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DATE December 6, 1971

FROM Don Metzger DWM

SUBJECT CONFIDENTIAL

Attached is your copy of the Vinyl Chloride Plant Hazard Review report.

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CHEMICALS PPG INDUSTRIES INTEROFFICE / LAKE CHARLES

TO C. L. Payne DATE

FROM Don Metzger SUBJECT Hazard Review of Vinyl Chl ride

Hazard Review Team: Alleman, Work, J. M. Davis, Duhon, Gorton, Metzger

Summary

The Vinyl Chloride plant Hazard Review revealed several potential problems. Most of these problems are minor or have a low probability of occurrence. Questions which are unresolved at this point include the subjects of electrical gear ignition potential in areas adjacent to the plant, vapor detector sensitivity problems and overpressure protection on some heat exchangers. The resolved questions requiring further action and those listed for records purposes cover all aspects of the plant process, equipment and operating procedures.

Discussion

The Hazard Review of the Vinyl Chloride plant included equipment design, equipment condition, operating procedures, operating instructions, chemical safety, process safety and personnel safety. The Hazard Review Manual and associated worksheets were used to conduct the review. The Hazard Review team spent a total of 96 manhours on the review.

Several questions were raised during the review which are unresolved at this time. These questions are listed below. Also listed are the more important resolved questions, with answers, to provide a readily accessible record of the review.

Unresolved Questions

1. The area west of the Vinyl Chloride plant has several potential ignition sources, including electrical gear at the air compressor building, construction warehouse, construction welding shop and construction guard gate. In view of the potential for vapors from spills of flammable materials reaching this area, is it permissable to have these potential ignition sources?

2. The main sewer in Area "B" is designed to allow straight-through flow with no seals provided at the surface run-off collection boxes. A major spill of VC (or any other volatile flammable material) could result in having a flammable mixture for an appreciable distance in the sewer system and having a source of vapor cloud formation at each box. Does the loss potential involved warrant revisions to the sewer system?

3. The Furnace Feed Cooler and Economizer are designed at 400 psig; the actual operating pressure is 360 psig. D adh ading of th pumps could caus overpressure of the exchangers. A similar situation exists on the

three lean oil coolers. They are designed for 150 psig and actually operate at 140 to 150 psig. What changes are needed to assure adequate protection of this equipment?

4. The vapor detectors have not performed satisfactorily when subjected to spills of EDC. A substantial EDC spill in the furnace area gave only a 20% of lower explosive limit alarm. The instrument manufacturer states that the vapor detectors, which are calibrated for ethyl chloride, will produce a response with EDC of about one-half the magnitude of that of EC. Should the vapor detectors in an area be calibrated for the component in that area for which they are the least sensitive?

5. The combustion chambers on the furnaces are now checked with an explosimeter to assure adequate purging before making the initial try on lighting the pilots. If ignition does not occur on the first try, the purge timer is not used to assure adequate purging before the next try, nor is another explosimeter check made because it is felt that the natural draft provides adequate purging. A leaking pilot valve would not be detected. Should some means of recheck be used before trying to re-ignite the pilots?

6. Is the Albi-Clad fireproofing on the Dock VCM and EC spheres (which are not sprinkled) adequate protection in view of the current questions on the effectiveness of Albi-Clad?

7. Does the loss potential presented by the possibility of getting flammable vapors into the suction of the Instrument Air Compressors warrant revision to the system?

8. The discharge line from the furnace feed SRV has a block valve at the Heavies Still Reflux Tank. Also, the thermal relief SRV on the transfer line to the dock has block valves on the inlet and discharge. What measures should be taken to assure that these valves are open except during maintenance on the SRV?

9. Do the instrument air compressors have adequate capacity to insure continuous operation of Area B and Silica Pigments?

10. Neither the main supply steam pressure control valve nor the bypass valve are large enough to handle the required flow. The flow is maintained by running with both valves open. Can the supply pressure be raised permanently or should the PCV and bypass be replaced with a larger system?

11. Should the pressure between SRV's and rupture disc combinations be routinely checked?

12. Vapor detectors are now located immediately south of the VC furnaces. Are additional vapor detectors needed further south of the VC furnaces to give adequate warning of an approaching vapor cloud?

13. Is a hydroshield needed on the south side of the VC furnaces?

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14. A large ar a between the control room and the VC process pad is flooded when the EC and VC sprinkler systems are tripped. Since both EC and VC will float on water, should the drainage be improved to prevent the spreading of a large spill?

