1 Attachment II

OSHA Issues Hazard Alert in Wake of Amoco Explosion

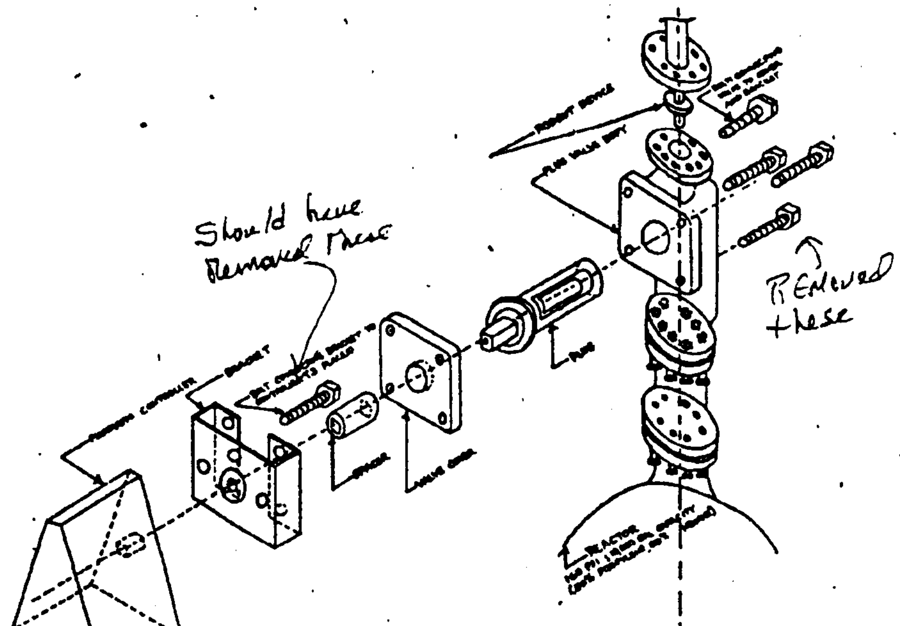
To prevent further tragedies like the October, 1980 fire and explosion at the Amoco, New Castle Delaware polypropylene plant which leveled the plant, killed six people and injured 28 others, the OSHA Philadelphia Regional Office sent out a hazard alert to OSHA compliance officers and others in the chemical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



CHEMICAL PROCESS AND OIL INDUSTRY
CONTROLLER-PLUG VALVE ASSEMBLY SCHEMATIC

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 cooker (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.

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E. J. Rousselle, *Vice President*
Anthony Mazzocchi
Director, Health and Safety Dept.
Sylvia Krekel
Occupational Health Specialist
Rafael Moure
Industrial Hygienist
Steve Wodka, *Intl. Representative*
Items of interest for the May issue should be sent in by April 20.
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1 Attachment III

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)

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:

		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

ATTACHMENT IV

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?

ATTACHMENT II

SUMMARY OF OPERATOR TRAINING QUESTIONNAIRE

The following is a summary of the 32 responses to the operator training questionnaires:

1. What is the approximate number of people in your total work force involved in manufacturing?

0 to 100	19
100 to 300	8
300+	6

   Some responses covered several different plants.

2. Do you have a formal training program for operating personnel:

   Yes 28 No 4

3. Does your plant organization have a full-time person whose primary responsibility is training?

   Yes 17 No 15

4. If your answer to No. 3 is "yes," to which functional part of the organization does this person report? (Employee relations, manufacturing, technical, etc.)

   Typical responses:

   a. Manufacturing department (8 responses)
   b. Employee relations department controls overall program with a coordinator from the manufacturing department implementing most of program at unit level (4 responses)
   c. Employee relations
   d. Safety
   e. Technical

5. If your answer to question No. 3 is "no," who in your organization is primarily responsible for training?

   Typical responses:

   a. Operating supervisor or foreman
   b. Safety Department
   c. Manufacturing engineer
   d. Personnel

6. How long does the typical operator spend in the training program?

   At least half of the respondents indicated the length of their program as 3 to 6 weeks.

