

RECOMMENDED OCCUPATIONAL HEALTH STANDARD

FOR

THE MANUFACTURE OF SYNTHETIC POLYMER FROM

VINYL CHLORIDE

MARCH 11, 1974

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

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1. SCOPE AND APPLICATION

This standard regulates the manufacture of synthetic polymer from vinyl chloride (chloroethene, Chemical Abstracts Registry No. 75014), in order to protect the health and safety of workers.

Vinyl chloride also known as vinyl chloride monomer (VCM), chloroethylene and chloroethene, is a colorless sweet smelling gas at ordinary temperature and pressure and has a boiling and melting point at one atmosphere of -13.8°C, and -153.71°C, respectively. Its chemical formula is CH_2CHCl and it has a molecular weight of 62.50. Although noncorrosive at normal atmospheric temperatures, in contact with water and at elevated temperatures it accelerates the corrosion of iron and steel. Of considerable concern is the fact that vinyl chloride is easily ignited and has a lower and upper explosive limit of 3.6% and 26.4%, respectively.

2. DEFINITIONS

For the purpose of this standard:

- a. "Assistant Secretary" means the Assistant Secretary for Occupational Safety and Health, U.S. Department of Labor or any person directed by him.
- b. "Director" means the Director, National Institute for Occupational Safety and Health, or any person directed by him or the Secretary of Health, Education, and Welfare to act for the Director.
- c. "Authorized employee" means an employee whose duties require him to be in the regulated area and who has been specifically assigned by the employer.
- d. "Detectable levels" means the determination that airborne concentrations of vinyl chloride are in excess of the limit of sensitivity of the sampling and analytical method recommended by the Director.
- e. "Clean change room" means a room where employees put on clean clothing; clean change room shall be contiguous to and have an entry from a shower room, when the shower room facilities are otherwise required in this standard.
- f. "Closed container" is any container which is used to prevent the physical contact of employees with material containing vinyl chloride monomer.
- g. "Closed system" means an operation involving vinyl chloride where containment prevents the release of vinyl chloride into regulated areas, nonregulated areas, or the external environment.
- h. "Contaminated" refers to detectable levels of vinyl chloride monomer.

i. "Decontamination" means the inactivation of vinyl chloride to less than detectable levels or its safe disposal.

j. "Disposal" means the safe removal of vinyl chloride from the work environment.

k. "Emergency" means an unforeseen circumstance or set of circumstances, such as a ruptured transfer line, resulting in the release of vinyl chloride sufficient to produce acute symptoms among workers exposed or having contact with the vinyl chloride.

l. "External environment" means any environment external to regulated and nonregulated areas.

m. "Regulated area" means an area where entry to and exit from a vinyl chloride workplace is restricted and controlled.

n. "Nonregulated area" means any area under the control of the employer where entry and exit is neither restricted nor controlled.

o. "Protective clothing" means clothing designed to protect an employee against contact with or exposure to vinyl chloride.

p. "Waste resin" means any resin or other vinyl chloride reaction product which has been removed from vessels during clean-up operations, or which has been collected as a result of in-plant housekeeping operations.

3. REQUIREMENTS FOR REGULATED AREAS

A regulated area shall be established where synthetic resins containing vinyl chloride are manufactured. These regulated areas shall include but are not limited to vinyl chloride loading or unloading operations, storage, and transfer facilities; synthetic resin polymerization processes and operations; and resin handling, compounding, packaging and storage areas. Access shall be restricted to authorized employees only. All such regulated areas shall be controlled in accordance with the following requirements.

a. Routine Operations

(i) Initial concentration of vinyl chloride in all regulated areas shall be determined by performing air measurements at strategic sampling points under normal operating conditions. These initial sampling points must be selected by a professional industrial hygienist and will serve as monitoring locations for future environmental measurements.

The sampling pattern shall be adequate to represent the environment of the controlled area.