15. Should the operator and lead operator be given more training in fire fighting?

16. Do the woods next to the tank car loading rack present a significant fire hazard?

17. Is a permit system needed to control traffic on the road to the control room?

18. Two shutdown devices, the low outlet process pressure shutdown and the low feed flow in a pass shutdown, have been bypassed on the VC furnaces. These devices were bypassed because of the history of device failure causing shutdown. A tube rupture would thus not automatically shutdown the furnace. If the rupture occurred inside the furnace, ignition of the spill would occur regardless of an automatic furnace shutdown. Rupture of the tube outside the furnace could possibly result in a large spill and vapor cloud formation before ignition occurs. Does the probability of tube failure outside the furnace justify using the shutdown features?

19. The VC process pad sewer drains to the ditch on the west side of the VC plant, which drains to the sewer on the south side of the plant. Does the spill potential involved justify rerouting of the sewers to prevent vapors from reaching the furnace area from the sewer?

20. The VC Dopp Kettles can occasionally operate liquid full for periods up to an hour. Can this operation cause significant plugging of the nozzles in the kettle vapor space?

Resolved Questions

A. Chemical and Process Safety

1. Question: Is adequate toxicity and handling information available on all chemicals in the area?

   Answer: Some information is available on cooling water treatment chemicals, but treatment and toxicity levels are not adequately stated. Betz has been contacted to get this information. A similar situation exists on the additive inject d into the Heavies Still Reboiler, Aftol. The distributor of Aftol will be contacted to supply the needed data. Also, handling information is not readily available to the operators on all chemicals used in the laboratory.

2. Q: Is vinyl acetylene present in significant quantities in the process?

   A: Th high st concentration found has been about 150 ppm, which should present no problems.

3. Q: Can foreseeable contaminants cause serious polymerization of VC?

A: None of the known potential contaminants will polymerize VC.

4. Q: Can monochloroacetylene or dichloroacetylene be concentrated in the VC still train?

A: Concentration of these components could occur, although no indication of this has been seen in the past. An analysis program will be initiated to verify that no problem exists.

B. Personnel Safety

1. Q: Do areas which are subject to becoming wet and slippery have adequate skidproofing?

A: Additional skidproofing is needed around the refrigeration units and Dopp Kettles.

2. Q: Are adequate warning signs posted in the area?

A: Additional signs are needed at the south and west perimeter of the plant to warn unauthorized personnel to keep out of the area.

3. Q: Are safety showers and eyewash fountains checked periodically?

A: No. This will be accomplished by using a checklist.

4. Q: Is the control room pressure checked routinely?

A: A routine check is needed.

5. Q: Are all moving parts of equipment adequately guarded?

A: Guards are being considered for the Dopp Kettle agitator shafts and for the portable belt conveyor.

C. Agitators

1. Q: Do the mechanical seals on the Dopp Kettle agitators present significant vapor cloud potential?

A: No. Seal failure has historically occurred slowly.

D. Columns

1. Q: Does the new neutralizer need fire protection?

A: Yes. A work order will be written.

2. Q: Can the HCl Scrubber take full HCl flow in the event of a major process upset?

A: While the Scrubber is only designed for the output of one cracking furnace, it is adequately protected by a rupture disc and seal loop to prevent rupturing of the vessel.

3. Q: Are any of the SRV nozzles subject to plugging?

A: Some plugging of the SRV nozzles on the neutralizers have been noticed. This probably occurs during charging of the vessel with flake caustic. These nozzles will be routinely cleaned after charging.

E. Compressors

1. Q: The auxiliary oil pump on the Freon Compressors will start-up if the oil pressure drops to a certain point. No alarm is given on start-up of the pump. Can the auxiliary oil pump continue to run and thus hide an undesirable condition?

A: The auxiliary oil pump would cycle on and off and eventually be noticed by the operator.

2. Q: Should the automatic shutdown devices on compressors be periodically checked?

A: These devices should be checked on the major machines, such as the VC Refrigeration Compressors. An engineering work order has been written to work up a testing program.

3. Q: Are means of monitoring bearing temperatures needed on the Instrument Air Compressors?

A: The manufacturer is being contacted to determine the need for monitoring bearing temperature.

4. Q: Is an alarm needed on the Air Compressors to warn of high discharge temperature?

A: The compressors are adequately protected by an alarm on surging and by a shutdown device on high intercooler water temperature (an alarm is being installed on this temperature).

5. Q: Operator rounds on the Instrument Air Compressors are made by the auxiliary operator. Does this provide adequate coverage, considering the importance of the compressors and the inexperience of the new auxiliary operators?

A: The auxiliary operator takes readings only (with the exception of switching air dryers). It is felt that the surveillance provided by the lead op rator is adequat .

6. Q: The Air Compressors automatically shut down with loss of il pressure. Should warning be given b fore shutdown occurs?

A: An alarm is not justified.

7. Q: Can water build-up between stages on the Air Compressors cause compressor damage?

A: The drain valves have holes drilled in the gate so that a flow is always assured. The drains are also checked frequently.