7. Is your program one continuous cycle or is it divided into several stages separated by practical on-the-job experience? Could you please describe (Example: Orientation/limited training - 1 week, advanced - 1 week, recycle training - 2 days)

   Typical responses:

   a. Five phases (I - Orientation - 3 weeks; II - Departmental Training - 2-3 weeks; III - On the Job and Advanced; IV - Self-study Pilot Book Training; and V - Advanced Classroom Training)

   b. Three weeks operator training; 2 weeks supervisor training 3 months OJT, annual review

   c. One continuous cycle of classroom and OJT

   d. Three days formal classroom, 1 month OJT, 2 days recycle classroom training per year

   e. 90-day apprentice training; 45 days OJT and classroom, qualification courses in process, mechanical, electrical, instrument

   f. Orientation one-half week; Buddy on the job 2-3 months, probationary period until passes test.

8. Please check those of the following topics which are included in your training program:

   X Orientation
   X Safety
   X Fire Fighting
   X Process Technology
   X Instrumentation
   X Basic Equipment
   X Regulatory (EPA, OSHA, RCRA)
   X Industrial Hygiene
   X Respirator Protection
   X Company Philosophy
   X Company Organization

   List others not mentioned above: EEO, Company Policy.

9. As a part of your operator training program, do you use proficiency tests to evaluate the effectiveness of the program?

   Yes 22 No 10

10. Do you use tests to qualify operators for promotion:

    Yes 14 No 18

11. What do you feel are the strengths of your program?

Typical responses:

a. Six weeks formal training
b. Locally produced video tapes
c. Management support
d. Operator input
e. Uniform format for procedures
f. Company philosophy and attitude

12. What area of your program would you like to improve:

Typical responses:

a. Supervisor training
b. Detailed orientation for advanced program
c. Operator retention of material
d. Improve higher technology training
e. Add formal followup
f. Formalized testing
g. More formal procedures
h. Full time supervisor for training
i. Follow-up on a more formal basis

13. Which, if any of these training aids do you use in your operator training program?

All of the following are being used to some degree:

Film
Slide/tapes Presentation
Video Tape
Commercially Produced Video Tapes
Home-made Video Tapes
Mock-up Equipment or Process Area
Demonstration Instruments

14. Do you use video tape recordings produced at your facility by your own people?

Yes 11 No 19

If "yes," could you please comment on the effectiveness of this technique? Do you recommend this technique to others?

Typical responses:

a. Good for repetitive routine information
b. Very good because of local background
c. Very relevant
d. Prepared by a special training division
e. Good - but still learning how to do it
f. Only 25% good enough to re-use
g. Two respondents said not using but plan to start.

9/18/81

ATTACHMENT VI

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

4. Switch all devices to manual operation

5. Gr Pac → 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) <u>Have you had any problems with the computer opening valves or reactors which were out of service for maintenance?</u>

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) <u>How do you maintain operator proficiency on manual operation during long periods of computer operation?</u>

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 up-time averages about 98%.
6. Schedule periods of MANUAL operation in order to maintain proficiency.

2. <u>OPERATORS TRAINING</u>

A) <u>How do you train new operators?</u>

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) Do you have refresher training for experienced operators?

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) How do you retrain after major program revisions?

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 operat~~ions~~ORS?

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.

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) How do you change formulation variables, such as catalyst and suspending agents?

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. REACTOR CHARGE VOLUME CONTROLS

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

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 past 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-tree 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. ____________________

Attachment VII

THE EXOTHERMIC DECOMPOSITION OF PVC AND DRY BLEND

I. EXPERIENCES WITH EXOTHERMIC DECOMPOSITION OF PVC

A. Fluid Bed Dryer Explosion and Fire

During a dryer startup, the inlet air temprature to the plug flow section of the dryer reached 215°C. The dryer was shut down. An exhaust fan was started to purge HCl from the dryer. Immediately there was a mild explosion and fire inside the plug flow section.

B. Exothermic decomposition experiences with dry blend and flexible compound.

II. CALORIMETRIC STUDIES OF PVC DECOMPOSITION

A. Instruments Used

1. DSC--Du Pont 990 Thermal Analyzer and Pressure Differential Scanning Calorimeter

2. ARC™--Columbia Scientific Industries Accelerating Rate Calorimeter

B. Material Tested

1. General purpose suspension resin.

2. Twin screw pipe dry blend.

C. Results

1. DSC--Open Cup, Air Atmosphere

	Resin	Dry Blend
Exotherm Began At	185°C	200°C
Endotherm(s) Began At	225 and 255°C	260°C
Exotherm Resumed At	265°C	275°C
Ignition Occurred At	440°C	425°C

