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June 27, 1974

Docket Officer
Docket OSH-36
Room 230
1726 M Street, N.W.
Occupational Safety and Health Administration
Washington, D. C. 20210

Dear Sir:

Continental Oil Company manufactures about 500 million pounds of polyvinyl chloride (PVC) per year at two plants, one located in Aberdeen, Mississippi, and the other at Oklahoma City, Oklahoma. Continental Oil Company also produces about 700 million pounds of vinyl chloride monomer (VCM) at a plant located in Lake Charles, Louisiana. The proposed occupational health and safety regulations regarding vinyl chloride as published in the Federal Register, pp. 16896-16900, Vol. 39, No. 92 - Friday, May 10, 1974, are of significant concern to Continental Oil Company.

We wish to record comments regarding (I) proposed permanent standard for Vinyl Chloride, § 1910.93q, (II) problems associated with analytical detection of vinyl chloride, (III) information related to large polymerization reactors, and (IV) the economic impact of a "no detectable level" of VCM upon Continental Oil Company employees.

In summary, the recommended Occupational Health Standard regulating vinyl chloride, dated May 10, 1974, will have a significant impact upon the economy of the United States and upon Continental Oil Company operations should the standard be implemented as proposed. It is our belief that the proposed standards would result in the cessation of production for an extended period of time because of the improbability of meeting a "non-detectable level" for VCM in the work place. Continental Oil Company has made significant improvements in its PVC manufacturing operations towards reducing exposure of employees to VCM vapors and we are convinced that considerable additional improvements in this respect can and will be made by our plants and the industry.

Very truly yours,

R.W. Gerwig by wck
R. W. Gerwig, Vice President
Continental Oil Company

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ATTACHMENT I

DEPARTMENT OF LABOR
Occupational Safety and Health
Administration
(29 CFR Part 1910)
(Docket OSH-36)
VINYL CHLORIDE
Proposed Standard

OBJECTIONS AND PROPOSALS TO THE PROPOSED PERMANENT STANDARD

<u>Objection Number</u>	<u>Provision 1910.93g</u>	<u>Objection</u>	<u>Objections Recommendations Grounds</u>
1	(b) (6)	Definition of Detectable Level	It is our position that the "detectable level" requirement stated throughout the standard is not a feasible requirement in view of existing technology. We propose that this definition be changed to "base level" and that the "base level" of VCM be defined as 25 ppm Time Weighted Average (TWA) and 40 ppm ceiling. Such a requirement for atmospheric VCM levels has been proposed by the Society for Plastics Industry group, effective October 5, 1974. We also propose that the "base level" be lowered to 25 ppm ceiling, effective October 5, 1975, and that the "base level" be further lowered to a 10 TWA and 25 ppm ceiling effective October 5, 1976. It is our intention to continue to strive to achieve the lowest practical level of employee exposure consistent with our use of the best available technology. At the proposed permanent standard level of "no detectable level" we would not be able to operate our monomer or polymerization facilities. We do not believe that available technology would permit us to define a feasible operating level below the levels suggested above at this time.
2	(b) (8)	Definition of Emergency	Since the realization of no detectable level of VCM in workplace environments is not feasible, we propose that an emergency be defined to reflect an unforeseen circumstance or set of circumstances resulting in the release of vinyl chloride of greater than an allowable ceiling into areas occupied by employees. An allowable ceiling should be defined as atmospheric concentrations of VCM not in excess of the ceiling value.

