U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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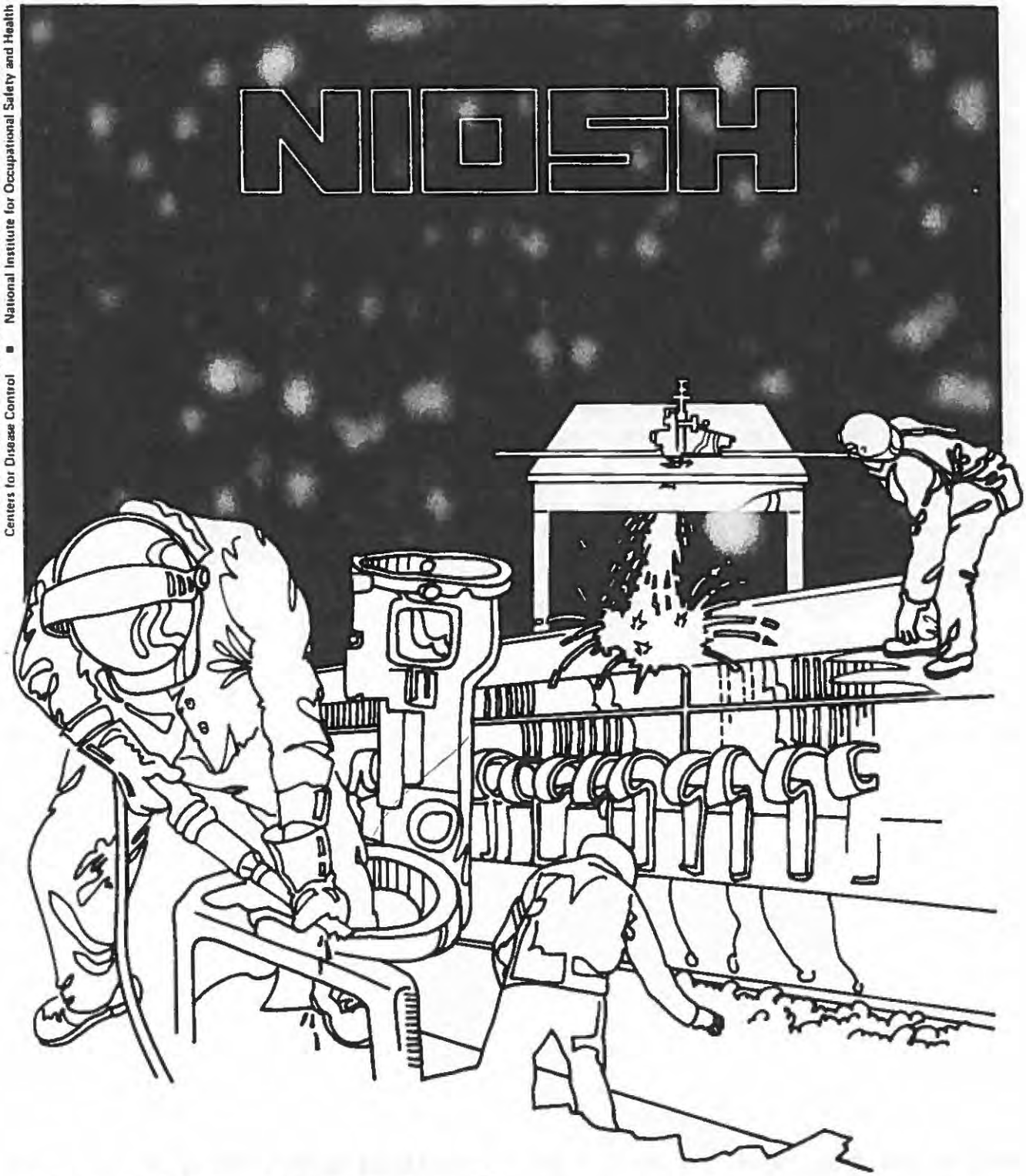

Health Hazard Evaluation Report

HHE 80-68-871
SINCLAIR PAINT COMPANY
LOS ANGELES, CALIFORNIA

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from 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 Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HE 80-68-871
MAY 1981
SINCLAIR PAINT COMPANY
LOS ANGELES, CALIFORNIA

NIOSH INVESTIGATOR:
Pierre L. Belanger, I.H.
Molly J. Coye, M.D.

I. SUMMARY

On January 27, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) at Sinclair Paint Company, Los Angeles, California. The requestor was concerned that the long time (17 years) exposure at the resin building to vinyl acetate, ethyl acrylate and butyl acrylate may have produced his "asthma-like symptoms and central nervous system disorders."

