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M I N U T E S

VINYL CHLORIDE SAFETY ASSOCIATION
October 24-26, 1973

Cleveland, Ohio

Distribution List

J. M. Black
J. Brooks
D. T. Boumans
A. W. Clements
C. B. Cooper
J. J. Dunn
J. M. Hyslop
R. M. Kreager
R. A. Krueger
P. H. Lawrence
C. C. Nelson
H. E. Phelps
R. N. Rylands
P. R. Schwaegerle
J. R. Shellenberger
G. D. Schaaf
H. Waltemate
A. R. Webber
P. T. Whitmire
C. L. Woods

CIRCULATE IN TURN TO:

~~R. D. Scott~~
~~J. L. Nelson~~ DEC 4 1973
~~D. P. Gray~~
~~E. W. Harrington~~
~~R. D. Terry~~
~~R. A. Healy~~
~~C. Dow~~
~~W. E. Brodiner~~
~~S. W. Gressler~~

M_I_N_U_T_E_S

VINYL CHLORIDE SAFETY ASSOCIATION

October 24-26, 1973

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GENERAL

A total of thirty companies were represented at this meeting comprising 55 people. A list of people and companies represented is attached to this report.

A permanent secretary and treasurer were nominated so that continuity in the group can be maintained from meeting to meeting. The permanent secretary is Mr. Walt M. Iliff of Uniroyal. The permanent treasurer is Mr. Ray A. Asti of Stauffer. The secretary will be responsible for keeping all the tapes of the previous minutes in his possession.

BFG representation at the meetings consisted of Messrs. H. Waltemate, G. D. Schaaf, and J. R. Shellenberger. Mr. Shellenberger attended the meeting on October 25th.

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Mr. P. Bogart from Tenneco, discussed his proposed standard for vinyl chloride slurry tanks. A copy of this proposed standard has been circulated to our Engineering Department and the Avon Lake plant for their comments.

Mr. D. Miller, of Shell, discussed vinyl chloride loading and storage. One of the important points he emphasized was to have some way to catch the liquid if the tank ruptures, and not to allow the vinyl chloride monomer to get into the sewer. Tanks in the tank farm should be placed at least one full diameter apart. Safety walls are required to separate one tank farm area from another. All valves should be located outside of the fire wall, and be of the automatic cut-off type and spring loaded. Piping for vinyl chloride storage should be above ground and supported on the same foundation as the vessel.

Deluge systems should be provided for vinyl chloride spheres in addition to monitor nozzles.

Mr. Jack Palinsky of Universal Resins, discussed their reactor entry procedure. The discussion is summarized as follows.

A written permit is required with a check-off list. This is signed by the foreman. The shift foreman must sign each entry request. The entry request is then displayed at the site of entry. These forms are ultimately filed in the safety supervisor's file and retained for 90 days. All feed and exit lines, except vent lines, are blanked or removed. The vessels are flushed and purged. The vessel environment is checked with an MSA explosion meter or an oxygen meter. Protective clothing is no substitute for good air.

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They have sampled some of their polys to determine the vinyl chloride content and have noted values as high as 32 parts per million in the vessel. They have a thirty minute period from the time the permit is filled out until the time cleaning must begin. If cleaning is started after that time, a new permit is required. The evacuation hose is put into the vessel through the manhead down to a level of about two feet. The air is then sucked through the vessel from an opening on the bottom of the poly. The man wears a harness and wristlets, but these are not attached to anything. They have one man that sits by the poly as a watch. There are two air horns; one that he controls, and one controlled by the man inside the vessel. They have a block and tackle arrangement for removal of personnel. They use explosion-proof extension cords, 110-volt design.

Twenty companies blind or disconnect all lines, while twelve use the double block and bleed arrangement.

The electrical circuit to the agitator is locked out at the breaker box. Each person, including the observer, must have a lock on the breaker and the key in his possession. The foreman also has a lock on the breaker. He is the first to put his lock on the breaker, and the last to take it off. The foreman cannot delegate this responsibility to the worker.

Ten companies provide a continuous watch for the man inside the vessel. This continuous watch does not do anything except watch the man in the vessel at all times. Fourteen companies provide an intermittent watch, that is, one that is responsible for men in a series of vessels simultaneously. Three companies use a protective alarm system and no watch. All PVC manufacturers indicated that they had to clean vessels at some frequency, with one exception. Stauffer apparently does not enter their polys, except, on a very infrequent basis.