<u>Objection Number</u>	<u>Provision 1910.93q</u>	<u>Objection</u>	<u>Objections Recommendations Grounds</u>
3	(b) (9)	Definition of Exposure	Consistent with the comments made above, we feel that exposure should be defined to designate actual contact with vinyl chloride in concentrations above ceiling value.
4	(4) (sic)	New Definition	The regulated areas defined in the standard are general enough to include the entire plant area. We feel that there should be at least two categories of limited access areas. For example, a regulated area is an area wherein a likely opportunity for exposure exists and a controlled area is an area wherein there is not a reasonable chance for exposure. This would allow the definition and policing of high risk, regulated areas, while not requiring such stringent record keeping, etc., for lower risk, controlled areas. Access to regulated areas should be extended to include authorized persons. The daily roster requirement should be limited to people whose normal, routine duties could result in exposure.
5	(e) (2)	Definition of Monitoring	Monitoring requirements should allow the use of more sophisticated system than personnel mounted devices, such as continuous, fixed point monitors. These units should be allowed as primary units with personnel mounted devices used as backup units. Options should exist, however, to allow only personnel monitoring where continuous, fixed point monitors are impractical. The requirements of paragraph (e) (2) are unclear and need to be rephrased and defined. Entire paragraph (e) (3) should be deleted and replaced with one allowing the individual employee and OSHA employees free access to monitoring records, techniques, etc. Allowing any "designated representative" to do the extensive observing defined in this section as it exists now could lead to difficulties with insurance, secrecy, licensing agreements, evaluations by unqualified persons, etc.
6	(f) (1)	Engineering Controls and Work Practice Methods	All engineering controls and work practice methods indicated in this section would be activated by VCM levels exceeding the base level as proposed in Objection 1, above. The word "airborne" should be replaced by "atmospheric" to avoid possible confusion. With specific reference to Subparagraph (ii) and (iii), it is noted that it is impractical and unsafe for employees to regularly and routinely work in respirators as proposed by the present standard. The use of respirators should be considered only as a temporary practice when atmospheric levels rise above the permitted maximum and should be required only until corrective measures have been taken to reduce the level of vinyl chloride below the permitted maximum.

<u>Objection Number</u>	<u>Provision 1910.93g</u>	<u>Objection</u>	<u>Objections Recommendations Grounds</u>
7	(g) (3)	Respiratory Protection	We propose that full face piece masks should be required whenever respiratory protection is specified. However, full face respirators restrict vision and make working more hazardous, and there appear to be mouth and nose masks which provide the same respiratory protection as full face respirators. We also propose that the requirements for combination units as specified by subparagraphs (iii) and (iv) be changed to allow the use of airline respirators without a self-contained backup unit on the employee's person. Self-contained respirators should, however, be located in readily accessible areas when airline respirators are used. When it can be demonstrated that canister type masks accompanied by appropriate work practices would provide adequate protection against VCM exposure, this type of protective respirator should be allowed under the standard.
8	(h) (1)	Protective Clothing	The purpose and significance of the paragraph is difficult to understand. If protective clothing is intended to provide an impermeable barrier to liquid or gaseous vinyl chloride, we know of no practical clothing that can be worn which will permit employees to perform their necessary duties. If protective clothing means closely woven work clothing which can be laundered, there should be no problem. We feel that only employees whose <u>normal duties</u> require presence in the regulated areas should be required to wear protective clothing. The requirement that personnel be required to wear gloves in regulated areas is not justified. Gloves could create a safety hazard.
9	(i) (3)	Storage of Food, etc.	The use of non-food chewing products should not be prohibited in regulated areas. Since no harmful levels of vinyl chloride will be present where employees work, there is no reason to deny employees their use of non-food chewing products. Should levels of vinyl chloride rise above the maximum permitted, the mandatory use of respirators will automatically preclude the use of chewing products. There is also no reason why the application of cosmetics should be prohibited, and therefore, it should be permitted.
10	(k) (1) (2) (3) (4) (5)	Signs and Labels	The sign labeling requirements as defined in paragraphs (1) (3) (4) and (5) should be modified to declare vinyl chloride as a "hazardous chemical" instead of a "cancer-suspect agent". We believe that the declaration of VCM as a cancer-suspect agent at this time will unduly alarm people.

ANALYTICAL PROBLEMS

Since the vinyl chloride health problem became a major concern in January 1974 Continental Oil Company and others have undertaken a substantial amount of research to perfect methods to monitor personnel and workplace areas for vinyl chloride.

