individual or in the vessel; the checklists were violated, and there was insufficient awareness of the nitrogen danger. The actions that they took was to conduct a plant poll. Mainly in this poll, they were interested in finding out what was really going on in the checklist. It was found out primarily that the oxygen measurements were not being done, and the items were not being completed prior to marking off the checklists. The other actions taken were disciplinary actions on the individuals involved in the checklists and a program to increase safety awareness particularly in the case of nitrogen.

Cant see this
fitting inside of
reactor!

ITEM IV. Lauroyl Peroxide Incident. An incident occurred at the B. F. Goodrich Plant at Plaquemine, Louisiana. This is a bulk polymerization plant with 16 cubic-meter reactors. Basically, a reactor operator was adding low peroxide initiator to an autoclave, and upon the adding of the initiator, it began to fume and ignited causing severe burns to the individual. Fortunately, the individual did recover after five weeks in the hospital. The cause of the incident was traced back to a hot jacket. A jacket had been maintained at 80 degrees centrigrade, whereas normally the jacket is kept at 40 degrees centrigrade because of humidity. At our Plant, we keep the jacket at approximately 20 to 25 degrees centrigrade. The actions taken were disciplinary actions of the control room operators. Control room operators would not announce the autoclave internal temperature prior to initiator adding. The initiator cannot be added without the proper temperature being obtained.

ITEM V. VCM Column Explosion. A VCM Column Explosion occurred at the B. F. Goodrich Plant at Convent, Louisiana. At the time of the explosion they were operating high flow rates, liquid level on column had been removed, and they were having trouble with the rupture disks. They feel that the cause was a detonation of explosive gases in the top of the column by unstable condition. The actions taken were to reverse the feed and discharge lines so that the column is operated full. Waste water was rerouted around the column. Piping was rearranged to prevent gas buildup.

ITEM VI. Polypropylene Plant Fire. This incident should be really called teflon bonnet bolt incident. Basically, in the incident a line on a polypropylene reactor had become plugged, and to clean this section of the line it was necessary to degas the section before it, remove that section, and for some unknown reason, work on the teflon valve that was the main block valve between the reactor and the atmosphere. When the maintenance operators, one of which who had ten years or so experience and two of which who were rather inexperienced but had three years on the job, were held on overtime at the same time of the World Series Game. Basically, the men were to clean the line, and then replace it. For some unknown reason, they chose to also work on the valve and instead of removing the bolts for the operator, they removed the four bonnet bolts that held the plug in. When the bolts were removed the plug disengaged and caused a very serious leak of propylene. This large leak of propylene resulted in five deaths, twenty-nine injuries, $69 million in damages, and a plant that will not reopen with a loss of 200 jobs. They said that the basic cause of working on a live reactor was maintenance procedures were wrong, and the men were in a rush on overtime.

In reviewing these major incidents, it can be seen that they largerly revolve around:

1. Maintenance issues.

2. Violations of operating procedures.

3. Design errors.

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pc Rod Bollich
Bruce Brocka
Frank Conrad