2. ARC™--Open Cup, Air Atmosphere

	Resin	Dry Blend
Exotherm Began At	185°C	185°C
Endotherm Began at	203°C	225°C
Exotherm Resumed At	215°C	240°C

II. CALORIMETRIC STUDIES OF PVC DECOMPOSITION (CONTINUED)

C. Results (Continued)

3. ARC™--Closed Bomb, Air Atmosphere

Resin

Exotherm Began Below	140°C
Endotherm Began At	170°C
Exotherm Resumed At	190°C
Pressure in Bomb	5 psig at 140°C
	1,050 psig at 190°C

Dry Blend

Exotherm Began At	217°C
Pressure in Bomb	100 psig at 220°C
	1,350 psig at 230°C

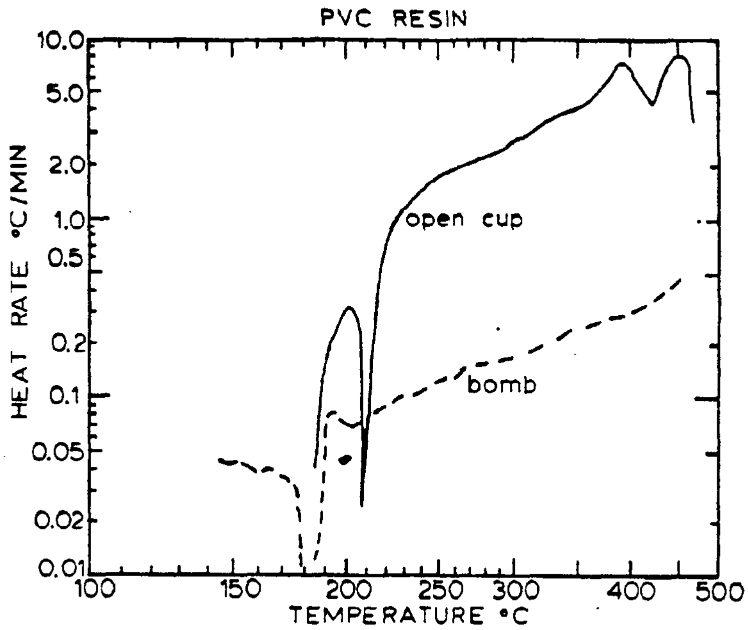
III. CONCLUSIONS

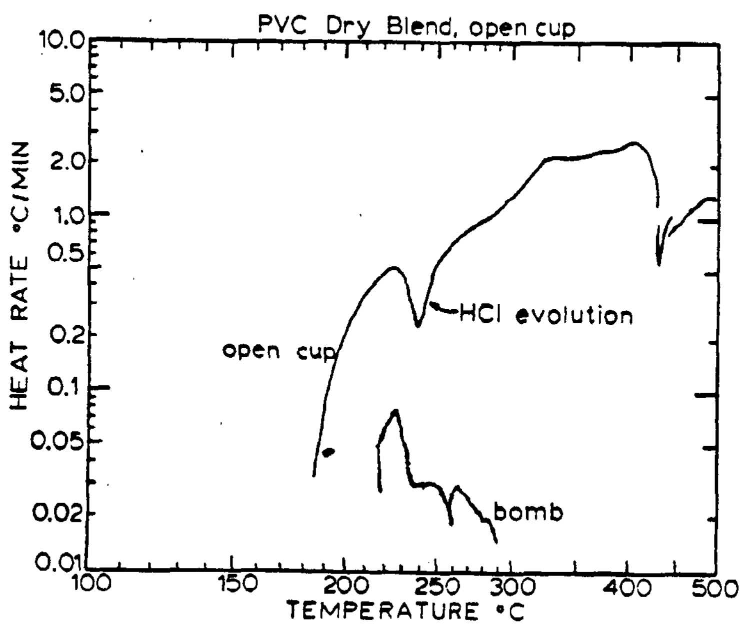
A. PVC resin and dry blend decomposition can become exothermic at 185°C when exposed to air at atmospheric pressure.