Mr. Palinsky indicated that he feels the environment in the poly is intrinsically safe, and there is some question among their Medical Department whether a man who falls or is otherwise injured in the poly should be removed quickly. They are looking into the possibility of sending a first aid team down into the poly to provide any emergency treatment required.

Mr. R. L. Frantz, from Union Carbide, discussed safety valve testing. Safety valves are divided into three classes for determining test intervals. Class I: These are to be tested on a frequency not to exceed one year. Normally, they are in corrosive service, and subject to polymer plugging. Undefined installations will fall under this class. Class II: Examined on a one to two year frequency. Fired pressure vessels, corrosive service, but where the rate of corrosion is known. Class III: Examined on a two to five year frequency. Non-critical service, gas, air tanks, etc.

Each safety valve is then spray paint coated with different colors to determine testing frequency. To determine when the valves are tested is monitored by the computer program, which includes the building number, location, set pressure, service code, equipment code, and date of next inspection required. It also includes the design vessel pressure and the classification of the particular valve. The operating department head is required to schedule testing with the maintenance department. If the valve goes past its normal test time for the second time, the plant manager must give his personal approval before the equipment can be operated.

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Union Carbide does not use relief valves on polymerizers, but use rupture discs. On a 5,700 gallon polymerizer, they use a 3" disc and a 4" disc on separate lines. The 3" disc is set for a 220 psig and has an RB90 disc. The 4" disc is made of Teflon and stainless steel, and is a PLDV BS&B disc. The vessels are glass-lined and the reverse buckling discs have cutting edges.

Mr. Mal Trowbridge, from Goodyear, indicated that BS&B does not recommend running a vessel completely full with an RB90 disc. (Apparently, Goodyear must be operating their polymerizer hydroful, because this point came up several times during the discussion.) Several companies indicated they were using carbon discs. Many companies use a rupture disc and a relief valve combination. Some companies use rupture discs and relief valves separately, and some companies use a pilot relief valve to relieve a slight overpressure.

Nineteen companies test poly relief valves on a one-year frequency or less, while the remainder of the companies test on a two-year schedule, if the rupture discs do not leak (below the relief valve). Nineteen companies had vinyl chloride storage tanks containing relief valves only, and twelve companies have storage tanks with rupture discs plus relief valves. Most companies reported testing these on a frequency of one to three years. Six companies have rupture discs only on PVC polymerizers. One manufacturer said that on vessels with two vent lines there is a valve located on one line which can be valved off to prevent loss of vinyl to the atmosphere. However, the other vent line, or the high pressure vent line, does not have a valve in it.

Mr. R. E. Frey, from Diamond Shamrock, discussed relief valve sizing. Mr. Frey mentioned the need for determining some guidelines to adequately size relief valves for PVC polymerization reactors. The old rule of thumb, .0012 square inches per gallon of reactor size, does not hold for the larger sized reactors. Much discussion centered around the best procedure for the group to get some definite guidelines. No agreement was reached. It was decided to talk to several experts in the field, such as Dr. Huff at Dow-Midland, and Bill Boyle from Monsanto. Before a study is undertaken by the group, these experts should review the available literature.

Another source of information is Mr. Howard Fawcetts, Secretary, National Academy of Science, Washington, D.C. He is doing some work sponsored by the Coast Guard to measure adequate sizing of rupture discs.

To get a better perspective on the requirements for large polys, several manufacturers indicated the size valves they were using. Georgia-Pacific indicated they had to use two 12" relief valves on their 20,000 gallon poly, rated at 200 psig. They indicated the European manufacturers use a smaller size. These two 12" x 16" valves represent 141 square inches of area for these reactors, and have been approved by F.I.A.

John Barr, from Air Products, itemized their calculations for rupture disc sizes or relief valves for various size reactors.

<u>Reactor Volume/Gallons</u>	<u>Relieving Area</u>	<u>Relief Valve Size</u>
4,000 gallon	16" ²	6 x 8
10,000 gallon	26" ²	8 x 12
16,000 gallon	52" ²	2(8 x 12)
24,000 gallon	220" ²	3(12 x 16)

Calculations made for vessels rated at 190 psig.

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The above data was calculated, based on a mixed three-phase flow from the venting line, consisting of vapor, water, and polymer.

Conoco reported using 90 square inches for their 16,000-gallon polys. They have three vent lines on the reactors, and each vent is set with a 20-pound differential pressure from the other vents. They normally relieve so close together that the 20-pound pressure differential is not really worthwhile.

