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Date 11 October 1983

INTEROFFICE
MEMORANDUM

Subject VINYL CHLORIDE SAFETY AND HEALTH
WORK PRACTICE STANDARD - CALVERT
CITY PLANT (REVISED 25 APRIL 1983)

To Distribution

From M. R. Chmura

(Location, Organization, or Department)

Chemicals Manufacturing - Safety

(Location, Organization, or Department)

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Attached for your guidance is the approved copy of the Vinyl Chloride Safety and Health Work Practice Standard for the Calvert City plant.

As part of the administration of this standard, we will be implementing a mandatory review on an annual basis. The next review will be due 1 October 1984.

M. R. Chmura

MRC/dmg
Attachment
0219g

(320)

AP00026466

SAFETY AND HEALTH

WORK PRACTICE STANDARD

- Vinyl Chloride -

Calvert City Plant

Revised 25 April 83

AP00026467

SAFETY AND HEALTH WORK PRACTICE STANDARD
VINYL CHLORIDE
CALVERT CITY PLANT
REVISED 25 APRIL 1983

Approvals:



Chemicals Group Manager of Safety
18 July 83
Date



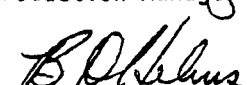
Manager of Manufacturing Services
20 Jul 83
Date



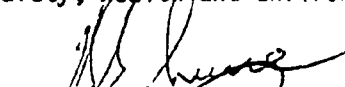
Plant Manager - Calvert City
29 Apr 83
Date



Production Manager - Calvert City
29 Apr 83
Date



Safety, Health and Environmental Manager
29 Oct 83
Date



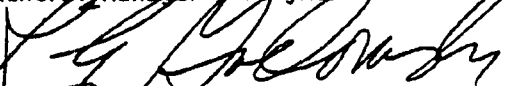
Manufacturing Manager
25 Jul 83
Date



General Manager - Plastics
10 Oct 1983
Date



General Manager - Polymer Chemicals
6 Oct 83
Date



General Manager - Manufacturing
8 Aug 83
Date

NOTE: The purpose of this Standard is to promote safe conditions through the avoidance of exposure and prevent accidents affecting the safety and health of employees, visitors, and contractors through proper instruction and implementation of safe operating procedures, so as to protect the well being of individuals and minimize product or property losses. It addresses the safety and industrial hygiene concerns involved with the handling of vinyl chloride monomer. As the need for new procedures is recognized, it is intended that they will be developed and added to this standard.

AP00026468

TABLE OF CONTENTS

	<u>Page</u>
1. Objective	1
2. Scope	1
3. Permissible Exposure Limits	2
4. Monitoring	3
5. Regulated Areas	5
6. Deregulation of Areas	7
7. Personal Protective Equipment	9
8. Emergencies	12
9. Training	20
10. Medical Surveillance	23
11. Recordkeeping	24
12. Reports - KOSHA Requirements	25
13. Signs and Labels	27
14. Sanitation	29
15. Health Hazards	30

Appendices

- I. Vinyl Chloride - Properties
- II. Analytical Method - Vinyl Chloride In Air
- III. KOSHA Vinyl Chloride Standard 1910.1017

AP00026469

1. OBJECTIVE

The objective of this standard is to promote safe conditions and prevent accidents affecting the safety and health of employees and integrity of the plant and product through proper instruction, control of the work environment, and implementation of safe operating procedures. It is the further objective of this standard to assure compliance with the Kentucky Occupational Safety Administration's (KOSHA's) standard on Vinyl Chloride 1910.1017.

2. SCOPE

This standard applies to all Calvert City operations involving the manufacture, reaction, packaging, storage, transfer, sampling or analysis of vinyl chloride or polyvinyl chloride where the potential for exposure to vinyl chloride equals or exceeds 0.5 parts per million. Specifically the Standard applies to the PVC plant, Emulsion plant (EVC1) and the laboratory.

4. MONITORING

Initial Determination

Each operation involving vinyl chloride, polyvinyl chloride or vinyl chloride emulsions shall undertake a program of initial monitoring and measurement to determine if any employee is exposed, without regard to the use of respirators, in excess of the "action level (0.5 ppm)". Area and personnel monitoring will be used.

Personnel Monitoring

A program of continued monitoring of all employees in an area shall be established to define the exposure levels. Each employee shall be monitored as a minimum:

- a. Monthly where exposure is in excess of the permissible exposure limits;
- b. Quarterly where exposure is in excess of the "action level" but not in excess of the permissible exposure limits.

When exposure is shown to be consistently below the "action level" for a particular work area or job classification, the monitoring program may be discontinued. However, annual air sampling should be performed to confirm that exposure levels remain below the "action level".

Whenever there has been a change in operating procedures, equipment, or controls which may result in an increase in the atmospheric concentration of vinyl chloride, or there is any reason to suspect that an employee may be exposed in excess of the "action level", a program of monitoring must be re-instituted.

Respirators

All monitoring shall be interpreted without regard to the use of respirators except that the use of respirators by employees being monitored shall be documented as to the type of respirator and the duration of use during the sampling period.