On March 3, 1980, NIOSH conducted an initial environmental and medical survey at Sinclair Paint Company. A follow-up environmental survey was conducted June 18-19, 1980. Sixteen environmental air samples (personal and area) were collected for ethyl acrylate and butyl acrylate. Ethyl acrylate concentrations ranged from below the limits of detection to 5.8 ppm (parts of a vapor or gas per million parts of contaminated air) which are below the California Occupational Safety and Health Administration (Cal-OSHA) standard of 25 ppm. Butyl acetate concentrations were all below the limit of detection with the exception of one sample (.92 ppm) which was below the Cal-OSHA standard of 10 ppm. Sixteen environmental air samples were collected for vinyl acetate. The 8 hour, time-weighted average (TWA) concentrations ranged from 1.0-8.4 ppm. None of the samples exceeded the Cal-OSHA TWA standard for vinyl acetate (10 ppm). One 15 minute personal sample was collected; it did not exceed the NIOSH ceiling concentration of 4 ppm.

Medical interviews with three workers revealed a range of symptoms including decreased appetite, irritability, headache, eye and upper respiratory system irritation. The last two symptoms were occasionally associated with chest tightness after cleaning the reactor vessels or when there was a release of vapors from the pressure relief system.

On the basis of the data obtained during this investigation, no overexposures to vinyl acetate, ethyl acrylate or butyl acrylate were measured during paint batch mixing. However, a health hazard previously existed during the tank cleaning operation based on Cal-OSHA environmental air results for vinyl acetate and the medical problems reported to the NIOSH medical investigator. The tank cleaning process has changed between the initial survey and the follow-up environmental survey. The environmental air results collected for vinyl acetate during a Cal-OSHA consultative visit indicates the problem has been corrected.

Recommendations, to further reduce worker exposures occurring during paint batch mixing, have been incorporated into the body of this report.

KEYWORDS: SIC 2851 (Polyvinyl acetate emulsion manufacturing) latex paint manufacturing, vinyl acetate, ethyl acrylate, butyl acrylate.

II. INTRODUCTION

On January 27, 1980, the National Institute for Occupational Safety and Health received a request for a health hazard evaluation from an employee at Sinclair Paint Company to evaluate worker exposure at the resin building. It was reported that workers may be exposed to vinyl acetate, ethyl acrylate and butyl acrylate during the manufacturing of a polyvinyl acetate emulsion (paint).

NIOSH conducted an initial environmental and medical survey on March 3, 1980 and a follow-up environmental survey on June 18-19, 1980. An interim report was released in August 1980.

Additionally, it was learned that the California Occupational Safety and Health Administration (Cal-OSHA) was conducting a similar study at Sinclair Paint Company. The Cal-OSHA environmental air sampling results were forwarded to NIOSH in June 1980. The company was cited based on quantitative measurements made on March 26, 1980. Personal breathing zone air sample concentrations of vinyl acetate were measured while workers cleaned the inside of the mixing vessel. The employees TWA exposure was measured to be 33.9 and 36.4 ppm. Subsequent to this citation, the company changed the reactor vessel wash-down procedure prior to workers entering the vessel. A Cal-OSHA consultant returned to the plant to monitor the workers during the reactor vessel clean-out procedure. The consultant indicated that the newly instituted procedures have reduced worker exposure to levels below the Cal-OSHA standard.

III. BACKGROUND

Sinclair Paint Company is a paint manufacturer located in Los Angeles, California. The company employs about 180 workers of which 100 are factory workers and 80 either work in the laboratory, the warehouse or are drivers. Two employees (kettle operator and paint screening laborer) work in the resin department. The employees generally work nine hours per day, five days per week. However, during the summer, these employees work 11-12 hours per day, five days per week. Resin department workers are provided lockers, goggles, rubber gloves, coveralls and a full face organic vapor cartridge respirator. The respirators are maintained by one of the supervisors.

The resin building contains three reactor vessels and two temporary storage tanks. One side of the building is open to the outside. The building has six fans; three operate by convection currents and three are motorized. The electrically-operated fans are connected to a timer. Consequently, these are activated prior to the beginning of the shift and shut off at the end of the shift.

