U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-71-142

DELCO REMY DIVISION
ANAHEIM, CALIF. 92801
SEPTEMBER 1974

I. TOXICITY DETERMINATION

It has been determined that vinyl chloride vapor from a battery separator manufacturing operation is not toxic at the concentrations measured within the worksite area during normal operating conditions. This determination is based upon environmental measurements, analysis of work practices, and on available information regarding the toxicity of vinyl chloride. During the day of the evaluation (July 15, 1974), no levels of vinyl chloride were detected. The lower limit of detection for vinyl chloride in the method used is approximately 0.2 part per million parts of air.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a) Delco Remy Division of General Motors, Anaheim, California
b) Authorized Representative of Employees
c) U.S. Department of Labor - Region IX
d) NIOSH - Region IX

For purposes of informing the approximately 10 "affected employees" the employer will promptly "post" the Determination Report in a prominent place(s) near where exposed employees work for a period of 30 calendar days.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure to vinyl chloride gas at the Delco Remy Division of General Motors, Anaheim, California.

IV. HEALTH HAZARD EVALUATION

A. Introduction

The Delco Remy Division of General Motors is involved in the production of automotive batteries. An evaluation of the PVC Separator Manufacturing Operation for vinyl chloride (VC) vapor was requested by an authorized representative of employees.

One of the major thrusts in a health hazard evaluation is the identification of the significance of any symptomatology experienced by employees from exposure to a particular substance. In the case of vinyl chloride, which is now suspected as being the etiological agent in the development of angiosarcoma (a rare form of liver cancer), or any carcinogen, the presence or absence of adverse symptomatology would not be a good indicator of potential toxicity because positive symptoms may already mean the presence of irreversable disease. Additionally, based on theoretical considerations, as stated in NIOSH's Recommended Standard For Occupational Exposure to Vinyl Chloride, "there is probably no threshold for carcinogenesis although it is possible that with very low concentrations, the latency period might be extended beyond the life expectancy. In view of these considerations and NIOSH's inability to describe a safe exposure levels as required in section 20(a)(3) of the Occupational Safety and Health Act, the concept of a threshold limit for yinyl chloride gas in the atmosphere was rejected." Therefore, medical surveillance was not incorporated in this evaluation, and it was limited to an environmental study of the workplace for VC. Consequently, NIOSH recommends that where any employee is exposed to measurable concentrations of vinyl chloride, as determined by the recommended sampling and analytical method, he shall wear an air supplied respirator.

B. Plant Process

On July 15, 1974, NIOSH investigator Melvin T. Okawa conducted a conference with representatives of management and labor as an introduction to the hazard evaluation. A preliminary walk-through survey of the PVC Separator Manufacturing Operation was conducted. Bulk PVC in powder form is brought to the plant in railroad tank cars and is pumped into a holding system for use. A single worker connects a hose to an outlet near the bottom of the tank car (which is located outdoors) and does not remain in the area. The hose remains connected to the tank car until the PVC is unloaded and another car takes its place. One tank car of PVC lasts for several days. The PVC is aerated in a closed system to keep it loose before it is fed onto a belt. Air from the system is exhausted out a stack on the roof of the plant. If any was pre-

sent, the aeration process would serve to liberate and exhaust much of the VC trapped in the PVC. When the PVC is fed onto the belt, it passes through a "profile comb" which combs it to a correct thickness before it enters a sintering oven. The sintered PVC forms the battery separator which is cut and stacked at the end of the conveyor line. The sintering oven is enclosed and exhausted. One employee works in the "feed-in" room and about eight workers are at the stacking end. One utility man roams the length (200 feet) of the conveyor line.

C. Worksite Evaluation

On July 15, Mr. Okawa conducted an environmental evaluation for VC in the work atmosphere of the PVC Separator Manufacturing Area.

D. Evaluation Methods

Employee exposures to VC were measured via personal air sampling equipment. Breathing zone air samples were obtained using Sipin Personal Sampler pumps and charcoal air sampling tubes. Sampling rates were less than 75 cc/minute and sample volumes ranged from 0.8 - 1.7 liters of air. The charcoal tubes were sealed, refrigerated in dry ice, and mailed immediately to NIOSH laboratories in Salt Lake City for analysis. General area samples were taken with the same Sipin pumps and charcoal tubes.

E. Evaluation Results

Five personal breathing zone samples were taken on the "feed-in" operator while he conducted his normal duties. No vinyl chloride was detected in any of the samples. The limit of detection for VC using this method is about 0.2 ppm. Four personal breathing zone samples were taken on employees working near the PVC cutter at the stacking end of the conveyor line and one sample was collected on the utility man. Vinyl chloride levels were not detected. Two general area samples were collected near the railroad tank car and two samples were taken near the sintering oven. Vinyl chloride levels were not detected. Therefore, based on the criteria outlined in part A (introduction), it was determined that no vinyl chloride hazard was found in the PVC separator manufacturing area.