5. REGULATED AREAS

For the purposes of this work practice regulated areas shall be maintained in the PVC reactor building, monomer recovery, slurry stripping, gas holder and VCM storage, and railcar unloading areas. Additional areas shall be regulated when results of employee exposure monitoring show vinyl chloride exposure levels in excess of permissible exposure limits (1 ppm for 8 hr. time-weighted average or 5 ppm averaged over any period not exceeding 15 minutes). Regulated areas shall be designated by the plant manager after a review of the monitoring data by Chemicals Group Safety.

Extent of Regulated Area

The extent of the regulated area shall be determined by the ability to physically segregate the area by means of a fixed barrier or control access at limited entry points. It will be common therefore to have a regulated area encompass a larger area than would be strictly required by monitoring results.

Regulated Area Segregation

Each regulated area shall be physically segregated from other non-regulated areas by a fixed barrier. For large, open, outdoor areas a 3-foot high fence is recommended. Chain is acceptable. For indoor areas, existing building walls and doors will serve as the barrier. The number of access points to the controlled area should be minimized, consistent with safety considerations for emergency egress.

Non-APCI Employees (contractors who are frequent visitors and those who actually engage in work):

1. Review with the management of the contracting firm the requirements set forth by KOSHA for working in a VCM regulated area. A copy of KOSHA Regulations will be given to each contracting firm. (See Appendix III)
2. Establish the responsibility for medical program and its implementation.
3. Provide the contractor's employees with the prescribed and the necessary safety and health training.
4. The contractor should be (and legally is) the responsible party for maintaining the medical and exposure records for its employees.
5. Personnel monitoring of contractor's employees is the contractor's responsibility.
6. Contract personnel must comply with the same requirements when in a regulated area as do APCI employees. They may not, however, enter a regulated area when vinyl chloride concentrations exceed 1 ppm even if wearing respiratory protection, unless special clearance shall be clearly indicated on their work permit. (Note: 1 ppm has been selected to avoid exceeding the PEL and to agree with existing area chromatograph alarm levels.)

6. TEMPORARY DEREGULATION OF AREAS

Those areas which are regulated may be cleared of all VCM exposure potential and declared non-regulated after satisfactory area monitoring and upon approval of the plant manager. This procedure will normally only be used for plant turnarounds when the production unit is down.

7. PERSONAL PROTECTIVE EQUIPMENT

Respiratory Protection

Respirators used for protection against vinyl chloride exposure shall be selected from among those approved by the National Institute for Occupational Safety and Health (NIOSH).

A respiratory protection program shall be established and maintained which meets the requirements of the OSHA respiratory protection standard 29 CFR 1910.134 as well as the APCI "Respiratory Protection Program Guide" issued by the Corporate Medical Department. The Calvert City Respirator Program includes all areas where potential exposure to VCM exists (see Safety Manual Procedure 20).

Respiratory Protection (Cont'd)

self-contained breathing apparatus in the event that the first employee should require assistance. Should maintenance or other work be performed which will require an extended time period (greater than 10 min.) air-line respirators may be used when the concentration has been determined by HNU meter measurements to be less than 1,000 ppm VCM.

LEL (Lower Explosive Limit) warning lights and audible alarms indicate at 20% of the LEL (LEL = 36,000 ppm VCM) which is 7,200 ppm. This condition, because this level exceeds 3600 ppm or 10% of the LEL, requires the use of a self-contained breathing apparatus (Scott or equivalent) and entry into the area may be made for life rescue, securing equipment or fire fighting purposes only.

Hazardous Operations

Employees engaged in hazardous operations, including vessel entry for cleaning and line/tank openings, and any other operation that contains liquid VCM until cleared of VCM, shall be provided and required to wear respiratory protection and appropriate protective clothing to prevent skin contact with liquid vinyl chloride.

Other Personal Protective Equipment

Other personal protective equipment such as hard hats, safety shoes, safety glasses, goggles, hearing protectors, etc. shall be required based on standard plant safety rules and requirements.

Emergency Plan (Cont'd)

shall further specify that employees not so equipped shall evacuate the area and not return until the emergency is under control as indicated by area chromatograph points and/or portable detection equipment.

Reporting - Internal

The Plant Superintendent or Assistant Plant Superintendent is responsible for ensuring that the incident is reported immediately to the Plant Manager, along with all relevant information available at the time.

In Laboratories Using VCM - The Lab Superintendent or Q.A. Manager is responsible for ensuring that the incident is reported immediately to the Plant Manager, along with all information available at the time. The Lab Superintendent or Q.A. Manager is responsible for ensuring the incident is reported to the Plant Manager.

The Plant Manager is responsible for ensuring that Chemicals Group Safety is contacted as soon as practical, but never more than 18 hours after the emergency occurs. Chemicals Group Safety will notify the departments listed below. Each department will be given all the information available at the time. This will allow each of these departments to provide appropriate assistance and guidance based on the specific circumstances.