Attachment

APPENDIX I

VINYL CHLORIDE SAFETY ASSOCIATION MEETING
SEPTEMBER 24 AND 25, 1981
HILTON HEAD, SOUTH CAROLINA

AGENDA

SEPTEMBER 24

8:00 - 8:30		Registration and Coffee Social	
8:30 - 9:00		Chairman's Welcome and Business Agenda VCSA History/Status Review Preview Business Agenda	Glen Schaaf B. F. Goodrich Chairman Doug Frey - PVC Plant Diamond Shamrock
		Program Preview	Tom Moore Tenneco
		I. True Confessions/Major Incidents CONT SUBJECT	— BETTER MEETING / SETUP
9:00 - 9:15	1	Furan Process Sewer Explosion Conoco	
9:15 - 9:30	2	Control Room/Laboratory Explosion Dow	
9:30 - 9:45	3	Nitrogen Inhalation Incident BFG	
	3a	Lauroyl Peroxide Incident BFG	
9:45 - 10:00	4	VCM Column Explosion BFG	
10:00 - 10:15		Coffee Break	
10:15 - 10:30	5	Reactor Lockout Device Report	Herm Waltemate B.F. Goodrich
10:30 - 11:00	6	Polypropylene Plant Fire Depurizer	Darwin Rhoads Tenneco
11:00 - 12:00	7	Small Reactor Safety Survey Report	Jerry Brumbaugh General Tire
12:00 - 1:45		Lunch Lunch Speaker: Gary Baise Law Firm of Beveridge & Diamond SUBJECT: VCM Regulatory Status	
		II OSHA/EPA Topics	
2:00 - 2:30	8	Regulatory Update	John Barr Air Products
		Regulatory Incidents	
2:30 - 2:45	9	Hazardous Materials Notification	Harold Dubec Hooker
2:45 - 3:00	10	OSHA Inspection - Respiratory Protection	Dave Lull Diamond Shamrock
3:00 - 3:15		Coffee Break	

CTL021325

SEPTEMBER 24

III. Operator Training

3:15 - 4:00	11	Operator Training Survey Report NEED COPY	Doug Frey Diamond Shamrock
4:00 - 4:30	12	Implementing an Effective Plant Safety Program GET MANUAL	Stephen Brouillard Diamond Shamrock
4:30 - 5:00	13	Video Tape Demonstration OSHA VCM Standard	John Barr Air Products

SEPTEMBER 25

8:30 - 9:00		Business Meeting Election of Officers/1982 Meeting Location	Glen Schaaf/ Doug Frey

IV. Safety Systems Reports

9:00 - 9:30	14	Computer Safety Survey Report	Jim Gabbett Georgia Pacific
9:30 - 10:00	15	VCM Safety Condensation System	B. Terwiesch Chemische Werke Huls
10:00 - 10:15		Break	
10:15 - 10:45		Compound Ignition Hazards	John McCully Conoco
10:45 - 11:15		VCM Tank Car Wreck	Everson Weekly Pantasote
11:15 - 12:00		Wrap Up/Survey Questionnaire Completion	Tom Moore Tenneco

pc R T Kelly 8/05/81

PPG - BEN REYNOLDS - VCM PLANT II SUPT

CONOCO - JOHN MCCULLY - TECH ENGR SUPR

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APPENDIX II

COMPUTER CONTROL SAFETY QUESTIONNAIRE

Dear VCSA Member,

Computer control of PVC plants has very definite safety benefits. However, there are some safety problems which computers introduce which are not readily apparent. The purpose of this questionnaire is to survey computer-operated plants to discover any special problems related to computers, either design or operator interface related, and how these have been solved.

1. COMPUTER/MANUAL OPERATION

A) Do you have provisions for independent computer and manual operation? ______

1. No
2. Yes
3. Not Totally
4. Yes
5. Yes
6. Yes

B) How do you isolate the computer from the plant during manual operation or when the plant is down for computer repairs?

1. The portion of the computer used for temperature control is kept active when the computer is in repair. No manual control is possible in other portion when computer is down.

2. A key switch which turns complete plant control into manual operation.

3. Mechanical disconnect, at I/O and at remote (air supply to valve, etc.)

4. Switch all devices to manual operation

5. There is a relay switching system that is activated on computer failure or by manual request. This system deactivates panel push-buttons during computer operation and isolates the computer I/O from the device relays during manual or panel mode.

6. Have MANUAL/AUTO switch which electrically isolates computer. Had one incident during trouble shooting of computer when switch was bypassed accidentally. Future design will consider more tangible isolation than switch.

C) Have you had any problems with the computer opening valves or reactors which were out of service for maintenance?

1. No operation is possible without computer.
2. No-air is removed from solenoid operated valves when out of service.
3. Once - installed lockout on positioners.
4. One occasion due to human error.
5. No - All valves on reactors down for maintenance are "air-failed" so that they cannot open.
6. Air supply to reactors is locked out during maintenance.

