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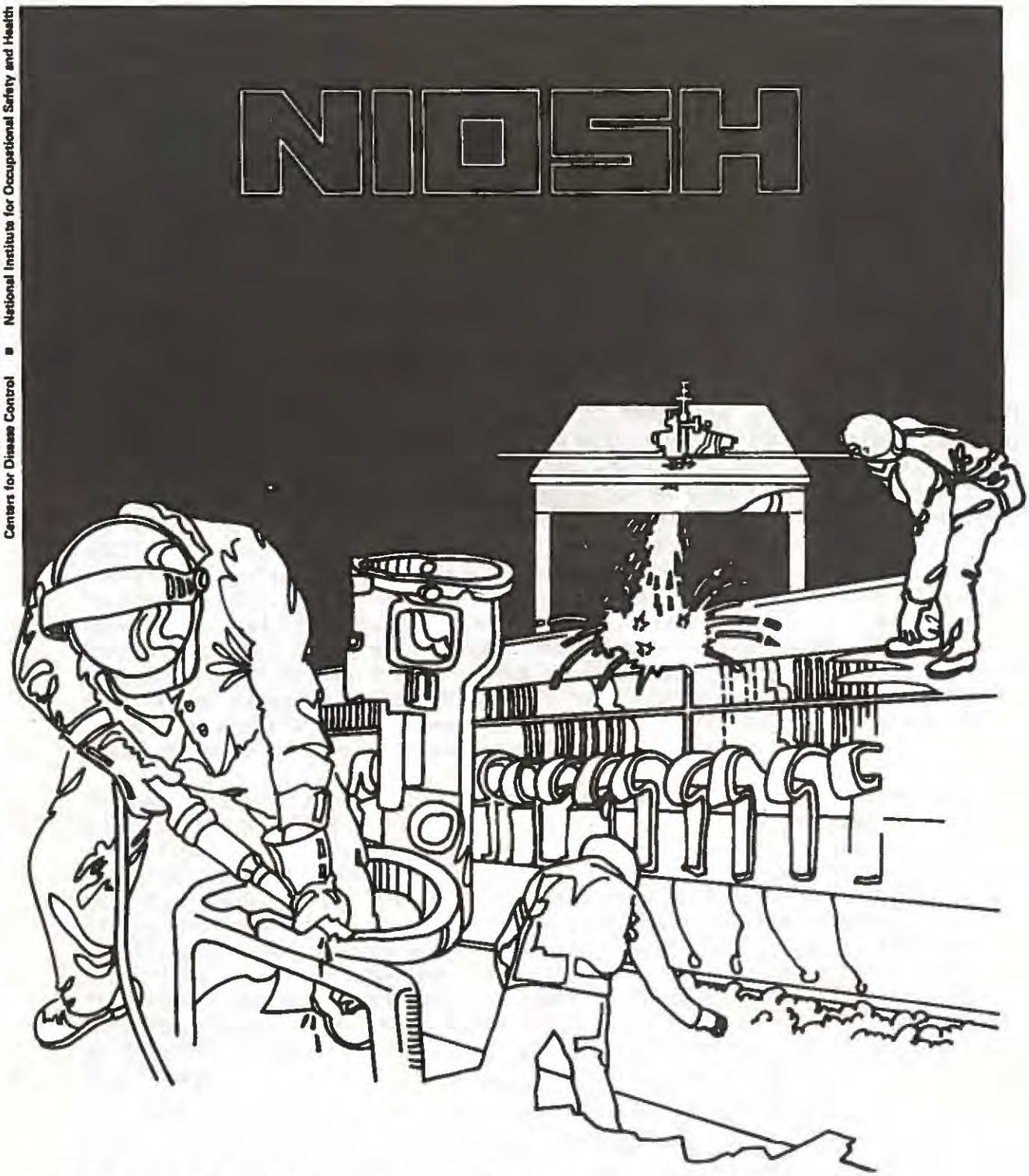

Health Hazard Evaluation Report

HETA 82-103-1369
WYANDOTTE PAINT
PRODUCTS COMPANY
PONTIAC, MICHIGAN

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.

