U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 77-78-466

PRE FINISH METALS, INC.
ELK GROVE VILLAGE, ILLINOIS

FEBRUARY, 1978

I. Toxicity Determination

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on May 19, August 29, September 19-20, and November 1, 1977, at Pre Finish Metals, Inc. in Elk Grove Village, Illinois. Breathing zone and general area samples were taken for benzene, toluene, xylene, methyl ethyl ketone, methyl isobutyl ketone, isophorone, cyclohexanone, 2-ethoxyethyl acetate, n-butyl alcohol, 2-butoxyethanol, isopropyl alcohol, and chromium (VI). Concentrations of benzene, in two of the eight samples taken during the blue and black vinyl coating process and seven of nine during the striated white Plastisol® process, exceeded the evaluation criteria. The airborne concentration of methyl ethyl ketone, taken at the 2111 Pratt buildings' reclaimed solvent room (line clean-up process) and during the blue strippable Plastisol® coating process (line clean-up process), also exceeded the evaluation criteria. Two of the eight samples taken during the black and blue vinyl coating process exceeded the evaluation criteria for mixtures of substances with similar toxicological properties. The concentrations of benzene, methyl ethyl ketone, and the mixture of substances as they existed during the time of this evaluation, constitute a health hazard to the workers involved.

Recommendations have been offered in this report to reduce the exposure of employees to these substances.

II. Distribution and Availability

Copies of this determination report are currently available upon request from NIOSH, Division of Technical Services, Information 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:

a) Pre Finish Metals, Inc.
b) Authorized Representative for Employees, USSW Local 7650
c) United States Steel Workers International, Pittsburgh, Pennsylvania
d) U. S. Department of Labor - Region V
e) NIOSH - Region V

For the purpose of informing the 120 affected employees, copies of the report shall be posted in a prominent place accessible to the employees 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 received a request from an authorized representative of employees regarding exposure to carcinogens at the 2111 and 2300 Pratt Building, at Pre Finish Metals, Inc.; Elk Grove Village, Illinois.

IV. Health Hazard Evaluation

A. Plant Process

Pre Finish Metals, Inc.; Elk Grove Village, Illinois, is in the business of coating coiled stock metals, either aluminum or steel, with a wide variety of chemical coatings, usually paints or laminates and/or rustproofing.

The coating process is a multiple stage operation in which the metal is uncoiled, cleaned, prime coated, finish coated, and rewound for shipment. Anywhere from four to five workers are needed to pperate a coating line. Job classifications include the crew chief, prime and finish coater, and the unwind and rewind operator. Both of the buildings in the plant are run on a schedule of 3 eight hour shifts per day, seven days a week; with some of the employees working more than eight hours per shift and five days a week.

Unwinding -- in the unwinding stage of the process the unwind operator is responsible for attaching a new coil of metal stock to the end of

the coil that is already being run through the coating process. Next, the new coil is run through a set of accumulation rollers which will later allow the coating process to continue even though the end of the unrolled coil has been stopped to attach a new coil.

Cleaning -- this stage of the coating process is unmanned, except for an occasional visit in order to maintain the cleaning solutions. Cleaning involves numerous steps in which the metal is dipped in a caustic bath, hot water rinsed, dipped in a caustic bath, rust-proof coating applied, cold water rinsed, and then dried. This part of the process is located above the prime and finish coat areas, and is enclosed and exhaust ventilated.

Prime and Finish coating -- in this area the various chemical coatings are rolled on the metal, oven baked, then water cooled. The prime and finish coaters are responsible for maintaining proper coating thickness by solvent reduction, maintaining and adjusting coating machinery, and general housekeeping around the coating area. Both the roller areas and ovens are exhaust ventilated.

Rewinding -- in this area the metal goes through another set of accumulation rollers, printing is applied if necessary, rerolled, cut, and prepared for shipment.

Reclaimed Solvent Area -- Each of the plant's two buildings contains a reclaimed solvent room, where parts from the prime and finish coat machinery are cleaned in large solvent tanks. Ventilation in this area consists of plain end ducts at floor level, which are utilized to reduce the solvent vapor explosive hazard.

B. Evaluation Design

An Initial survey was conducted on May 19, 1977. A NIOSH Regional Consultant made a complete walk through of the entire plan, accompanied by management and union representatives. About 20 of the employees were given nondirected interviews to determine if they had experienced health problems as a result of their work place exposure. During the private employee interviews, many of the workers complained about the use of White Plastisol®. Those interviewed made complaints such as; "nausea from fumes," "eye irritation," "skin irritation," etc. Material safety data sheets on the chemical coatings used were obtained from the plant safety director.

On August 29, 1977 an environmental follow-up survey of the plant was conducted by a NIOSH Regional Consultant and Regional Hygienists to further assess the alleged hazard. It was decided that direct measurements for vinyl chloride monomer should be taken during this visit using colorimetric detector tubes. No detectable levels of the vinyl chloride monomer were found. It was also noted that the plant was using the services of a laboratory consultant for the determination of

vinyl chloride levels. All data from the laboratory consultant also showed the level of vinyl chloride as being below detection. A direct reading hydrocarbon meter was used to monitor solvent vapor levels and to locate areas for follow-up sampling.

