



FLOTRONICS

PRODUCTS OF SELAS CORPORATION OF AMERICA SPRING HOUSE, PA. 19477

November 3, 1976

J SANDSTEDT
NOV 13.

Tenneco Chemicals, Inc.
Burlington, N.J., 08016.

Attention: Mr. W.T. Anderson

Dear Sir:

It has been brought to our attention, through various publications, that you are currently facing a situation in which you will be required to reduce your emissions of hydrocarbons, organic vapors, or poly vinyl chloride monomers. We, at the Flotronics Division of the Selas Corporation of America, have pioneered a complete treatment package, known as Vape-Sorption, which is geared in the direction of just such an application.

I am enclosing several of our bulletins which I feel may be of interest to you in the future, in considering your possible alternatives. One of the bulletins entitled "PVC Plant Reduces VCM in Breathing Air to One-Tenth OSHA Standard" should prove to be most interesting to you in that it's application would probably relate directly to your future needs.

Please feel free to contact us at any time in the future concerning this particular application or any other possible filtration, separation, or adsorption application, which you may come in contact with. We currently have a representative in your area who would be glad to visit with you and discuss this possible application first hand.

Thanking you again for your time and consideration.

Very truly yours,

Stephen T. Bateman
Engineering Department

STB:jmh

cc: Our representative is:

Plummer, Lawley & Company

P.O. Box 1067, Bryn Mawr, Pa., 19010.
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-or release IMMEDIATE

PVC PLANT REDUCES VCM IN BREATHING AIR TO ONE-TENTH OSHA STANDARD

A simple but highly reliable system for removing vinyl chloride gas and other contaminants from the air breathed by plant workers is in operation at General Tire & Rubber Company's PVC resin production facility in Ashtabula, Ohio.

Extensive testing of the purified air has demonstrated that the system reduces the monomer gas content to about one-tenth the level permitted by current regulations of the Occupational Safety and Health Administration (OSHA).

Other advantages of the plant life support air system, proved out in many months of round-the-clock operation, include the following:

1. Air breathed by the workers through half-mask respirators is cool, clean and odorless, with a comfortable relative humidity of about 20 percent. Minimum Federal standards for breathable air are exceeded substantially.

2. Maintenance cost has been negligible and operating cost (comprised mainly of electrical energy for the compressor drives) is regarded as favorable.
3. Inherent safety and security of the system is assured by the redundancy of essential components and other design features.

The first of its kind in the industry, the system utilizes a central purification station where hydrocarbon vapors, including the monomer, are removed from a compressed air stream by adsorption. The purified air is then piped throughout the plant.

THE OSHA IMPACT

By now the problems facing the industry are a familiar story. Long-term exposure to vinyl chloride monomer gas (VCM) has been linked to a rare cancer of the liver. Under terms of OSHA rulings, the industry has been obliged to sharply reduce worker exposure to VCM. Such efforts, in any case, are consistent with long-standing policy of the Chemical Division of the General Tire & Rubber Co., which operates the Ashtabula plant.

Whereas the initial interim OSHA standard generally allowed exposures of up to 50 ppm, the present regulation -- effective last April 1 -- sets exposure limits of one ppm for a time-weighted average over an eight-hour day with exposures up to five ppm allowed for periods of less than 15 minutes.

Our position from the outset was to devise a system and procedure which would meet not only the interim and present standards, but also the even more stringent OSHA regulations due to go into effect on April 1, 1976.

Like most PVC resin producers, we also had to face the fact that the plant was designed and built long before anyone was aware of the possible hazards of exposure to the monomer gas. The Ashtabula facility went on stream in 1953 with an initial capacity of 25 million lbs./yr. and has been enlarged in stages to its present rated output of 125 million lbs.

Coping with the problems and limitations of such older plant layouts and equipment presents a formidable technical challenge. Nevertheless, we have made very significant progress at Ashtabula in reducing the monomer content of the ambient air throughout the plant.

SYSTEM CONCEPT AND DESIGN

Taking all these factors into account -- including worker safety and comfort, reliability, ease of operation and costs -- we concluded that our objectives would best be met by a system with the following principal components:

1. A compression and distribution system capable of supplying the breathing air requirements of up to 50 people simultaneously. Although about 100 quick-connect air outlets are located throughout the plant, usually no more than seven or

- .. eight workers on a shift are hooked up at any one time.
- 2. A purification step with redundant capacity capable of removing hydrocarbon contaminants from the compressed air down to fractions of one ppm.
- 3. A supply of Type C, continuous flow respirators of the half-mask design to provide protection to plant operating personnel in designated areas, or when performing certain tasks, where the possibility of VCM concentration is greatest.

Design, equipment specification and installation supervision of the system -- which went into operation in August, 1974 -- were the author's responsibility. It is noteworthy that all components are standard items available in a range of sizes and types from the manufacturers.

At the heart of the system are two Model VS-50-B-150 Vape-Sorbers^R, supplied by the Flotronics Division of Selas Corporation of America, Dresher, Pa. The Vape-Sorber is widely used throughout industry for the removal of oil and other hydrocarbon and organic vapors from compressed air and process gases.

