

OSHA - ENGINEERING AND WORK PRACTICE

CONTROL PLAN

DECEMBER 1, 1982

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ENGINEERING AND WORK PRACTICE CONTROLS

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I. WORK PRACTICE CONTROLS

A. Respiratory Protection Guidelines

Although most of the planned engineering and work practice control programs for the plant have been implemented, some of the routine operational jobs require the use of respiratory protection. The OSHA Vinyl Chloride Standard states "Employees engaged in any operation, procedure or activity where a release of vinyl chloride liquid or gas might be expected as a consequence of the operation, which would result in an employee exposure in excess of the permissible limit, shall be provided and required to wear respiratory protection." Employees must use fresh air respirators for the following operations, because the possibility of exposure to greater than the permissible limit exists.

1. General Plant

- a. When opening and performing work on any piece of process equipment in vinyl chloride service, including:
 1. Pumps
 2. Compressors
 3. Filters
 4. Vessels
 5. Piping
- b. When entering vessels or any confined areas that have contained vinyl chloride.
- c. When using the portable vinyl chloride detector to pinpoint a vinyl chloride leak detected by the continuous monitoring system, and the VCM concentration exceeds or is expected to exceed 10 ppm.
- d. When repairing a leak on any equipment which contains VCM.
- e. When sampling reactors, VCM railcars or storage tanks.
- f. When working in an area where the local VCM warning beacon is flashing, or the fixed point monitor indicates a VCM concentration of 3 ppm or more in the area.
- g. When performing any other operation which has the possibility of resulting in exposure greater than the permissible exposure limit. The permissible exposure limit is defined as:
 1. No employee may be exposed to vinyl chloride at concentrations greater than 1 ppm averaged over any 8-hour period.

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- ii. No employee may be exposed to vinyl chloride at concentrations greater than 5 ppm averaged over any period not exceeding 15 minutes.
- iii. No employee may be exposed to vinyl chloride by direct contact with liquid vinyl chloride.
- h. VCM cannister masks may be used under the following conditions:
 - i. Working in a contaminated area of less than 10 ppm for up to 10 hours.
 - ii. Performing leak detection operations while Honeywell units are indicating between 1 and 10 ppm VCM.
 - iii. Escape from an area of high VCM concentration to obtain a Scott Air Pak.

2. VCM Tank Farm Area

- a. When checking the sphere vapor space oxygen content.
- b. When working at the compressor station.
- c. When opening domes on railcars prior to connecting hoses.
- d. When connecting and disconnecting hoses to the railcar.

3. Reactor Area

- a. When opening a Lenape manway on a reactor without using steam jet evacuation on the reactor.
- b. When changing filters which have been contaminated by VCM. This includes but is not limited to fresh and recovered VCM filters, recovery seal water filters, recovery knockout tank scrubber water filters, etc.
- c. When on top of any blend tanks which are regulated areas.
- d. When working on a plugged reactor dump valve or line.
- e. When working near the dump Sweco while dumping a coarse batch.
- f. When working near the dump Sweco while dumping a reactor, and the Sweco exhauster is inoperative.

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B. Exposure Protection Guidelines

This section covers work practices which help to minimize employee exposure to VCM, regardless of whether or not respiratory protection is used. In general, this includes VCM exposure caused by performance of certain jobs, and VCM exposure caused by unknowingly being in an area which has a high VCM concentration.

1. Hazardous Job Posting

Whenever any job is performed in which VCM will potentially be dispersed around the workplace, hazardous job signs must be posted around the site in order to warn passerbys. These signs read "DANGER - POTENTIAL VCM EXPOSURE AREA - RESPIRATOR REQUIRED." Personnel are not to enter marked off areas unless they are wearing respiratory protection, or they have obtained verification from a calibrated HNU that the area is safe to enter without a respirator. The following jobs are hazardous, and must be posted as such.

- a. VCM or VCM-contaminated filter changes.
- b. Vessel opening and cleanout.
- c. Flushout of VCM-contaminated material to grade or sewer.
- d. VCM leak repair.

2. Filter Cleaning, Removal and Replacement

The following procedure must be used when changing filters which have been in contact with VCM.