HETA 82-103-1369
SEPTEMBER 1983
WYANDOTTE PAINT PRODUCTS COMPANY
PONTIAC, MICHIGAN

NIOSH INVESTIGATORS:
Paul A. Schulte, Ph.D.
Raymond L. Ruhe

I. SUMMARY

On January 11, 1982, the National Institute for Occupational Safety and Health (NIOSH) received a joint request from the Wyandotte Paint Products Company and Local 7-126 of the Oil, Chemical and Atomic Workers (OCAW) Union to evaluate the work environment and to interpret the findings of an OCAW-sponsored medical evaluation of 24 workers. The OCAW medical evaluation indicated that apparently large percentages of the workers examined had health problems involving various organ systems.

Characterization of normal workplace exposures was hindered by the unusually low production levels during the period March to October 1982. However, the initial walk-through survey indicated that many solvent and paint containers were not well covered. Subsequent interviews of management and employees revealed a history of poor industrial hygiene practices and numerous large spills of paint and solvent. Despite continued lowered production, a NIOSH industrial hygienist performed environmental sampling and personnel monitoring in October 1982. As a result, NIOSH determined that one material stager was exposed to lead (68.2 ug/m^3, time-weighted average (TWA)) in excess of the OSHA standard of 50 ug/m^3. A batch maker and a kettle cleaner had exposures to methyl ethyl ketone (MEK) for two hour periods that were near or above the recommended exposure limit. Exposures to solvents such as acetone, toluene, cellosolve acetate, and xylene and to total particulate, carbon black, and total chromium were well below the criteria used in this report.

The epidemiologic study performed as part of this investigation involved admimistration of a symptom questionnaire to workers in the plant and a comparison of the results with other workers in a similar plant who previously answered the questionnaire. The analysis of the questionnaire results suggests that for the Wyandotte workers there is a greater frequency of health problems of the skin and eyes, which are known target systems for solvents. Additionally, many of the workers (although not a statistically significant proportion) reported experiencing a variety of acute neurological effects; fifty-three percent of the workers reported acute symptoms consistent with solvent poisoning. Although these findings are not conclusive, they do point to the need for greater control of solvents and inorganic lead dusts in the environment.

Based on these results, the investigators concluded that there is a potential health hazard from exposure to solvents (particularly methyl ethyl ketone) and lead at the Wyandotte Paint Products Company. Recommendations to control these hazards are found in section VIII of the report.

KEYWORDS: SIC 5198 (paints, varnishes and supplies), coatings manufacturing, lead, methyl ethyl ketone, acetone, toluene, cellosolve acetate, xylene, total particulate, carbon black, total chromium, skin, eye, and neurologic effects.

II. INTRODUCTION

On January 11, 1982 NIOSH received a joint request from the Wyandotte Paint Products Company and Local 7-126 of OCAW to evaluate the work environment and an OCAW-sponsored medical evaluation of 24 workers. This medical evaluation was conducted approximately seven months prior to the request and indicated that apparently a large percentage of the workers had health problems involving various organ systems. The request expressed the concern that the numerous substances used in manufacture of paints might be related to the apparent health problems found in the medical evaluation.

III. BACKGROUND

The Wyandotte Paint Products Company manufactures industrial paints primarily for the automobile industry. These paints are manufactured in batch processes that involve mixing ingredients in various types of vessels, then decanting the final products into containers for shipping. After a batch is made, or when a tank's contents are used, it is necessary that vessels and tanks are cleaned. Tank cleaning is therefore a major activity.

This plant was purchased by the Wyandotte Company in mid-1981, two months after a medical evaluation sponsored by the OCAW. Since the purchase, various production and industrial hygiene changes have resulted in a qualitatively cleaner plant, according to both union and company representatives.