LEAK DETECTION

The simplest type of VCM monitoring is for leak detection. A portable organic vapor analyzer offered by Century Systems, Inc., Arkansas City, Kansas is light and has an extremely rapid response to VCM and is used by industry at this time. Unfortunately, the Century is not specific to VCM; it responds to all light hydrocarbons and thus provides only a maximum value which could be VCM. This apparatus is excellent for gross leak detection but has little utility below 25 ppm of VCM.

PERSONNEL MONITORING

Personnel monitoring is accomplished by placing a device on the employee and sampling his breathing zone for VCM. Two methods are generally used: activated charcoal adsorption and gas bag inflation.

The charcoal adsorption technique (recommended by Occupational Safety and Health Administration in the Emergency Temporary Standard, Federal Register page 1, 2,3,4,2, volume 39 April 5, 1974) requires a suitable pump to pull air through a tube packed with charcoal. The VCM adsorbs on the charcoal. After a prescribed time period, the charcoal tube is taken to the laboratory, eluted with carbon disulfide and the resultant eluate, containing the VCM, is analyzed by gas chromatography and detected with a flame ionization detector. The assumptions inherent in this method are: (1) the VCM is quantitatively adsorbed on the charcoal; (2) the VCM is quantitatively desorbed by CS₂; (3) pumping rates are precisely known; and (4) the analytical procedure is accurate, precise and reproducible.

This technique is fraught with problems. First, the adsorption efficiency of charcoal is highly dependent on activation, supplier and batch. Second, the VCM must be quantitatively desorbed from the charcoal with carbon disulfide. All solutions must be handled at dry ice temperature in closed containers to achieve any resemblance of analytical accuracy. Carbon disulfide appears to be a good solvent for desorption, but has a very unpleasant odor, is highly volatile and extremely toxic (OSHA limit is concentration of 20 ppm over an eight-hour TWA). Third, pumps suitable for pulling air through the charcoal must have a constant pumping rate and the cost is \$300-\$350 per pump. Fourth, the time the air is pumped through the charcoal must be accurately known since it is an integral part of the final calculation and requires either a digital readout showing the volume pumped or careful monitoring by the individual to record the start and stop time of the pump and the pumping rate. Each pump must be calibrated to assure a constant, known pump rate. Both variables are extremely difficult to control since it must be the operator who verifies both. Fifth, repeatable injections of disulfide mixtures into gas chromatographs are difficult to obtain because of the high volatility of the solvent. Experienced analysts are generally required to obtain accurate, meaningful data. Sixth, calculation of the final VCM concentration is relatively complex. Seventh, laboratory analysis time of the charcoal is inordinately long which limits the amount of surveillance that can be accomplished. It is questionable that the desired accuracy of 1 ppm $\pm$ 50% can be obtained with this method.

The gas bag technique is simple and straightforward. A low-cost pump can be employed, e.g. aquarium pumps (either the Lewis Air Pump or NAPCO Pump is suitable, both are available at sporting goods stores) at a cost of \$4 - \$7 per pump. The bags (available from Calibrated Instruments, Inc., 731 Sawmill River Road, Ardsley, N.Y.) are relatively inexpensive (\$7 - \$8 per bag) and can be used over and over until failure. There is no need to know pump rate since the sample is analyzed by gas chromatography and concentration is calculated based on standard gas blends; however, the rate must be constant. The time to acquire a sample can be easily regulated from about 4 minutes to over 2 hours when using a 7-liter bag. This can be varied by using a simple check valve and a Tee splitter. Any analyst with the ability to inject gas samples into a chromatograph with a syringe can do the analysis.

Analysis time is about five minutes. If an analysis is ruined, another sample can be run from the same bag and the results salvaged which is not true with the charcoal dosimeter. The bags can be easily attached to the individuals, are of light weight, and the pumps used are small, light and convenient. The low initial cost of the entire apparatus coupled with the speed of analysis will permit significantly more monitoring to be accomplished than can be done with charcoal dosimeters. The results obtained are much more reliable, easier to produce and should instill greater confidence in the actual levels of exposure being encountered. The gas bag analysis method was tested using 1.0, 5.0, and 10.0 ppm VCM-in-air standards. Analytical precision is excellent, between $\pm 10\%$ at the 99% confidence level. Various sized bags are available for longer sample times. One disadvantage of the bag is bulkiness during and after the sample is collected.