- A. Higher Chemicals Group Management
- B. Law
- C. Public Relations
- D. Corporate Medical
- E. Corporate Safety

Reporting - KOSHA (Cont'd)

Legal approval should be obtained prior to making both the initial telephone contact and any subsequent written report. However, the initial telephone contact must not be delayed beyond the 24-hour deadline. If legal advice is not available during this 24-hour period, the report should be reviewed by Chemicals Group Safety.

Emergency Medical Surveillance

These emergency medical surveillance procedures represent a consensus of the Corporate Medical Director, consulting physicians and plant physicians. Hospitals used by the plant should be made aware of these procedures, in advance, by the plant physician so that delays are not encountered during an emergency. If any difficulty arises, the hospital should be instructed to contact the plant physician for whatever directions or approvals they require.

Guidelines for help in identifying the need for emergency medical treatment are given below:

1. Identify all persons potentially exposed to vinyl chloride during the emergency. This means all persons in the vicinity of the release including plant operators, supervisors, maintenance personnel, visitors, contractors, etc. Area monitors may be used to assist in determining those areas which were not exposed to high levels. It also means other persons, not associated with the PVC plant, who may inadvertently be downwind of the release and exposed to vinyl chloride concentrations over 100 ppm. This need to identify potentially exposed persons requires that the shift foreman be constantly aware of who is in the PVC plant by means of access logs, work permits, etc. The shift foreman must also be prepared to do a little detective work and "ask around" to identify those persons inadvertently exposed.

the foreman must use his best judgement. Individuals identified as being exposed should receive medical surveillance. (The Corporate Medical Director has indicated that this should include blood tests; however, hospitalization is not required.)

Emergency Medical Surveillance (Cont'd)

1. The shift foreman or Lab Superintendent will identify the individual(s) who have been exposed and will escort him(them) to the plant clinic.
2. The safety officer/nurse will arrange for transportation of the victim(s) to and from the hospital, if required.

Employee Training (Cont'd)

j. Specific information to aid the employee in recognizing conditions which may result in the release of Vinyl Chloride.

k. A review of the KOSHA Vinyl Chloride standard 1910.1017.

This training shall be given to each employee before assignment to a job involving the manufacture of Polyvinyl Chloride.

This training shall be repeated annually for each employee assigned to jobs involving Polyvinyl Chloride manufacturing. This training shall be documented to include a statement signed by each employee that he/she has received and understood the information in a. through k. above.

Visitor Orientation (casual or one-time visitors both APCI and non-APCI)

Each visitor to an area where Vinyl Chloride or Polyvinyl Chloride is processed shall receive a safety orientation to include the following information:

- a. The nature of the health hazard from chronic exposure to Vinyl Chloride including specifically the cancer hazard.
- b. The nature of the health hazard from acute exposure to Vinyl Chloride.
- c. The fire hazard of Vinyl Chloride.
- d. The specific nature of operations which could result in exposure to Vinyl Chloride in excess of permissible limits.
- e. Warning lights and alarms in the work area to be visited.
- f. Respirator types available, their location and use.
- g. Emergency procedures.

This orientation shall be given to each visitor before he/she may enter an area where Vinyl Chloride is used, stored, or transferred.

10. MEDICAL SURVEILLANCE

A Medical Surveillance Program shall be instituted for each employee engaged in operations which involve Vinyl Chloride, Polyvinyl Chloride, or Vinyl Chloride Emulsions. Such a system, including computerized storage of medical records and Vinyl Chloride exposure data, has been established by the Corporate Medical and Management Information Departments. Administrative procedures relating to this Medical Surveillance Program may be found in the APCI Corporate Occupational Health Manual.

Required Information (Cont'd)

- c. Type of instruments and methods used.
- d. Concentrations determined.
- e. Type of respirator and duration of use, if any.

12. REPORTS - KOSHA REQUIREMENTS

Regulated Areas

Not later than 1 month after the establishment of a regulated area, the following information shall be reported to the KOSHA Area Director. Any changes to such information shall be reported within 15 days:

- a. The address and location of each establishment which has one or more regulated areas, and
- b. The number of employees in each regulated area during normal operations, including maintenance.

Such reports should be reviewed by Chemicals Group Safety and the Legal Department before being sent to KOSHA.

Emergencies

Emergencies, and the facts obtainable at that time, shall be reported within 24 hours to the KOSHA Area Director. Upon request of the Area Director, the plant manager shall submit additional information in writing relevant to the nature and extent of employee exposures and measures taken to prevent future emergencies of similar nature.

See the "Emergencies" section of this standard for further details on emergency reporting procedures.

Monitoring

Monitoring of employee exposures will be carried out by the plant laboratory. Monitoring results shall be reported to the Plant Superintendent and SHE Manager within 3 days. Scheduling of the monitoring and

13. SIGNS AND LABELS

Regulated Areas

Entrances to regulated areas shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT AREA
AUTHORIZED PERSONNEL ONLY

Hazardous Operations

Areas containing hazardous operations or where an emergency currently exists shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT IN THIS AREA
PROTECTIVE EQUIPMENT REQUIRED
AUTHORIZED PERSONNEL ONLY

Containers

Containers (bags, cars, silos, boxes, etc.) of polyvinyl chloride resin waste from reactors or other waste contaminated with vinyl chloride shall be legibly labeled:

CONTAMINATED WITH
VINYL CHLORIDE
CANCER-SUSPECT AGENT

Containers of polyvinyl chloride shall be legibly labeled either:

POLYVINYL CHLORIDE (OR TRADE NAME)
CONTAINS

VINYL CHLORIDE
VINYL CHLORIDE IS A CANCER-SUSPECT AGENT

Note: A hopper car is a container and requires a label.

