INTERNAL CORRESPONDENCE
GA 1076

FROM R. T. Cheng

IN REPLY REFER TO RTC 76:07

TO G. M. Hale

DATE 1/20/76

SUBJECT COMMENTS OF CGPC's VINYL CHLORIDE ENGINEERING CONTROL MODIFYING PROJECTS

Attached are my comments on the four vinyl chloride engineering control modifying projects as summarized in a letter from Mr. W. T. C. Shyeh to Mr. G. M. Hale on December 22, 1975.

1. Building a Supplied-Air Respirator System

A. Source of Air: I presume a compressor will be used to supply respirable air through a small diameter hose to the individual wearing the airline respirator. Most air compressor systems employ internally oil-lubricated pistons for air compression. Oil and water droplets, scale and other foreign particles and oil vapors may be present in the compressed air. These contaminants should be removed by a mechanical and chemical compressed air filter. Oil-lubricated compressors should be well maintained to prevent overheating from excessive friction. An overheated compressor may form harmful amounts of carbon monoxide gas. OSHA regulations in the U.S. requires that oil lubricated compressors be equipped with a high-temperature-actuated alarm to warn if the compressor begins to overheat and a carbon monoxide alarm (or periodical carbon monoxide measurement) to warn of harmful concentrations of carbon monoxide.

Certain types of air compressors which may be water lubricated or which may utilize non-lubricated diaphragms, graphite rings or graphite vanes for air compression are available. These compressors are superior to oil lubricated compressors in supplying respirable air. If possible, an air compressor separate from that used to supply compressed air for industrial equipment is recommended for airline respirators. This should be considered for new installations.

B. Compressor Air Intake: The compressor intake should be located in an area where the air is clean and uncontaminated. The intake should be kept away from all sources of air contamination including engine exhaust. Chemical and mechanical filters for connection to the compressor intake are available. Mr. Wilbur Shyeh might remember the comments by the Plant Managers, Mr. John Gilmore of Goodyear Niagara Falls Plant and Mr. Joe Mydd of General Tire Ashtabula Plant, on how to secure a clean air source by the use of a tall air-intake stack and by an air-inlet charcoal absorption filter.

C. Respirators: Since MSA masks were mentioned in Mr. Sheyh's letter, I presume they are the continuous-flow type. Each respirator wearer should be supplied a flow of air not less than 115 liters (4 cubic feet) per minute, and not more than 425 liters per minute. It is also important that the pressure of the supplied air be maintained within the limits through a pressure control valve (MSA Hyper-Flo Control Valve controls pressure between 40 to 100 psig with up to 250 feet of hose).

D. Couplings: Couplings for attaching airline respirators to the source of respirable air should be incompatible with couplings for other gas systems to prevent accidental connection of airline respirators with sources of non-respirable gases or oxygen. The respirator couplings should also be clearly labelled for identification. If more than one airline respirator is being used simultaneously and their connections are close together, these connections should be identified to prevent one person from disconnecting another wearer's supply of breathing air. Oxygen should never be used with airline respirators.

2. Design Removable Suction Hood for Bottom Manhole Ventilation

This is an excellent approach to eliminate the residual vinyl chloride monomer in the reactors before manual cleaning. In this way we are assured that the trapped VCM is exhausted out of the polymerization plant. Of course, there are many ways to design the ventilation system with good results. My idea is to design the hood approximately the same size as that of the bottom manhole opening to make, essentially, an air-tight fit. The minimum suction flow rate for each hood should be such that, during the air evacuation, the room air sucked in from the reactor top manhole should flow at more than 250 feet per minute. For example, if the top manhole is 2 feet in diameter, the minimum flow rate for each suction hood should be:

$$250 \frac{ft}{min} \times 3.14\ ft^2 \sim 800 \frac{ft^3}{min}$$

Since several hoods are connected to a common duct to a blower, the blower should be sized so that it can operate two or possibly three hoods at the same time, i.e., blower capacity should be 1600 cfm or 2400 cfm with adequate pressure to compensate for the friction loss in the stack and network system.

There is no need to blow additional air into the reactor from the top manhole when the suction hood is in operation. However, when the reactor cleaners are working inside the

reactor, blowing air from the top manhole should dissipate the VCM permeated from the PVC scales and help to cool the reactor's inside temperature.

3. Design a Discharge Duct at the PVC Slurry Storage Tank Air Vent

VCM escaping to the atmosphere in offgases is an environmental air pollution problem. The U.S. Environmental Protection Agency plans to put a 10 ppm ceiling on such losses in offgases. The venting of the PVC slurry storage tank represents a concentrated VCM effluent stream at a rather small rate of gas flow. Instead of discharging this offgas stream directly into the atmosphere, I wonder whether we should try to treat it. Control technology is already available, or nearly so. Tenneco Chemical installed in February, 1975 the first full-scale carbon absorption system at its Saddle Brook, New Jersey Plant and claimed that it meets the 10 ppm emission limit. Another alternative is emission control by solvent scrubbing. Recently, Union Carbide commissioned a system using cold methyl-ethyl ketone as the scrubbing solvent. Other solvents include ethylene dichloride and acetone.

4. Water Scrubbing for VCM and PVC Dust Control at First and Second Stages of Drying System Exhaust

Due to the facts that vinyl chloride is rather insoluble in water and the dissolving rate of vinyl chloride into water is rather slow, the use of water scrubbing for VCM removal will be very inefficient. Anyway, the little amount of VCM removed from the gas stream by the scrubbing water will eventually be a water pollution problem if the waste water is discharged into the environment without further treatment.

If the goal is really to control the release of both the VCM gas and PVC dusts into the atmosphere, then we should look into a two-stage emission control system. A fabric-filter baghouse or a high energy cyclone as the first-stage device would provide at least as good a collection efficiency as that provided by the proposed water scrubber for the PVC dusts. The dusts would be collected in dry powder form which might be an additional advantage.

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The second-stage device is solely devoted to the collection of VCM gases. The already available control technology includes carbon absorption and solvent scrubbing. Calgon Corporation (Pittsburgh, Pa.) has been working with a half-dozen or so VCM and PVC producers on pilot plant projects. A Calgon spokesman stresses that in work so far there have been no problems with unloading spent beds for VCM recovery or with bed clogging or monomer polymerization in the beds. Solvent scrubbing techniques for VCM recovery would require the use of organic solvents such as ethylene dichloride, acetone or methyl ethyl ketone.

There are other new VCM gas clean-up developments, but technical and economic feasibility still remains unproven on a large scale. Recently, Dr. Roy L. Gibson mailed you the B.F. Goodrich Company's report on "Progress in Vinyl Chloride Containment" in which they discussed the success of reduction of VCM in products through continuous stripping of VCM from PVC resin during its manufacture. This patented technique would not only lower the residual VCM in products, but substantially reduce the amount of VCM which could be discharged to the environment with the air from the dryer or with effluent from other downsteam operations.

I would appreciate receiving drawings on the designs of the ventilation suction hood and the drying system exhaust emission control. Please advise me if I can be of further assistance.

R. T. Cheng

RTC/ELK

cc: Dr. Roy L. Gibson, M.D.
Mr. H. E. Runion
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