- a. Steam purge and recover the filter to the process until a vacuum is reached.
- b. The operator must put on a CFFAM, impervious gloves and impervious suit.
- c. Post hazardous job signs around the area of the filter.
- d. Change the filters.
- e. Dispose of the used filters in accordance with Section (I)(B)(7) of this manual.

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B. Exposure Protection Guidelines

3. Pump, Condenser, Subcooler, Line and Vessel Maintenance

The following procedure must be used when performing maintenance on lines, vessels, subcoolers and condensers which have contained VCM.

- a. The equipment must be blinded and evacuated until free of VCM as detected by the HNU portable hydrocarbon detector.
- b. Post hazardous job signs around the area of the equipment to be opened, if VCM is still present in the equipment.
- c. Open the equipment.
- d. Dispose of any VCM-contaminated waste material in accordance with Section (I)(B)(7) of this manual, where applicable.
- e. When drilling a reactor condenser, perform work using an air mover on the Lenape manway for ventilation of the condenser.

4. Opening Manhead on Empty Reactor

The following procedure must be used when opening the manhead on a reactor.

- a. Check the external pressure gauge to insure that the reactor is not under pressure.
- b. Unlatch the manhead roll bar, and crack the manway.
- c. Radio the panel operator to open the evacuation jet to the reactor. This will move air inward and disperse VCM vapors.
- d. Open manhead completely, after verifying that the evacuation jets are on.
- e. Inspect reactor.

NOTE: The manhead is not opened after every reaction but only periodically to check the internal condition.

5. Manual Reactor Entry

The following procedure must be used when entering a reactor.

- a. Open manhead using the procedure described in Section (B)(4).
- b. Follow equipment entry procedure as described in Attachment "A" of Safety and Health Manual.

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B. Exposure Protection Guidelines

5. Manual Reactor Entry (Cont.)

- c. Perform work using a Lenape-mounted air mover for ventilation of the reactor. Entry without a respirator can be permitted if the supervisor has verified that the VCM concentration inside the reactor is less than 1 ppm.
- d. Close the top manhead.
- e. Hydrostatically test reactor for leakage.

6. VCM Leak Detection And Elimination

VCM leaks which are detected by any of the following means, or by any other means, must be expeditiously isolated and repaired within a reasonable period of time.

- a. The continuous monitoring system data logging computer notifies the panel operator with a panel alarm whenever the monitor picks up three consecutive readings above 5 ppm on an individual stream. Following awareness of a leak condition, a reasonable effort must be made by the operating department to locate the leak and isolate it.
- b. A weekly VCM Leak Survey is conducted with an HNU. This survey checks a substantial number of potential VCM Leak sources in the plant.
- c. A more thorough VCM Leak Survey than required in Section (I)(B)(6)(b) is conducted at least once per year, in which every flange, gasket and fitting on equipment in VCM service is checked with an HNU.

7. Isolation Of VCM - Contaminated Wastes

Any waste material which is contaminated with VCM, as determined with a calibrated HNU, must be moved to the designated area south of the new module before being dumped in the plant's waste disposal bins. Such wastes may be moved to the plant's waste disposal bins after they have aerated long enough to strip out VCM, as verified by a calibrated HNU. Examples of candidate wastes are VCM filters, vessel clean-out debris, coarse resin, etc.

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C. PVC And VCM Sample Handling Guidelines

1. PVC Resin Analysis

PVC resin, in small individual samples, is brought to the Laboratory for the performance of certain physical tests. The following work practices apply to handling of dry PVC resin.

- a. Samples fresh from the dryer department should not exceed 3 pounds. This will limit exposure to residuals of VCM in resin.
- b. Upon completion of testing, sample to be retained is stored on sample shelves. Any spillage is immediately swept up and along with samples not to be retained, discarded in a waste can and removed from the area to be placed in a waste box outside the Laboratory.

2. VCM Analysis

From time to time it will be necessary to perform chemical analysis on samples of VCM. These samples are taken from various points in the process stream in stainless steel pressure vessels. The following work practices apply to the handling and testing of VCM in the Laboratory.

- a. When pressure vessels are brought to the lab for analysis, they must be placed in a fume hood for storage.
- b. Any transfer and testing of VCM shall take place in an adequate vent hood. Technician will wear impervious gloves when transferring liquid VCM.