8. Q: The Dock Sphere Vent Compressor can have liquid in the suction line. Does this create a hazardous situation?

A: This compressor is belt driven and probably would slip the belts before any damage could occur.

F. Filters

1. Q: The filters in the VC Plant do not have safety relief devices. Are safety reliefs needed?

A: No. All of the filters have been checked and are either protected by other SRV's in the system or are of a higher pressure design than can be imposed by the process. Also, isolation of a liquid full filter does not represent a substantial spill volume if rupture did occur.

G. Fire Protection

1. Q: Does all equipment have adequate fire protection?

A: The new Neutralizer, Waste Recovery Tank and the pipe rack from the control room to the process pad need fire protection. A work order is being written to install fire protection at these locations.

2. Q: The drainage from the east side of the tank car loading area goes immediately adjacent to the west VC sphere. Does this present a significant hazard?

A: Major spillage of a VC, VDCM or butadiene tank car would pass close to or under the sphere. An RES will be written to engineer regrading of this area.

3. Q: Should the vapor detectors be periodically calibrated?

A: Periodic calibration is recommended by the manufacturer. A work order has been written to check calibration on a periodic schedule. An inspection of the flame arrestor will be included on this schedule.

4. Q: Is the fire water system adequately freeze protected?

A: Drains will be installed at ground l vel on the hydro-shields and monitor nozzles.

5. Q: Can flammable vapors or liquids pass under the hydro-shield?

A: Yes. A work order has been written to install a concrete barrier and lower the hydroshield to the top of the barrier.

H. Furnaces

1. Q: All of the safety shutdown features on the VC furnaces are bypassed except the loss of flame shutdowns. Is this acceptable?

A: The potential problem presented by bypassing the low outlet process pressure shutdown and low feed flow in a pass shutdown has been questioned in Unresolved Question No. 18. No hazards are presented and potential loss of production is actually reduced by bypassing the other shutdown features. The reasoning for each feature is as follows:

a. Low gas pressure shutdown. Low gas pressure is alarmed to give prior warning. If the gas pressure continues to fall until flame loss occurs, the flame loss shutdowns would close the Maxon gas valves.

b. High bridge wall temperature. This temperature is alarmed and monitored. The alarm provides adequate warning before shutdown is necessary.

c. High outlet quench tower temperature. This temperature is alarmed, which provides adequate warning before shutdown is required.

2. Q: Should the furnace tube wall temperature be alarmed?

A: Any sudden change in tube metal temperature would be seen by alarms on other variables.

3. Q: Is an automatic double block and bleed arrangement needed on main gas flow?

A: An emergency shutdown now would rely on closing of the Maxon valve to each burner. Past experience has shown that these valves leak through occasionally, thus sometimes leaving a small flame in the furnace. Since this becomes a potential ignition source, serious consideration is being given to a double block and bleed arrangement.

4. Q: Liquid in the natural gas to the plant has caused a serious problem at the VC Furnaces on one occasion. Is the natural

gas system designed to give adequate warning of liquid in the natural gas?

A: Consideration is being given to installing a high level alarm on the natural gas knock-out drum.

5. Q: Are all personnel aware of the requirement of checking the furnace combustion chambers with an explosimeter before lighting the pilots?

A: Personnel now in the area are aware of this requirement. The procedure will be written and inserted in the Standard Procedures Manual.

6. Q: Should the fire-eye devices be periodically checked?

A: A periodic check is not needed because each burner has a fire-eye device and any one of the devices is adequate to sense flame loss in the furnace.

7. Q: Is continuation of the air purge of the electrical gear cabinets in the furnace area adequately assured?

A: The air purges will be checked weekly.

I. Heat Exchangers (Condensers, Coolers, Reboilers)

1. Q: Is fire protection needed on the heat exchangers on the second deck in the process area?

A: FIA required waterspray protection of equipment and structural steel to the 27 feet elevation. These exchangers ar above the 27 feet elevation.

2. Q: Leakage of steam into the nitrogen in the nitrogen heater could lead to severe corrosion in the HCl Carbon Beds (heated nitrogen is used to reactivate the Carbon Beds). Should the heated nitrogen be monitored for moisture?

A: Leakage will be checked for during slack periods by observing for moisture in a slow bleed off the bottom of the heater with full steam pressure on the chest.

3. Q: Can the water side of the Primary Quench Condensers be safely cleared for maintenance if one condenser is still in service?

A: The water side has bleeds and the process side can be blocked on the liquid outlet. This allows the exchanger to fill with liquid, thus stopping heat transfer.