Only two of the three reactor vessels are used at once unless the paint supply is extremely low. The reactor vessel is filled with water and a surfactant the day before the batch is prepared. The vessel is steam heated prior to the beginning of the shift. The kettle operator adds the basic ingredients to the heated water. At the prescribed temperature, the monomer mixture (either vinyl acetate and ethyl acrylate or vinyl acetate and butyl acrylate) is pumped to the mixer from one of the underground storage tanks. A catalyst is also added to the vessel. Chemical mixing is performed at atmospheric pressure. As polymerization occurs, the vessel temperature and pressure increases. The vessel vapor pressure is released (kick) via the tank pressure relief valve. The kick can be detected by the kettle operator by the pungent odor released. Once mixing is completed, the paint is transferred to one of two temporary storage tanks and held overnight. The reactor vessel is then washed down, after which water and surfactant are added to the vessel for the next days operation.

The laborer monitors the draining, straining and transfer of the paint from the temporary storage tank to the outside holding tank. As the straining filters become clogged, the worker cleans and replaces the filter.

The reactor vessels are scrubbed down about every 50 batch runs or whenever the vessel does not heat up properly. The current wash-out procedure of the reactor vessel requires that the vessel be pretested before the worker enters the vessel. This consists of disconnecting chemical supply lines to the vessel, washing down and streaming the vessel for a prescribed time. The tank is then emptied and a blower is turned on prior to the worker entering the vessel donning a full-face, chemical cartridge respirator.

IV. EVALUATION DESIGN AND METHODS

A. ENVIRONMENTAL

Personal and area air samples were collected for vinyl acetate, ethyl acrylate and butyl acrylate during the entire work shift. Personal samples were attached to the workers shirt collar in order to characterize breathing zone samples. Area samples were positioned at a breathing zone height near the source of exposure.

1) Bulk Sample Analyses - Bulk samples of vinyl acetate, ethyl acrylate and butyl acrylate were collected and submitted to the laboratory for analyses.

2) Personal and area air samples were collected using a sampling train consisting of a vacuum pump and a 150 milligram (mg) activated charcoal tube through which a known volume of air was drawn.[1] The air contaminants were adsorbed to the charcoal grains and later desorbed and analyzed by gas chromatography following a modification of NIOSH Physical and Chemical Analytical Method (P&CAM) 127 using a Hewlett-Packard 5731A gas chromatograph equipped with a flame ionization detector.[2] One charcoal tube was used to sample ethyl acrylate and butyl acrylate and a separate charcoal tube was used to sample vinyl acetate.

B. MEDICAL

Two workers employed in the resin department and one employee who was on sick leave were interviewed for medical history and current symptoms. The plant personnel manager provided information on medical surveillance and acute care.

V. EVALUATION CRITERIA

A. ENVIRONMENTAL

There are several criteria used to evaluate the toxic air contaminants of an employees work environment: (1) NIOSH Criteria Documents for a Recommended Occupational Health Standard, (2) Proposed and Recommended Threshold Limit Values (TLV's) as suggested by the American Conference of Governmental Industrial Hygienists (ACGIH), (1980) (3) The Federal Occupational Safety and Health Administration (OSHA) Standards. California enforces the Cal-OSHA standards through the Division of Occupational Safety and Health.

TABLE A

Substance	NIOSH Recommended Criteria	Cal-OSHA Standard
vinyl acetate	4 ppm a)	10 ppm
ethyl acrylate	---	25 ppm
butyl acrylate	---	10 ppm

a) NIOSH Criteria Document (1978) based on 15 minute sampling period. Cal-OSHA standards are 8 hour, time-weighted averages.

B. TOXICOLOGICAL EFFECTS

1. Vinyl Acetate

There is no federal standard for vinyl acetate. The NIOSH recommended criterion for occupational exposure to vinyl acetate is 4 ppm. The recommended standard is based on data indicating that vinyl acetate vapor at concentrations below 83 ppm is a primary irritant to the upper respiratory tract and eyes and that the liquid may irritate skin to the point of vesticulation. The effects reported have all been reversible, and there are no known residual systematic effects.[3]

2. Ethyl Acrylate

The Cal-OSHA standard for ethyl acrylate is 25 ppm. Ethyl acrylate is a marked irritant causing salivation, conjunctival (eye) irritation, severe respiratory irritation and pulmonary edema (fluid in the lungs) at levels 4 to 5 times threshold limit value (TLV). Based on its highly irritative p roperties, the American Industrial Hygienists Association Hygienic Guide found the ACGIH-TLV of 25 ppm limit too high to prevent irritative effect in humans. Animal studies have found no apparent effects of long-term exposure; no studies have been done of humans exposed on a chronic basis.[4]

3. Butyl Acrylate

The TLV for butyl acrylate is 10 ppm. Butyl acrylate is a moderate irritant to the skin, eyes and upper respiratory system. In animal studies, direct eye exposure produced corneal necrosis. The TLV is set to prevent eye, skin and upper respiratory irritation. No long-term studies of chronic human exposure have been done.