Containers of vinyl chloride shall be legibly labeled either:

(A) VINYL CHLORIDE
EXTREMELY FLAMMABLE GAS UNDER PRESSURE
CANCER-SUSPECT AGENT

14. SANITATION

General

In all areas covered by this standard, the storage, handling or consumption of food or beverages shall be prohibited. Food or drink is only to be consumed in office areas and lunch rooms. Also, the storage or use of tobacco products, and the storage or use of cosmetics shall be prohibited, except in approved smoking/break areas, lunch rooms, etc.

Washing Facilities

Showers, hand washing facilities, and soap and water shall be available to all employees working in areas covered by this standard.

Clothing

Clothing saturated with vinyl chloride monomer or with other materials containing vinyl chloride monomer shall be promptly removed and replaced with uncontaminated clothing.

Acute Effects (Cont'd)

per million. After the body eventually eliminates the vinyl chloride, a process which takes several hours, normal heart rhythm usually resumes.

Chronic Effects

Chronic effects of vinyl chloride are effects that develop over a long time, and are often delayed in appearing. Chronic effects may occur after repeated exposures, which individually are not intense enough to cause obvious immediate symptoms.

The most serious chronic effect is cancer. Specifically, long-term exposure to vinyl chloride is known to cause angiosarcoma of the liver, a very rare tumor in humans. While angiosarcoma of the liver has appeared in people with no known exposure to vinyl chloride, it is fair to say that many cases of angiosarcoma of the liver have followed overexposure to the substance. Over 100 of the world's vinyl chloride workers have had this disease since vinyl chloride was first used commercially over forty years ago. Their exposures, when known, have been high -- not necessarily high enough to cause acute symptoms, but well above the currently accepted limits.

Commonly, the cancer is detected ten to twenty-five years or more after the beginning of exposure. Angiosarcoma is difficult to detect and there is no effective treatment. Untreated angiosarcoma of the liver is usually fatal within 8 months of diagnosis. Even with treatment, death usually occurs within 16 months. Therefore, the emphasis must be placed on prevention of the disease, not treatment.

APPENDIX I

Vinyl Chloride - Properties

PHYSICAL PROPERTIES

Synonyms: Vinyl Chloride, vinyl chloride monomer, VCl, VCM,
chloroethylene, chloroethene

Chemical Formula:	CH ₂ CHCl
Molecular Weight:	62.5
Boiling Point:	-13.8°C 7.0°F
Freezing Point:	-153.7°C -245°F
Flash Point, Open Cup:	-78°C -108.4°F
Flammable Limits, volume % in air at 25°C (77°F):	3.6 to 33
Autoignition Temperature:	472°C 882°F
Minimum Oxygen for Ignition (with nitrogen as diluent):	12.0% approx.
Vapor Density, air = 1:	2.15
Liquid Density, 25°C:	0.9013 g/ml
Vapor Pressure at 20°C:	35 psig
Odor Threshold:	1000 ppm

AP00026486

APPENDIX II

ANALYTICAL METHOD - VINYL CHLORIDE IN AIR

Physical and Chemical Analysis Branch (NIOSH)

Analytical Method

Analyte:	Vinyl Chloride (Chloroethene, Chloroethylene)	Method No.:	P&CAM #178
		Range:	0.2-1500 ng per injection
Matrix:	Air		
Procedure:	Adsorption on charcoal, desorp- tion with carbon disulfide, GC		
Date Issued:	9/3/74	Precision:	Unknown
Date Revised:	10/15/74	Classification:	D (Operational)

1. Principle of the Method

- 1.1 A known volume of air is drawn through a charcoal tube to trap the vinyl chloride present.
- 1.2 The charcoal in the tube is transferred to a small vial containing carbon disulfide where the vinyl chloride is desorbed.
- 1.3 An aliquot of the desorbed sample is injected into a gas chromatograph.
- 1.4 The area of the resulting peak is determined and compared with areas obtained from the injection of standards.

2. Range and Sensitivity

- 2.1 The minimum detectable amount of vinyl chloride was found to be 0.2 nanograms per injection at a 1 x 1 attenuation on a gas chromatograph.

AP00026487

3.4 If the possibility of interference exists, separation conditions (column packing, temperature, etc.) must be changed to circumvent the problem.

4. Precision and Accuracy

The precision and accuracy of the total sampling and analytical method have not been determined.

5. Advantages and Disadvantages of the Method

5.1 The sampling device is small, portable, and involves no liquids. Interferences are minimal, and most of those which do occur can be eliminated by altering chromatographic conditions. The tubes are analyzed by means of a quick, instrumental method. The method can also be used for the simultaneous analysis of two or more components suspected to be present in the same sample by simply changing gas chromatographic conditions from isothermal to a temperature-programmed mode of operation.