On March 23 and 24, 1982, an initial environmental and epidemiological survey was conducted at the plant by a NIOSH industrial hygienist and two epidemiologists. A walk-through survey was conducted, chemical inventory and industrial hygiene measurements were reviewed, and a medical questionnaire was administered to 28 workers. No environmental samples were taken because the plant was in a period of unusually low production and it was decided that sampling would be delayed in the hope that normal production would resume soon. The walk-through showed that many solvent and paint containers were not well covered.

In August 1982, an interim report was issued that indicated that with the exception of skin, eyes, and possibly the nervous system, the workers at the Wyandotte plant did not appear to be experiencing health problems at a rate greater than a similar group in the coatings industry who were found to be generally in good health on the basis of extensive medical evaluation.[1]

During the period June to September 1982, the Michigan Department of Public Health evaluated employee exposures in the plant and found that an operator charging a batch with lead silico chromate was exposed to lead in excess of twice the Michigan Maximum Allowable Concentration (MAC) of 50 ug/m^3. Further, the Michigan report indicated that a tank cleaner was exposed to a concentration of methyl ethyl ketone, naphtha, toluene, acetone and xylene in excess of the Michigan MAC of 1.0 (estimated equivalent exposure).

In October of 1982, even though production was still below the usual level primarily because of a general slowness in the automobile industry, a NIOSH industrial hygienist sampled the workplace. To supplement this information, the investigators also relied on the findings of the Michigan Department of Public Health which evaluated solvent exposures in the plant during the period June to September 1982.

IV. METHODS

A. Environmental

1. Particulate, Metals

The environmental survey included five personal breathing zone air samples for total particulate, carbon black, total chromium, and lead on preweighed millipore M-5 PVC filters, using MSA Model G personal sampling pumps operating at 1.5 liters per minute (lpm).[2,3]

Five samples and three blanks were analyzed for carbon black, chromium, and lead analysis. These filters were previously weighed for total particulate weight determination.

Each filter was then placed in a preweighed aluminum pan, which was then placed in a low-temperature asher in order to ash the carbon black (and other organics) in each sample. The samples were ashed under vacuum using radio frequency power and oxygen. When ashing was complete, each aluminum pan was reweighed to obtain the amount of material remaining in the pan. The difference between the amount of particulate collected on the filters and the amount remaining after ashing is considered to be the maximum amount of carbon black contained on each filter.

After the carbon black analysis was completed, the samples were transferred from the aluminum weighing pans to Phillips beakers with distilled water. The samples were then digested with concentrated nitric acid and the residue dissolved in dilute acid. The resulting solutions were analyzed by inductively coupled plasma-atomic emission spectroscopy for chromium and lead.

2. Methyl ethyl ketone

One area sample and three personal samples for methyl ethyl ketone were collected on XE-347 Ambersorb Tubes using a vacuum pump operating at 1pm and analyzed by NIOSH Method No. S-3.[4]

3. Other organic vapors

One area sample and seven personal samples for acetone, toluene, cellosolve acetate, and xylene were collected on 150 mg activated charcoal sorbent tubes, using a vacuum pump operating at 0.10 lpm and analyzed by NIOSH Method P&CAM 127.[5,6]

B. Medical

A study was designed to compare the responses to a medical questionnaire administered to 28 production workers in the Wyandotte plant and to a presumed "healthy" reference group of 143 production workers in another paint manufacturing plant in the Detroit area. This latter group had been studied previously, at which time they were

administered not only a questionnaire (to elicit central and peripheral nervous system symptoms), but also given an extensive medical evaluation that included complete blood count, electrocardiogram, serum analysis for biochemical entities (especially measures of liver function), tests of higher central nervous system function (such as memory, reaction time, and various measures of intelligence), a physical examination, and determination of peripheral nerve conduction velocity.[1] The medical interpretation of that study was that there were very few signs either of acute exposure to solvents or of acute toxic effects. With regard to long-term effects, 8 (18%) of 45 people tested at the Detroit plant were found to have abnormalities of nerve conduction velocity; this was considered by the investigators[1] to be an "unexpectedly high rate." However, this only correlated with age and not with any of the exposure parameters. No other chronic neurological effects were found in this group. Other organ systems were not found to be abnormal.

