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FROM: R. A. Frohreich, Aberdeen, Mississippi
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DATE: December 30, 1981

SUBJECT: September Vinyl Chloride Safety Association Meeting

Notes on this year's Vinyl Chloride Safety Association meeting are attached. Please contact us if there are any questions.

Miscellaneous information gained from conversations with different attendees outside the meeting is listed separately. Please do not discuss this information with people outside our company.

R.A. Frohreich by JHM

R. A. Frohreich
Chief Process Engineer
Aberdeen PVC Plant

sight glasses
nuclear level probe
1 - clean wash (emergency) lists

John H. McCulley, Jr.

John H. McCulley, Jr.
Chief Process Engineer
Chemicals Division
Process Engineering Department

pjc
Enc
CC:
JF:RAF:CRM:PKM:AS:RAC:AWS
CWT:JPW:RH:JADe:JWW:MLA:GLF
SA:AFG:JJM:JCL:JFA:GJF:RJR
RGG:PVC Group

file VC SA

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MISCELLANEOUS INFORMATION

I. Air Products

A. Reactors

1. Their reactors have a high L/D which is roughly twice ours. They have two impellers plus a kicker impeller. From the discussion it seems their vortex is not at deep as ours. The Calvert City reactors are 24,000 gallon.

2. The reactors are clad with 316 stainless steel over carbon steel. They did not know of any problems with the cladding separating from the carbon steel. They do check for chloride cracking and have never found it in the reactors. Corrosion of the carbon steel exterior of the reactor wall in the reactor jacket has not been a problem. They have experienced cracking of the carbon steel exterior wall of the jacket which sounds similar to our jacket cracking problem.

3. They use L-10 and 11 initiators. PPG initiators are not used. They think the Noury initiator is better than Lucidol's because it has a more consistent quality.

4. They have done their own initiator relief tests and have received initiator decomposition pressure increase data from Lucidol. From this work they concluded that a four-inch rupture disc followed by a relief valve was adequate for an initiator injection pot that is "larger than 12 gallons" and in L-11 service.

5. All reactors have a sight glass port and a light port on the top head. The outside operators use the sight glass to confirm that the reactor is empty on dump and to watch the reactor level on charge to prevent over charging. They said the reactor level on charge was watched only before the "final water" is added. The Pennsacola reactors were not originally equipped with sight ports but they have since been retrofitted. They have never had a sight glass blow out. They can see the agitation and condenser reflux during the reaction.

6. Fluid Bed Dryer and Dried Resin

   a. Their fluid bed dryers have to be controlled carefully to avoid static. They have found static to be more of a problem with a fluid bed dryer than with a rotary dryer. They have had customer complaints about static and wet resin. They hold loaded railcars for several days and then check the outlets for wet resin. From their comments it seemed that they do not do anything special to prevent wet resin or control static.

I. Air Products (Continued)

A. Reactors (Continued)

6. Fluid Bed Dryer and Dried Resin (Continued)

b. They have heard that Georgia Pacific has continued to have chloride cracking problems in their NIRO fluid bed dryers even after controlling the pH of the slurry feed. They said Georgia Pacific has one heat exchange bundle crack a month. A replacement bundle costs roughly $20,000.

c. They use both Bird and Krause-Mafei centrifuges. The wet cake water content is similar for both and ranges between 20 and 25 percent.

d. The back-mixed section of their fluid bed dryer is roughly 8' x 17' and it uses steam in the heat exchanger bundles. Its capacity is approximately 19,000 pounds per hour.

e. They have tried using a Unidyne moisture analyzer at the Pensacola plant to monitor the air leaving the back-mixed section. It uses instrumentation to monitor the cloud point on a mirror. It was installed downstream of the cyclone. They said it worked okay until they had a dryer upset causing the air stream humidity to go to 100 percent, which led to resin being carried through the cyclone and into the instrument.

f. They are considering using an infrared moisture analyzer to monitor the dried resin and improve dryer control.

II. ICI

A. ICI has tried a number of different types of level probes in PVC reactors and have concluded that the nuclear radiation type is the best. The radiation probes are used for both high and low-level indication and are very reliable. Tom Moore of Tenneco exchanged information on nuclear probe reliability and concluded that the ICI probe (made by ICI) is more reliable than the Ramsey Engineering probe used by Tenneco. The low-level indicator is located 18 inches above the low point of the bottom head.

B. They have found that the radiation level probes also work well as pressure-indicating instruments. They are capable of sensing increased pressure via the increase in vapor density. In fact, the radiation

II. ICI (Continued)

probes are used as a backup to their normal pressure transmitters on the paste PVC reactors. They find there that the radiation probes alarm on increasing pressure roughly one minute before the pressure transmitter responds.

C. They have roughly one premature rupture disc failure a year on 72 small reactors. The rupture discs are replaced after every 100 batches.

III. BFG

A. They have had problems with premature failure of rupture discs on PVC reactors. They use ~four-inch BS&B prescored reverse buckling discs rated at ~180 psig. They had BS&B cycle test a new disc and it did fail prematurely. They now have BS&B cycle test one disc from each lot at an added cost before accepting the lot. The reactor discs are replaced every four months.

Mr. Bernel Sawyer of BS&B confirmed that two discs from each lot are cycle tested for BFG. The discs are cycled between 85 to 90 percent of set pressure and full vacuum for 3,000 to 5,000 cycles. However, he said they have never seen prescored reverse buckling (S-90) discs fail the cycle test. The cycle testing started some years ago when BFG was using a special BS&B disc (a GFN model) developed for their Avon Lake plant. This disc was developed to be resistant to the high pressure BFG reactor cleaning system.

The water blasting system damaged S-90 discs. The GFN disc was scored on the process side and was concave toward the process. They did find premature failure of a GFN disc in a cycle test. Since then BFG has apparently stopped routine water blasing and has returned to the S-90 disc. However, they have retained the cycle test requirement.