(ii) Where detectable levels of vinyl chloride are measured, a Control Plan to reduce such levels shall be developed and implemented. The Plan shall consist not only of establishing goals for reducing vinyl chloride levels by designing and introducing engineering and process controls, but shall also identify plans for developing additional (healthful) work practices. Target dates shall be established for all goals and the Plan must be updated at least on an annual basis. Copies of the Control Plan shall be posted in all regulated areas and be provided to all authorized employees.

(iii) There shall be periodic tests for process or equipment leaks and for emission of vinyl chloride which may result from work practices. The frequency of these tests shall be such as to insure the integrity of equipment, adherence to proper work practices, and to determine achievement of the goals of the Control Plan. Tests shall be performed at each sampling point at least daily or more frequently if concentrations of vinyl chloride are in excess of those established in the Plan. When such levels are exceeded, additional samples to identify sources of contamination shall be taken. Results of all such tests shall be made available to authorized employees in such a manner as to evaluate achievement of goals contained in the Control Plan.

(iv) Until exposures to vinyl chloride are reduced below detectable levels, employees entering any regulated area shall be provided with and required to wear and use a full-face, supplied air respirator, of the continuous flow or pressure demand type in accordance with §1910.134.

(v) In operations involving loading or unloading vinyl chloride monomer from tank cars, trucks, barges, or other conveyance equipment, each transfer line and each vapor-equalizing line shall be equipped with vent connections permitting, at the completion of the transfer, pressure to be vented and the hose purged with an inert gas in such a manner to preclude any employee exposure. Specific and detailed transfer procedures shall be developed and provided to involved employees in written form.

(vi) Employees shall be provided with and required to wear, clean, full-body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), and gloves prior to entering the regulated area.

(vii) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and

equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified as required under paragraph e(2)(i) of this standard.

b. Reactor and Vessel Entry

(i) A reactor and vessel entry procedure shall be developed and provided to involved employees in written form. Employees shall be familiarized with the procedure and shall be trained and rehearsed in the techniques provided for in the procedure. Emphasis shall not only be placed on concern for potential exposure to vinyl chloride but shall also include appropriate precautions for entry into confined spaces.

(ii) Techniques shall be developed and applied to minimize to the maximal practicable extent employee exposure to vinyl chloride when opening any closed vessel. Examples of effective methods are the application of heat or suction to the vessel prior to opening, or use of sufficient exhaust ventilation around the vessel. Where operations such as cleaning or maintenance conducted inside an open vessel could result in the liberation of vinyl chloride, suitable procedures such as exhaust ventilation shall be developed and implemented to insure that vinyl chloride is not released into the general work environment.

(iii) Exhaust air shall not be discharged to regulated areas, nonregulated areas, or the external environment unless decontaminated.

(iv) All piping to and from the vessel shall be blanked or otherwise isolated prior to entry.

(v) Employees entering the reactor or vessel shall be provided with and required to wear and use a full-face, supplied air respirator, of the continuous flow or pressure demand type in accordance with §1910.134.

(vi) Employees entering the reactor or vessel where levels of vinyl chloride are monitored and are found to not exceed ambient levels external to the vessel shall be provided with and required to wear clean, full body protective clothing (coveralls or long-sleeved shirt and pants), gloves, footwear or foot coverings, and head covering. Where vessel levels are in excess of ambient levels, employees shall instead be provided with and required to wear impervious clothing to prevent skin contact of vinyl chloride or other materials containing vinyl chloride.

(vii) After each exit from the reactor or vessel, employees shall be required to remove and leave protective clothing and equipment at a designated point in the regulated area, and at the end of each work shift to place used clothing and equipment in impervious but vented containers for the purpose of decontamination or disposal. The contents of such impervious containers shall be identified as required under paragraph e(2)(i) of this standard.

(viii) Employees engaged in reactor cleaning or other operations involving vessel entry shall shower at the end of the work shift.

c. Maintenance and Decontamination Activities

(i) Emphasis shall be placed upon immediate clean up of spills, periodic inspection, prompt repair of equipment and leaks, and proper handling, storage and disposal or decontamination of materials to prevent airborne contamination and accidental skin contact with vinyl chloride. Because vinyl chloride is a gas at normal temperatures, waste materials, equipment, and other sources of the monomer in closed containers, shall not be placed in areas of excessive temperature or sunlight since build-up of internal pressure may result in rupture of the container, fire or explosion.