VI. RESULTS AND DISCUSSION

A. ENVIRONMENTAL

Sixteen personal and area air samples were collected for butyl and ethyl acrylate during paint mixing, straining and filling of the underground reservoir. The airborne concentration of ethyl acrylate ranged from less than 0.11 to 5.8 ppm. All of these samples were well below the Cal-OSHA standard (25 ppm). The airborne concentrations of butyl acrylate were all below the limit of detection (0.01 milligram per sample) except for one sample which was measured at 0.92 ppm. All of these were below the CAl-OSHA standard (10 ppm).

Sixteen personal and area air samples were collected for vinyl acetate during the processes described above. The airborne time-weighted average concentrations ranged from 1.0 to 8.4 ppm. None of the samples exceeded the Cal-OSHA standard of 10 ppm. One airborne sample was collected for 15 minutes to determine whether the NIOSH ceiling concentrations (4 ppm) were exceeded while filling the underground reservoir. The concentration of the 15 minute sample was at a concentration below the limit of detection (0.01 milligram per sample).

Although paint batch mixing is a closed system operation, vinyl acetate, ethyl acrylate and butyl acrylate were detected on the charcoal tubes. The source of exposure is believed to be the kick (release of vapor pressure) from the reactor vessel. The vapor which is released and condenses is vented from one pipe to another funnel inlet pipe. The pipes are not physically attached thus the vapors escape to the atmosphere, The plant manager indicated that the pipes have been connected recently and the condensate is collected in a drum. The drum is vented away from the work area.

No environmental air samples were collected during the reactor vessel scrub down because none of the vessels were in need of cleaning. However, based on discussions with the Cal-OSHA consultant, the airborne concentrations of vinyl acetate measured in the reactor vessel were well below the Cal-OSHA standard. Additionally, the employee who enters the vessel now wear a full face chemical cartridge respirator.

B. MEDICAL

Interviews with three workers revealed a range of symptoms including decreased appetite, decreased ability to concentrate, irritability, headaches, and eye and upper respiratory system irritation. The last two symptoms were occasionally associated with chest tightness after cleaning the reactor vessels or when there was a back flow of vapors from the vapor release system. These complaints of eye, skin and upper respiratory irritation and central nervous system effect are consistent with the effects of exposure to vinyl acetate, ethyl acrylate and butyl acrylate.

The workers are not provided with a regular medical surveillance program; pre-employment examinations are given, but no subsequent examinations are offered except when a worker requests to visit the industrial medical clinic.

VII. CONCLUSIONS

Based on environmental concentrations measured during paint batch mixing on the follow-up survey, no overexposures to vinyl acetate, ethyl acrylate or butyl acrylate were measured. However, based on medical interviews performed during the initial survey and Cal-OSHA environmental air results, a health hazard consisting of exposures to vinyl acetate during the tank clean-out resulted in eye, upper respiratory irritation and central nervous system effects existed. The tank clean-out process has changed between the initial survey and the NIOSH follow-up survey, and the problem has been corrected based on a Cal-OSHA consultative visit. There is no medical surveillance or worker education program which dealt with previously reported symptoms.

VIII. RECOMMENDATIONS

1. The company should perform environmental air sampling of the reactor vessels prior to the worker entering the vessel to assure the worker will not be exposed to residual contaminants inside of the tank.

2. The company should discontinue the use of respirators in the reactor vessel if there is no detectable worker exposure to vinyl acetate.

3. If respirators are to be used by the workers upon entering the enclosed vessel, then the company should institute a formal respirator program in accordance with the OSHA requirements outlined in 29 CFR Part 1910.134.

4. All resin department workers should receive a baseline spirometry test, to be repeated annually if monitoring of the reactor vessel detects exposures over the current permissible exposure limit.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. REFERENCES

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2. NIOSH Manual of Analytical Methods, DHEW (NIOSH) Publication No. 78-175.
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XI. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. Sinclair Paint Company
2. U.S. Department of Labor
3. California Occupational Safety and Health Administration

For the purpose of informing the approximately three " affected employees," the employer shall promptly "post" for a period of 30 calendar days this Determination Report in a prominent place(s) near where exposed employees work.