J. Instruments

1. Q: Do all control valves fail in the desired position on air failure?

A: The failure position of the following valves should be changed.

a. The Absorber PCV should be changed to fail open on loss of air. Failure in the closed position creates immediate overpressure problems in VC and the potential for going into the explosive range in the OHC reactors.

b. The Freon-12 Hi-Pressure Float Chamber LCV should be changed to fail open with loss of air. Failure in the closed position causes immediate shutdown of the refrigeration units on high discharge pressure. Failure in the open position would cause hot gas short circuiting to the Freon exchangers, but this problem could be satisfactorily handled without shutdown.

c. The Freon-12 LCV to the 30° Leon Oil Cooler should be changed to fail open on loss of air. All the Freon exchangers receive their feed through this valve, and closing of the valve would quickly create serious problems. Opening of the valves would be sensed by a high level alarm in the 30° Knockout Drum and could be satisfactorily handled.

d. The well water FCV to the HCl Scrubber should be changed to fail open with loss of air. This will provide scrubbing capabilities during upsets.

2. Q: Malfunction of the snuffing steam control valves to the furnaces leaving them in the closed position would not be detected. Should these control valves be periodically checked?

A: The snuffing steam valves will be periodically blocked and stroked.

3. Q: Can enough air be pulled into the Vaporizer or Cracking Furnaces to provide complete combustion if the methane FCV fails open?

A: Opening of the FCV's would result in about 25% increase in gas flow. It is felt that there would be no significant pressure or incomplete combustion problems.

4. Q: What is the failure position of the air operated ball valves on Lower Intercooler feed and the Freon FCV's from the Freon heat exchangers?

A: The air operators on these ball valves are not spring loaded and thus will not change position on air failure.

5. Q: Are adequate spare parts on hand for all critical instruments?

A: A more complete set of spare parts are needed for the Thermoelectric switch used to monitor tube metal temperatures in the furnaces.

K. Layout

1. Q: Are all work areas provided with adequate means of exit?

A: The Dopp Kettle platform should be provided with a ladder at the northeast corner, in addition to the existing stairway at the west end.

2. Q: Are all work areas adequately lighted?

A: Lighting should be provided at the Waste Recovery Tank.

L. Piping

1. Q: Can the safety relief valve vent header fill up with liquid and restrict flow under foreseeable circumstances?

A: Liquid could build up in the header from leakage of several SRV's, such as the SRV's on the EDC feed lines. Currently, the header is partially filled with solids. This line will be cleaned during the next major outage, and the liquid level will then be routinely checked.

M. Pumps

1. Q: Both Furnace Feed pumps are required to maintain full production rate. Is a spare pump, or a larger pump and motor needed?

A: A loss of one of the pumps would necessitate a 10% cut in production. The frequency of losing a pump and the time required to perform normal maintenance do not justify the cost of additional pumping capacity.

2. Q: Both Heavies Still Reflux pumps are required at full rate. Are larger pumps justified?

A: No significant loss potential is presented by loss of one of the pumps. However, check valves should be installed s that loss of one of the pumps does not cause complete loss of pumping capability until valves are manually closed.

3. Q: Are adequate spare parts on hand for all pumps?

A: A spare impellor should be stocked for the cooling tower pumps.

N. Tanks

1. Q: Are the block valves needed under the SRV's on the Phase Separator and Dehumidifier?

A: These vessels can be isolat d for maintenance purposes during normal operation. The block valves under the SRV's will be removed.

2. Q: The VC Day Tanks can be overpressured by overfilling, particularly on transfers between tanks. The high level alarm is now used to notify the operator when to switch tanks. Any error in switching which would cause additional flow to go to the tank would not be seen. Is another alarm needed?

A: This problem has occurred and a substantial vapor cloud resulted. Methods of providing a second alarm are being considered. A similar problem exists on the EC Day Tanks.

3. Q: Do all sight glasses have excess flow valves?

A: The sight glasses will be checked during the next major outage.

4. Q: Should the glass sight ports be removed from the Dopp Kettles?

A: These sight ports are not used and will be removed.

5. Q: Are SRV nozzles on any of the tanks susceptible to plugging?

A: The SRV's on the Phase Separator and Dehumidifier have plugged in the past. The plugging was a result of clearing of the neutralizers. The cleaning procedure and piping has been changed to alleviate this problem.

6. Q: The Tar Buggy could be overpressured by blocking the vent to the vent header. Are modifications needed?

A: No. The actual pressure will not exceed 105 psig, and the vessel design is 100 psig. Also, the operator stands by during the dumping of the Dopp Kettle.

O. Sewer Systems

1. Q: Are all sewers provided with liquid seal loops to prevent flow of flammable vapors into areas with ignition sources?

A: The sewer line from the Coke Knockout Drum to the North-South process sewer by the control room road does not have a seal loop. This seal should be provided.