Goodyear reported that two 4" rupture discs are required on a 50 cubic meter mass autoclave. ICI reported they use a total of 160 square inches in two 10" rupture discs on 10,000 gallon polys rated at 200 psig. They have never blown both rupture discs on the vessels that are in operation.

Pantasote uses 3" rupture discs on 2200-gallon polys and a 4" rupture disc on 6,000-gallon polys.

After much discussion, Mr. Frey is still interested in getting a research project to establish guidelines for rupture disc and relief valve sizing. Any companies that are interested in this should drop him a line so the program can be formulated.

Mr. Roy Stack, from PPG, discussed catalyst handling. He showed a film of various types of IPP and SBP catalyst decompositions. It was emphasized that PVC manufacturers should tell their catalyst suppliers what type of accidents they have had so that the Peroxide Manufacturer's Association can come up with adequate safety procedures.

Seven manufacturers indicated they have had peroxide decompositions of some type since the last meeting.

Mr. John Barr, of Air Products, discussed pressure vessel obsolescence. Pressure vessels can become obsolete because of corrosion, physical damage, revision to the process, and many other reasons. ICI (England) has a graded system to check pressure vessels on a routine basis, much the same as relief valves are checked. BP (England) has a company policy and an insurance company policy requiring pressure vessel testing on a routine basis. Most companies reported they test vinyl chloride spheres on a regular basis. Two companies use hydrostatic testing, and one company uses a thickness testing method.

Many companies indicated they hydro-test their reactors each charge. Also, many vacuum test reactors each charge. Glass-coated reactors at Airco, are checked with a Sona-Ray unit once per year in areas where the glass is chipped off. Many companies reported using the Sona-Ray unit for pressure vessel testing. Some people cut into the jackets and inspect vessel surface for glass-lined polys on a two-year frequency.

General Tire feels the useful life of a glass-lined reactor is twelve years. Most people feel that after ten years there is quite a bit of damage to the glass. Many companies reported having glass-lined reactors in service, in some applications, from seventeen to twenty years.

For stainless steel reactors, no service life could be pinned down, since many people have reactors in service as long as thirty years. Dye penetration testing for stress and corrosion cracking has been conducted by ICI on some of their vessels. Most people commented that they had not seen the type of corrosion in stainless steel polys as they had in their centrifuge; in fact, all except Stauffer, indicated they had experienced stress corrosion in PVC centrifuges.

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Later conversations with Ray Asti of Stauffer indicated that he feels this absence of corrosion in the one centrifuge he was referring to is due to the fabrication and type of metal used. He indicated that other plant locations using the same recipes have corrosion problems. He said that sometimes you get a good centrifuge and sometimes you get a bad one.

Mr. W. J. Bradford, of Olin Corporation, discussed static control. Most PVC producers use a system to ground lines containing vinyl chloride monomer in their unloading and polymerization system. Everyone grounds tank cars and unloading systems. Mr. Bradford questioned the group concerning why this is done, since the monomer is contained in the continuous line. Tenneco reported F.I.A. required this sort of grinding.

Mr. Bradford also discussed OSHA inspections. He reported they have had 32 inspections in their 100 plants. These were based on 16 complaints, 13 compliance violations, and 3 accidents involving fatalities. The cost of the OSHA violations has been averaging about \$4,000 per plant in fines. Most companies reported the OSHA inspectors were good quality who knew their business. However, three PVC plants reported being inspected by an optometrist. No OSHA inspector has checked for vinyl chloride content in the working environment.

The Massachusetts Department of Labor checked plant personnel for hand x-ray data, as they are required to submit this data on a routine basis. The two companies located in Massachusetts both reported the situation. On the hand problem, six companies discontinued hand x-rays, while 16 companies are still continuing their x-ray policy. Of the companies represented at the meeting, eight indicated some sort of hand problem, with a total of five proven cases. BP has a man who worked as a bagger, listed as an AOL case. With the exception of those plants in Massachusetts, no one is reporting data to any regulatory agency at the present time.

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Dr. Ralph Langer, Dow Chemical Company, discussed handling monomer leaks. Dow has a program of vinyl chloride monitoring very close to our program in Building 451 at Avon Lake. They have detection devices located throughout the area with a recorder in the control room. One plant was monitoring 36 points. The probes shown in the slides were directly up against a "typical" poly manhead, at a pump seal area, and in the proximity of one of their Sweco slurry filters. They reported this was one of the high concentration areas. They also had a probe in the control room and lunch rooms.