5.2 One disadvantage of the method is that the amount of sample which can be taken is limited by the number of milligrams that the tube will hold before overloading. When the sample value obtained for the backup section of the charcoal trap exceeds 20% of that found on the front section, the possibility of sample loss exists. During sample storage, volatile compounds such as vinyl chloride will migrate throughout the tube until equilibrium is reached. At this time, 33% of these compounds will be found in the backup section. This may lead to some confusion as to whether sample loss has occurred. This migration effect can be considerably decreased by shipping and storing the tubes at -20°.

AP00026488

- 6.6 Two ml vials which can be sealed with caps containing teflon-lined silicone rubber septa.
- 6.7 Microliter syringes: 10- μ L, and convenient sizes for making standards.
- 6.8 Gastight syringes: 1-m L, with open/close valve.
- 6.9 Pipets: 0.5-m L delivery pipets or 1.0-m L type graduated in 0.1-m L increments.
- 6.10 Volumetric flasks: 10-m L or convenient sizes for making standard solutions. It is preferable to have plastic stoppers for the volumetric flasks.

7. Reagents

- 7.1 Spectroquality carbon disulfide.
- 7.2 Vinyl chloride, lecture bottle, 99.9% minimum purity.
- 7.3 Toluene, chromatographic quality.
- 7.4 Bureau of Mines Grade A helium.
- 7.5 Prepurified hydrogen
- 7.6 Filtered compressed air.

8. Procedure

- 8.1 Cleaning of Equipment. All glassware used for the laboratory analysis should be detergent washed and thoroughly rinsed with distilled water.
- 8.2 Calibration of Personal Pumps. Each personal pump must be calibrated with a representative charcoal tube in the line. This will minimize errors associated with uncertainties in the sample volume collected.

8.3.10 Capped tubes are packed tightly before they are shipped to minimize tube breakage during transport to the laboratory. If the samples will spend a day or more in transit, cooling (e.g., with dry ice) is necessary to minimize migration of vinyl chloride to the backup section.

8.3.11 Samples received at the laboratory are logged in and immediately stored in a freezer (around -20°) until time for analysis. Samples may be stored in this manner for long periods of time with no appreciable loss of vinyl chloride (2 months). Even around -20°C , vinyl chloride will equilibrate between the two sections of charcoal, i.e., will migrate to the backup section. This phenomenon is observable after two weeks and may be confused with sample loss after 1 to 2 months.

8.4 Analysis of Samples

8.4.1 Preparation and Desorption of Samples. In preparation for analysis, each charcoal tube is scored with a file in front of the first section of charcoal and broken open. The glass wool is removed and discarded. The charcoal in the first (larger) section is transferred to a small vial containing 1 ml of carbon disulfide. (Note: the addition to the CS_2 is important.) The vial is topped with a septum cap (see Section 6.6). The separating section of foam is removed and discarded; the second section is transferred to another

the sample, and a 5- μ L aliquot is withdrawn to the 7.4 L mark (2 μ L solvent + 0.4 μ L air + 5 μ L sample = 7.4 μ L). After the needle is removed from the sample and prior to injection the plunger is pulled back a short distance to minimize evaporation of the sample from the tip of the needle. Duplicate injections of each sample and standard are made. No more than a 3% difference in area is to be expected.

8.4.4 Measurement of area. The area of the sample peak is measured by an electronic integrator or some other suitable form of area measurement, and preliminary results are read from a standard curve prepared as discussed below.

8.5 Determination of Desorption Efficiency

8.5.1 Importance of determination. The desorption efficiency of a particular compound can vary from one laboratory to another and also from one batch of charcoal to another. Thus, it is necessary to determine at least once the percentage of vinyl chloride that is removed in the desorption process. Desorption efficiency should be determined on the same batch of charcoal tubes used in sampling. Results indicate that desorption efficiency varies with loading (total vinyl chloride on the tube), particularly at lower values, i.e., 2.5 μ g.

AP00026491

9. Calibration and Standards

CAUTION:

Laboratory Operations Involving Carcinogens

Vinyl chloride has been identified as a human carcinogen and appropriate precautions must be taken in handling this gas. The Occupational Safety and Health Administration has promulgated regulations for the use and handling of vinyl chloride. They may be found in 29 CFR 1910.93q (Section 1910.93q in Title 29 of the Code of Federal Regulations available in the Federal Register, Vol. 39, No. 194, Friday, October 4, 1974, pp. 35890-35898).

A series of standards, varying in concentration over the range of interest, are prepared and analyzed under the same GC conditions and during the same time period as the unknown samples. Curves are established by plotting concentration in $\mu\text{g}/1.0\text{ mL}$ versus peak area. There are two methods of preparing standards and as long as highly purified vinyl chloride is used, both are comparable.

NOTE: Since no internal standard is used in the method, standard solutions must be analyzed at the same time that the sample analysis is done. This will minimize the effect of day-to-day variations of the FID response.