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II. ENGINEERING CONTROLS

A. Fresh Air Supply Systems

1. Respiratory Breathing Air System

A Continuous Flow Fresh Air System (CCFAS) has been installed. Air is supplied by two Nash compressors, each capable of supplying 100 CFM at a maximum pressure of 80 psig. Each compressor can supply air to about 15 fresh air masks at a time. One of the compressors is in operation at all times. The second compressor is put in service manually when needed.

The system is equipped with both visible and audible alarms which are activated when the pressure drops to 50 psig. A revolving beacon light and an alarm horn are located in the compressor area.

The clean air then flows to all affected areas of the plant. These include the Vinyl Reactors, Dryers, VCM Tank Farm (both unloading and pumping stations), Silo Storage Area, Plasticizer, Compound Line I and III, Dry Blend, Warehouse and Bagging Areas. The individual lines from the piping headers are of 3/4" piping with Snap-tite, quick disconnect fittings. These are designed for flow of 6 CFM to each mask at 1-15 psig. An air-pressure regulator, shutoff valve and an air filter are provided in the piping header to each area.

To ensure that the vinyl chloride concentration in the breathing air is minimized, an activated carbon canister has been installed on the inlet header to the breathing air compressors. Activated carbon will filter out higher concentrations of vinyl chloride which may be present in the air at the intake to the breathing air compressors.

The plant breathing air system has had a moisture problem. To eliminate this problem an air-water separator, a surge vessel, and several coalescing filters have been installed.

Continuous Flow Fresh Air System: In Operation

2. Environmental Air Supply System

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An environmental air system supplies non-contaminated air to the central control room, old control room, and the motor control centers in the vinyl reactor areas. The air is gathered from the intake point located south of the railcar unloading area. A fan is then used to supply the air through ductwork to the control rooms, which are pressurized to insure that any contaminated air outside of the control room is unable to enter the control- led area.

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2. Environmental Air Supply System (Cont.)

There is a remote possibility that the environmental air supply could become contaminated with VCM. A continuous monitoring point is located in the process control room to analytically determine VCM concentration. If the air ever becomes contaminated, an alarm will sound to alert employees to put on protective equipment.

Environmental Air Supply System: In Operation

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B. Fixed Point Monitoring System

The plant's fixed point monitoring system consists of four Honeywell gas chromatograph units and a sampling network of forty sampling lines. Gas samples are continuously pulled from various locations within the plant and analyzed for VCM at the chromatographs. A warning light grid on the control panel in the vinyl control room warns the panel operator when the VCM concentration at any location exceeds 1 ppm.

A computer data logging system has been added in order to tabulate data, monitor leaks and drive a network of VCM warning beacons in the plant. There are sixteen beacons spread throughout the reactor areas and the VCM Tank Farm, which are activated when the VCM concentration in their respective areas exceeds 3 ppm. Plant personnel are required to either leave the area or put on breathing air protection when a beacon is flashing. VCM leaks detected by the computer set off a panel leak alarm in the vinyl control room, which the panel operator must respond to.

Data tabulated by the computer is printed out at the end of every shift, and includes the high and average VCM concentrations at each sampling location. VCM leaks are also serially numbered and printed out in each shift report.

Fixed Point Monitor, Data Computer and Warning Lights: In Operation

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C. VCM Tank Farm Area

1. VCM Tank Farm Area

The VCM unloading compressors have been modified to reduce emissions. A distance piece has been added to the compressors. The distance piece is vented to the emission recovery system.

VCM Unloading Compressor Revisions: Complete

2. Unloading and Transfer Pump Seals

Double mechanical seals are now installed on all pumps in the VCM unloading area. This will minimize emissions and exposures which result from leaking seals.

Unloading and Transfer Pump Seals Installation: Complete

3. Railcar Unloading Arm Revisions

The railcar unloading arms have been modified such that they are evacuated with the emission recovery system prior to being disconnected. This reduces VCM emissions in the area.

Railcar Unloading Arm Revisions: Complete

4. General Compressor Revisions

The piping and valving arrangement in the VCM unloading area has been revised and simplified to reduce the number of potential emission sources.

General Compressor Revisions: Complete

5. Sphere and Bullet Vents

Piping has been installed which will allow the sphere and bullets to be recovered into the emission recovery system.

Sphere and Bullet Vents: Complete

6. Relief Valve Leakage

Emissions from relief valves have been minimized by installing rupture discs under all relief valves in VCM service in the tank farm area.