Their equipment pulled with a one cfm rate into a "furnace" in the control room. It burned the components to a Halide and the concentration of Halides was measured potentiometrically. The device was not able to differentiate between components such as vinyl chloride and VCl_2 , which are both present in their plants. Their detection equipment is a "homemade" system rather than a Bendix unit as BFG is using. It's been in use since the 1950's.

Dow's objective is a TWA for vinyl chloride of 50 ppm. They have a lot of operator involvement in explaining the peaks that are above the base line standard of 50 ppm. Dow felt they were above 50 ppm only about 10% of the time. They have a high vinyl chloride concentration alarm set at 150 ppm.

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Dow is planning a computer program that is tied into their payroll system that will print out by name how much vinyl chloride every man in the plant has been exposed to in an eight-hour period. This data is based upon predetermined percentages of time that each man spends in the area of each probe. They will keep these records for OSHA inspections, should they occur.

Miscellaneous:

1. They do not monitor vinyl chloride unloading operations--just polymerization conditions.
2. They calibrate their equipment every six months.
3. Their tubing being used is polypropylene.
4. All of their plants are open plants. They do not have exhaust blowers or ventilation problems.
5. Instruments paid for themselves with the savings in vinyl chloride.
6. Vinyl chloride can be lighter than air because of the elevated temperature.
7. Charcoal tubes are used for personnel sampling.
8. They are using a Davis Halidimeter for leak detection and pinpointing of leaks.

Mr. Mal Trowbridge, Goodyear, discussed safe monomer venting. The major causes for vented charges at Goodyear:

1. Power Failures: They recommend an emergency power system for agitators. They have a separate spare power line to the plant from the power company at Niagara Falls.
2. Runaway Reactions: They have two approaches: (a) shortstops (styrene, AMS, and isoprene are used), and (b) degas quickly--all of their polys have manual vents, and they swear by them.
3. Fatigued Rupture Discs: They recommend operating well below disc rating and routine rupture disc changing.

The Niagara Falls plant has an unusual set up on their rupture disc stack. Above the rupture disc they have a 3-way valve. They have this valve normally open to the main vent. On top of this vent line is a relief valve with a pressure setting equivalent to burst pressure of primary rupture discs. The alternate position of the 3-way valve opens to the manual vent line, which has a rupture in it with a burst pressure of five pounds, less than the primary rupture disc. They stated they had one incident where the 3-way valve was improperly reassembled after cleaning. Fortunately, the improper assembly did not affect them, but the idea of a valve that can be reassembled wrong above a rupture disc seems sort of hazardous.

Miscellaneous comments on the subject of vented charges and monomer venting.

1. Of the 28 companies represented, 28 reported having a manual vent system on their polys.
2. Some companies have steam injection into the vent line to hasten the volatilization of monomer during a vented charge.
3. Manual vent line sized versus reactor size at the various companies:

2,000 Gallon Reactor = 2" Vent Line
4,000 Gallon Reactor = 2" Vent Line
13,000 Gallon Reactor = 4" Vent Line

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4. A German PVC company has designed and operates a recovery system that catches and contains vented charges.
5. All companies have vents from their recovery systems.
 - a) Some companies have a snuffer (steam inject) to these vents in case they are struck by lightning.
 - b) Twelve companies had flame arrestors on recovery vent lines while 13 companies did not have flame arrestors. Should BFG consider flame arrestors on recovery vents?
 - c) Several companies reported fires on top of their recovery system vents that occurred during electrical storms. One company (Tenneco) actually reported a 12' flame during one storm.
6. The A. D. Little Company, in conjunction with the Coast Guard, has a computer program for cloud dynamics of vinyl chloride. They also have some information on what happens to vinyl chloride in the atmosphere during a venting incident. The Secretary of the Vinyl Chloride Safety Association was to check into this as to its availability for the industry.
7. Operator intercommunications equipment is very valuable in reducing venting.

Mr. Pete Bogart, of Tenneco Chemicals, discussed noise control. One of the Tenneco engineers presented the approach that Tenneco is taking towards noise. He had attended a 9-day course at Rutgers and heartily recommended all companies do the same. The presentation was extremely general in nature, but he did say that all noises can be engineered out of equipment if you want to spend the money. Many of the approaches, especially duct work, blowers, and pipe line noises, are trial and error by nature. Applications experience will tell you where best to use isolation lead, etc., needed to reduce the sound level.

Twenty-two companies reported they have done noise surveys. Most of all the companies reported they routinely did audiometric tests. They solved their Schwitzer blower noise problem by installing a muffler on the intake and the discharge, and installed 2" fiber glass with a lead wrap on the lines. This reduced the noise from 102Db to 85 Db level.

