

APPENDIX C

Report of SPI-VCM Monitoring Working Group

A. Methods

1. Area Monitoring

Fixed point area monitoring systems should be used in VCM and PVC plants for indicating the potential exposure of employees to vinyl chloride. The number and location of such monitoring points should be established in such a way that they will be representative of the workplace atmosphere.

The testimony offered by The Dow Chemical Company clearly demonstrated that fixed point area monitoring, backed up with personnel monitoring has been quite successful in quantifying worker exposure to vinyl chloride. Additionally, more recent information and experience has been coming from other companies.^{1/}

Fixed point area monitoring systems are necessary because personnel monitoring systems will not provide adequate warning of VCM excursions, leakage and the like. The only rapid method for noting an excursion and warning employees to take precaution

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^{1/} See, e.g. Air Products (Tr. 795), B.F. Goodrich (Tr. 1113), Dow (Tr. 877) and Union Carbide (Exhibit 94(b) in the Record.)

measures is with area monitoring. Personnel monitoring over extended sampling periods does not give "rapid" results and thus cannot give current protection to employees. Personnel monitoring only provides a historical record of exposure.

Fixed point area monitoring provides for continuous, sequential sampling. The frequency of sampling should be a function of the system design so that it provides representative sampling of workplace atmosphere in the occupied part of regularly established work areas, and alerts employees to excursions over the permitted ceiling.

The sampling points at various locations are measured in sequence. The time required to complete a full cycle, measuring all points, varies from plant to plant but can be designed so that excursions will be noted and an alarm will be sounded without undue delay. The design for each installation must take in consideration the specific details of process variation, the type and location of the plant, and any other relevant characteristics of the particular plant.

In addition to the fairly short time it takes to complete a full sampling cycle, fixed point area monitoring systems have a built-in backup in that points adjacent to one another will, on sampling, be sensitive to the exposure levels at adjacent points. This "redundance" or overlap provides very effective area coverage in that excursions in nearby areas will be picked up at adjacent sampling points. Thus, in the event an excursion has occurred, the redundancy or overlap of nearby sampling points will prevent an undue time delay in sounding the warning alarm. By comparison to personnel monitoring, this system provides almost instantaneous warning that precautionary measures should be taken. This is the only currently available method which can provide adequate worker protection.

In short, with adequate fixed point area monitoring systems no major excursions will occur without being detected on monitoring equipment.

Properly designed fixed point area monitoring systems will be equipped with warning devices designed to notify employees of workplace exposure levels exceeding the limitation of the standard. When the warning alarm or signal is triggered by the area monitoring system, it will be a notification to employees that they should take appropriate protective measures. In the instance of an excursion beyond the permitted level, the warning system would signal employees to don appropriate respiratory equipment. If a major spill were to occur, another set of signals could direct personnel evacuation and spill containment procedures.

Fixed point area monitoring systems in vinyl chloride and polyvinyl chloride plants will be equipped with detection systems of a suitable sensitivity, that is, capable of measuring the vinyl chloride monomer content in the air with accuracy of approximately $\pm 10\%$ in the range of interest. Examples of systems which are commercially available at this time are: infrared; total hydrocarbon detectors; combustion analyzers; and gas chromatography. Such monitoring systems can also provide a record of actual monitoring results. For purposes of validating the detection sensitivity of a fixed point area system, gas chromatography with flame ionization detector should be the "reference" method. (Tr. 569). Certified calibration gas mixtures are available commercially, or can be prepared

and calibration should be performed at least monthly.

2. Personnel Monitoring

Personnel monitoring is suitable for validation and confirmation of fixed point area monitoring systems. It is also suitable for measuring employee exposures in areas outside normal work areas that are not included in the area monitoring system. To be effective, personnel monitoring systems must be carried on in such a way that samples are taken over an adequate time period. Monitoring with short sampling times has been proposed as a procedure to verify that exposure levels above ceiling limits are not being experienced. However, this has been found to give erratic results in actual practice. If the plant involved has a well designed fixed point area monitoring system, these job segments or areas of potential high exposure will be known, and the individual will then be wearing suitable respiratory protection where needed.