The BFG discs are four inch and are rated at 196 psig.

The cycle test costs $500 plus the cost of two discs.

B. The Plaquemine plant had a flashback in the vent line from the recovery system to the VCM incinerator. The flame front stopped at the first flame arrestor which was 12 feet from the incinerator. There is a second flame arrestor at the recovery unit. Both arrestors are mechanical types. The flashback was only noticed when the paint on the line began to smoke and peel.

C. Construction on the new Convent, Louisiana PVC plant has been stopped. Their corporate people think the economy may be bad for the next three years.

D. Both BFG and Diamond Shamrock have automatic resin bagging systems.

IV. Georgia Pacific

A. Their PVC plant is now running closed mode - with no reactor opening losses.

B. They have had layoffs due to the weak PVC demand.

V. Ethyl

A. The Baton Rouge plant requires the top operator to connect the unloading hose to the railcar and open the valve. A fresh-air mask is required. Their monitoring does not show high VCM exposures there. They think hammer unions are used.

B. They are very concerned about a VCM release from a broken hose or bad hose connection. The unloading hoses are stainless steel corrugated lines covered with a stainless steel wire braid. That size hose is only used in the unloading area to help prevent mixups with hoses for other services.

VI. PPG

A. The flammability of the vent from the direct chlorinator is monitored. The reactor vapor space is purged with natural gas.

B. An explosion occurred in a cyclone in the off-gas section of their oxy unit. No one was injured although there was some equipment damage. Normally they operate ethylene rich in the off gas. In a startup the vent gas went through the flammable zone and into the ethylene lean area and an explosion occurred. They do not computer monitor the approach to flammability in the oxy unit.

JHM-pjc

VINYL CHLORIDE SAFETY ASSOCIATION MEETING REPORT

SEPTEMBER 24 AND 25, 1981

Doug Frey, a Diamond Shamrock PVC Plant Manager, announced that there are now 46 companies in the VCSA. Twenty-one of those companies are located outside the United States. New members this year include Iraq PVC, Solvay, and Tallyrand Chemical.

I. True Confessions/Major Incidents

A. Furan Process Sewer Explosion - J. McCulley

The VCM plant's process sewer drum explosion in the Spring 1978 turnaround was briefly discussed. The process sewer system was installed to collect VCM and EDC containing water streams from equipment clearing, etc. to reduce employee exposures and process area emissions. Furan sewer lines were installed that drained to a below grade Furan drum. Liquid was pumped from there to a smaller above-ground drum, and from there it was pumped to the water stripper. The two process sewer drums were vented to the plant's atmospheric oxy vent stack.

The plant had used this new process sewer system to handle the flush water from two or three light end column washes. The sewer drums were vented through an overflow line to T-2, a nearby water pit, since the oxy vent header tie-in had not been made. The tie-in was completed during the turnaround and the sewer drum system was then vented to the vent stack.

An explosion occurred in the top portion of the above-ground sewer drum during the dump of the light ends column wash water. Although people had been around the sewer drum just prior to the explosion, none were present at the time of the explosion and no one was injured. One large piece was blown 200 feet down the road and another fell through the roof of the maintenance shop. One person reported seeing a flash but this was not confirmed. The board-mounted level indicator on the top sewer drum dropped from a 70-75 percent reading to zero percent suddenly just before the explosion.

An extensive investigation of the incident was made. This included numerous analyses of material left in the sewer system and of the streams draining to it at the time, and plant measurements by SWRI of the potential for static discharge in the Furan headers. Only trace quantities of unstable compounds were found in the sewer system. The SWRI measurements indicated that static discharge in the headers should not be a problem but that it could occur in a Furan drum under the proper conditions. The Furan drum internal surface and inlet nozzle were not grounded with special grounding probes. The contractor had grounded the drum with a cable and ground rod as if it were made of a conductive material.

1. True Confessions/Major Incidents (Continued)

A. Furan Process Sewer Explosion (Continued)

The plant has taken the following corrective measures.

1. The top sewer drum was replaced with a carbon steel, grounded drum. A pH control system was added to minimize drum corrosion.

2. The liquid inlet nozzle on the steel drum is below the normal liquid level to prevent static discharge from charged, falling liquid.

3. The vapor space of the drum is nitrogen purged.

More information on the different plant, R&D, and SWRI investigations is available.

B. Control Room/Laboratory Explosion - John Oubre, Dow

At 7:01 a.m., May 27, 1981 an explosion occurred in the laboratory portion of the combination control room/laboratory building at a Dow VCM plant in Saskatchewan, Canada. The explosion was caused by VCM leaking into a sewer and then backing up into the laboratory.

The plant has two caustic pots in parallel which remove trace amounts of HCl from the VCM product. Excess liquid caustic drains to a caustic drum, and from there to the sewer on level control. One pot was in service and the other out of service. The one out of service had been washed out the day before. A closed valve leaked VCM into the pot that was out of service. The VCM then entered the caustic drum and was discharged to the sewer. The flow rate was very high. VCM spurted from the floor drain under a safety shower in the lab and in other areas of the plant. Six flammable hydrocarbon detectors in the process area were triggered. The explosion occurred in the laboratory while the operators were responding to the alarms.

Five people were in the control room and one was in the air lock entrance to the control room. No one was in the lab. Five of those people required hospitalization, primarily due to burns. All of them have since returned to work.

I. True Confessions/Major Incidents (Continued)

B. Control Room/Laboratory Explosion (Continued)

The equipment in the control room/laboratory building was not explosion proof. The building was designed to withstand an external blast. Apparently this aggravated the damage inside the building by partially confining the explosion. The explosion blew out a 23 x 40 foot section of the reinforced concrete roof over the lab. This roof section was nine inches thick and weighed 90,000 pounds. It then fell back into the lab and destroyed what was left of the lab. A concrete block wall between the lab and the control room was destroyed and the adjacent control panel was shifted twelve feet. The wall and panel shielded the employees inside the control room. The doors were blown off the building but the external walls remained intact.