Mr. Bogart recommended the use of flexible ducts and flexible conduit connections for isolation of noise; also, to isolate blowers from the floor along with isolating the floors from the walls.

On 3600 RPM motors he recommended the installation of mufflers on the air intake, use of non-symmetrical fans and the removal of grills.

Mr. Bogart then went on to discuss the monomer exposure standard. This portion of the meeting was devoted to the question, "should the Association take a stand on the industry's position on a 200 ppm or 50 ppm, or some other level for an 8-hour TWA employee exposure". The alternates are: (a) get involved and say what the level should be; or (b) say nothing and wait for the Government to impose a maximum vinyl chloride level. The consensus of opinion was to wait for the results of an MCA animal versus vinyl chloride exposure study, now under way. The results are expected by January.

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Miscellaneous notes taken during this topic:

1. Seventeen companies have someone specifically assigned to environmental health problems.
2. One report mentioned that inhalation of 50 ppm is equivalent to 400 ppm in the diet.
3. Four companies (including BFG) have established 50 ppm as an objective for TWA exposure. Eleven other companies have made various studies to determine their vinyl chloride levels, but with no TWA set as an objective. Of the four companies with a 50 ppm objective, three have open buildings, and one (BFG) has closed buildings.
4. A company in the United Kingdom has a dosimeter for vinyl chloride measurements that is good for four hours of continuous use. The company's name is "Casella" (this may not be the proper spelling).
5. Most companies had used the J&W Super Sniffer for their studies. Most agreed that this unit is not accurate at the 50 ppm levels.

A general discussion was then held on accidents and lessons for experience.

Catalyst Incidents

Many companies reported various incidents with their catalyst storage process. The comments below pertain to the recommendations that came as a result of these incidents:

1. The companies seemed to agree that the chest type freezers/coolers are better than the upright. No company using the chest type has had a decomposition incident, where as all incidents that have occurred involved the upright units.
2. F.I.A. requires that dry ice be removed from the paper before use. Most companies were removing the paper.
3. A grate of some sort should be on the bottom of the chest and upright freezers so that convection currents inside the cooler can keep the whole freezer at a uniform temperature.
4. Ten companies do not permit catalyst to be returned to the primary storage area after it has been removed. The purpose of this is because there have been decompositions resulting from the practice when the catalyst temperature went up to some point and then was later cooled off.
5. Gasketing on coolers and freezers is very important.
6. Most companies felt mechanical refrigeration was the best with dry ice and emergency power sources used as back-up methods.
7. Cracks in the freezer's casing should not be ignored. One company had a catalyst fire, because the catalyst solvent had seeped into the insulation. Later, when the solvent evaporated, a decomposition occurred.
8. Monsanto reported an IPP box decomposition five hours after a shipment arrived. There was a communication problem upon arrival, and the freezers were not checked until the incident. Broken shelves were found, which caused a packing problem and connection within the freezer was not proper.
9. One company had their high temperature alarms on their catalyst freezers tied into the fire alarm system.

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Monomer Incidents

The following are miscellaneous comments on this subject, based upon incidents at the various companies.

1. Herman Waltemate showed the film and discussed the Fort Wayne, Indiana vinyl chloride tank car derailment. Several companies requested loan of the film.
2. Dow had a big vinyl chloride escape at their tank farm, similar to the one at Avon Lake General Chemical. Their problem was caused by a defective section in the flexible hose connection. Dow has remotely operated valves at the tank cars so that this problem could be stopped remotely rather than going into the area. They expressed the same disenchantment with excess flow valves on the railroad cars. Other companies agreed upon the lack of dependability of railroad car excess flow valves. Dow recommends that both the inside and the outside braid on flexible connections be made of stainless steel. Other companies agreed. We should investigate the possibility of utilizing these remotely operated valves on BFG unloading stations.
3. Six companies have remotely operated automatic valves on bottom valves of vinyl chloride storage tanks.
4. Five companies do not have dikes around vinyl chloride storage tanks.
5. Three companies used fusible link excess flow valves in vinyl chloride service.
6. Five companies have vinyl chloride storage tanks underground.
7. Nine companies still have sight glasses on their reactors.
8. Fourteen companies use swivel joints rather than flexible hoses for vinyl chloride unloading.
9. A Canadian PVC plant reported a blend tank explosion. They really do not know the cause, but suspect the explosion somehow originated in the exhaust blower, which was off at the time. The ignition source never was found, nor could they say that a static electricity condition existed. This incident led to this survey of the companies present:
 - a) Eight companies do not purge, nor air sweep their blend tanks.
 - b) Two companies use inert gas purge for blend tanks.
 - c) Eleven companies use the air sweep approach on blend tanks.
 - d) Two companies continuously monitor vinyl chloride levels in blend tank exhaust streams; two companies have routine checks, while eleven spot-check the exhaust vinyl chloride levels.