AIR MONITORING

Personnel monitors are obviously "after the fact" analytical devices; that is, no instant warning is provided to indicate the level to which he is being exposed. Sophisticated, expensive (\$15,000 per unit) fixed point area monitors can do this. The gas chromatographic methods appear more feasible at this time than infrared analyzers since the accuracy of the infrared unit is questionable at the 1.0 ppm level of VCM. Continuous ten-point gas chromatographic process analyzers are available (Honeywell, Inc. Model GC-16, Fort Washington, Pa.) which can be programmed to analyze one point each minute in the PVC plants. An analyzer can be placed in a reactor building and one in each other processing area which should provide good information about the workplace environment for the worker. The units will be provided with variable set point alarms to warn employees of VCM concentrations the instant the concentration is determined, and also recorded on strip charts.

At this time we have no firm data base to determine the levels in Conoco Chemicals plants today. We are awaiting delivery of the continuous gas chromatographic area monitors (due in July and August, operable in early September) and have recently elected to go gas bags for personnel monitoring after encountering many frustrating difficulties with the charcoal procedure. However, we believe we do know maximum values for VCM exposure levels to our employees in our operations which permits us reasonable assurance of complying with the following: a schedule for maximum exposure in the workplace; i.e., a 25 ppm TWA-40 ppm ceiling in October 1974, a 25 ppm maximum in October 1975, and a 10 ppm TWA-25 ppm ceiling in October 1976 (see Attachment I).

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Suspension polymerization of VCM is the dominant process (80%) to make polyvinyl chloride (PVC). There are certain steps common to all suspension PVC processes: reactor charging, polymerization, recovery of unreacted VCM, dumping of the batch from the reactor and cleaning the reactor in preparation for the next charge. Continental Oil Company during the period 1969 to 1971 developed a suspension polymerization process in 18,000 gallon large reactors which are significantly larger than the average PVC reactor in use in the United States today. Several other foreign companies also developed large reactor technology during about the same period. The advantages of this technology relate to most of the steps mentioned above and have significant advantages in reducing the employee exposure to VCM. A relative comparison of these two processes should be of interest.

A new Conoco PVC plant based on the large reactor technology came on stream in 1971 in Oklahoma City, Oklahoma. Conoco also operates a small reactor PVC plant in Aberdeen, Mississippi, and the following data are related to small reactor plants based on our experience at the latter plant. Approximately 32 to 34 small 2200 gallon reactors are needed to provide the same capacity that is obtained in 4 large reactors at Oklahoma City. This means that 8 times as many reactors must be charged, polymerizations contained, stripped, dumped, cleaned, etc. The number of mechanical entities (valves, flanges, pumps, etc.) requiring maintenance (leak problems) is substantially less in the large reactor plant, a strong positive factor in its favor. Moreover, most of the mechanical steps in the new plant are carried out by remote control while the operator keeps all phases under observation by means of charts, schematic diagrams, lights, and closed circuit TV cameras. These comparisons are also based on considerations of the cooling water availability, product mix and the particular chemical and engineering approach in use.

Most of the small reactor plants have been constructed with the reactors contained in buildings. Our large reactor plant has only a roof over the reactor building. The associated piping, instrumentation, etc. are enclosed on the sides by a protective metal screen-like structure which covers only about two-thirds of the vertical rise. Therefore, the reactor area is essentially "open air".

The large reactor technology, when producing construction type resin, requires personnel entry only about once every thirty days; in small reactors, entry for cleaning is about every 4 or 5 days. Reduced entry frequency is obviously preferred until the goal of zero personnel entry can be achieved by additional research on "clean wall" polymerization formulations. Until that time a combination of solvent cleaning followed by periodic personnel entry in the reactor to manually chip away polymer will be required.