D) How do you maintain operator proficiency on manual operation during long periods of computer operation?

1. No manual operation is made.
2. We do not run full production without computers.
3. Don't try.
4. Once per month each operator must operate manually for at least four hours.
5. We do not, at this time, have a specific program or method. This has not been a problem for us because our computer uptime averages about 98%.
6. Schedule periods of MANUAL operation in order to maintain proficiency.

2. OPERATORS TRAINING

A) How do you train new operators?

1. Through education in special lecture program and on the job training.
2. On-the-job with a background of basic theory once familiar with job.

3. Some classroom and theory - mostly on the job buddy system.

4. Formal Class Room Training for approximately four weeks. Then work with existing operator for approximately two months.

5. New computer operators receive most of their training by working with experienced operators. They also spend approximately eight hours with one of the computer programmers for technical instruction about the computer.

6. New operators are not trained on the computer until all other jobs in plant are mastered. Training involves several weeks of on the job dual operation with experienced operator, on both MANUAL and COMPUTER modes.

B) <u>Do you have refresher training for experienced operators?</u>

1. Yes

2. Yes - Limited to last job rotation otherwise operators are encouraged to keep current at all times.

3. Yes

4. Sometimes when operating procedures are updated.

5. We do not have regularly scheduled retraining classes for experienced operators, but retraining is done if operational performance indicates the need.

6. No

C) <u>How do you retrain after major program revisions?</u>

1. By lecture and simulation training.

2. Process and staff engineering will assist in this effort.

3. Written, classroom, and demonstration.

4. Systems Engineer conducts training sessions. Includes practice on CRT.

5. When possible, major changes are made gradually and training classes are held to inform operators of the effects of the changes on them.

6. (1) 12-15 hours classroom
   (2) 1 to 3 days water batching

D) How do you communicate minor program revisions to all operators?

1. Either by an official transmittal note or either by starting meeting of the day.

2. Memos and log book.

3. Written - notice and description.

4. Operator log book and notices.

5. This is done through operation department communication channels. (IE., instructions in supervisors instruction log).

6. Have separate log book to record all revisions.

3. FIRST-LINE SUPERVISOR TRAINING

A) How do you train new supervisors?

1. By on the job training.

2. Allow upgrade system to cover vacancies.

3. A - Senior operator system leads to promotion.
   B - No formal method - probationary period.
   Both - Use outside training programs.

4. New first line supervisors are promoted from the operators ranks and are already familiar with operation. Other training consists of familiarization with maintenance procedures, company policy, etc.

5. New supervisors do not undergo any formal training because they are all ex-computer operators.

6. Had problems during startup of plant because supervisors had no time for first hand solo operation of computer, following the classroom sessions. Since then, however, all new supervisors selected have come from best computer operators.

B) <u>Do you have refresher training for experienced supervisors?</u>

1. Not done usually, except on emergency training.
2. They participate in all training sessions for each unit.
3. Yes
4. Yes - Same as with operators. In addition they get refresher on supervisory skills.
5. No
6. No

C) <u>How do you retrain after major program revisions?</u>

1. By a lecture and simulation training.
2. Process engineering will assist in this effort.
3. Same as operators.
4. Same as operators.
5. They attend the same training classes that operators attend for major changes.
6. (1) 12-15 hours classroom.

   (2) 1 to 3 days water batching.

D) <u>How do you communicate minor program revisions to all supervisors?</u>

1. By an official transmittal note.

2. Memos and log book.

3. Written and discussions.

4. Same as operators.

5. The same as for operators, through operation department's communication channels.

6. Separate log book to record all revisions.

E) <u>Have you had any problems with first-line supervisors losing proficiency with computer operations because of problems in other non-computer-operated parts of the plant? How are these problems overcome?</u>

1. Very few case only. We give them refreashing education and make them supervisors.

2. No - Most first-line supervisors have only a limited working knowledge of computer operations.

3. Some refresher period and assignment with capable operators.

4. No

5. We do not attempt to keep a supervisor completely up-to-date on computer operations. We feel that with two console operators and two senior operators on each shift, it is unnecessary to keep supervisors proficient on the computer.