The lab shower drain did have a liquid seal and it probably did contain water. Dow speculates that the flashing VCM entering the sewer at the caustic drum may have frozen water and plugged the normal outlet end of the sewer. It would then back out the up-stream sewer inlets.

To prevent this from happening in the future, they have changed their vessel isolation procedures to include blinding to prevent one leaking valve from causing this type of situation. They also installed a separate sewer for the lab.

The valve that leaked was a metal-to-metal seated ball valve.

C. Nitrogen Inhalation Incident - Glen Shaaf, BFG

A Senior Technician at BFG's Heddricktown mass PVC plant was overcome by nitrogen while trying to replace the packing on the dump end of the reactor agitator. Initially he tried to remove the packing from outside the reactor by pressuring the packing gland with 50 psig of nitrogen. The packing did not come out, so he vented the nitrogen to the atmosphere and decided to remove the packing from inside the reactor.

He isolated lines to the reactor and locked the agitator breaker. The top manhead was removed and he climbed in the reactor. The reactor had been air purged before this maintenance work started. An air mover was not used while he was inside. He did carry the BFG automatic watch unit that flashes a light that must be acknowledged by the mechanic in the vessel every three minutes or an alarm sounds outside.

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I. True Confessions/Major Incidents (Continued)

C. Nitrogen Inhalation Incident (Continued)

Three minutes after entering the alarm sounded. However, the outside area operator just reset it and did not investigate. He did check the permit which said the oxygen content of the air in the reactor had been checked. When the alarm sounded again, he checked the reactor and could not get a response. Two air line respirators were put in the reactor and the mechanic was given mouth-to-mouth resuscitation until his breathing resumed. The operator then pulled him out of the reactor. The plant first aid team started him on oxygen and he regained consciousness on the way to the hospital. He was released the next day.

An investigation determined that the reactor had not been cleared of nitrogen before entering, the reactor atmosphere had not been tested, and the mechanic did not wear a respirator and safety harness as required. The two men involved had 10 to 12 years experience with BFG and were good employees with good safety records. Both were given severe disciplinary action. All plant employees were told that violation of safety procedures could lead to termination.

A subsequent face-to-face survey found the following:

1. There was an insufficient awareness of the hazards of nitrogen.

2. Employees questioned why they were required to check for oxygen since they are required to wear a respirator in the reactor anyway.

3. The oxygen concentration was checked only infrequently.

4. The entry permit was often filled out before inspection.

5. Things in general are not double-checked as required.

BFG decided to try to make the operators more aware of the reasons for safety precautions by having them help prepare the procedures. They also encourage employees to police each other.

I. True Confessions/Major Incidents (Continued)

D. Lauryl Peroxide Fire - Glen Shaaf, BFG

A lauryl peroxide (LP) flash fire occurred inside an open batch reactor at BFG's Plaquemine, Louisiana mass PVC plant. Before charging a reactor, the reactor jacket is cooled to 80°C and LP initiator (a solid) is dumped into the reactor through a top manway. After adding the LP, the operator decided to replace the "O" ring gasket on the manhead. Several minutes later flames suddenly shot 15 to 20 feet out of the manway. The operator was bent over the manway at the time. He received burns over 20 percent of his body and was hospitalized for five weeks. His safety glasses were charred by the flash. The fire quickly self-extinguished.

An investigation determined that:

1. The reactor had not been cooled down as required by the board operator.

2. The hot reactor caused the initiator to decompose and the decomposition gases ignited.

3. The flash lasted only a few seconds.

4. VCM vapor was not involved.

5. The board operator had made the same mistake on the previously charged reactor. However, the charge operator had not paused to replace the "O" ring after adding the LP. The LP must have flashed because the reaction did not start and, after recovering the reactor's VCM, they found the reactor walls covered with soot.

The control room operator, who had eight years of experience, was given time off. The operating procedure was changed to require the board operator to cool the reactor to 40°C and then announce the temperature of the reactor to the outside operator. The outside operator must acknowledge that before charging the LP.

In the past they had treated LP as a relatively stable initiator. However, in a lab simulation of this incident they found that the LP melted rapidly and that the fumes from decomposition could self-ignite.

I. True Confessions/Major Incidents (Continued)

E. Decomposer Explosion - Ron Kaminski, BFG

A decomposer column at BFG's Convent, Louisiana, EDC plant exploded during start-up operations. The top three or four feet of the column was blown off. Fragments ruptured an EDC line which caught fire. Two people were injured.

Herm Waltemate of BFG had been scheduled to discuss this incident but was called out of the country. Ron Kaminski, a BFG PVC production manager, discussed the incident in his place. However, he was not familiar with the EDC process and could not answer many questions. His information on the incident is followed below by additional information from Waltemate subsequent to the meeting.

1. Ron Kaminski's Version

The decomposer column processes waste liquids and gases from the EDC plant. The plant was in start-up operations at the time of the explosion and process operations were not stable. There was some oxygen present. The decomposer was operating at a high draw-off rate. They had had problems with a blown rupture disc on the decomposer prior to the explosion. A level alarm at the top of the decomposer had been removed for repairs. The liquid level in the column had fallen. Suddenly there was an explosion inside the decomposer. From pictures of the column afterwards the explosion must have been quite violent. The column dimensions were roughly 4 x 15 feet.

The explosion was caused by the decomposition of unstable gases that had accumulated in the top of the column. They think the unstable gases were nitrogen trichloride or chlorine oxide.

BFG took the following corrective action:

a. The vessel purging and vent collection systems were modified to prevent gases from accumulating in equipment head space.

b. Waste water streams containing certain chemical compounds were re-routed.