(ii) Waste resins or other materials contaminated with vinyl chloride shall be placed in closed containers identified as required under paragraphs e(2)(i) or (ii) of this standard.

(iii) Appropriate procedures shall be developed and implemented for the decontamination and/or disposal of all such waste material.

(iv) In clean-up of leaks or spills, maintenance or repair operations on contaminated systems or equipment, or any operation involving work where direct contact with vinyl chloride monomer could result, each authorized employee involved in such operations shall be provided with and required to wear clean, impervious garments, including gloves, boots and continuous air supplied hoods in accordance with §1910.134, be decontaminated before removing the protective garments and hood; and be required to shower upon removing the protective garments and hood.

d. General Regulated Area Requirements

1. Employee identification.

A daily roster of employees entering regulated areas shall be

established and maintained. The rosters or a summary of the roster shall be retained for a minimum period of 20 years by the employer or successors thereto. The rosters and/or summaries shall be provided upon request to authorized representatives of the Assistant Secretary and the Director. In the event that the employer ceases business without a successor, rosters shall be forwarded by registered mail to the Director.

2. Emergencies.

In an emergency, immediate measures including but not limited to the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this subparagraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the existence of the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted within 24-hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (g)(3) of this standard.

(iv) Where an employee has a known contact with liquid vinyl chloride such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (g)(3) of this standard.

3. Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e)(3).

(iii) Where employees are required by this standard to wash, washing facilities shall be provided in accordance with §1910.141(d) (1) and (2)(ii) through (vii).

(iv) Where employees are required by this standard to shower, shower facilities shall be provided in accordance with §1910.141(d) (3).

4. Contamination control.

(i) Regulated areas, except for outdoor systems, shall be maintained under negative pressure with respect to nonregulated areas. Local exhaust ventilation may be used to satisfy this requirement. Clean tempered makeup air shall replace air removed. Exhaust air shall not be discharged to regulated areas, nonregulated areas, or the external environment unless decontaminated.

(ii) Any equipment, material, or other item taken into or removed from a regulated area shall be done so in a manner that does not cause contamination in nonregulated areas or the external environment.

(iii) Decontamination procedures shall be established and implemented to remove vinyl chloride from the surfaces of materials, equipment and the decontamination facility.

e. Signs, Information, and Training

1. Signs.

(i) Entrances to regulated areas shall be posted with signs bearing the legend.

CANCER-SUSPECT AGENT AREA

AUTHORIZED PERSONNEL ONLY

(ii) Entrances to regulated areas containing operations covered in paragraph 3(c) of this standard shall be posted with signs bearing the legend:

CANCER-SUSPECT AGENT IN THIS AREA. IMPERVIOUS-SUIT INCLUDING GLOVES, BOOTS, AND AIR-SUPPLIED HOOD REQUIRED AT ALL TIMES. AUTHORIZED PERSONNEL ONLY.

2. Container contents identification.

(i) Containers of waste or other materials contaminated with vinyl chloride shall be labelled as follows.

VINYL CHLORIDE CONTAMINATED MATERIAL

CANCER SUSPECT AGENT

DISPOSE OF OR DECONTAMINATE USING

APPROVED PROCEDURES

(ii) Containers of synthetic polymers made from vinyl chloride shall be labelled as follows.

SYNTHETIC VINYL CHLORIDE POLYMER

VINYL CHLORIDE IS A CANCER SUSPECT AGENT

POLYMER CONTAINS ____% BY WEIGHT UNREACTED

VINYL CHLORIDE

*(To be analytically determined by manufacturer and appropriate value entered on labels.)

(iii) Containers of vinyl chloride shall be labelled as follows.