The Vape-Sorber operates in two stages on two different principles of contaminant removal. The compressed air first enters a liquid-gas separation section containing a number of special hydrophobic-treated

ceramic elements. Phase separation is accomplished by means of controlled porosity which causes water, water-oil emulsions and dirt in the air stream to collect on the surface of the elements. The rejected phase is collected at the bottom of the Vape-Sorber tank and is vented periodically.

In the second stage a bed of activated carbon removes the hydrocarbon vapors by adsorption. Surface area, mass flows, velocities and contact times across the carbon bed are carefully and conservatively calibrated to assure positive extraction of the chlorinated hydrocarbon and other organics from the air stream.

Removal of free liquids in the phase separation stage of the Vape-Sorber prevents saturation of the adsorbent. Change-out of the activated carbon and ceramic elements is carried out routinely once every six months.

Samplings of the purified air by a variety of methods has confirmed the efficiency and reliability of the Vape-Sorber over the full period of operation.

Testing for vinyl chloride and gaseous hydrocarbons was by means of flame ionization chromatograph. The VCM gas was sampled both by direct injection of the purified air and by the use of personal monitoring pumps with charcoal tubes operating for eight-hour periods. The air has been tested at least three times monthly since the system was installed. Results are as follows:

<u>PROPERTY</u>	<u>MEAN</u>	<u>HIGH</u>	<u>LOW</u>
Oxygen, %	20.5	21	20
VCM, ppm by direct injection	.11	.31	.04
VCM, ppm by 8 hr. personal monitor	.10	.18	.01
Gaseous Hydrocarbons, ppm	1.0	1.0	1.0
Carbon Monoxide, ppm	1.0	7.0	Non-detectable
Carbon Dioxide, ppm	.005	.067	Trace
Dew Point, °F	+20.9	+35	-15

In addition to assuring worker safety, use of the Vape-Sorber with the activated carbon adsorbent has also eliminated any detectable odor in the breathing air. The approximate relative humidity of 20 percent has ended complaints arising from the drying out of the mucous membranes which were experienced before installation of the central system when breathing air was supplied from compressed air bottles.

COMPRESSION AND DISTRIBUTION SYSTEMS

Four water sealed compressors with 30 hp drives are each capable of delivering 70 scfm at 60 psig. Operating economy and a high degree of reliability is assured by the use of four compressors rather than one large unit, since normally only one is in operation. A pressure sensing device automatically starts additional units in sequence as required. In the event of insufficient pressure due to pump failure, an alarm would sound.

Selection of water-sealed compressors was based on their ability to scrub impurities from the inlet air and because the air leaves the compressor saturated with water vapor and at ambient temperatures. This last feature eliminated the need for an after-cooler.

The compressed air is collected in two receivers and then piped to the Vape-Sorbers. Although both purifiers normally are in operation, either one can handle the total maximum flow of 280 scfm (56 acfm after compression) if the other is taken off the line for servicing. Thus they are running at well below their rated extraction capacity.

To reduce the likelihood of picking up contaminants from the ambient air in the vicinity of the plant, the compression and purification installation is located inside the warehouse. From this point, three-inch headers carry the compressed air to all areas of the facility. Distribution branch lines consist of two-inch pipe running to 100 "Shrader" type quick-connect couplings. These couplings are not used for any other purpose in the plant so that there is no possibility of a user connecting the face-mask line to the wrong outlet. All of the air piping is color-coded as an additional precaution and to facilitate quick location of the outlets. Pressure drop across the system from purifier to mask is under three psi.

The quality of breathing air from compressed air systems is set by Federal standards. The required minimum is Grade D breathing air as described in the "Compressed Gas Association Commodity Specifications G-7.1-1966." The system described here not only meets this minimum standard, but has tested out consistently at Grade F or higher.

CONCLUSIONS

It is understood that every maker of vinyl chloride, PVC resins, as well as certain plastics fabricators must make their own determination

of how they are to comply with the OSHA standards, depending on individual circumstances and practices. While the approach we have chosen has worked well for us, we do not suggest that it is universally applicable throughout the industry.

Design and operational data on the system has been made available by General Tire & Rubber Co. to the industry, both by means of a technical report and through plant visitations. Since the start-up last year, delegations from 22 companies, including seven overseas firms, have been shown the life support air system. As a result, several companies have made similar installations built around the Vape-Sorber. Our company, of course, does not guarantee the performance of these other systems nor assume any liability for their use.

In our judgement, the system is an effective "insurance policy" which assures our compliance with present and future standards while giving us time to complete more fundamental improvements and modifications aimed at keeping monomer gas content in the plant environment at an irreducible minimum.

While precise comparisons are difficult, the cost of the system appears reasonable compared to practical alternatives. The total cost for equipment (including masks) and installation was \$60,000. We estimate that if canister-type masks had been used, with the canisters replaced at the end of each eight hours of use, the annual cost may have exceeded the total installed cost of the present system.

Apart from cost, extensive experience with the system has convinced us that it is also superior in terms of worker safety and comfort, as well as operational reliability.