9.1 Standard Preparation

Gravimetric Method - Vinyl chloride is slowly bubbled into a tared 10-ml volumetric flask containing approximately 5 ml of toluene. After 3 minutes, the flask is again weighed. A weight change of 100-300 mg is usually observed. The solution

10. Calculations

10.1 The weight, in g, corresponding to each peak area is read from the standard curve for vinyl chloride. No volume corrections are needed, because the standard curve is based on g/1.0 mLCS₂ and the volume of sample injected is identical to the volume of the standards injected.

10.2 Corrections for the blank are made for each sample.

$$\mu g = \mu g_s - \mu g_b$$

where:

μg_s = μg found in front section of sample tube

μg_b = μg found in front section of blank tube

A similar procedure is followed for the backup sections.

10.3 These values are further corrected for the desorption efficiency at the level of vinyl chloride measured.

$$\text{Corrected } g = \frac{\mu g}{\text{desorption efficiency}}$$

10.4 The corrected amounts present in the front and backup section of the same sample tube are added to determine the total amount of vinyl chloride in the sample.

10.5 The concentration of the vinyl chloride in the air sampled is expressed in mg/m³, which is numerically equal to g/liter of air

$$\text{mg/m}^3 = \mu g/L = \frac{\text{total } \mu g \text{ (Section 10.4)}}{V}$$

where: V is the volume of air sampled

AP00026493

§ 1910.1017 Vinyl chloride.

(a) *Scope and application.* (1) This section includes requirements for the control of employee exposure to vinyl chloride (chloroethene). Chemical Abstracts Service Registry No. 75014.

[Section 1910.93q(a)(1) amended at 39 FR 41848, December 3, 1974; 1910.93q was redesignated as 1910.1017 at 40 FR 23072, May 28, 1975]

(2) This section applies to the manufacture, reaction, packaging, repackaging, storage, handling or use of vinyl chloride or polyvinyl chloride, but does not apply to the handling or use of fabricated products made of polyvinyl chloride.

(3) This section applies to the transportation of vinyl chloride or polyvinyl chloride except to the extent that the Department of Transportation may regulate the hazards covered by this section.

(b) *Definitions.* (1) "Action level" means a concentration of vinyl chloride of 0.5 ppm averaged over an 8-hour work day.

(2) "Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or his designee.

(3) "Authorized person" means any person specifically authorized by the employer whose duties require him to enter a regulated area or any person entering such an area as a designated representative of employees for the purpose of exercising an opportunity to observe monitoring and measuring procedures.

(4) "Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare, or his designee.

(5) "Emergency" means any occurrence such as, but not limited to, equipment failure, or operation of a relief device which is likely to result in massive release of vinyl chloride.

(6) "Fabricated product" means a product made wholly or partly from polyvinyl chloride, and which does not require further processing at temperatures, and for times, sufficient to cause mass melting of the polyvinyl chloride resulting in the release of vinyl chloride.

(7) "Hazardous operation" means any operation, procedure, or activity where a release of either vinyl chloride liquid or gas might be expected as a consequence of the operation or because of an accident in the operation, which would result in an employee exposure in excess of the permissible exposure limit.

[Section 1910.93q(b)(17) amended at 39 FR

41848, December 3, 1974; Section 1910.93q was redesignated as 1910.1017 at 40 FR 23072, May 28, 1975]

(8) "OSHA Area Director" means the Director for the Occupational Safety and Health Administration Area Office having jurisdiction over the geographic area in which the employer's establishment is located.

(9) "Polyvinyl chloride" means polyvinyl chloride homopolymer or copolymer before such is converted to a fabricated product.

(10) "Vinyl chloride" means vinyl chloride monomer.

(c) *Permissible exposure limit.* (1) No employee may be exposed to vinyl chloride at concentrations greater than 1 ppm averaged over any 8-hour period, and

(2) No employee may be exposed to vinyl chloride at concentrations greater than 5 ppm averaged over any period not exceeding 15 minutes.

(3) No employee may be exposed to vinyl chloride by direct contact with liquid vinyl chloride.

(d) *Monitoring.* (1) A program of initial monitoring and measurement shall be undertaken in each establishment to determine if there is any employee exposed, without regard to the use of respirators, in excess of the action level.

(2) Where a determination conducted under paragraph (d)(1) of this section shows any employee exposures, without regard to the use of respirators, in excess of the action level, a program for determining exposures for each such employee shall be established. Such a program:

(i) Shall be repeated at least monthly where any employee is exposed, without regard to the use of respirators, in excess of the permissible exposure limit.

(ii) Shall be repeated not less than quarterly where any employee is exposed, without regard to the use of respirators, in excess of the action level.

(iii) May be discontinued for any employee only when at least two consecutive monitoring determinations, made not less than 5 working days apart, show exposures for that employee at or below the action level.

(3) Whenever there has been a production, process or control change which may result in an increase in the release of vinyl chloride, or the employer has any other reason to suspect that any employee may be exposed in excess of the action level, a determination of employee exposure under paragraph (d)(1) of this section shall be performed.

