

Monsanto Company
Springfield Plant
Indian Orchard, Mass.

cc: Mr. G. H. Ellsworth
Mr. J. R. Belschwender
Mr. W. P. Willis

November 2, 1971

CC: RWB

TO: Mr. R. E. Cummings Mr. Y. P. Philips
Mr. W. F. Gabel Mr. J. L. Shriver
Mr. R. B. McTaggart Mr. G. W. Smith
Mr. D. J. Miller

SUBJECT: Near-Miss Investigation #14-71, PVC Burning Stack

Summary

On Tuesday, September 21, 1971, at approximately 1 PM, an extremely serious condition was discovered in the PVC emergency vent system. The vent system was found to contain several thousand gallons of liquid monomer. Action was taken from the time of discovery to: first, determine the source of this venting monomer; next, to stop the flow of monomer; and last, to ensure reasonably safe disposal of the VCM then in the venting system.

No injuries or equipment damage resulted, with the only loss being VCM raw material.

The potentially serious nature of this incident cannot be over-emphasized. This was brought out by subsequent investigation findings, and also by the reference investigation (Accident Investigation No. 287, PVC Stack Fire, 8/10/59) which had resulted in an extremely serious fire in 1959.

Accident Cause

The overflow of VCM, contained within the emergency vent system, was caused by incorrect valve positioning in tank farm K-1...an operator error.

Contributing to the potential of this near miss was the failure of the stack pilot burning system which then gave no visible flame; and, also, no immediate alarm system to detect the VCM overflow.

Accident Description (See attached sketch for reference.)

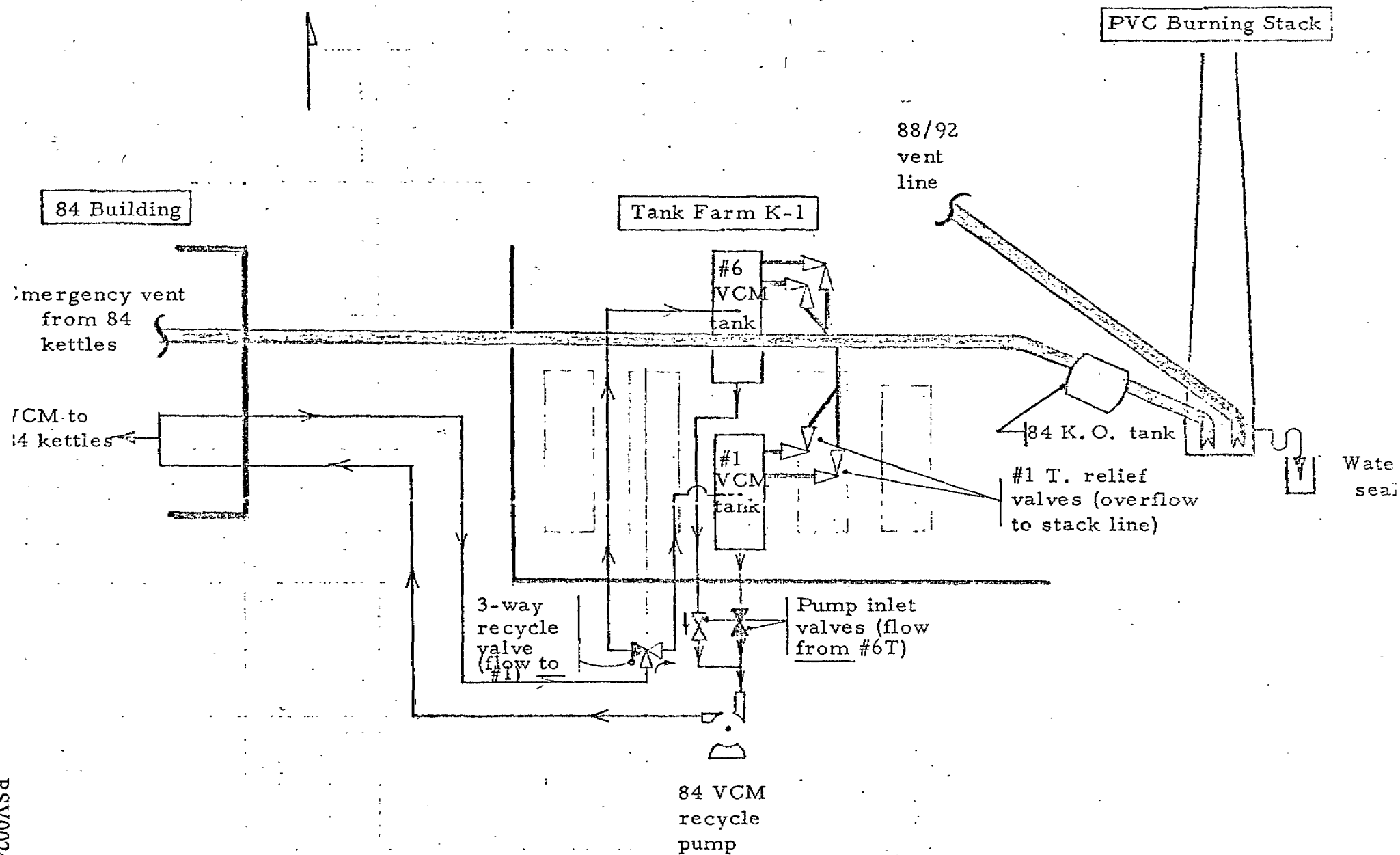
At approximately Noon on Tuesday, September 21, 1971, a PVC foreman was notified that the water seal at the base of the burning stack was full of a white water/resin mixture. This foreman, upon investigation, found that the seal was plugged. There was no water flow and evidence was found of paste resin in the discharge from the seal.