I. True Confessions/Major Incidents (Continued)

E. Decomposer Explosion (Continued)

1. c. The decomposer piping was changed to make it operate liquid full.

d. In similar upsets streams going to the decomposer are blocked in.

2. Herm Waltemate's Version

At the time the plant was having considerable problems controlling liquid level and pH in the decomposer which are the two most important variables in safe decomposer operation. They were also having temperature control problems. The column feed entered at the top and exited from the bottom. The nozzles were arranged this way because they were concerned about sludge accumulation in the column. The column contains trays of some sort; he thought they were sieve trays.

The column was processing just liquids at the time. They think the upper third of the column was filled with vapor. There was EDC and some oxygen in the column. They found EDC on some of the trays after the explosion. The oxygen is thought to have been generated by a reaction between the sodium sulfite that they add to the column (apparently to control hypochlorite) and the valadium stabilized titanium wall of the decomposer column.

Their calculations indicate that 62 pounds of nitrogen trichloride, or 60 pounds of chlorine oxide, or 12 pounds of EDC vapor in oxygen would be required to cause such an explosion. They suspect that decomposition of a smaller amount of either nitrogen trichloride or chlorine oxide then ignited EDC vapors to cause the destruction. They think the explosion would have been less violent if EDC had not been present. One confusing point is that Herm said the column was operating at 235°F and 120 psig, that is well above the vapor pressure of EDC.

Herm said that both of the unstable gases can be formed in the decomposer when they have both pH and temperature control problems. He thought the ignition source probably was chlorine oxide.

He said the two most important changes made to prevent a reoccurrence were the elimination of the vapor space and the installation of a positive pH control system.

I. True Confessions/Major Incidents (Continued)

F. Reactor Lockout Device Report - Glen Shaaf, BFG

After hearing Great American's discussion in last year's meeting of a fire caused by an operator opening a valve on the wrong small PVC reator, Glen decided to review BFG's small reactor release incidents for the past ten years. Excluding relief valve venting, he found the following:

Batch Step	Number of Times A Valve Was Manually Opened by Mistake
Charge	19
Reaction	12
Blowdown	17
Total	48

To help prevent this from happening, the blowdown drum connection was hard piped to each reactor. Also a mechanical/electrical valve interlock system was designed for each small reactor.

The mechanical portion of the interlock system is made by Best and costs around $2,000 per reactor. It consists of a key box and separate locks for the manhead, drain valve, and charge valve. It works as follows:

To Charge - The manhead must be closed and locked and its key removed and inserted in the lock box.
- Same for the drain valve.
- Charge valve key can only be removed from the lock box when the first two keys are in the box. The charge key must be inserted in the charge valve lock before the valve can be opened.

The electrical portion consists of input to the lock box from a reactor pressure transmitter. None of the keys can be removed from the lock box if there is pressure on the reactor.

John Vaughan of ICI commented that they have used a similar device made by Castell for approximately 20 years. They have found it to be very reliable. It does require maintenance and the locks must be well fitted. They have used them on PVC reactors and in other areas. For example, they are used at VCM truck loading

I. True Confessions/Major Incidents (Continued)

F. Reactor Lockout Device Report (Continued)

stations to prevent the truck from trying to leave with the hoses connected. This is done by either locking a boom in front of the truck during loading or by locking the truck ignition off and combining that lock with locks on the hose connections. These mechanical interlocks are also used for maintenance shields on equipment and in a number of other areas.

Ben Reynolds of PPG reported that their Lake Charles VCM plant has adapted a KIRK lock system for similar uses.

G. Polypropylene Plant Fire - Darwin Rhoads, Tenneco

Darwin reported an unofficial account of an explosion at an Amoco polypropylene plant. His information came from contacts within Amoco and other sources. An official account has not been released by Amoco.

The explosion occurred in a 270 MM pounds per year grass roots polypropylene plant built in 1961. There were three parallel reactor trains separated by 50 feet. Each contained a 10 M gallon reactor. The explosion was caused by mechanics mistakenly removing the top flange of a Tufline valve. The plug blew out, which then allowed the reactor to depressure propylene and hexane in the unit. The blast resulting from the ignition of that vapor cloud killed five and injured 29 plant employees. The explosion blast damage was primarily in one direction, like a blast from a shotgun. The polypropylene finishing building was in the path of the blast wave and it was destroyed by a polypropylene dust explosion. A large resin silo collapsed and burned. Windows were rattled ten miles away in the direction of the blast. Propylene railcars only 250 feet off to the side of the reaction area were not damaged.

Two or three of the people killed were in the reactor area. Several people were killed in the control room which was across a plant street from the reactors and on the back side of the blast pattern. The control room was not blast proof. It was made of concrete blocks and had windows. A heavy air conditioning unit on the control room roof fell into the control room.

I. True Confessions/Major Incidents (Continued)

G. Polypropylene Plant Fire (Continued)

The plant had separate manually-activated deluge systems for each of the three reactors. The deluge water was supplied by an electric firewater pump. The reactor depressured for approximately two minutes before the vapor ignited. They do not know the source of ignition. The operators had started the deluge on the reactor that was venting but not on the other two reactors. Paint in the deluged area was not even burned whereas equipment in the other two reactor lines was charred and lines were warped. They credit the deluge with minimizing damage in the reactor train where the accident occurred.

The force of the blast snapped an eight-inch riser in the deluge system and knocked out a transformer which shut down the deluge pump and boiler. They had a 1,500 GPM gasoline-engine-driven firewater pump but they could not get any firewater pressure due to the broken eight-inch deluge line. Damage was extensive ($65 million). Amoco decided not to rebuild the unit.

They think the blast wave produced a "several psi pressure wave. The main reactor column was shifted. The control room could only withstand a "0.1" psi pressure wave. John Barr of Air Products said their calculations say that an unconfined VCM vapor cloud explosion can develop five psi. Diamond Shamrock designs their control rooms for three psi. Dow designs control rooms for four to four and one-half psi.