Our large reactor plant provides about a 98% yield of PVC based on vinyl chloride monomer charged whereas small reactor plant yield is only about 94 to 95%. While the distribution of the yield loss is not fully defined, we believe a significant reduction in atmospheric emissions is being obtained. In addition to the differences in product mix, this difference in yield reflects the fact that fewer operational steps are required in large reactor technology which minimizes the loss of both solid PVC and gaseous VCM. This should provide a workplace with a lower risk for the employee of VCM exposure.

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Large reactor manpower requirements are approximately one half that of small reactors on an equal production basis. Two large reactors require two reactormen per shift. Sixteen small reactors, the number necessary to equal the production of two large reactors, require four reactormen per shift. On a per pound basis, large reactors require 0.084 reactormen per million pounds per year while small reactors require 0.168.

In view of what we believe to be positive advantages for large reactor plants, we plan to install additional large reactors to replace the small reactor sections of the Aberdeen plant when appropriate technology is available. At the present time, large reactor technology is limited to a very specific range of resins which find application in the construction industry. These types of resins do not have rigorous requirements on several important PVC properties; e.g. "fisheyes". Although higher quality resins suitable for wire and cable, calendering and other applications have been demonstrated to be technically feasible in our large reactor technology, significant additional developmental effort will be required to demonstrate production of these resins on a commercially practical basis. To accomplish the goal of replacing our small reactors at Aberdeen and of providing resins required by the market, we believe that the following is a very realistic timetable:

- Basic R & D Program - 1 year.
- Engineering design and obtaining bids - 1 year
- Plant construction and start up - 3 years

This engineering analysis indicates that 5 years are required to implement technology required to satisfy market demands while maintaining our employee VCM exposure in keeping within our proposed standards. In the interim, we plan to meet the proposed standards by restricting work practices (by use of protective equipment, etc.), until such time as we are able to implement the replacement of small reactors with large reactors.

Economic Impact

The following Continental Oil Company plants would be shut down as a result of a combination of provisions which lead to an effective zero tolerance level for vinyl chloride in the workplace:

Conoco Chemicals PVC Plant, Aberdeen, Mississippi. This will cause a loss of 375 jobs and a loss of \$3,600,000 to the community in direct wages alone.

Conoco Chemicals PVC Plant, Oklahoma City, Oklahoma. This will cause a loss of 53 jobs and a loss of \$577,000 to the community.

Conoco Chemicals Vinyl Chloride Plant, Lake Charles, Louisiana. Will shut down if PVC is not manufactured and will cause a loss of 107 jobs and a loss of \$1,000,000 to the community in direct wages.

An additional result of shutting down the PVC industry would be that plasticizer alcohols would no longer be required for various plasticizers used in the plasticization of PVC resin. Conoco Chemicals currently markets 50MM pounds per year of plasticizer range (C sub 6 - C sub 10) alcohols valued in excess of 11 million dollars to the vinyl industry. The plasticizer alcohols are produced concurrently with other higher molecular weight (C sub 12 - C sub 18), alcohols at Lake Charles, Louisiana. If the market does not exist for the plasticizer range alcohols, the production of the higher molecular weight alcohols will be curtailed accordingly. At the present time, the only acceptable substitutes for these higher molecular weight alcohols are natural alcohols derived from imported coconut oil. At the present extremely high prices of imported coconut oil, the natural alcohol replacements for these synthetic higher molecular weight alcohols would be 2 to 4 times as expensive as the synthetic molecular weight alcohols. In addition to the balances of payments problems created by the importation of the additional quantities of imported coconut oil, there is insufficient capacity in the U. S. to convert the coconut oil to natural alcohols. This supply dislocation would cause severe problems in the supply of the derivatives of these alcohols; examples: bactericides, ingredients for synthetic rubber production, ultra violet stabilizer for polyolefins and household detergents.