At approximately 1 PM, two additional members of supervision joined the first foreman to investigate the same problem with the water seal. It became apparent that there were strong VCM vapors in the discharge from the seal, and a valve in the discharge line to the sewer was closed. Also, "frosting" was noticed on the external surface of the stack at the base ("frosting" being indicative of VCM evaporating and cooling the adjacent metal surfaces to form frost).

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PVC BURNING STACK INVESTIGATION - NEAR-MISS #14 (9/21/71)

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Accident Description (continued)

The Building 84 vent line knockout tank was found frosted around the entire circumference of the reinforcing rings, all the way to the top. (This knockout tank has a 4,000-gallon capacity.) There also was evidence of frosting on the vent line leading to Building 84 and tank farm K-1 (common to both).

The supervisory personnel then split up in order to determine the source of monomer in the vent system. One member of the group stayed at the stack and attempted to restore the seal. Another member proceeded to tank farm K-1, where he found the emergency relief valves on #1 VCM storage tank cold and frosted. At approximately 1:30 PM, a tank farm operator was summoned and found that #1 VCM storage tank was completely filled and #6 VCM tank was at a low level.

Next, a lead operator from Building 84 was brought to the tank farm to determine the position of the three-way recycle monomer valve. This lead operator determined at 1:45 PM that the three-way valve was incorrectly positioned, drawing monomer from #6 VCM tank and recycling to #1 VCM tank, thereby overfilling #1 VCM tank. The valve was temporarily changed to draw from #1 and recycle to #6, to immediately bring down the #1 tank level. (This valve was then later returned to the correct position of drawing and recycling to the same tank.)

A steam hose was connected to the Building 84 vent line knockout tank to speed up the vaporization of liquid monomer. Also, the seal water was turned off at the stack, and steam only was turned on to the seal itself in an effort to free up the frozen water seal. It was noted that the stack was frosted to a height of 25 to 30 feet, indicating a substantial head of monomer in the stack itself. This would indicate a total of approximately 6,000 gallons of VCM in the system, including the knockout tank.

The drain valve on the Building 84 vent line knockout tank was momentarily opened, and a discharge of foamy resin and liquid monomer sprayed into the tank farm dike area. This valve was immediately closed, since the discharge was nearly all liquid monomer.

It was noted at this point that although there was no visible flame, the stack steam system was on. The steam was apparently activated by the automatic control system which has been recently installed. When the steam was then manually turned off, it was found that the pilot lights were not burning, and vinyl chloride gas was then being vented with no method of burning. It was decided NOT to attempt reigniting the stack due to the serious problem created by the large amount of VCM in the emergency vent system. Steam sparging was resumed, however.

Note: The stack was reported to be burning earlier in the morning of September 21. A pronounced flame plus steam was noted at around 11:30 AM; at 12 Noon, steam only was seen. For some reason, the flame was lost.

During this accident investigation, operation with auto steam snuffing was simulated, and it was possible to extinguish the pilot in some cases.

Accident Description (continued)

At about 2:20 PM, Fire Service was requested to bring over a fire hose to wash down the tank dike area which had been sprayed with the 84 knockout tank discharge. The fire chief and his assistants arrived and proceeded to wash down this area. Operations in Buildings 84, 88, and 92 were placed in a "hold" category, at this time.

At 3 PM, the Safety Department arrived on the scene, and reviewed the situation with manufacturing. Also, at 3 PM, the stack water seal cleared, due to the continuous application of steam. It was noted that the frost line on the stack had started to drop.

At 4 PM, an additional steam line was connected to the stack to increase the heat available to vaporize the monomer. From this time until 7 PM in the evening, steam was continually applied on the Building 84 knockout tank, water seal, and the stack itself. The vent system operation was continuously monitored during this time.