6. Yes - Require supervisors to spend more time in control room and place more responsibilty on outside operators.

4. INFORMATION OVERLOAD

A) Have you had any problems of operators being swamped with computer messages and alarms so that some are ignored? How are these problems overcome?

1. No - Only important messages and alarms are kept, so there will be no neglecting possible.

2. Yes - Use of two people helps to overcome problems when the extra person is available.

3. Yes -
   1. Establish higher threshold for emergency alarms.
   2. Have some data indicated, not alarmed.
   3. Hardwire really critical alarm.
   4. Training employees.

4. Yes - Added a second operator in control room to handle all operations after the reactors. In another plant - the supervisor assists the operator.

5. Yes - We are constantly working to eliminate unecessary messages and redundant alarms to reduce the amount of information being fed to the operators.

6. Yes -
   1. Revised program to reduce number of alarm messages.
   2. Use separate printers for messages and alarms.
   3. Some critical alarm messages are printed with exposed type in order to make them stand out.

5. OPERATOR COMPLACENCY

A) Have you had any problems with operators relying too heavily on the computer to correct all mistakes? How are these problems overcome?

1. No - Cross checks by operators are inserted at important locations.

2. No

3. A- No
   B- Yes - have mandatory log sheets to record reaction to alarm.

4. No - Not since instituting manual operations once per month.

5. No

6. Yes - Diligent follow up on all incidents (major and minor) where mistakes using the computer are made. Operator making mistake is counseled and other operators are informed.

6. MAJOR PROGRAM REVISION SIMULATIONS

A) Do you perform any plant-scale simulations when major program revisions are made?

1. No

2. On start-up we provide dummy batches to walk through the program.

3. No - Except water batch tests.

4. No

5. No

6. Yes - Charge full batch quantities of water, VCM, and all additives except catalyst. Use catalyst solvent to simulate catalyst. Simulate alarm conditions, including emergency shortstop. Period lasts from 1 to 3 days.

7. OPERATOR/SUPERVISOR PROGRAM VARIABLE CONTROL

A) Do you use an operator/supervisor control key to limit changes to program variables through the CRT?

1. No

2. Yes - Key switch

3. Yes - Many are not accessible to operators.

4. No

5. Yes

6. Have key - but do not use it.

B) How do you limit program variable changes by operations?

1. ________

2. Some parameters cannot be charged from CRT - engineer has to charge (key-switch).

3. Yes - written authorization and record.

4. Through directed operator CRT keyboard function.

CTL021335

5. By requiring them to obtain permission and key from supervisor.

-6. Program variables are changed by engineers. Have not had problems with operatiors changing program variables. Had some problems with operators tampering with FLAG changes in order to get programs to run. Educated operators to high danger of this and revised programs for better operability.

C) <u>How do you change formulation variables, such as catalyst and suspending agents?</u>

1. No operators are involved in recipe changes.

2. Done with consultations with process engineering group through supervisor. Engineer normally makes changes.

3. By CRT, but only as written authority.

4. Process Control Engineer or Shift Supervisor accomplishes through CRT keyboard.

5. We have programs that allow operators to change the amount of ingredients used within certain limits and this is not a permanent change. Permanent changes to recipes are made by the programmers on request from the technical group.

6. Formulation page has variables which can be changed from CRT entries. The change must be input twice in order to be accepted. CRT changes are valid for one batch only. Long term formulation changes are made by engineers.