Personnel monitoring will document average exposure if it is conducted over an adequate sample time. This should be at least 4 hours and preferably longer so that a meaningful, 8 hour TWA can be determined. However, personnel monitoring, although useful for an exposure history, should be used only as an auxiliary method of monitoring or one to check on unusual work duties because such personnel monitoring provides no means of warning employees of immediate exposure levels. An analogy

to personnel monitoring for exposure to vinyl chloride can be made to the film badges worn by persons handling radioactive materials. A film badge provides a historical TWA-type measurement and area monitoring in such situations is conducted with a radiation survey meter, either fixed or portable, capable of determining current exposure levels to radioactivity.

Personnel monitoring systems should be designed so as to measure the exposure in the breathing zone. In order that such monitoring provides an accurate exposure history, personnel monitoring devices should not be used or should be turned off when the employee is wearing a respirator.

Personnel monitoring systems should be capable of measuring vinyl chloride concentrations accurately, that is, they should be capable of measuring the vinyl chloride content in the air with an accuracy of approximately $\pm 10\%$ in the range of interest.

Plants in which there is a potential for an emergency should have an ongoing program using both fixed point and personnel monitoring. Personnel monitoring systems should be used to validate the area system periodically for each job classification and to determine the adequacy of the number and location of the fixed points. In order to accomplish this and to develop a high degree of confidence in the area monitoring system, by use of personnel monitoring of individual job

classifications, should be conducted as follows:

No less than monthly monitoring for three consecutive months in which no exposure above the limit is found; thereafter quarterly.

At any time when a level exceeding the limit is found in a particular job classification, the complete validation process for that job classification should be repeated.

In this connection, it should be restated that, in all cases, the personnel monitoring system should reflect the actual breathing conditions and not include the times when adequate respiratory protection is being worn.

3. Patrol Systems

In locations or places where the probability of a major release of vinyl chloride into the air is either remote or impossible, portable monitoring systems may be employed in place of fixed point area monitoring. Such portable monitoring systems can typically be employed, for example, where the only vinyl chloride present is that contained in polymeric products.

B. Reporting

Although each fixed point area monitoring system in a vinyl chloride or polyvinyl chloride plant will automatically provide a record of exposure levels sample by sample, there is no necessity for retention of sample by sample printouts beyond 6 months. Summaries of monitoring information should, however, be prepared and maintained for a minimum of twenty-five years.

Such summaries should be kept available to present and former employees for their review. Summary records more than one year old should be reviewable by employees and former employees only upon a reasonable showing that exposure information is being sought for medical purposes.

Observation of the monitoring system and access to the results should be available to an employee or to his designated representative at all reasonable times.

Mandatory reporting of "exposures" to the regional OSHA office should be required only in instances where an emergency has occurred. Emergency situations should be defined in accordance with the SPI recommended definition.

Employee notification of exposure beyond the permitted limit and the corrective action being taken or contemplated to correct such exposure situations should be accomplished promptly and in the most reasonable manner available. Employee notification should not be required to be in writing.

APPENDIX D

§1910.93g Vinyl Chloride

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(f) Monitoring

(1) Every regulated area shall be continually sequentially monitored for levels of vinyl chloride.

(2)(i) Probes shall be so located in every regulated area to provide a representative profile of the workplace atmosphere.

(ii) The validity of the location of the probes and frequency of analysis of the samples obtained from each probe shall be assured by comparison of the results obtained by the area monitoring system with those obtained by personnel monitoring conducted at the same time for periods of at least four hours, and preferably longer. After the validity of a new continual sequential monitoring system has been established, it shall be similarly re-validated at intervals not exceeding three months.

(iii) The analytical instruments shall be checked and re-calibrated to assure proper functioning at intervals not exceeding one month. The analytical instruments must be capable of measuring the vinyl chloride concentration in air at concentrations in the range of 5 - 100 ppm with an accuracy of $\pm 10\%$ of the measured value. For calibration and "reference"

purposes, a gas chromatograph equipped with a flame ionization detector shall be used, and certified calibration gas mixtures shall be used as standards.

(iv) The monitoring equipment shall produce an effective alarm in the plant area when the concentration of vinyl chloride in that area exceeds the limit set forth in paragraph (b).

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