Miscellaneous non-safety comments:

Monsanto, Springfield, Massachusetts, uses reflux condensers in their paste operation. They have flares on top of the condenser vents to burn the vinyl chloride emitted. They also use lauric acid in their paste operations, and it was concluded from the comments that they use large quantities. Their supplier has told them their lead time on lauric acid had just been increased from 30 to 90 days.

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Accidents and Near Misses (Group Discussion)

Olin reported a 2200-gallon polymerizer was over pressurized. The operator saw vinyl chloride coming out of the agitator seal. He heard the rupture disc go and then tried to vent the poly manually through a 4" valve. The manhead gasket at that time started to leak. He then tripped the deluge system and evacuated. The foreman came back with a Scott Air Pak and blew the remaining part of the reactor to the atmosphere. The gasket on the manhead had blown. The operator stated the agitator was on, but data indicated it had been off, and when turned on probably caused the reactor to over pressure. The over pressure chipped off 95% of the glass on the walls of the reactor at the bottom. Since there was no pressure alarms or recorders on the vessel, it is not known definitely what pressure the vessel was up to. They feel the 4" rupture disc was too small for this particular situation. They are spending \$100,000 to interconnect the steam heat-up system with the agitator to be sure the agitator is on at all times when the vessel is being heated up.

Pantasote Company reported an operator opened a line on their reactor that was under pressure. The deluge system came on and the building was evacuated. They now have a new system, whereby the bottom valve on a poly cannot be opened while the poly is under pressure. A copy of this design system has been requested.

Ten people have double valves on the bottom of polys to prevent dropping the wrong vessel. A brief discussion was held on the Wacker accident in Europe involving the mass reactors. No new facts were brought out.

ICI reported a PVC silo dust explosion. This explosion occurred in one of the five sections of the silo after some welding had been done on the top to install another opening. The welding was completed and the piece was being knocked out when an explosion occurred. The explosion knocked off the dust collector and a fire started, which burned a man and resulted in his death. It is felt this explosion was caused by fines accumulated in the upper section of the silo. This particular section contained a powder compound with modifier and other sensitive elements. It is believed that the fines in the filter, including stearates, may have been a factor in this explosion.

Goodyear mentioned an incident with a Henschel mixer using mass resin when a vinyl chloride explosion resulted. A copy of this information is attached.