V I N Y L C H L O R I D E

DANGER! EXTREMELY FLAMMABLE LIQUID AND GAS UNDER PRESSURE

CANCER SUSPECT AGENT

HARMFUL IF INHALED

MAY POLYMERIZE VIOLENTLY UNDER FIRE CONDITIONS
OR LOSS OR REMOVAL OF INHIBITOR

Keep away from heat, sparks, and open flame.
Keep container closed.
Use with adequate ventilation.
Avoid breathing vapor.
Avoid contact with skin.
Keep cylinder out of sun and away from heat.
Container should be grounded when being emptied.
Never drop cylinder.

FIRST AID: If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

In case of:

Fire - Use water spray, dry chemical, or CO₂.

Spill or Leak - For small spills, evacuate area and permit to evaporate. For large spills or leaks, evacuate area. Dike or flush to ground and let evaporate. Do not flush to sewer because of explosion hazard.

3. Training and indoctrination.

(i) Each employee, prior to being authorized to enter a regulated area, shall receive a training and indoctrination program including, but not necessarily limited to:

(a) The nature of the carcinogenic hazards of vinyl chloride monomer, including local and systemic toxicity;

(b) The specific nature of the operation involving vinyl chloride monomer which could result in exposure;

(c) The purpose for and application of the medical surveillance program;

(d) The purpose for and application of decontamination practices and purposes;

(e) The purpose for and significance of emergency practices and procedures;

(f) The employee's specific role under normal operating or emergency conditions;

(g) Specific information to aid the employee in recognition and evaluation of conditions and situations which may result in the release of vinyl chloride monomer;

(h) The purpose for and application of specific first aid procedures and practices;

(i) A review of this standard at the employee's first training and indoctrination program and annually thereafter.

(ii) Specific emergency procedures shall be prescribed, and posted, and employees shall be familiarized with their terms, and rehearsed in their application.

(iii) All materials relating to the program shall be provided upon request to authorized representatives of the Assistant Secretary and the Director.

f. Environmental Monitoring and Recordkeeping

(i) Environmental concentrations of vinyl chloride shall be determined through the use of methods for sampling and analysis

recommended by the Director or by methods of at least equal sensitivity.

(ii) Employees or their representatives shall be provided with the opportunity to observe environmental monitoring activities and shall have access to the results.

(iii) Complete and accurate records of all environmental measurements shall be maintained for at least 20 years by the employer or successors thereto and shall be provided upon request to authorized representatives of the Assistant Secretary or the Director.

g. Reports

1. Operations.

Within 60 days the following information shall be reported in writing to the appropriate Occupational Safety and Health Administration (OSHA) Area Director. Any change in such information shall be similarly reported within 15 calendar days of such change.

(i) A brief description and in-plant location of the area(s) regulated and the address of each regulated area.

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

(iii) A copy of the Control Plan as developed under paragraph 3(a)(ii).

(2) Environmental Measurements.

On a semi-annual basis the results of measurements taken at strategic sampling points, presented in such a manner as to identify achievement of goals established in the Control Plan, shall be reported in writing to the appropriate OSHA Area Director.

(3) Incidents.

Incidents which result in the release of vinyl chloride monomer into any area where employees may be potentially exposed shall be reported in accordance with this subparagraph.

(i) A report of the occurrence of the incident and the facts obtainable at that time including a report on any medical treatment of affected employees shall be made within 24 hours to the appropriate OSHA Area Director.

(ii) A written report shall be filed with the appropriate OSHA Area Director within 15 calendar days thereafter and shall include:

(a) A specification of the amount of material released, the amount of time involved, and an explanation of the procedure used in determining this figure;

(b) A description of the area involved, and the extent of known and possible employee exposure and area contamination;

(c) A report of any medical treatment of affected employees, and any medical surveillance program implemented; and

(d) An analysis of the circumstances of the incident, and measures taken or to be taken, with specific completion dates, to avoid further similar releases.

h. Medical Surveillance

(To be provided by NIOSH as soon as possible.)