The medical results were evaluated by comparing the proportions of positive responses in the Wyandotte group and in the reference group. Responses that were statistically significantly different ($p < 0.05$) were considered as indications of effect likely to be related to occupational exposure.

V. EVALUATION CRITERIA

A. Environmental Criteria

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information of the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: (1) NIOSH Criteria Documents and recommendations, (2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and (3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based solely on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet only those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

Multiple concurrent chemical exposures were experienced by various workers evaluated. Thus, in addition to evaluating the contaminants individually, their combined effect must also be considered. The workers equivalent exposure from a mixture of air contaminants was calculated as follows:

E_m = (C_1 divided by L_1 + C_2 divided by L_2) + . . .

(C_n divided by L_n),

Where:

E_m is the equivalent exposure for the mixture,

C is the airborne concentration of the particular contaminant,

L is the exposure limit for that contaminant.

Exposure is considered excessive if E_m is greater than 1.0.

The criteria used for this evaluation are listed in Appendix A.

VI. RESULTS

A. Environmental

Table I presents the personal breathing zone and general area concentrations of airborne methyl ethyl ketone, acetone, toluene, cellosolve acetate, and xylene by a kettle cleaner and a batch operator. Results of the environmental study showed that on October 26 and 27, 1982, the kettle cleaners and batch operator were not exposed to concentrations of organic solvent mixture above the environmental evaluation criteria used in this report. However, MEK exposures for two hour periods were near or above the recommended exposure limit for the batch maker and kettle cleaner (see Table 1). The airborne exposure concentrations were less on October 27, 1982, due to the windows and doors being open and the kettles being cleaned in front of the open door.

Results of environmental samples collected for airborne total particulate, carbon black, total chromium, and lead are presented in Table II. A material stager and batch mixer were exposed to airborne lead concentration ranging from 76 to 410 ug/m^3. Two of the five samples (55.4 and 68.2 ug/m^3) exceeded the OSHA standard (50 ug/m^3, 8-hour TWA). All other airborne exposure concentrations were within the environmental evaluation criteria.

B. Medical

When Wyandotte employees were compared with the reference group no statistically significant differences were observed for age, sex or race. The Wyandotte group was slightly younger than the referents, who had a significantly longer duration of employment. No differences were found for history of regular alcohol use.

A comparison of symptoms experienced during the previous year showed no statistically significant differences in the following categories: all symptoms, chronic symptoms suggestive of solvent poisoning, or symptoms relating to the central or peripheral nervous systems, cardiovascular, gastrointestinal, genitourinary systems, or ears (ringing or buzzing). The only category where the Wyandotte group reported symptoms in statistically significant excess was related to the eye, 36% vs 14% ($p < .025$). Dermatologic symptoms were in excess but this was not statistically significant, 36% vs 17% ($0.10 < p < .05$). For health conditions previously experienced, only the prevalence of contact dermatitis was significantly greater in the Wyandotte group, 18% vs 0.7% ($p < 0.001$). The Wyandotte group reported no cases of cancer, compared with five in the referents.

Sixty percent of the Wyandotte group said they frequently washed hands or arms or cleaned clothing with solvents, and 89% reported having felt "high" from solvent exposure. Fifty-seven percent of the Wyandotte group reported eight or more symptoms (of all types) in the previous year, compared with 39% of the referents. More specifically, 53% of the Wyandotte group, compared with 35% of the referents, reported symptoms consistent with solvent poisoning. Although these prevalences were not statistically significantly different from those of the referent group, they indicate that a large percentage of the workers reported symptoms.