G. D. Schaaf
J. R. Shellenberger
H. Waltemate

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VCM SAFETY ASSOCIATION

Attendees at October 24-26, 1973 Meeting

Cleveland, Ohio

558-100

3-100000

Mr. J. T. Barr	Air Products and Chemicals, Inc.
Mr. Earl Primeau	Air Products and Chemicals, Inc.
Mr. Norm Brock	Air Products and Chemicals, Inc. -
Mr. M. M. Garretson	Allied Chemical Corporation -
Mr. Harold Kling	American Chemical -
Mr. A. Godfried	Borden Chemical -
Mr. Don Young	Borden Chemical
Mr. J. A. Gray	B.P.C.I. -
Mr. C. Arthur Gellner	Certain-Teed Products Company -
Mr. Suchochleb	Conoco Chemicals
Mr. Earl Gremillion	Continental Oil Company
Mr. A. F. Gallagher	Continental Oil Company -
Mr. R. E. Frey	Diamond Shamrock Chemical Company
Mr. J. Robert Mehall	Diamond Shamrock Chemical Company
Mr. Eli Zinn	Diamond Shamrock Chemical Company -
Mr. Bob Dostal	Dow Chemical Company
Mr. Larry Adcock	Dow Chemical Company -
Mr. Henry G. Smith	Ethyl Corporation -
Mr. Francis Hoy	Firestone Plastics Company -
Mr. Harlan Jewett	General Tire
Mr. Joe Mudd	General Tire -
Mr. Claude Acree	Georgia-Pacific
Mr. Harry Lloyd	Georgia-Pacific
Mr. Glen D. Schaefer	B. F. Goodrich
Mr. Herman Waltemate	B. F. Goodrich -
Mr. Amos Dixon	Goodyear
Mr. Mal Trowbridge	Goodyear -
Mr. John C. Floros	Great American Chemical Corporation -
Mr. Brian D. Cole	Hooker Chemical Company -
Mr. Maryin LeCornu	ICI, Ltd - England
Mr. D. B. Hopkinson	ICI, Ltd - England -
Mr. J. R. Sanchez	Industrias Resistol, S. A. -
Mr. S. D. Law	Keysor-Century Corporation -
Mr. David L. Gendron	Monsanto Chemical Company -
Mr. H. L. Donaldson	Olin Corporation
Mr. W. J. Bradford	Olin Corporation
Mr. E. J. Goettman	Olin Corporation (Assonet, Mass.)
Mr. R. H. Carte	Olin Corporation (Assonet, Mass.) -
Mr. Roy W. McCune	Pantasote Company
Mr. K. K. Sheth	Pantasote Company
Mr. Henry Rzempoluch	Pantasote Company -
Mr. William A. Keim	Pittsburgh Plate Glass
Mr. Roy Stack	Pittsburgh Plate Glass -
Mr. Ray Asti	Stauffer Chemical Company
Mr. L. W. Hager	Stauffer Chemical Company -
Mr. Don Miller	Shell Chemical Company -
Mr. P. Bogart	Tenneco Chemicals
Mr. John T. Sweeney	Tenneco Chemicals -
Mr. David A. Ellwood	Union Carbide (So. Charles, W. Va.)
Mr. Jay E. Giffin	Union Carbide (So. Charles, W. Va.)
Mr. R. L. Frantz	Union Carbide -
Mr. Walt M. Iliff	Uniroyal, Inc.
Mr. Norman C. Walter	Uniroyal, Inc. -
Mr. Jack Palinsky	Universal PVC Resins, Inc.
Mr. Cal Rehfuss	Universal PVC Resins, Inc. -

NGC 23092

1. 2. 3.
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Definition: A "Blend Tank" is defined as a vessel utilized to contain resin slurry prior to drying. Such tanks may also be referred to as "Slurry Tank" or "Holding Tank".

Type: Blend tanks are normally non-pressure vessels equipped with power-driven agitators. (Slurry is retained under agitation.)

Hazard: The primary hazard connected with blend tanks is associated with the unreacted monomer carried within the slurry after stripping. This in turn comprises two areas of concern:

- I. Explosibility
- II. Toxicity

Suggested methods of control for each category include:

I. EXPLOSIBILITY

- A. Insure that vapors within the blend tank do not enter the explosive range.
- B. Prevent any source of ignition within the tank.

(Note: While either of these steps taken alone should theoretically suffice, experience has shown that a combination of both objectives is required.)

- A-1. Maintain vapors constantly above the U.E.L. (upper explosive limit). Filling and emptying of the tank, varying monomer contents of the slurry, and varying rates of monomer release under agitation makes this approach impractical.

NOT RECOMMENDED.

- A-2. Maintain vapors constantly below the L.E.L. (lower explosive limit). This may be accomplished by controlling the amount of unreacted monomer carryover, or dilution of vapor within the tank.

Preliminary indications are that the percentage of unreacted monomer carried over is greater than has heretofore been recognized. Until more efficient methods of stripping are developed and implemented, control of monomer quantity cannot be depended upon to achieve vapor-air mixtures below L.E.L.

Dilution with air, introduced at atmospheric and exhausted mechanically; introduced mechanically or by pressure and exhausted at atmospheric; or introduced and exhausted at atmospheric ("open-hatch" method), is the most common current practice and has been thought for many years to be a satisfactory precaution. There is, however, serious question as to whether introducing air into the vapor space may not actually increase the hazard by diluting the vapor below the U.E.L. There is also the problem of insuring that all the vapor space is sufficiently diluted.

RECOMMENDED WITH RESERVATIONS

Should the air-dilution method be chosen, the following precautions are suggested:

- Introduce a sufficient supply of air, at a constant rate, to fully dilute the entire vapor space, regardless of slurry level, to below L.E.L.
- Insure the reliability of air supply, including power supply to blowers or exhausters.
- Design air introduction or exhaust so that sufficient velocity is maintained to insure dilution. Do not rely upon natural draft.
- Monitor the vapor space for monomer content.
- Connect the monitor to an alarm and develop procedures to be followed if monomer content exceeds L.E.L.

A-3. Inert the atmosphere of the vapor space

Maintaining an inert atmosphere in the entire tank vapor space effectively precludes ignition of vapors. This can be accomplished by introduction into the tank of an inert gas in sufficient quantity, at a controlled continuous rate, to preclude the presence of sufficient O₂ to sustain ignition. It should be understood that introduction of inert gas does not preclude the presence of monomer in the vapor space.