D R A F T

OCCUPATIONAL SAFETY AND HEALTH WORK PRACTICE STANDARD FOR THE
MANUFACTURE, STORAGE, AND LOADING OF VINYL CHLORIDE MONOMER

I. Scope and Application

This standard applies to any area in which the manufacturing and storage of vinyl chloride monomer, tank car, tank truck, barge and ship loading and unloading operations, and filling of cylinders of vinyl chloride monomer. This standard shall start at the cracking furnace. This work practice standard shall not apply to solid or liquid solutions or mixtures of gases containing 0.1% or less of vinyl chloride monomer.

II. Purpose

The purpose of this work practice standard is to limit exposure of workers to vinyl chloride monomer in manufacturing, storage, and loading.

III. Definitions

- a) "Regulated area" means an area where entry and exit is restricted and controlled as provided for in this standard.
- b) "Waste material" shall mean any sludge (solid, semi-solid, liquid), spent catalyst, column packing, carbon, drying agent or any other solid or liquid materials which contain freely emanating vinyl chloride monomer and which have been removed and are to be discarded.
- c) "Closed container" is any container, vessel, tank which is used to prevent waste material containing freely emanating vinyl chloride monomer from contact with the individual.
- d) "Contaminated" refers to the presence of freely emanating vinyl chloride monomer where it would not normally be found or expected and where it could contribute to employee exposure.

e) "Saturated" refers to clothing contaminated with materials containing freely emanating vinyl chloride monomer so that the clothing may become a source of exposure.

f) "Immediate" means without delay, at once.

g) "Prompt" means within a reasonable time. This refers to situations less urgent than those requiring immediate action.

h) "Working level" refers to the atmospheric concentration of a contaminant or material which, in the light of current knowledge and technology, may be achieved.

i) "Vessel" means any part of a closed system in which vinyl chloride monomer is or was once contained including but not limited to the furnaces (crackers), heat exchangers, reboilers, towers, stills, surge tanks, day tanks, storage tanks, and other process units.

IV. Environmental (Workplace Air)

a) Concentrations

Vinyl chloride monomer concentrations in the breathing zone of employees shall not exceed a working level of _____ ppm, determined as a time-weighted average (TWA) exposure for an eight-hour work day.

b) Sampling, Calibration and Analysis

Procedures for the collection of environmental samples shall be as provided for in Appendix I* of this work practice standard or by an equivalent method. Analysis of samples shall be as provided in Appendix II* or by any method shown to be equivalent in precision, sensitivity, and accuracy to the specified method.

V. Medical

a) Medical surveillance as specified in this section of the work practice standard for manufacturing and storage of vinyl chloride monomer, tank car, tank truck, barge and ship loading and unloading, filling of cylinders, and sample collection shall apply to all employees engaged within the scope of this standard.

*To Be Supplied Later

b) Medical surveillance shall be provided or made available to workers covered by this work practice standard no less frequently than every twelve (12) months. This medical program shall be reviewed every three (3) years for revisions where indicated.

c) The preplacement and annual examinations shall consist of:

1) History

- A. Medical history
- B. Comprehensive work history
- C. Specific past exposures to VCM-PVC
- D. Cancer background history

2) Physical

Complete physical examination by a physician

3) Radiological Examination

14 x 17 chest x-ray

4) Pulmonary Function

- A. FVC
- B. FEV₁

5) Blood Work

A. Complete blood count

- (1) red blood count
- (2) white blood count and differential
- (3) hemoglobin
- (4) hematocrit

B. Platelet count

C. Blood chemistry

- (1) bilirubin
- (2) SGO-T
- (3) SGP-T
- (4) alkaline phosphatase
- (5) LDH
- (6) BUN
- (7) total protein
- (8) albumin

6) Urinalysis

- A. Routine urine chemistries
- B. Microscopic

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7) Other.

Other tests as may be indicated based on medical findings, history, or state of the art.

d) If an employee shows an abnormal test or finding, more frequent examinations shall be performed.

e) Initial annual examination for presently employed workers shall be completed within six (6) months of the promulgation of this standard.

f) The medical representatives of the Secretary of Health, Education, and Welfare, of the Secretary of Labor, and of the employer shall have access to these medical records. Physicians designated and authorized by any employee or former employee shall have access to the results of these examinations for that employee.

g) These medical records shall be maintained for twenty (20) years.