Factors that contributed to or caused the accident were:

1. The Tufline valve was of an old design where the valve actuator mounting assembly was bolted to the valve body with the same bolts used to hold the top flange of the valve on the valve body. The mechanics mistakenly removed those bolts rather than the bolts holding the actuator to the mounting assembly. Tufline had redesigned their valve prior to this accident to eliminate this potential problem, but there were a number of the older valves still in use in the plant. The mechanics were removing the actuator to confirm that the valve was closed before attempting to blind its downstream flange. Tests have shown that if the top flange is removed by mistake, the valve plug does not blow out immediately. A drawing of this type valve is attached.

I. True Confessions/Major Incidents (Continued)

G. Polypropylene Plant Fire (Continued)

2. Only one of the mechanics was experienced. The other three were "drafted" because there were no volunteers since the work started just before a World Series game.

3. The mechanics were working much faster than normal in order to finish in time to see some of the game.

4. The maintenance job had last been done several years ago so it was not a routine job.

A similar valve accident occurred at a Pemex VCM tank several years ago.

II. Small Reactor Safety Survey Report - Jerry Brumbaugh, General Tire

This survey and three others covered later on are based on questionnaires mailed to the U.S. members. Twenty responses were received. The survey results are attached.

Some of the more interesting results are listed below.

A. Most plants measure reactor charge water by flow meter, VCM by either meter or weight, and suspending agent and catalyst by weight.

B. Twelve plants indicated that reactor relief valve nozzles are inspected at least every three days.

C. Two plants do not have a reaction shortstop system.

D. Most plants rely on operator injection of the shortstop.

E. Seventeen plants do not distill recovered monomer.

F. Polyperoxide formation in recovered monomer is controlled by a short retention time, an inhibitor, basic pH control, and/or by keeping oxygen levels low.

Diamond Shamrock commented that Edmont-Wilson makes a light-weight (one pound) passive-oxygen monitor that costs $300-$400. However, They find that they are not too rugged. They use this meter, too.

Ten plants use relief devices to protect remote operated pumps.

III. OSHA/EPA Topics

A. VCM EPA Regulatory Status - Gary Baise, Law Firm of Beveridge and Diamond

The EPA has investigated the public health aspects of the present status of compliance with the VCM standard. They think that in a general sense there is not a health problem. However, they probably will make some changes to the standard. TRW's Phase I work pointed to some areas needing changes and these will be pursued in Phase II. Gary said he knows people within the EPA who think that the VCM industry has done enough already and who do not support the EDF. These contacts have provided him with some information on what may happen to the standard which he discussed with us. He did ask that we keep the following information to ourselves.

He thought the June 2, 1977 amendment will be withdrawn. Instead EPA will issue an Advanced Notice of Proposed Rulemaking (ANPR) which will then be followed by a proposed regulation and then the final regulation. He did not know when the ANPR will be issued.

He thought the EPA is no longer supporting a goal of zero emissions. There is concern within EPA about EDF's reaction.

His information on changes that will come from EPA's Phase II work on the standard is outlined below. Their premise is that they want to make certain that plants are using best available technology (BAT). They will go beyond BAT only if they determine the public health is not protected.

1. Ten ppm VCM in Vents - The EPA does not see any hazard at staying at ten ppm so this may not be changed.

2. Oxy Vent - The EPA will investigate lowering the emission limit. It may be dropped to five ppm.

3. Reactor Opening Losses - He said the EPA probably will not change it because there is no new technology to use.

4. Stripping - He has been told that the EPA cannot adequately define a new resin to insure that all new resins are stripped to lower levels as proposed in the amendment. Therefore, they will leave the stripping limits where they are now. (This is difficult to believe.)

III. OSHA/EPA Topics (Continued)

A. VCM EPA Regulatory Status (Continued)

5. Fugitive Emissions - There is too much variation in the quality of leak detection plans now being used. The EPA will use the better plans as its standard and ask plants with less complete or vigorous plans to improve theirs.

6. Relief Discharges - The EPA will try to better define terms, and may list examples of preventable and nonpreventable discharges. They realize they have an enforcement problem.

7. Malfunction - If a plant shutdown caused by malfunction of an emission control system will emit more VCM than continuing to operate the plant while repairing the emission control system, they may allow the plant to continue to run.

8. Reactor Opening Loss Testing - Many plants have gotten waivers for alternate methods of compliance that do not require sampling and analysis of the reactor vapor space. He expects the EPA to acknowledge that such waivers are acceptable.

9. Leak Monitoring - The EPA may drop the requirement for fixed-point monitoring and instead require that leak monitoring be done only with portable monitors.

10. Test Method 107 - The EPA probably will incorporate some industry suggestions. They will consider simplifying the analysis.

11. New Sources - They probably will not regulate PVC fabricating plants but they may consider regulating plants using VCM to produce pesticides and trichloroethylene.

12. Nonplant Transfer Facilities - They may regulate ships, trucks, loading and unloading facilities and other transportation equipment.

13. Land Fills - They probably will not attempt to regulate land fills because they have found VCM emissions from them to be insignificant.

14. Offset Policy - He thinks there will not be an offset policy.

III. OSHA/EPA Topics (Continued)

A. VCM EPA Regulatory Status (Continued)

When asked, Gary said that he knew of three companies that have received Section 114 letters on relief discharges. The Justice Department has been referred seven companies for civil action and one for criminal action. Air Products and Tenneco are involved in litigation now. He cautioned companies to be very careful in responding to Section 114 letters for you can "hook yourself if you are not careful."

He expects a separate Phase I document on the results of their investigation of the public health aspects of compliance with the present standard.

B. Regulatory Update - John Barr, Air Products

John reviewed the status of the different OSHA, FDA, and EPA regulations briefly. The results of a member survey on OSHA and EPA inspections are attached.