VII. DISCUSSION AND CONCLUSION

This study indicates that, with the exception of eye irritation and previous contact dermatitis, the workers at the Wyandotte plant do not appear to be experiencing health problems at a rate greater than a similar group of coatings industry workers who were found to be generally in good health on the basis of extensive medical evaluations.

With regard to the nervous system, it is difficult to interpret the comparison of the Wyandotte group with the referent group since a non-randomly selected subset of the referent group had evidence of peripheral neurologic disease at an "unexpectedly high rate." Consequently, to say that the Wyandotte group is not different from the referent group for symptoms and health conditions related to the nervous system is to say that they are no different from a group with some documented pathology.

In contrast, the referent group did not differ from "normal" for the neurobehavioral tests, and the Wyandotte group did not differ from the referent group. The conclusion about whether there are chronic effects of solvent exposure is not clear. It is clear that a large percentage of workers have had a history of solvent exposure and acute effects. This finding is consistent with the observation of many uncovered solvent containers and with the finding of solvent exposures of the Michigan Department of Public Health.

The Michigan Department of Health Report also discussed the need for supplied air (airborne) respirators for workers involved in tank cleanings. This protective equipment was not in use at the Pontiac plant.

Another difficult question is how the results of this study relate to the findings of the union's consulting physician, who examined 24 Wyandotte workers approximately two years prior to this study. He found the following prevalences of conditions: dermatitis 22/24 (92%), abnormal urinalysis 16/24 (67%), genitourinary problems 20/24 (83%), prostatic enlargement 15/24 (63%), peripheral neuropathy 5/29 (21%), and various respiratory problems 18/24 (75%). The current study supports the findings of dermatologic problems. It does not, however, support the other findings, although it does not disprove them either. Many of the consultant's findings combine disparate symptoms and

findings that happen to involve the same organ system. Many of these may not have the same etiologies, and he did not necessarily intend to indicate that they did. But when symptoms are combined by organ system, that interpretation is likely to be made.

VIII. RECOMMENDATIONS

1. The diversity of past exposures and findings in this study and in the consultant's study support the recommendation that some type of medical surveillance be initiated. The specific content of this surveillance should be partially determined by the results of subsequent industrial hygiene evaluations which should be performed when normal production levels resume. At the present, workers should be given annual physical examinations with attention to skin, eyes, and nervous system.

2. Personal protective equipment should be provided for employees exposed to hazards which cannot be adequately abated by engineering controls. At no time should personal protective equipment be substituted for engineering controls when engineering controls are feasible. The type of engineering controls that should be considered include local ventilation at sites where vessels or containers are charged or filled with solvents or powders.

3. Respiratory protection should be used as an interim control measure until the air lead concentrations are reduced below 50 ug/m^3 through engineering and administrative controls.

4. Efforts should be made to ensure that solvent containers are effectively covered. Good work practices for handling solvents should be promoted. These include ventilating areas where there are spills, not using solvents to clean paint off of skin and clothes, and generally avoiding skin and respiratory exposure.

IX. REFERENCES

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X. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Prepared by:

Paul A. Schulte, Ph.D.
Epidemiologist
Medical Section

Raymond L. Ruhe
Industrial Hygienist
Industrial Hygiene Section

Originating Office:

Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations, and Field Studies

Report Typed By:

Stephanie Harris
Clerk Typist
Medical Section

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1. Wyandotte Paint products Company, Pontiac Michigan
2. Authorized Representatives of Employees, Local 7-126, OCAW
3. NIOSH, Region V
4. OSHA, Region V

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

APPENDIX A

Evaluation Criteria
Wyandotte Paint Products Company
Pontiac, Michigan

HETA 82-103

	NIOSH Recommended Criteria TWA (mg/m^3)	OSHA Standards TWA (mg/m^3)
Methyl Ethyl Ketone[4]	590	590
Acetone	--	2400
Toluene[5]	375 750 ceiling	750
Cellosolve Acetate	--	270
Xylene[6]	434 868 ceiling	434
Total Particulate	10	15
Carbon Black	3.5	3.5
Total Chromium	0.5	0.5
Lead[3]	50 ug/m^3	50 ug/m^3