Relief Valve Emission Reduction: Complete

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II. RAILCAR UNLOADING AREA - (Continued)

7. Vent Gas Emission Recovery System

The emission recovery system provides a vacuum source in the area to return VCM vapors to the process, thus reducing emissions to the atmosphere.

Vent Gas Emission Recovery System: Complete

8. VCM Unloading Revisions

A knockout tank has been added to the vapor line between the sphere and the compressors in order to minimize liquid VCM carryover into the compressors. High pressure and high level alarms for the sphere have also been installed, with annunciators in the control room.

VCM Unloading Revisions: Complete

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II. D. REACTOR AREA

1. Inert Vent Containment

Inerts from the reactors are vented into the recovery system and then into the recovered monomer storage tanks.

Inert Vent Containment System: Complete

2. Recovered VCM Receiver Drain

Water is drained from the recovered VCM receivers into the blowdown tanks.

Recovered VCM Receiver Drain System: Complete

3. Batch Water Stripping System

VCM contaminated waste water is collected in the batch water strippers where the VCM content is reduced to less than 10 ppm. The stripped waste water is then drained to the waste water treatment system through a closed process sewer to minimize employee exposure to VCM.

Batch Water Stripping System: In Operation

4. VCM Pump Seals

Double mechanical seals have been installed on all pumps which have VCM as the fluid. This minimized emissions and exposure which result from seal leaks.

VCM Pump Seals: Complete

5. Compressor - Vacuum Pump Seal Revisions

Double mechanical seals on the vacuum pumps and compressors in the recovery area have been installed to reduce emissions from these sources.

Seal Revisions: Complete

6. Emergency Shortstop System

A shortstop addition system to be used in case of emergencies such as power failure has been installed.

Emergency Shortstop System Installation: Complete

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II. D. Reactor Area (Cont.)

7. Steam Stripping

Steam Stripping is being used to reduce slurry VCM concentrations. This in turn lowers VCM concentrations in the Sweco, Chem Wash, Reactor and Sewer areas.

Steam Stripping: In Operation

8. Vent Gas Emission Recovery System

This system provides a vacuum source which collects VCM vapors in the process area. The vapors are then condensed and the liquid VCM is used to produce PVC. Use of the system reduces VCM emissions in the process area.

Vent Gas Emission System: In Operation

9. Vent Gas Incineration System

Inerts and VCM vapors contained by the emission recovery system accumulate in the recovered VCM receivers. The vent from these receivers is refrigerated to reduce VCM content prior to incineration. Incineration of this inert vent stream minimized VCM emissions. A spare inert vent incinerator has been installed, in order to provide backup in the event of failure of the existing incinerator.

Vent Gas Incineration System: In Operation

10. Emergency AMS Kill System

An improved emergency kill system has been installed to kill the reactors in case of emergencies such as power failures. This system will inject a large volume of AMS into any reactor during critical condition.

Emergency AMS Kill System: In Operation

11. Reactor Double Rupture Disc Replacement

The double rupture disc assemblies on the reactors have been replaced with relief valves. This reduces the amount of VCM released due to an overpressure or a premature rupture disc failure since the relief valve should reseal.

Reactor Double Rupture Disc Replacement: Complete

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II. REACTOR AREA (Cont.)

12. Emergency Cooling For Reactors

The capability to supply cooling water to the reactors during a power failure has been provided. This reduces the possibility of a release occurring due to a power failure.

Emergency Cooling For Reactors: Construction in Progress

13. RVCM Receivers High Level Alarms

An independent high level alarm has been provided for the recovered VCM receivers to reduce the possibility of a release due to overfilling the receivers.

RVCM Receivers High Level Alarms: Complete

14. Improved Rupture Disc Holders

Improved rupture disc holders that can be pretorqued in the shop have been installed on all reactors and most all other process equipment to reduce the chance of premature rupture disc failure due to improper torquing of the disc.

Improved Rupture Disc Holders: Complete on all process equipment, with the exception of the Emission Recovery System.

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E. Laboratory

1. Laboratory Analysis Hood Revisions

An improved hood system with fan type exhausters has been installed in the lab area where liquid VCM analysis is performed. This removes VCM vapors from the area thus limiting employee exposure.

Laboratory Analysis Hood: In Operation

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