OSHA's carcinogen policy is under review. It will probably be two or three years before a carcinogen policy is proposed. There must be a significant health hazard before OSHA can regulate.

C. PVC Dust Exposure - John Vaughan, ICI

ICI started a major study of 800 of its employees to determine if there are health hazards associated with PVC dust exposure. A temporary report was prepared; then 300 additional employees were included in the study. The final report concluded that exposure to PVC dust alone (and not in combination with smoking, etc.) is not a health hazard. An abbreviated report is attached.

A copy of their final report can be obtained by writing the Institute of Occupational Medicine and Health in Edinburg.

D. Hazardous Materials Notification - Harold Dubec, Hooker

The Burlington Hooker plant purchased shortstop technology from another company. The Hooker management talked to some of the plant people to explain what they were doing. However, when the shortstop chemical was brought into the plant, the union walked out. At first the union said the walkout was primarily over employee relations but safety and environmental concern was also mentioned. One day later the prime issue was the safety/environmental concern about the shortstop chemical.

III. OSHA/EPA Topics (Continued)

D. Hazardous Materials Notification (Continued)

The plant management could have avoided the problem by taking more time to talk to the employees. The plant shortstop injection system was not installed nor were operating manuals prepared when the shortstop was received. They were not ready to discuss the shortstop system when the shortstop arrived.

Many government agencies sent inspectors to the plant. For example, five OSHA people, three EPA people, and six outside consultants were all at the plant on the same day. OSHA refused to enter the plant during the two-week walkout. This activity resulted in hazardous waste and PCB violations.

A Philadelphia organization was behind a lot of the trouble. That organization receives grants from OSHA to educate union members about health problems.

The plant management is now talking to the employees to make sure they understand what is being done and why before a change is made.

In response to a question, 13 plants indicated they have a formal system of advising the local police and fire departments of hazardous materials stored in the plant. Thirteen others have an informal system.

E. OSHA Inspection - Dave Lull, Diamond Shamrock

Diamond's Delaware City, Delaware PVC plant had an unannounced OSHA inspection on February 4, 1978. One of the two inspectors was female. Diamond had a company policy excluding fertile women from working with VCM. Therefore, they would not allow the female inspector to enter the plant. After much argument and six weeks later, the inspector was allowed to enter the plant. They think; "she was mad and out to get them, and she did a fine job of it." In a September closing conference, there was no mention of a citation although some problems were discussed. The events that followed are outlined below.

October 4, 1979	Two serious and five willful citations were received with a total fine of $52,040.
October 8, 1979	Hooker filed notice of contention.
October 17, 1979	They met with the Regional Administrator. Two citations were dropped, two were reduced. The total fine was reduced to $14,320.

III. OSHA/EPA Topics (Continued)

E. OSHA Inspection (Continued)

November 13, 1979	Hearing with the review commission with more negotiating with OSHA.
April 2, 1980	Final extension for time to respond. Two issues were respiratory protection and willful VCM exposure. OSHA said the plant could not be in compliance with the OSHA VCM standard when their continuous monitoring system alarm was set at five ppm. OSHA wanted the plant to alarm and require respirators at one ppm. The plant started ultrasonic cleaning of these respirators.
April 1, 1980	Diamond Shamrock filed a motion denying each and every allegation and asking for a more definitive statement.
April 16, 1980	The motion was rejected by a judge.
July, 1980	Resumed negotiating with OSHA again.
August 5, 1980	Final settlement. The fine was reduced to $4,720. They still alarm at five ppm. Their original three or four-page respiratory protection manual was upgraded to a 32-page manual with information on each respirator.

Three PVC plants require respiratory protection at one ppm. All negotiations were with the Regional Administrator.

IV. Operator Training

A. Operator Training Survey Report - Doug Frey, Diamond Shamrock

Thirty-two plants responded to the operator training questionnaire. The survey is attached.

IV. Operator Training (Continued)

A. Operator Training Survey Report (Continued)

Major conclusions were:

1. Almost all plants have formal training programs.

2. Most have full-time people for training.

3. Most people responding want to increase their training effort.

B. Implementing an Effective Plant Safety Program - Steve Brouillard, Diamond Shamrock

The Independence VCM plant started up in April, 1978. The plant was designed to comply with the OSHA and EPA VCM regulations. There are 157 employees, all nonunion. The plant has had two lost-time accidents shortly after start-up. One employee slipped on a ladder and another was hurt by stepping on a rock. Since then, the plant has operated over 1,200 days (1 MM + manhours) without a lost-time accident. There were six reportable accidents in that period.

The safety department consists of a Loss Control Supervisor and a Safety and Health Engineer. Their responsibilities are safety/fire/medical and regulations/industrial hygiene, respectively. They report to the Employee Relations Supervisor, who reports to the Plant Manager.

The plant was a grass roots plant. It was staffed with people that had no prior operating experience (with the exception of the top operators). The new people had a higher than average intelligence level. Now they are finding that some of the employees are becoming bored with their work and are leaving to go back to college, etc.

Important factors in their successful safety program are:

1. Management supports the safety program, from the top man down. This support is a day-to-day, active thing.

2. Workers know that procedures are to be followed and that it is their responsibility to report work that does not follow them.

IV. Operator Training (Continued)

B. Implementing an Effective Plant Safety Program (Continued)

3. There is a lot of interaction between people.

4. Have monthly safety meetings which emphasize safe work procedures by going out in the plant and discussing the proper procedures for a particular job. Films are de-emphasized and are used primarily for training.

They are finding it difficult to maintain peoples' interest in safety when the plant runs safely for a long time. They are planning to repeat the plant-wide training done before start-up to maintain their employees' interest and to train all the new people that have been hired. They do have a formal training supervisor. They also test after training. A survey of the people at the meeting showed 11 plants tested after training.