At 7 PM, it was felt that the stack pilot light could be safely reignited, since the stack itself was free of liquid monomer and the seal was in normal operation. The stack was then relighted, and venting operations were continuously covered by PVC supervision. The stack continued burning the VCM gas from this overflow for four days, until the afternoon of September 24, at which time the system was free of residual monomer and could be described as "back to normal."

Buildings 88 and 92 operations were kept in a "hold" position until the stack was relighted at 7 PM Tuesday. Building 84 operations were held down through the morning of September 22 until the vent lines up to the knockout tank were flushed out. As these vent lines were flushed, there was pronounced evidence of resin in the vent line from Building 84 to the stack.

Adequate steps were taken ultimately to control this VCM overflow. However, at no time during the preceding action was Emergency Control activated or adjacent operating areas notified. This point is brought out in the recommendations.

As initially indicated, this committee used the August, 1959 stack fire incident as a reference. Recommendations 5, 6, 7 and 12 are either carry-over recommendations from the August 10, 1959 fire, or these same recommendations deal with points common to both investigations. This reinforces the need to successfully implement these recommendations, since we have now had two separate stack near misses where these safety features would have minimized the severity of these near misses.

Although the stack itself may be considered an emergency alarm by virtue of the visible flare acting as an alarm, backup alarms are needed to improve reliability and the response to abnormal conditions.

The preceding investigation covers the excess monomer in the vent system. However, a related incident was uncovered during this investigation...the venting of two coagulated paste resin batches to the emergency vent system which had occurred prior to the VCM overflow. This investigation report includes this incident.

Accident Description (continued)

On the morning of Monday, September 20, a T&M tank farm operator reported evidence of a white residue coming out of the water seal at the stack. Also, this same white discharge was reported on Tuesday, September 21, and this second report really uncovered the VCM problem upon investigation by the foreman. In this case, the seal problem served as an indirect alarm, and the actual VCM overflow may have gone on for some additional time if the seal problem did not trigger investigation by the foreman.

On the morning of Tuesday, September 21, beginning at approximately 4 AM, an experimental batch of heavy or coagulated material was vented to the emergency vent system. Also, a second batch of experimental material was vented at approximately 9 AM the same day. When the VCM overflow began later on, the vent system, including the Building 84 knockout tank and the water seal, may have been partially full or contaminated with paste resin. Hence, the excess resin in the vent system is included in this investigation, since it had bearing on the VCM incident.

Accident Recommendations

1. Review this investigation with all PVC personnel (84, 88 and 92) to ensure complete understanding of the potential of this accident. Include a review of procedures for venting to the stack; highlight Building 84 procedures with coagulated material. Also, reemphasize the need for emergency notification of adjacent areas and plant emergency control.

RESPONSIBILITY: PVC MANUFACTURING SUPERINTENDENT
COMPLETION: November 15, 1971

2. Review specifically with Building 84 lead operators, the operation and valve positioning in the recycle monomer charge system.

RESPONSIBILITY: PVC MANUFACTURING SUPERINTENDENT
COMPLETION: November 15, 1971

3. Permanently and clearly label valve positions on Building 84 monomer system.

RESPONSIBILITY: PVC MANUFACTURING SUPERINTENDENT
COMPLETION: Done

4. Install adequate common overflow facilities between the Building 84 VCM storage tanks to prevent overfillage due to operator error. The overflow line is to be installed so as to be open and available for overflow under all normal operations with appropriate signs.

Alternate A: Change Building 84 VCM storage to #3 and #6 tanks. Install common overflow line at tank bottom nozzles (#3 and #6 tanks of same size and elevation).

Alternate B: Install top overflow of existing #1 and #6 tanks.
NOTE: Above alternates subject to review upon development of design/cost details by engineering.

RESPONSIBILITY: PVC MANUFACTURING SUPERINTENDENT

Accident Recommendations (continued)

5. As regards operation of the stack:

- a. Temporarily disconnect the automatic steam snuffing recently installed, and revert to manual initiation until below is resolved.

RESPONSIBILITY: PVC MANUFACTURING SUPERINTENDENT
COMPLETION: Done

- b. Redesign auto steam system in combination with the gas pilot burner system, such that the pilot burner system will remain on and available 99+per cent of the time.

RESPONSIBILITY: PLANT ENGINEER
COMPLETION: February 15, 1972

6. Equip or upgrade the instrumentation on the stack to:

- a. Detect and alarm loss of pilot lights.*
- b. Detect and alarm high liquid level (either seal water or VCM).*
- c. Detect and alarm loss of flow on seal water via flow switch.

*Some existing instrumentation exists, but requires repair or replacement.

- d. Establish a routine testing program for the above to ensure serviceability.