V. AUTHORSHIP

Report Prepared By: Melvin T. Okawa
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San Francisco, California

Originating Office: Jerome P. Flesch, Chief
Hazard Evaluation Services Branch
Cincinnati, Ohio

NIOSH Recommended Standard for Occupational Exposure To Vinyl Chloride

On January 22, 1974, representatives from the B. F. Goodrich Chemical Company informed NIOSH that the deaths of several employees of their Louisville, Kentucky, plant might have been related to occupational exposures. An immediate industrial hygiene walk-through survey of the facility was conducted by NIOSH and resulted in developing and transmitting to affected companies recommendations for precautionary monitoring and control procedures for polymerization processes involving vinyl chloride. On February 1, 1974, NIOSH/CDC conducted a briefing for other Federal agencies with health research responsibilities at which it was disclosed that four employees of the plant in question had died of angiosarcoma of the liver. Because of the extremely low incidence of this disease, estimated to be on the order of 20 to 30 deaths per year in the United States, the history of four cases in a five-year period in one plant was considered of great importance. It was concluded at the briefing that a new occupational cancer had been discovered: angiosarcoma of the liver. It was further concluded that this disease was associated with the manufacture of polyvinyl chloride and that vinyl chloride was the prime etiological candidate in producing the disease.

NIOSH, with the assistance of expert consultants from both industry and organized labor, began development of a recommended occupational health standard. These and other activities were discussed in more detail at the OSHA Informal Fact-Finding Hearing on Possible Hazards of Vinyl Chloride Manufacture and Use on February 15, 1974. It was also during this Hearing that Professor Cesare Maltoni of Bologna, Italy, presented the preliminary results of his research which showed induction of angiosarcoma of the liver and other organs, as well as the production of other cancers in rats exposed to vinyl chloride. The results of these studies identify vinyl chloride as a carcinogen and further confirm its role in inducing the cancers observed in the B. F. Goodrich workers . . .

Although vinyl chloride must be considered as a carcinogenic agent, the immediate problem appeared to be concentrated in polymerization facilities. Consequently, the attached NIOSH recommended standard only applies to such operations. This is not to say, however, that appropriate standards should not be developed for other exposures to the basic chemical. NIOSH is implementing further evaluation of the data, coupled with field observations, to determine exposure potentials in pre- and post-polymerization operations . . .

Consultants from industry who worked with NIOSH proposed that the recommended standard contain the concept of an allowable "working level" for vinyl chloride gas in the atmosphere, which they identified as a time weighted average of 50 ppm. They recommended that where workers were exposed to concentrations in excess of this level they should wear air-supplied respirators. This concept of an allowable "working level" might seem justifiable in that Professor Maltoni found no liver tumors at 50 ppm, but there is the possibility that tumors might have been produced if a larger number of animals had been exposed at that concentration. Based on theoretical considerations, there is probably no threshold for carcinogenesis although it is possible that with very low concentrations, the latency period might be extended beyond the life expectancy. In view of these considerations and NIOSH's inability to describe a safe exposure level as required in section 20(a)(3) of the Occupational Safety and Health Act, the concept of a threshold limit for vinyl chloride gas in the atmosphere was rejected.

Consequently, the recommendations are such that where any employee is exposed to measurable concentrations of vinyl chloride, as determined by the recommended sampling and analytical method, he shall wear an air supplied respirator. This recommendation is based on some preliminary information that the standard chemical cartridge respirators are inefficient in protecting against vinyl chloride. NIOSH is implementing a study to evaluate the degree of protection afforded by different types of respirators using vinyl chloride as the test gas. As information becomes available, it will be forwarded to OSHA as recommendations for alternative respirator usage. The employer is also required to develop a Control Plan to reduce airborne concentrations of vinyl chloride to levels not detachable by the recommended method . . .

(Excerpts from a March 11, 1974, memorandum from Marcus M. Key, Director, National Institute for Occupational Safety and Health to John H. Stender, Assistant Secretary of Labor, Occupational Safety and Health Administration transmitting the NIOSH recommendations.)