John Vaughan of ICI commented that they use a system where the shift supervisor checks off the duties each man has done each day. If a man has not done a job in three months, he is disqualified from doing it until he is retrained.

C. Video Tape Demonstration, OSHA VCM Standard - John Barr, Air Products

Air Products expanded their video tape group. That group got a contract from OSHA to prepare an OSHA VCM standard training film for use in training plant operators. They prepared a script, and OSHA approved it before Barr or others in Air Products PVC plants found out about it. They wanted to make a lot of changes to the script but all changes had to be approved by OSHA. The video tape has now been completed and is in OSHA's possession. The tape was shown to the VCM Safety Association. It is well made.

V. Safety Systems Reports

A. Computer Safety Survey Report - Jim Gabbett, Georgia Pacific

A copy of the computer safety survey is attached. Only six questionnaires were returned.

V. Safety Systems Reports (Continued)

A. Computer Safety Survey Report (Continued)

Three types of computer systems are used. They are:

1. No manual backup.

2. Partial manual backup.

3. Total analog backup.

Benefits listed for computer control were:

1. Header monitoring.

2. Temperature/pressure monitoring.

3. Operations monitoring.

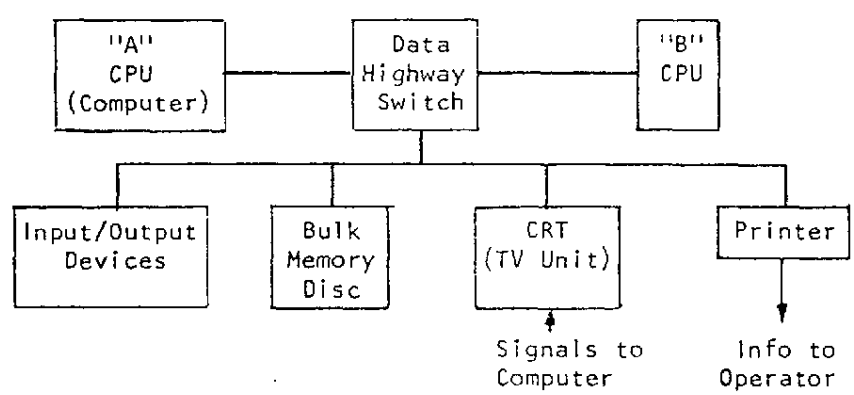
4. High reliability (98%).

5. Improved product quality.

A disadvantage is the higher maintenance cost, expecially with ancilliary devices.

Gabbit outlined the Georgia Pacific Plaquemine PVC plant computer system. They don't consider their computer system proprietary and are willing to discuss it with other producers.

They use a Taylor system organized as follows.

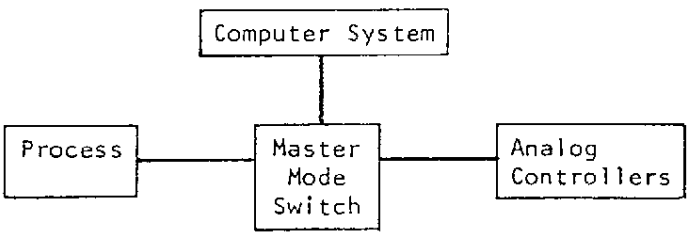


V. Safety Systems Reports (Continued)

A. Computer Safety Survey Report (Continued)

Their system has a tremendous number of wire connections which give them problems.

Georgia Pacific also has conventional analog controllers as backup for the computer. They find they cannot run as fast on analog control as with the computer with the main problem being maintaining calibration of the analog instruments while they are out of service. There is a master mode switch used to switch signals from the computer system to the analog controllers which has given them some trouble.



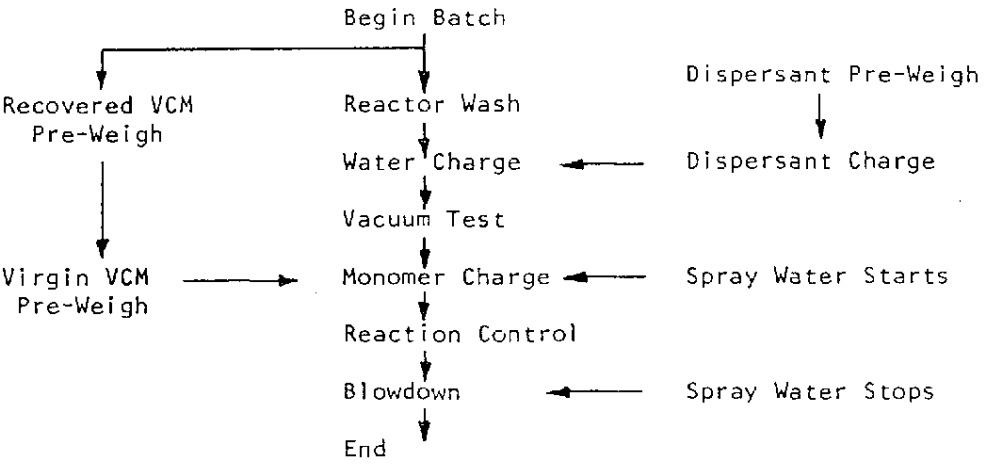
Once (Black Thursday) they switched to the manual mode to do some computer maintenance. All valves opened and all equipment started. Reactor number 4 was open. VCM was pumped to that reactor at the normal rate of 6,000 pounds per minute. They switched to a panel mode and started closing and shutting down the equipment. Then the malfunction occurred again. They then shut down the computers and reclosed the valves. Their reports determined that the trouble was in the master mode switch.

Another company's computer system (also Taylor) had a faulty charge card which opened the VCM valve on an open reactor but did not start the charge pumps.

The Georgia Pacific reactor cycle is as follows.