RESPONSIBILITY: PVC MANUFACTURING SUPERINTENDENT
COMPLETION: February 15, 1972

- 7. Redirect stack seal water line to within the tank farm dike to suitable organic trap arrangement. This recommendation must be accomplished to prevent monomer from entering plant sewers. Normal water flow from trap should go to "clean" or surface water type sewer line. If feasible, design to overflow excessive VCM to tank farm area. Height of trap should be above elevation of tank farm walls.

RESPONSIBILITY: PVC MANUFACTURING SUPERINTENDENT
COMPLETION: April 15, 1972

- 8. Establish a routine program for monitoring the PVC burning stack system. Monitoring of the stack system must be increased on each shift, including check of pilot lights, check of organic trap and visual check of stack tip for burning.

RESPONSIBILITY: PVC MANUFACTURING SUPERINTENDENT
COMPLETION: December 15, 1971

9. Complete the following general recommendations:

- a. Relabel tank farm K-1 tanks, valves, etc., as necessary to reduce potential for other operator errors. Recent painting of this tank farm has obliterated many previous markings.

RESPONSIBILITY: SERVICES SUPERINTENDENT

Accident Recommendations (continued)

9. b. Survey piping in tank farm K-1 to determine wall thickness in sections of severe corrosion (some pipe lines have pits of 1/8 inches to 3/16 inches depth and may be of inadequate strength).

RESPONSIBILITY: PLANT ENGINEER
COMPLETION: November 30, 1971

10. Regarding T&M operations:

Review this incident with all concerned wage T&M personnel.
Review any similar operations within T&M jurisdiction in the VCM tank farm and determine any further needs for labeling or procedural changes.

RESPONSIBILITY: SERVICES SUPERINTENDENT
COMPLETION: November 15, 1971

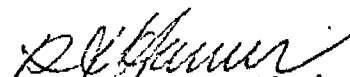
11. Tie VCM vapor detector project into the base of the stack and/or the seal water organic trap (see Recommendation #7) to detect abnormal presence of VCM.

Note: This project, to be installed in the VCM pumphouse, is currently approved and active.

RESPONSIBILITY: PVC MANUFACTURING SUPERINTENDENT
COMPLETION: January 15, 1972

Accident Investigating Committee

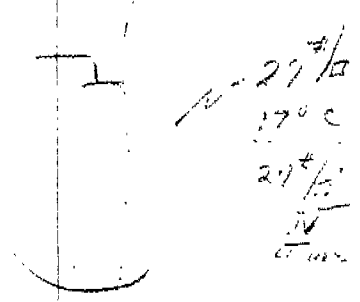
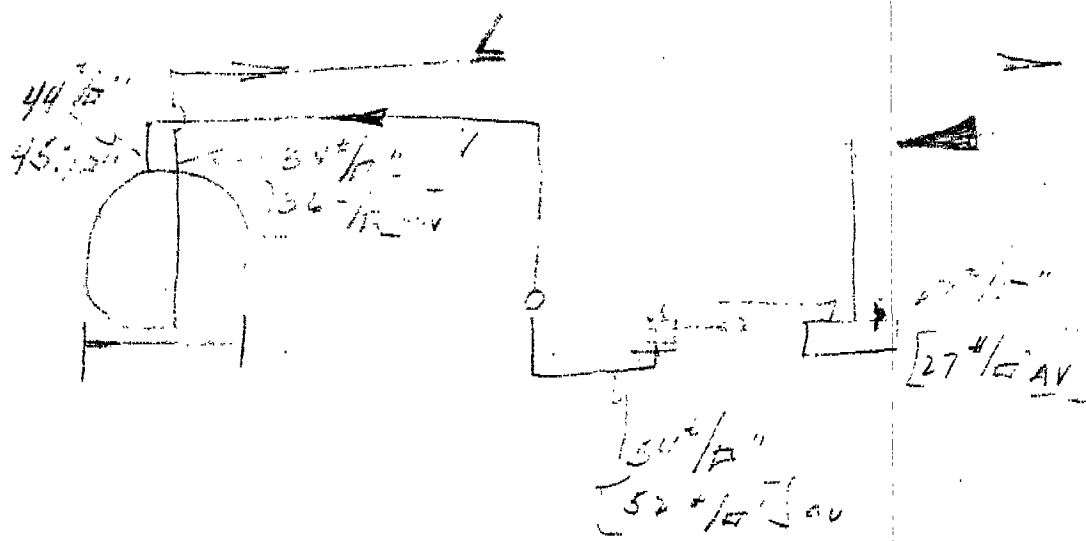
P..E. Bureau
D. L. Gendron
D. E. Philpott
P. A. Tardif


P. J. Hamer, Chairman

S.

(Approved: W.F.Gabel, 10/19/71)

5/9/50



For flow 32 M gal. per hr. from ...

- Cement ... 1/2 hr
- Pump ... 5-6 min
- Pump ... 3 min
- Discharge ... 1/2 hr