(4) The method of monitoring and measurement shall have an accuracy (with a confidence level of 95 percent) of not less than plus or minus 50 percent from 0.25 through 0.5 ppm, plus or minus 35 percent from over 0.5 ppm through 1.0 ppm, and plus or minus 25 percent over 1.0 ppm. (Methods meeting these accuracy requirements are available in the "NIOSH Manual of Analytical Methods").

(5) Employees or their designated representatives shall be afforded reasonable opportunity to observe the monitoring and measuring required by this paragraph.

(e) *Regulated area.* (1) A regulated area shall be established where:

(i) Vinyl chloride or polyvinyl chloride is manufactured, renewed, repackaged, stored, handled or used; and

(ii) Vinyl chloride concentrations are in excess of the permissible exposure limit.

(2) Access to regulated areas shall be limited to authorized persons.

[Section 1910.1017(e)(2) amended at 43 FR 49726, October 24, 1978, effective November 24, 1978]

(f) *Methods of compliance.* Employee exposures to vinyl chloride shall be controlled to at or below the permissible exposure limit provided in paragraph (c) of this section by engineering, work practice, and personal protective controls as follows:

(1) Feasible engineering and work practice controls shall immediately be used to reduce exposures to at or below the permissible exposure limit.

(2) Wherever feasible engineering and work practice controls which can be instituted immediately are not sufficient to reduce exposures to at or below the permissible exposure limit, they shall nonetheless be used to reduce exposures to the lowest practicable level, and shall be supplemented by respiratory protection in accordance with paragraph (g) of this section. A program shall be established and implemented to reduce exposures to at or below the permissible exposure limit, or to the greatest extent feasible, solely by means of engineering and work practice controls, as soon as feasible.

(3) Written plans for such a program shall be developed and furnished upon request for examination and copying to authorized representatives of the Assistant Secretary and the Director. Such plans shall be updated at least every six months.

(g) *Respiratory protection.* Where respiratory protection is required under this section:

(1) The employer shall provide a respirator which meets the requirements of this paragraph and shall assure that the employee uses such respirator, except that until April 1, 1976, wearing of respirators shall be at the discretion of each employee for exposures not in excess of 25 ppm, measured over any 15-minute period. Until April 1, 1976, each employee who chooses not to wear an appropriate respirator shall be informed at least quarterly of the hazards of vinyl chloride and the purpose, proper use, and limitations of respiratory devices.

[Section 1910.93q(g)(1) amended at 40 FR 13211, March 25, 1975; Section 1910.93q was redesignated 1910.1017 at 40 FR 23072, May 28, 1975]

(2) Respirators shall be selected from among those jointly approved by the Mining Enforcement and Safety Administration, Department of the Interior, and the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(3) A respiratory protection program meeting the requirements of § 1910.134 shall be established and maintained.

(4) Selection of respirators for vinyl chloride shall be as follows:

[Sec. 1910.1017(g)(4)]

AP00026494

(4) A statement of each employee's suitability for continued exposure to vinyl chloride including use of protective equipment and respirators, shall be obtained from the examining physician promptly after any examination. A copy of the physician's statement shall be provided each employee.

(5) If any employee's health would be materially impaired by continued exposure, such employee shall be withdrawn from possible contact with vinyl chloride.

(6) Laboratory analyses for all biological specimens included in medical examinations shall be performed in laboratories licensed under 42 CFR Part 74.

(7) If the examining physician determines that alternative medical examinations to those required by paragraph (k)(1) of this section will provide at least equal assurance of detecting medical conditions pertinent to the exposure to vinyl chloride, the employer may accept such alternative examinations as meeting the requirements of paragraph (k)(1) of this section, if the employer obtains a statement from the examining physician setting forth the alternative examinations and the rationale for substitution. This statement shall be available upon request for examination and copying to authorized representatives of the Assistant Secretary and the Director.

(l) Signs and labels. (1) Entrances to regulated areas shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT AREA
AUTHORIZED PERSONNEL ONLY

[Section 1910.93q (l)(1) amended at 39 FR 41848, December 3, 1974 and redesignated as 1910.1017 at 40 FR 23072, May 28, 1975]

(2) Areas containing hazardous operations or where an emergency currently exists shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT IN THIS AREA
PROTECTIVE EQUIPMENT REQUIRED
AUTHORIZED PERSONNEL ONLY

[Section 1910.93q (l)(2) amended at 39 FR 41848, December 3, 1974 and redesignated as 1910.1017 at 40 FR 23072, May 28, 1975]

(3) Containers of polyvinyl chloride resin waste from reactors or other waste contaminated with vinyl chloride shall be legibly labeled:

CONTAMINATED WITH
VINYL CHLORIDE
CANCER-SUSPECT AGENT

[Section 1910.93q (l)(3) amended at 39 FR 41848, December 3, 1974 and redesignated as 1910.1017 at 40 FR 23072, May 28, 1975]

(4) Containers of polyvinyl chloride shall be legibly labeled:

POLYVINYL CHLORIDE (OR TRADE NAME)
Contains
VINYL CHLORIDE
VINYL CHLORIDE IS A CANCER-SUSPECT AGENT

(5) Containers of vinyl chloride shall be legibly labeled either:

(i) VINYL CHLORIDE
EXTREMELY FLAMMABLE GAS UNDER PRESSURE
CANCER-SUSPECT AGENT

or (ii) In accordance with 49 CFR Parts 170-189, with the additional legend:

CANCER-SUSPECT AGENT

applied near the label or placard.
[Section 1910.93q (l)(5)(i) amended at 39 FR 41848, December 3, 1974 and redesignated as 1910.1017 at 40 FR 23072, May 28, 1975]

(6) No statement shall appear on or near any required sign, label or instruction which contradicts or detracts from the effect of, any required warning, information or instruction.