TABLE I

PERSONAL AND AREA AIR SAMPLES COLLECTED
FOR ETHYL AND BUTYL ACRYLATE
SINCLAIR PAINT COMPANY
LOS ANGELES, CALIFORNIA

June 18 and 19 1980

HE 80-68

LOCATION	TYPE SAMPLE	SAMPLE VOLUME (LITERS)	SAMPLE PERIOD	CONCENTRATION (ppm)[1] ETHYL ACRYLATE	BUTYL ACRYLATE
Batch Operator	P[2]	23.2	0705-1005	0.10	ND[3]
Batch Operator	P	9.5	1105-1245	0.51	ND
Batch Operator	P	11.1	1335-1530	0.44	ND
Platform Between Reactor 1-3	A[4]	21.9	0720-1100	0.11	ND
Platform Between Reactor 1-3	A	11.8	1115-1315	0.21	ND
Platform Between Reactor 1-3	A	11.1	1330-1520	ND	ND
Between Holding Tanks	A	28.1	0725-1120	0.52	ND
Between Holding Tanks	A	13.9	1125-1320	0.35	ND
Between Holding Tanks	A	14.5	1330-1530	0.16	ND
Batch Operator	P	12.5	0700-1100	ND	ND
Batch Operator	P	5.6	1100-1245	ND	ND
Paint Screening Operator	P	9.0	0745-1025	0.54	ND
Paint Screening Operator	P	5.9	(1030-1200 (1245-1310	3.31	ND
Laboratory	A	10.4	0750-1100	ND	0.92
Laboratory	A	9.1	1110-1410	0.54	ND
Batch Operator Filling Underground Reservoir	P	2.1	1345-1400	5.8	ND

1) ppm - parts of a vapor or gas per million parts of contaminated air
2) P - Personal Sample
3) ND - None Detected
4) A - Area Sample

NIOSH Criteria - None
CAL/OSHA Standard
1. Ethyl Acrylate - 25 ppm
2. Butyl Acrylate - 10 ppm

Limits of Detection for each chemical is 0.01 milligram per sample.

TABLE II

PERSONAL AND AREA AIR SAMPLES
COLLECTED FOR VINYL ACETATE
SINCLAIR PAINT COMPANY
LOS ANGELES, CALIFORNIA

JUNE 18 and 19

HE 80-68

LOCATION	TYPE SAMPLE	SAMPLE VOLUME (LITERS)	SAMPLE PERIOD	VINYL ACETATE CONCENTRATION (ppm)[1]	TWA[2]	8 Hour TWA
Batch Operator	P[3]	22.1	0705-1055	1.9		
Batch Operator	P	11.1	1105-1245	36.0		
Batch Operator	P	2.3	1335-1530	ND	9.1	8.4
Platform Between Reactor 1-3	A[5]	28.3	0720-1100	1.2		
Platform Between Reactor 1-3	A	11.8	1115-1305	2.2		
Platform Between Reactor 1-3	A	2.1	1330-1530	ND	1.1	1.0
Between Holding Tanks	A	23.6	0725-1120	10.4		
Between Holding Tanks	A	11.7	1125-1320	3.2		
Between Holding Tanks	A	2.8	1330-1520	ND	6.0	5.9
Batch Operator	P	3.4	0700-1000	4.2		
Batch Operator	P	3.0	1005-1245	1.9	2.9	2.2
Batch Operator Filling Underground Reservoir	P	2.3	1345-1400	ND		

1) ppm - parts of a vapor or gas per million parts of contaminated air
2) TWA - Time-weighted average
3) P - Personal samples
4) ND - None detected
5) A - Area sample

EVALUATION CRITERIA
NIOSH - vinyl acetate - 4 ppm
collected for 15 minutes
CAL/OSHA - vinyl acetate - 10 ppm
Limit of detection - 0.01 milligram per sample.

TABLE II (Continued)

HE 80-68

LOCATION	TYPE SAMPLE	SAMPLE VOLUME (LITERS)	SAMPLE PERIOD	VINYL ACETATE CONCENTRATION (ppm)[1]	TWA[2]	8 Hour TWA
Paint Screening Operator	P	3.3	0745-1025	8.7		
Paint Screening Operator	P	2.4	(1030-1200 (1245-1310	3.6	6.6	3.7
Laboratory	A	4.4	0750-1100	1.9		
Laboratory	A	2.3	1110-1410	2.0	1.9	2.5

1) ppm - parts of a vapor or gas per million parts of contaminated air
2) TWA - Time-weighted average
3) P - Personal samples
4) ND - None detected
5) A - Area sample

EVALUATION CRITERIA
NIOSH - vinyl acetate - 4 ppm
collected for 15 minutes
CAL/OSHA - vinyl acetate - 10 ppm
Limit of detection - 0.01 milligram per sample.

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