VI. Labeling and Posting

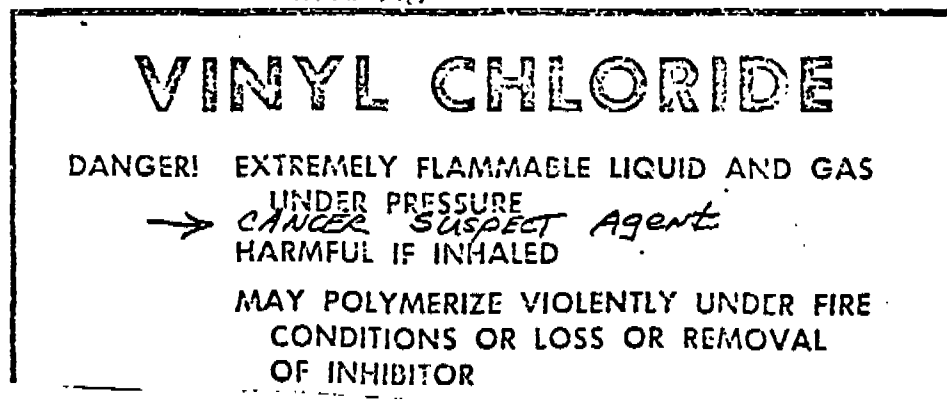
a) Signs

1) Entrances to the regulated areas shall be prominently posted with legible signs bearing the following:

DANGER!
CANCER SUSPECT AGENT AREA
AUTHORIZED PERSONNEL ONLY

b) Labels for Monomer Containers

Vinyl chloride monomer in containers or vessels located outside the regulated area shall be labeled as follows:



Keep away from heat, sparks, and open flame.
Keep container closed.
Use with adequate ventilation.
Avoid breathing vapor.
Avoid contact with skin.
Keep cylinder out of sun and away from heat.
Container should be grounded when being emptied.
Never drop cylinder.

FIRST AID: If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

In case of:

Fire — Use water spray, dry chemical, or CO₂.

Spill or Leak — For small spills, evacuate area and permit to evaporate. For large spills or leaks, evacuate area. Dike or flush to ground and let evaporate. Do not flush to sewer because of explosion hazard.

c) Waste Material

Waste material removed from regulated area in closed containers for disposal shall have the following label:

WASTE MATERIAL
DANGER! MAY CONTAIN VINYL CHLORIDE MONOMER
EXTREMELY FLAMMABLE
VINYL CHLORIDE IS A CANCER SUSPECT AGENT

d) Equipment

Equipment, material and clothing contaminated with vinyl chloride monomer shall not be removed from the regulated area unless it has been decontaminated or placed in closed containers bearing the following legend:

DANGER! CONTAMINATED WITH VINYL CHLORIDE MONOMER
CANCER SUSPECT AGENT

VII. Personal Protective Equipment and Clothing

a) Respiratory Protection

1) General

When the limits of exposure prescribed in Section IV (a) cannot be met by limiting the concentration of vinyl chloride monomer in the work environment through feasible engineering means, the employer must establish and enforce a program of respiratory protection detailing the required protection of each worker exposed.

2) Non-Routine Operations

The requirements set forth in this section shall apply for non-routine operations such as brief exposure to concentrations in excess of the working level as a result of maintenance or repair activities, emergency situations, or other short-time non-standard work routines. A respiratory protection program meeting the general requirements outlined in ~~Section 3.5~~ of the American National Standard Practices for Respiratory Protection Z88.2-1969 shall be established and enforced by the employer. This program shall include instructions on the selection, fitting, use, testing for leakage, cleaning, and maintenance of the respiratory protective device.

Respiratory protection as defined below shall be provided and used when a variance which allows the use of respirators as a means of controlling exposure for routine operations has been granted or while action on an application for a variance is pending.