(m) Records. (1) All records maintained in accordance with this section shall include the name and social security number of each employee where relevant.

(2) Records of required monitoring and measuring and medical records shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.20(a)(1-e) and (g)-(i). These records shall be provided upon request to the Director. Authorized personnel rosters shall also be provided upon request to the Assistant Secretary and the Director.

[Section 1910.1017(m)(2) amended at 45 FR 35212, May 23, 1980, effective August 21, 1980]

(l) Monitoring and measuring records shall:

(A) State the date of such monitoring and measuring and the concentrations determined and identify the instruments and methods used;

(B) Include any additional information necessary to determine individual employee exposures where such exposures are determined by means other than individual monitoring of employees; and

(C) Be maintained for not less than 30 years.

(ii) [Revoked]

[Section 1910.1017 (m)(2)(ii) revoked at 43 FR 49726, October 24, 1978, effective November 24, 1978]

(iii) Medical records shall be maintained for the duration of the employment of each employee plus 20 years, or 30 years, whichever is longer.

(3) In the event that the employer ceases to do business and there is no successor to receive and retain his records for the prescribed period, these records shall be transmitted by registered mail to the Director and each employee individually notified in writing of this transfer. The employer shall also comply with any additional requirements set forth in 29 CFR 1910.20(h).

[Section 1910.1017(m)(3) amended at 45 FR 35212, May 23, 1980, effective August 21, 1980]

[Section 1910.1017(m)(4) through (m)(6) revoked at 45 FR 35212, May 23, 1980, effective August 21, 1980]

(n) Reports. (1) Not later than 1 month after the establishment of a regulated area, the following information shall be reported to the OSHA Area Director. Any changes to such information shall be reported within 15 days.

[The next page is 31:8351]

(1) The address and location of each establishment which has one or more regulated areas; and

(ii) The number of employees in each regulated area during normal operations, including maintenance.

(2) Emergencies, and the facts obtainable at that time, shall be reported within 24 hours to the OSHA Area Director. Upon request of the Area Director, the employer shall submit additional information in writing relevant to the nature and extent of employee exposures and measures taken to prevent future emergencies of similar nature.

(3) Within 10 working days following any monitoring and measuring which discloses that any employee has been exposed, without regard to the use of respirators in excess of the permissible exposure limit, each such employee shall be notified in writing of the results of the exposure measurement and the steps being taken to reduce the exposure to within the permissible exposure limit.

[Section 1910.93q (n)(3) amended at 39 FR 41848, December 3, 1974; Section 1910.93q was redesignated 1910.1017 at 40 FR 23072, May 28, 1975]

(o) Effective dates. (1) Until April 1, 1975, the provisions currently set forth in Section 1910.93q of this Part shall apply.

[Editor's note: This paragraph refers to the emergency (temporary standard published at 39 FR 12343)]

(2) Effective April 1, 1975, the provisions set forth in Section 1910.93q of this Part shall apply.

[Section 1910.93q (o)(1) and (2) amended at 40 FR 13211, March 25, 1975; Section 1910.93q was redesignated 1910.1017 at 40 FR 23072, May 28, 1975]

APPENDIX A—SUPPLEMENTARY MEDICAL INFORMATION

When required tests under paragraph (k)(1) of this section show abnormalities, the tests should be repeated as soon as practicable, preferably within 3 to 4 weeks. If tests remain abnormal, consideration should be given to withdrawal of the employee from contact with vinyl chloride, while a more comprehensive examination is made.

Additional tests which may be useful:

A. For kidney dysfunction: urine examination for albumin, red blood cells, and exfoliating abnormal cells.

B. Pulmonary system: Forced vital capacity, Forced expiratory volume at 1 second, and chest roentgenogram (posterior-anterior, 14 x 17 inches).

C. Additional serum tests: Lactic acid dehydrogenase, lactic acid dehydrogenase isoenzyme, protein determination, and protein electrophoresis.

D. For a more comprehensive examination on repeated abnormal serum tests: Hepatitis B antigen, and liver scanning.

(Secs. 6 and 8, 84 Stat. 1506, 1509 (29 U.S.C. 655, 657); Secretary of Labor's Order No. 12-71, 38 FR 8754)

[Section 1910.93q added at 39 FR 12343, April 5, 1974, as emergency temporary standard; issued as permanent standard at 39 FR 35896, October 4, 1974; Section 1910.93q was redesignated 1910.1017 at 40 FR 23072, May 28, 1975]

[See 1910.1017 (Appendix A)]

AP00026495