TABLE I

Results of Personal Breathing Zone and General Area Concentration of Methyl Ethyl Ketone, Acetone, Toluene, Cellosolve Acetate, and Xylene

Wyandotte Paint Products Company
Pontiac, Michigan
HETA 82-103

October 26 and 27, 1982

Date	Job and/or Location	Sampling Period	Sample Volume (Liters)	Methyl Ethyl Ketone mg/m^3*	Acetone mg/m^3	Toluene mg/m^3	Cellosolve Acetate mg/m^3	Xylene mg/m^3	Estimated Equivalent Exposure for the Mixture (E_m)
10-26	Kettle Cleaner	0745-1008	14.6	628	190	35	9	22	1.31
		1008-1115	6.7	-	552	69	18	37	0.57 (0.56)***
		1300-1500	11.7	-	392	38	12	26	0.36
10-26	Kettle Cleaner	0738-1120	22.1	398	330	56	13	28	1.07 (0.49)
10-26	Batch Maker	0830-1005	9.8	583	-	-	-	-	0.99 (0.20)
10-26	Area Sample Pump on Desk (Bldg. 12)	1310-1515	10.9	211	-	-	-	-	0.36 (0.11)
10-26	Area Sample Pump on Desk (Bldg. 12)	1300-1507	11.9	-	334	54	17	37	0.43 (0.11)
10-27	Kettle Cleaner	0705-0855	10.5	-	144	37	13	24	0.27 (0.19)
10-27	Kettle Cleaner	0910-1110	12.6	-	484	67	13	26	0.49
10-27	Kettle Cleaner	0950-1050	5.6	-	23	70	LD**	2	0.21 (0.03)
Environmental Criteria (mg/m^3)				590	2400	375	270	435	1.0
Limit of Detection (mg/tube)				0.01	0.01	0.025	0.04	0.01	

* mg/m^3 = milligrams of substance per cubic meter of air sampled.
** LD = less than limit of detection.
*** Value in parentheses is the combined exposure equivalent exposed as an 8-hour TWA.

TABLE II

Results of Personal Breathing Zone Area Concentrations of
Total Particulate, Carbon Black, Total Chromium, and Lead

Wyandotte Paint Products Company
Pontiac, Michigan
HETA 82-103

October 26 and 27, 1982

Date	Job and/or Location	Sampling Period	Sample Volume (Liters)	Total Particulate mg/m^3*	Carbon Black mg/m^3	Total Chromium ug/m^3	Lead** ug/m^3
10-26	Batch Maker	0725-0950	217	1.1	-	11.1	5.9
10-26	Material Stager	0810-1435	525	1.9	0.5	3.8	5.3
10-27	Material Stager	0707-1415	589	2.1	0.8	5.4	76.5 (68.2)***
10-27	Batch Maker	0758-1040	246	1.4	0.7	5.7	5.3
10-27	Batch Maker	0937-1042	97	4.1	0.3	26.8	410.0 (55.4)
Environmental Criteria				10 mg/m^3	3.5 mg	500 ug	50 ug
Limit of Detection				0.01 mg	0.01 mg	1.0 ug	1.0 ug

* mg/m^3 = milligrams of substance per cubic meter of air sampled

** The 8-hour TWA PEL for inorganic lead has been reduced from 200 ug/m^3 to 50 ug/m^3 (29 CFR 1910.1025). Pending current litigation of the 50 ug/m^3 lead standard, employers must achieve the 200 ug/m^3 level through engineering and administrative controls, and must protect workers at the 50 ug/m^3 PEL through any combination of controls, including the use of proper respirators.

*** Concentrations in parentheses is 8-hour TWA.

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