3) Vessel Cleaning, Draining, Charging or Maintenance

Where employees are engaged in cleaning, charging or maintenance inside vessels, respiratory protection shall be worn at all times. Where the concentration of vinyl chloride monomer inside the vessel has been purged below _____ ppm, and there is adequate oxygen content to support life, a chemical cartridge respirator with an organic vapor cartridge(s) or a gas mask, chin type, with an organic vapor canister shall be used.

Where the concentration of vinyl chloride monomer cannot be brought below _____ ppm, the employees shall wear a demand or continuous flow or self-contained respirator (Type C).

Employees making the first break into a process line, storage line or vessel that contained vinyl chloride monomer shall wear an appropriate respirator.

4) Routine Operations

Workers loading or unloading tank cars, tank trucks, barges, ships, filling cylinders and other such similar operations where the facility does not have a closed system for vapor equalization, shall wear respiratory protection during the above-mentioned operations.

Where there are loading and unloading operations which incorporate equalization lines, employees shall have on their person an escape type respirator in the event of spillage, leaks or emergencies. This respirator is restricted to use only for immediate evacuation of the area.

Employees who collect samples for quality control purposes shall wear respiratory protection consisting of a chemical cartridge(s) type during the period when the sample is inserted and removed from the sampling line.

b) Clothing

Protective gloves, footwear or foot coverings, and protective head covering and protective eye wear shall be provided for use in regulated areas. This protective equipment shall be worn during maintenance and cleaning operations on/or inside previously purged vessels, pipes, pumps and valves not removed from the regulated area.

For vessel cleaning, maintenance and changing charges where the working level is above _____ ppm, protective clothing shall be worn to prevent skin contact with vinyl chloride monomer or other materials containing vinyl chloride monomer.

Protective clothing suitable to prevent skin contact during filling of cylinders, loading and unloading of tank cars, tank trucks, barges and ships and during sample collection shall be worn during these operations where it is reasonable to expect liquid vinyl chloride monomer to be encountered.

Employees making a break into a closed system line which contains or contained vinyl chloride monomer or other materials containing vinyl chloride monomer shall wear protective clothing.

VIII. Appraisal of Employees

Each employee working in a regulated area shall be apprised of all known hazards, the consequences of over-exposure, appropriate emergency procedures, proper conditions for safe use and precautions to prevent exposure to vinyl chloride monomer. Each employer shall have prepared an operations manual detailing procedures for performing the work which contains specific safe work practices. These practices shall not contain inherent steps that result in exposure of the employee.

IX. Work Practices

a) Emergency Procedures

Specific emergency procedures shall be prescribed. The procedures shall be readily available, in writing, to the employees. The employees shall be familiarized with these procedures, and trained and rehearsed in their application.

b) Engineering Procedures

An engineering review procedure shall be established to incorporate design changes where feasible to minimize sources of vinyl chloride monomer vapors from processes, loading, unloading operations and maintenance procedures that contribute to employee exposures. Where local exhaust ventilation is used, it shall be designed and maintained to prevent the accumulation of or recirculation of vinyl chloride monomer vapor into a non-regulated area. Sample collection ports shall be so designed that during the sample collection period, the sample container is part of a closed loop system. Valves shall be located as close as practical to the end of the disconnecting line. Valves shall be located where their frequent closings are necessary to isolate equipment. Valves shall be made of high-quality type to prevent leakage of vinyl chloride monomer or liquid streams containing vinyl chloride monomer.

Blow-down and purge lines from equipment shall be designed to discharge to a point remote from employees' work location.

c) Laboratory Procedures

All quality control testing and analyses shall be performed in a laboratory equipped with a chemical laboratory hood having a capture velocity adequate to collect vinyl chloride monomer vapors under conditions prevailing in the laboratory. The discharge from the laboratory hood shall be designed so that vinyl chloride vapors do not reenter other non-regulated areas.

All full sample containers (bombs) shall be stored inside the laboratory hood pending analysis. Sample bombs empty of liquid shall not be stored in the laboratory unless the storage space is properly ventilated and under negative pressure. Sample bombs may be stored outside the laboratory building provided the storage location meets the requirements specified elsewhere in this standard.