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NIOSH Recommended Standard

RECOMMENDED OCCUPATIONAL HEALTH STANDARD FOR THE MANUFACTURE OF SYNTHETIC POLYMER FROM VINYL CHLORIDE

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 know 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 empolyee 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 CONTAMINTED 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:

VINYL CHLORIDE

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 CO_2.
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 surviellance 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 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 chloride shall be determined through the use 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 is 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

The following recommendations are directed primarily at medical screening to detect liver disease and/or hepatic tumor. They should be considered in the context of routine health screening for any general employee health problems, including non-hepatic health conditions potentially related to vinyl chloride monomer exposure. Routine health screening should include at time of initial employment the recording of past medical history and the performance both of a general physical examination and certain basic laboratory procedures (e.g., complete blood count, urinalysis, chest x-ray); provisions should also be made for routine periodic health followup examinations.

Employees covered by the following specific recommendations shall encompass all persons engaged in vinyl chloride monomer production and polymerization, including personnel peripherally involved such as in clerical and management assignments. The recommendations shall be applied both as a preemployment requirement and as part of periodic health followup. Screening priority should be given to current employees with prolonged and close potential exposure to vinyl chloride monomer, whether in present or past work settings.

(i) At time of initial employment, or upon institution of screening, a physical examination shall be performed with specific attention to detecting enlargement of liver or spleen by abdominal palpation.

(ii) At time of initial employment, or upon institution of screening and annually thereafter, a medical history check-list shall be completed by the employee. This list shall include questions concerning:

(a) alcohol intake;

(b) past history of hepatitis;

(c) past exposure to potential hepatotoxic agents, including drugs and chemicals;

(d) past history of blood transfusions; and

(e) past history of hospitalizations.

Completed medical check-list shall be reviewed by a physician and should be acted upon as medically indicated for each individual employee.

(iii) At time of initial employment, or upon institution of screening, a serum specimen shall be obtained for screening with respect to the following five bio-chemical determinations of liver function:

(a) total bilirubin;

(b) alkaline phosphatase;

(c) serum glutamic oxalacetic transaminase (SGOT);

(d) serum glutamic pyruvic transaminase (SGPT); and

(e) gama glutamyl transpeptidase (GGTP).

Additional tests that may optionally be considered for use in screening include lactic dehydrogenase (LDH), serum protein determinations, serum protein electrophoresis, and platelet count. Laboratory analysis shall be performed in laboratories accredited by the College of American Pathologists or licensed in accordance with the provisions of the Clinical Laboratories Improvement Act of 1967.

(iv) If results or laboratory screening are normal, screening shall be repeated on an annual basis. If the person being screened has been employed directly in vinyl chloride monomer production or polymerization for 10 years or longer, screening shall be repeated every six (6) months.

(v) If one or more liver function tests are abnormal, serum testing shall be repeated as soon as possible, preferably within two (2) to

four (4) weeks. If no abnormalities are present upon rescreening, testing should be repeated in three (3) months.

(vi) If abnormalities persist on rescreening, the employee shall be removed from contact with vinyl chloride monomer operations and an individualized medical workup shall be instituted. Suggested as initial steps in medical workup are a complete physical examination and various special procedures such as hepatitis B antigen determination and liver scanning.

If liver function abnormalities are determined to be unrelated to liver disease (e.g., elevated alkaline phosphates in a young, physically active man or elevated bilirubin in Gilbert's syndrome) or to be transient (e.g., due to recent hepatitis or recent alcohol intake), the employee may be permitted to return to vinyl chloride-related employment, subject to individual medical evaluation.

(vii) In view of the preliminary results of animal toxicology studies, it is recommended that no woman who is pregnant or who expects to become pregnant should be employed directly in vinyl chloride monomer operations.

RECOMMENDED OSHA SAMPLING DATA SHEET

1. **Substance:**
   Vinyl Chloride Gas
2. **Scope of Method:**
   Vinyl chloride is a gas boiling at –13.4 degree C and having a vapor pressure of 2660 mm of mercury at 25 degree C. The lower limit of detection for the method is approximately 1 ppm.
3. **Sampling Equipment:**
   a) Personal sampling pump
   b) 250 cc glass gas collecting tubes with teflon stopcocks
4. **Sample Size:**
   250 CC
5. **Sampling Procedure:**
   Glass Gas Collecting Tubes
   a) The gas collecting tube is connected at one end to the personal sampling pump. Both stopcocks are opened and air pulled through at approximately one liter per minute.
   b) A sampling period of 15 minutes would allow collection of a representative sampling of the worker environment.
   c) Stopcocks shall be closed tightly, closing the stopcock nearest the pump first.
6. **Analysis:**
   The gas collecting tube sample is analyzed directly by gas chromatography.
7. **Shipping Instructions:**
   The gas collecting tube should be wrapped with cushioning material, placed in the shipping case and shipped via Air Mail to the OSHA laboratory, Salt Lake City.