8. <u>REACTOR CHARGE VOLUME CONTROLS</u>

A) <u>If you have primary and secondary measurement devices on charge quantities, how do you allow operator acceptance of deviations between primary and secondary devices?</u>

1. Only one measurement is present.

2. Yes - Deviations are questioned by operators, and supervision makes decision. Also process engineering can be consulted.

3. Computer queries, then operator must get visual field verification before proceeding.

4. Variance limits set, but Shift Supervisor has some discretion if barely over limit.

5. We have no secondary measuring devices.

6. Deviation during charge - steps charge, operation must repair problem or deselect one of devices. Deselection procedures are written, with acceptable limits. On some chemicals, high value is accepted, on others, low value is selected.

9. VALVE STATUS INDICATIONS

A) How do you handle problems with valve status indicators, such as microswitches? Do you override the computer hold or alarm, or do you manually adjust in the field on each batch?

1. ________

2. a) We override only after manually checked in field.
   b) Adjust in field if problem persists.

3. Allow override after field inspection, then write ASAP work order.

4. Device is visually checked in the field before over riding computer hold status. Device is not operated post next work day without repair.

5. If a position indicator fails (valve in the proper position and in contact with switch) an "override" can be placed on the device by using the "supervisory key" until it can be repaired by the I & E Group.

6. Diligent maintenance is required to keep microswitches in good condition. Use override and manual field adjustment to overcome problems. Neither is an acceptable solution, but is necessary for operation. Repeat that follow up on problems must be prompt and diligent.

10. PLEASE DESCRIBE OTHER COMPUTER-RELATED SAFETY PROBLEMS OR INCIDENTS AND HOW YOU RECOMMEND TO CORRECT THEM.

1. ___________

2. Operators do not always respond to computer initiated emergency type alarms - Computer print-out is reviewed duly by process engineer and recommendations made to production - Training sessions W/operators helps.

3. Preparing thorough fault-free analysis of computer operations on corporate basis.

4. None

5. In some instances, operators in the field have resorted to manipulating the instrument to process transducers (I to P's) by hand to force a valve or device to move contrary to computer command. This is a rather simple procedure that, only involves unscrewing the cover and using a finger, nut, bolt, rock or some other object to hold the pneumatic switch in the desired position.

   Our solution to the problem was to make this act a severe violation of safety procedure with resulting severe penalties for violators. Since instituting this policy, we have had no futher problems.

6. ________________

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 - near 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

	Yes	No	No Answer	N/A
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?

O-Rings	Flat	N/A
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 Reactors

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

	Number of Replies
1. Once per year	(14)
2. Every 6 months	(1)
3. N/A	(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 Shortstop

Number 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 Control

Number 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 Control

What 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)

10 COMPANIES HAVE PRESSURE RELIEF VALVE ON VCM PUMP

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

CTL021344

Question No. 9: VCM Storage Tanks

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

		Number of Replies
1.	Once per year — New VCM. 3-10 yrs?	(3)
2.	2 - 5 years — Recov'd " Shorter	(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)

CTL021345

Question No. 11: Reactor Entry

Do you require:

		Yes	No	N/A	No Answer
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

CTL021346

19 August 1981

INSTITUTE OF OCCUPATIONAL MEDICINE

EPIDEMIOLOGICAL AND CLINICAL STUDIES OF POLYVINYLCHLORIDE WORKERS

by

C A Soutar, S Gauld, M Lloyd, L H Copland, J F Hurley

ABBREVIATED SUMMARY

We have reported previously a medical survey of 818 present and past workers at a factory making polyvinylchloride (PVC) in which we showed that exposure to fine PVC dust was associated with a slight average reduction in tests of breathing capacity, and with the presence of small spots visible in X-rays of the lungs.

The present studies were designed to identify any chest illness in men who had worked in dustier plants in the factory but who had not been seen in the previous survey, and to examine similarly men working at a second factory manufacturing PVC; to re-examine the relationship between PVC dust exposure and small spots in the chest X-ray since in the first study there had been some disagreement between expert readers over the interpretation of the X-ray appearances, and to discover how seriously men may have been affected by PVC dust.