Analytical test instruments such as a gas chromatograph, that are located inside the laboratory but outside of the laboratory hood shall have their purge and bypass lines discharge to the laboratory hood.

All quality control sampling containers (bombs) shall be periodically checked to assure the integrity of the valves and for leakage.

d) General Housekeeping

1) To prevent airborne contamination and accidental skin contact with vinyl chloride monomer, emphasis shall be placed upon prompt clean up of spills, periodic inspection, prompt repair of equipment and leaks, and proper handling, storage, and disposal of materials.

2) An initial air monitoring survey and atmospheric sampling tests shall be made in the regulated area no less frequently than monthly. There shall be periodic tests for leaks at pumps, valves and flanges and for emission of vinyl chloride monomer. The frequency of these tests shall be such to insure the integrity of equipment and adherence to proper work practices.

3) For waste material and contaminated equipment handling, see Section VI (c) and VI (d) on Labeling and Posting.

e) Special Precautions

Vinyl chloride monomer is a gas at ambient temperatures. Therefore, waste materials, equipment, and other sources of the monomer in closed containers shall not be placed in areas of excessive temperature or sunlight where build up of internal pressure may result in rupture of the container, fire or explosion.

f) Vessel Entry

A vessel entry procedure shall be developed. Employees shall be familiarized with the procedure in writing, and shall be trained and rehearsed in the techniques provided for in the procedure.

Atmospheres within the vessel shall be purged to where vinyl chloride monomer contained therein is below _____ ppm and the oxygen content contained therein is sufficient for supporting life. Where either the vinyl chloride monomer concentration cannot be reduced below _____ ppm or where there is insufficient oxygen or where other toxic materials may be present in concentrations dangerous to life, an air-supplied respirator system and protective clothing, as stated in Section VII, of this work practice standard shall be provided by the employer and used by the employee.

All piping to and from the vessel shall be blanked or otherwise isolated prior to entry.

g) Blow-Down Procedure

Whenever any equipment which contains or contained vinyl chloride monomer is to be purged or blown-down, there shall be a written procedure established to prevent the worker from being exposed. This can be accomplished by returning the blow-down stream to the process through equalizing lines or locating the discharge point remote from the employee. If these systems are not feasible, Section VII of this standard shall be followed.

h) Tank Car, Tank Truck, Barge, and Ship Loading and Unloading

Each unloading line and each vapor equalizing line shall be equipped with vent connections permitting, at the completion of unloading, pressure to be vented, and the hose purged with an inert gas to a point remote from employees' workplace.

X. Sanitation

a) General

Storage or consumption of food, storage or use of containers of beverages, application of cosmetics or smoking are prohibited in regulated areas.

b) Showers and Hand Washing Facilities

Showers, hand washing facilities, and soap and water shall be available to all VCM workers.

c) Clothing

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

XI. Monitoring and Record-Keeping Requirements

a) Workplace Areas

1) Concentrations of vinyl chloride monomer in the regulated area shall be monitored at strategic sampling points. Adequate records of these concentrations shall be maintained and held available for inspection for a period of twenty (20) years.

2) A. Sampling frequency and patterns shall be adequate to represent the regulated area environment and to demonstrate proper work practices and the integrity of the equipment.

B. Vessel environments shall be periodically monitored at frequent intervals for vinyl chloride monomer concentrations during the times they are occupied by an employee. Summary records of these measurements shall be maintained for twenty (20) years.

3) Where the manufacturing process is located out-of-doors, a sampling station should be located down wind of the operation.

b) Personal Monitoring

Sampling shall be of such frequency and pattern as to represent levels of exposure of employees to vinyl chloride monomer. In no case shall the sampling be done at intervals greater than six (6) months. Records shall be maintained for twenty (20) years for all

sample schedules to include the sampling data, analytical methods, type of respiratory protection in use (if applicable), and the concentrations of vinyl chloride monomer. Job summary records shall be maintained so that they may be classified by employee.

Each worker shall have access to the sample results as they pertain to his occupational exposure.