RECOMMENDED.

Where inerting is used, the following suggestions are made:

- Nitrogen is the preferred inerting agent. Use of CO usually involves an inert-gas-generator, which can cause safety problems of its own.
- Insure a sufficient supply of inert gas, introduced at a rate which will suffice to inert the entire vapor space at all times regardless of slurry level.
- Monitor the nitrogen flow by the use of flowmeters or similar devices.
- Check O₂ level in the tanks by means of continuous-reading or frequent intermittent reading monitors. Such monitors should be programmed to give an alarm should the O₂ content approach unacceptable levels, and should preferably be designed to automatically increase N₂ flow when such a condition occurs.
- It is recommended that the O₂ level in the tank not be permitted to exceed 8%.

B-1. Ignition prevention

In order to prevent ignition of monomer vapors in, and associated with, blend tank operations, the following precautions are suggested:

- The blend tank area should be treated as part of the monomer train and all precautions taken in the reactor area should be applied here as well. These include, but are not limited to:
 - Class I, Group D, Div. I electrical equipment;
 - No smoking, flames or open lights;
 - Hazardous work (hot work) permit required.
- Where tank vents are provided, they should be equipped with flame arrestors, and in the case of inerted tanks, conservation vents.
- Vent discharge, even on inerted tanks should be remoted from ignition sources.

- Potential friction points, such as agitator shaft bearings, should be evaluated and precautions against static generation and friction heating, under both normal and abnormal conditions, taken.

Examples: Use of soft metal collars at point of entry of agitator shaft through tank top. Use of mis-alignment sensing switches on shafts, etc.

II. TOXICITY

The second area of hazard which must be considered with blend tanks is exposure to the anesthetic effects of monomer. This consideration is of course not exclusive to blend tanks, but assumes particular significance because of the tendency to regard blend tanks as beyond the monomer area.

Operations:

The primary area of exposure is the roof hatches, or manways. These hatches are opened to check levels in the tank, to check the condition of the tank interior, and to wash out the tank.

Elimination of the necessity to perform these tasks through the hatch in turn eliminates most of the monomer exposure.

It is recommended that:

- Operating procedures be so developed as to obviate the necessity for personnel to go on or across the tops of blend tanks.
- Hatches and manways be closed and sealed with a frangible seal, such as a railcar seal. *don't like*
- Tank levels be determined by the use of remote-reading level gauges. *- ? we have never tried this*
- Washout be accomplished by the use of remote-operated fixed or rotating nozzles within the tank.
- Agitator motor switches and any other operating devices be located at ground level.

Maintenance:

When it is necessary to go on top of a blend tank, to inspect, or perform maintenance, the buddy system should be strictly enforced. *Good idea*

When entering a blend tank, all confined space entry procedures shall be followed.

The Goodyear Tire & Rubber Company

(A CORPORATION)

P. O. BOX 460

NIAGARA FALLS, NEW YORK 14302

PHONE (716) 283-7882

October 10, 1973.

Mr. John Madden
Clow Corporation
Plastics Division
P. O. Box 626
Pell City, Alabama 35125

Dear Mr. Madden:

It has been called to our attention that under certain operating conditions, unacceptable concentration levels of Vinyl Chloride Monomer is present during the mixing cycle. This condition becomes acute when the resin is exposed to high intensity mixing where increased heats and shear cause any entrapped or residual VCM to be released in the mixer's air space. We feel that if air space in the mixer is not properly evacuated during the mixing cycle the accumulation of residual VCM would create a gaseous mixture that could exceed the lower explosive limit in your mixer and cooling blenders.

We recommend that you take the following steps to improve safety conditions at hand or return any unused resin to Goodyear.

- 1) Check to see that all transfer and mixing equipment is properly grounded.
- 2) Install adequate ventilation at mixing and cooling stations to insure proper evacuation and circulation of fresh air to the above.
- 3) Since Vinyl Chloride Monomer is heavier than air it is necessary to air purge the mixer after each cycle to eliminate the accumulation of VCM during a days operation.

*Confirmed
Waco, Texas*

One of our customers has experienced a small flash explosion in their high intensity mixer and suspected to be caused from concentrations of VCM that exceeded the LEL (lower explosion limit). While the resin is the same that has been used without an incident for a number of years and this type of resin has been used extensively in Europe without any reported incident, we feel obligated to inform you that there may be a potential problem.

OCT 22 1973

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