Two hundred and twenty-nine additional men were seen at the first factory, and little chest illness was found among them. One hundred and twenty-seven men were seen at the second factory, and even less illness was found in this workforce. Each man was sent a brief confidential medical report

The X-rays were re-read by the same three experienced readers whose results were reported previously, and also by another panel of five readers. The readings confirmed the results of our earlier study, in that PVC dust exposure was found to be associated with the presence of small spots in the chest X-ray.

Again, only some readers detected the effect of PVC dust, and the reasons for these differences probably include the slight degree of the abnormalities, which cannot be distinguished in an individual X-ray from changes related to age.

These changes of the chest X-ray were slight, on the borderline between normality and abnormality, and clinical examinations of a group of men who had these spots indicated that the health of their lungs was no worse than that of a group of men of similar age and smoking habits who had normal chest X-rays (except for a slight increase in sputum). We conclude that the presence of these spots does not indicate that PVC dust has seriously affected the lungs. Some men who had experienced relatively high estimated dust exposures were also examined if their breathing tests results were lower than those of other men. The non-smokers selected in this way all had healthy lungs, but some of the smokers had serious reductions of their breathing tests. This was probably the result of their smoking habit, and there was no evidence to suggest that PVC dust had seriously damaged their lungs.

We conclude that exposure to PVC dust has been shown to cause a slight reduction of tests of breathing and slight abnormalities of the chest X-ray, but that there is no evidence that PVC dust has caused serious illness among the workforce, although the possibility of a rare idiosyncratic response to dust cannot be excluded.

For details of this work, please refer to Institute of Occupational Medicine Technical Memorandum TM/81/8.

Regulatory Update

September 1981

OSHA

Carcinogen Policy

Amended to meet benzene case, January. Other amendments proposed and withdrawn. Under review, with 2-3 year goal. Candidate list unlikely.

Cotton Dust case stops cost/benefit analysis for health, reaffirms need for rule.

Lead Standard

Some details of rate retention still unsettled.

Qualitative mask fitting proposed.

Partial stay until October 11.

Medical Records Access

Proposal to tighten labor access to data.

Labeling

Reproposal scheduled for September-October.

Women in Workplace

General acceptance of employer right to exclude.

Reopening of VC/PVC Standard

Not expected for 2-3 years.

EPA

Carcinogen Policy

Being rewritten as response policy. Timing uncertain.

Vinyl Chloride Standard

Administrative changes this fall?

General Fugitive Rule

—

Hearings last spring.

Water Quality Criteria

Revised version out-lowered limit.

RCRA Listing - improbable.
Superfund repairing limit due next year.

All RCRA, Pretreatment, etc. rules reviewed.
Flurorcarbon action likely delayed.

FDA

Still no final action on PVC packaging, BATF request no help.

Plasticizer action unlikely until more tests.

SUMMARY OF OSHA/EPA INSPECTION QUESTIONNAIRE

The following is a summary of the 26 responses to the OSHA/EPA Inspection Questionnaire:

1. Do you have, for your supervisors and other employees, a written set of guidelines for use when a regulatory agency inspector arrives at the plant gate?

   Yes 15 No 11

2. Have you had either an OSHA or EPA inspection of your plant in the past 12 months:

   OSHA 10 EPA 18 None 7

3. If you had an OSHA inspection was it regarding the VCM standard or was it involved with another area?

   a. VCM standard (five responses)

   b. VCM, noise, heat, dust lead

   c. General - triggered by employee complaint

4. If you had an EPA inspection, was it regarding NESHAPS-VCM or was it about something else?

   Typical response:

   a. NESHAPS

   b. NPDES permit

   c. Hazardous waste - RCRA

   d. Permit to burn coal

   e. Landfill permit

   f. Incinerator operation

   g. PCB's

   h. PVC dust

   i. Safety relief valve discharges

5. **Did you receive any citations or notices of violation? If you wish, could you please describe the nature of the violation?**