B. The exothermic decomposition can start at a lower temperature in a closed pressure container.

C. The pressure in a closed container increases rapidly with temperature once the decomposition begins.

D. Exothermic decomposition probably did occur in the fluid bed dryer and lead to the explosion and fire.


PVC RESIN
HEAT RATE °C/MIN
TEMPERATURE °C
open cup
bomb
10.0
5.0
2.0
1.0
0.5
0.2
0.1
0.05
0.02
0.01
100
150
200
250
300
400
500


PVC Dry Blend, open cup
HEAT RATE °C/MIN
TEMPERATURE °C
HCl evolution
open cup
bomb
10.0
5.0
2.0
1.0
0.5
0.2
0.1
0.05
0.02
0.01
100
150
200
250
300
400
500

ATTACHMENT VIII

VCM

TANK CAR

DERAILMENT

Thursday, January 8, 1981

5:30 AM	Henry Rzempoluch, Plant Manager, is contacted by railroad and informed of VCM tank car derailment.
6:00 AM	Rzempoluch visits the disaster site and finds two hopper cars and five VCM tank cars involved. At least one VCM car has a serious leak.
6:30 AM	Jim Ferrell, Traffic Manager for Pantasoté, and Rzempoluch are at the scene with local authorities and railroad employees. It was decided by local authorities at the suggestion of Pantasote to secure the area. By this time, the railroad had contacted CHEMTREC.
7:00 AM	CHEMTREC contacts PPG in New Martinsville, West Virginia. Union Carbide in Charleston is also contacted in case their expertise is needed.
7:30 AM	Vapor cloud had increased to about one half acre. Local authorities and railroad evacuate families within one half mile radius.
8:00 AM	Ferrell contacts Bob Baker of PPG in New Martinsville; advises him of the situation and requests a response team.
	Rzempoluch; three Pantasote production foremen; and Everson Weekley, Safety Supervisor, visit the scene to determine extent of damage. Scott Air Paks are used by two men who examine the overturned cars. At this point we feel only one car has a serious leak. We find that dome valves have been completely sheared off allowing VCM to escape.
9:00 AM	Rzempoluch and Weekley formulate a program to monitor vinyl leaks. This is done by a Century Unit. A command post is set up at the plant and "walkie talkies" are used to relay information from the scene.
11:00 AM	Weekley returns to the plant and briefs local authorities, railroad officials and Pantasote personnel. Levels in the area are 60 ppm at 500 yards and 150 ppm at 200 yards.
	Pumps for the city water wells are shutdown since they could prove to be an ignition source and cause an explosion. Public is informed that there is no contamination problem.
12:00 NOON	Sheriff Bob Fruth is appointed to read a statement to the press and answer questions on the extent of the disaster.
	Bill Shaw, Train Master for Chessie System, arrives. Several railroad officials are now at the scene.
	Hulcher Emergency Service is called in to handle the cleanup.
	Security is now stepped up and local authorities (sheriff, city and state police) are joined by railroad police.

1:00 PM	Task force from PPG arrives and are taken to the site to make an assessment.
	Richard Fleece, Regional Manager for the Chessie System, arrives and helps to coordinate cleanup efforts. EPA, West Virginia Department of Health, and West Virginia Air Pollution Control Commission by now have contacted us by telephone.
2:00 PM	A conference is held to determine how to patch the leak. We know that all dome valves have been sheared off and that we must plug leaks and clear the atmosphere before cars can be raised. We must also be able to unload the remaining monomer.
5:00 PM	Regional Supervisor for Hulcher arrives and inspects the damaged car.
7:00 PM	Meeting held at the Point Pleasant Motor Inn to discuss progress on patching the leak, the possibility of explosion, health hazards involved, security, evacuation, etc.
	Consensus is that since all valves have been sheared, this is a unique situation.

Friday, January 9, 1981

10:00 AM	PPG states that they are beginning to fabricate a patch.
12:00 NOON	Ron Escue, an employee for Huntington Piping, is called to the disaster site; and he then takes the lead in designing and fabricating a patch.
3:00 PM	The leak from the Safety Relief on the tank car is patched. Gauge and vapor lines are also secured by the same patch.
5:00 PM	Both liquid lines are patched and the car is ready to be raised.
6:00 PM	Meeting at Point Pleasant Motor Inn to discuss progress made up to this point. Another task force from PPG's Lake Charles VCM plant arrive.

Saturday, January 10, 1981

3:00 AM - 3:00 PM	Cars are raised, set back on tracks, and moved to Pantasote's yard for unloading on Monday morning.