V. Safety Systems Reports (Continued)

A. Computer Safety Survey Report (Continued)

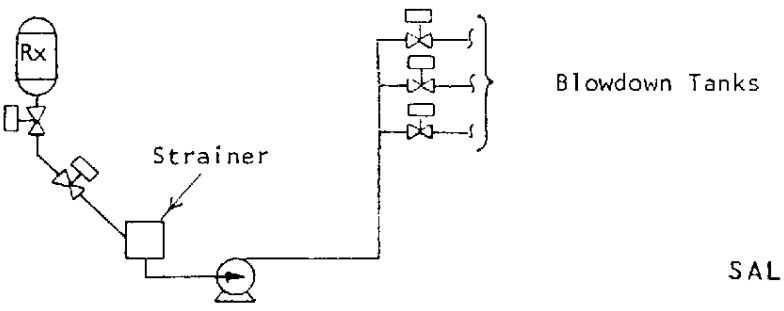


The original system required the operator to start the cycle and then the computer controlled the rest of the batch sequencing.

The have 12 reactors. Typical cycle time is 6 hours and 20 minutes. Their product temperature is 59.8°C (140°F).

They operate with two people on the CRT at all times. They are working at reducing the alarm information. They find at maximum production the computer alarm printout is voluminous. They think it is good to have important information printed in red.

It is possible for an operator to override a signal and procede with the batch sequence. Also they do not have secondary measurement devices on charge quantities. The reactor dump valve is not computer operated.



V. Safety Systems Reports (Continued)

A. Computer Safety Survey Report (Continued)

An operator tried to dump the wrong reactor but the computer would not allow the dump valve to open. The operator thought the computer system was malfunctioning, so went out into the process and shorted out the transducer. He then went back to the control room and dumped the reactor. The reaction was one hour away from completion. The flashing VCM blew the top of the dump strainer 50 feet and it bent the I beam it hit. No one was hurt. They are very concerned about this happening again and have installed lockout systems on some I/P transducers.

Georgia Pacific decided to install analog backup controllers in their recent expansion. The "push button" for manual operation of the valves are on the CRT and not on the semigraphic.

John Vaughan said ICI has used computers for many years. They handle software changes the same as equipment changes. A formal review procedure is used to make sure everything is considered. Their latest plant was built with analog controller backup but they now wish they had not. The computer system has been down for only 42 minutes in 18 months. ICI is also working to program a "phantom" reactor into their computer system for use in training operators.

B. VCM Safety Condensation System - Bernard Terweisch, Chemische Werke Huls

Huls 200 cubic meter reactors vent on high pressure to a relief system that contains a large knockout pot, (130 cubic meter), sloped VCM condensers, and a condensed monomer receiver large enough to hold the contents of two reactors. There are three reactors and two relief systems; one relief system serves two reactors and the other just one.

A copy of Terweisch's talk is attached.

Since start-up of the relief system, they have had to make full use of it only once during a power failure. The reactor relief valves have never opened during this period. The system is designed to work without any energy input. There is no requirement for electricity, air, pumped water, etc. Valves are operated on air from a bottled air reservoir.

V. Safety Systems Reports (Continued)

B. VCM Safety Condensation System (Continued)

They have conducted a lot of blowdown trials with their blowdown system. They do not experience any resin carryover.

The Huls relief condensation system is patented in the United States (No. 4004880, January 25, 1977) and is available for licensing.

C. Compound Ignition Hazards - John McCulley

The exothermic decomposition of PVC and an explosion and fire in a Stauffer fluid bed dryer involving that were discussed. Refer to Conoco research report No. 1001-1-1-81 for more information.

John Barr mentioned that he has seen copolymer decomposition on the steam coils of a rotary dryer. The steam was at 140-150 psig. They found soot and HCl in the dryer exhaust. They shut the dryer down, looked inside, and found glowing charcoal like clumps on the steam coils.

D. VCM Tank Car Wreck - Everson Weekly, Pantasote

Several PVC and VCM (PPG) cars were derailed near Pantasote's Point Pleasant, West Virginia, PVC plant. The wreck occurred near a navigable waterway and near city water wells. The wells were turned off to avoid ignition. Local people thought the wells were turned off because the ground water had become contaminated.

The top shield and all valves were sheared off one VCM car. The relief valve connection continued to leak. A cloud of VCM accumulated. All the excess flow valves checked, although one did leak briefly in a low point of a nearby corn field. Everyone within one-half mile radius of the wreck (only three or four families) was evacuated. Before the car was secured, two-thirds of the car contents was lost.

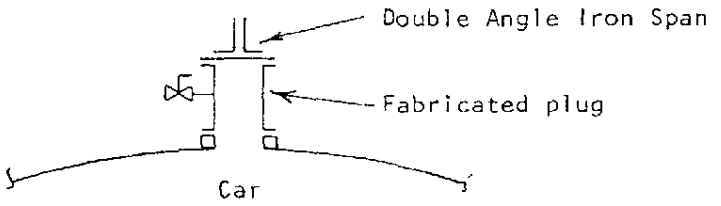
Several EPA people came to investigate the accident. They were kept at the plant until the vapor cloud at the low point dissipated. Then they looked over the wreck scene and left. The Coast Guard called a couple of times until it was determined that ship traffic would not be affected by the wreck. OSHA also inspected the derailment but there has been no followup.

V. Safety Systems Reports (Continued)

D. VCM Tank Car Wreck (Continued)

A command post was established at the plant. Portable radios were used to stay in contact with the command post.

After struggling for some time to stop the leak, a plant pipefitter was brought to the wreck to help. Several hours later, an angle iron span was attached to the car manway with J bolts. Plugs were fabricated to seal against the open flanges as follows:



The car was then righted, moved to the plant and unloaded.

PPG has the clamp made for this incident. The Compressed Gas Association has a kit (CGA-P-10 1980) which may be useful in an incident of this type. Also, Dow has developed a plug that uses a bladder and resin to plug a broken connection.

JHM-pjc
12/17/81