   Typical response:

   a. Notice of violation - improperly labelled PCB tank

   b. No violation but not satisfied with aqueous effluent sampling procedure

   c. Two OSHA citations on record keeping - one invalid - the other due to math error in number of injuries reported

d. OSHA citations: Inadequate maintenance on area monitoring equipment and working in an area with greater than 5 ppm VCM, not wearing respirator

e. OSHA - serious and fine; other and no fine

f. OSHA - High VCM levels in reactors during cleaning - no respirator

g. Incomplete compliance with VCM opening loss regulations and non-compliance with relief valve emissions even though all emissions were reported correctly and on time.

6. Could you give a brief summary of your recent experience with an OSHA or EPA inspection?

Typical reponse:

a. OSHA inspection included 3 days of personnel monitoring for VCM and 1 day of PVC dust monitoring and other visits to the plant

b. EPA was in the area and noticed black smoke from the incinerator stack and demanded an immediate inspection of the facility. We obliged and corrected the problem - also sent a letter to the EPA explaining the problem.

9/18/81

PVC POLY SIZE RELIEF AREA COMPARISION

Company and Location	POLY SIZE GAL	RATING PSIG	RELIEF NOZZLE SIZE	NUMBER	TOTAL AREA AVAILABLE	RELIEF AREA PER 1000 GAL
1.	1,100	200	2"	1	3.14	2.85
2.	2,500	200-400	4"	1	12.56	5.02
3.	3,300	250	4"	1	12.56	3.81
4.	4,300	300	4"	1	12.56	2.9
5.	16,500	240-300	10"	1	78.5	4.75
6.	2,000	180	3"	1	7.07	3.53
	4,000	180	3"	1	7.07	1.77
7.	4,000	200	4"	1	12.56	3.64
	6,000	200	4"	1	12.56	2.09
8.	2,400	200	4"	1	12.56	5.2
	3,500	185-200	4"	1	12.56	3.5
9.	4,000	200	4"	1	12.56	3.14
	6,000	220	4"	1	12.56	2.09
	24,000	200	18"	1	254.34	10.59
	24,000	180	16"	1	200.96	8.37
10.	20,000	260	16"	1	200.96	10.05
11.	35,000	172	8"	2	100.48	2.87

PVC POLY SIZE RELIEF AREA COMPARISION

Company and Location	POLY SIZE GAL	RATING PSIG	RELIEF NOZZLE SIZE	NUMBER	TOTAL AREA AVAILABLE	RELIEF AREA PER 1000 GAL
12.	35,000	185	8"	2	157	4.49
			6"	2		
13.	2,200	200	4"	1	12.56	5.71
	5,000	225	6"	1	28.26	5.65
	7,000	200	6"	1	28.26	4.04
	20,000	225	8"	2	100.48	5.02
14.	3,500	300	6"	1	28.26	4.07
	7,400	250	6"	1	28.26	3.82
15.	4,200	200	4"	1	12.56	2.99
	5,700	200	4"	1	12.56	2.20
	4,500	200	3"	1	7.07	1.57
16.	52,800	260	10.0"	3	235.62	4.44
	10,500	2609	10.0"	1	78.54	7.5
17.	8,000	128	3"	2	14.14	1.77
18.	4,000	240	3"	2	14.14	3.54
19.	20,000	220	6"	2	56.55	
			8"	1	50.27	
					107.12	5.36
	3,700	220	6"	1	28.27	7.64
	2,200	200	3"	1	7.07	3.21
	2,200	200	3"	2	14.14	6.43
20.	16,500	300	12"	1	113.09	6.85
	6,600	350	4"	3	37.7	5.71
	4,200	350	3"	3	21.21	5.05
21.	20,500	270	8"	1	50.26	2.45

Note: Total relief area is based on full nozzle size for comparison and does not include the reduction of area if a relief valve is used.

CTL021354

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