The plant has the capability of running hundreds of different coating processes according to customer specifications, so sampling had to be limited to the coating processes run most frequently or complained about the most. On September 19 & 20, 1977 both personal breathing zone and general area atmospheric samples were collected on Line #4 (Zincromet® process) and Line #3 (Blue strippable Plastisol® process). Several different types of solvents are used for reduction of chemical coatings, machinery cleaning, and housekeeping; thus sampling was conducted for several solvents, including benzene, toluene, xylene, methyl ethyl ketone, methyl isobutyl ketone, isophorone, cyclohexanone, 2-ethyoxyethyl acetate, and any other substances that could be identified by the laboratory. The Zincromet® process was also sampled for chromium (VI) after previously detecting the presence of chromium (VI) with a chromium (VI) reagent kit. Sampling of the reclaimed solvent rooms for the above mentioned solvents plus n-butyl alcohol 2-butoxyethanol, and isopropyl alcohol was also conducted due to the possible hazard potential during process clean-up. On November 1, 1977 Line #3 (Striated White Plastisol® process) was sampled for solvent vapors.

C. Evaluation Methods

Breathing zone and general area atmospheric samples for benzene, toluene, xylene, methyl ethyl ketone, methyl isobutyl ketone, isophorone, cyclohexanone, 2-ethoxyethyl acetate, n-butyl alcohol, 2-butoxyethyanol, and isopropyl alcohol were collected on organic vapor charcoal sampling tubes using portable battery powered sampling pumps operating at approximately 100 cubic centimeters (cc) per minute, except for some of the reclaimed solvent room samples which were collected at approximately 25 cubic centimeters (cc) per minute. Samples were analyzed by gas chromatography.

Atmospheric samples for chromium (VI) were collected on 37 millimeter polyvinyl chloride filters using battery powered gravimetric pumps operating at a flow rate of 2 liters per minute (lpm). Samples were analyzed colorimetrically using the diphenylcarbizide method as recommended by the NIOSH analytical method P&CAM No. 169, NIOSH publication No. 77-157-A, April, 1977.

D. Evaluation Criteria

In order that workers may better understand the potential health hazards associated with the chemical substances evaluated during this study, the following discussion is provided.

Benzene -- there is strong evidence that benzene can cause

progressive malignant disease of the blood-forming organs. Benzene can also result in central nervous system depression and skin irritation. NIOSH recommends a ceiling value of 1 part per million (ppm) for benzene. A ceiling value is a concentration that should never be exceeded.[1] The OSHA emergency temporary standard is also the same.[15]

Toluene -- the major problem of toluene is its narcotic effects on workers. Symptoms and signs of these narcotic effects are experienced in the form of muscular weakness, incoordination, and mental confusion. NIOSH recommends that no worker be exposed to a concentration greater than 100 ppm determined as a time - weighted average (TWA) exposure for up to a 10-hour workday, 40-hour workweek.[2] The OSHA standard is 200 ppm.[16]

Xylene -- the major problem of xylene is its narcotic effects on workers. Symptoms and signs of these narcotic effects are experienced in the form of muscular weakness, incoordination, and mental confusion. NIOSH recommends that no worker be exposed to a concentration greater than 100 ppm determined as a time - weighted average (TWA) exposure for up to a 10-hour workday, 40-hour workweek.[3] The OSHA standard is 100 ppm.[16]

Methyl Ethyl Ketone -- could produce some skin irritation if exposure are frequent and prolonged. Vapors may also cause irritation of the eyes and mucous membrane.[4] The American Conference of Governmental Industrial Hygienist (ACGIH) recommends that no worker be exposed to a concentration greater than the Threshold Limit Value (TLV) of 200 ppm determined as a time - weighted average (TWA) exposure for normal 8-hour workday or 40-hour workweek.[5] The ACGIH also recommends a Threshold Limit Value - Short Term Exposure Limit (TLV-STEL) of 250 ppm for methyl ethyl ketone. The TLV-STEL is the maximum concentration to which workers can be exposed for a period up to 15 minutes continuously, provided that no more than four excursions per day are permitted, with at least 60 minutes between exposure periods, and provided that the daily TLV-TWA also is not exceeded.[5] The OSHA standard is 200 ppm.[16]

Methyl Isobutyl Ketone -- exposure to concentrations of 200 ppm have been known to cause eye and respiratory passage, irritation headache, dizziness or nausea.[6] NIOSH recommends an exposure limit of 100 ppm (TWA).[7] The OSHA standard is the same.

Isophorone -- when workers are exposed to high concentrations of isophorone; symptoms such as nausea, headache, dizziness, faintness, inebriation, feeling of suffocation, eye irritation, and respiratory passage irritation are experienced.[8] ACGIH recommends a ceiling value of 5 ppm.[5]

Cyclohexanone -- has a narcotic potential, and is strongly irritating to your eyes, nose, and throat. Repeated and prolonged skin contact can cause dryness and irritation. NIOSH recommends an exposure limit of 50 ppm (TWA).[9] The OSHA standard is the same.

2-Ethoxyethyl Acetate -- high air concentrations may cause irritation of the eyes and nose, vomiting, kidney damage, paralysis and death. NIOSH recommends an exposure limit of 100 ppm (TWA).[10] The OSHA standard is the same.

n-Butyl Alcohol -- overexposure may cause irritation of the eyes, nose and throat, headache, dizziness, drowsiness, and blurred vision. Prolonged skin exposure may cause drying and cracking of the skin. NIOSH recommends an exposure limit of 100 ppm (TWA).[11] The OSHA standard is the same.

2-Butoxyethanol -- is an irritant to the eyes and upper respiratory system, and may cause hemolysis. Hemolysis is the separation of the hemoglobin from the red cells and its appearance in the plasma. NIOSH recommends an exposure limit of 50 ppm (TWA).[12] The OSHA standard is the same.

Isopropyl Alcohol -- causes mild irritation of the eyes, nose, and throat. High vapor concentrations may cause drowsiness, dizziness, and headache. Repeated skin exposure may cause drying and cracking. NIOSH recommends an exposure limit of 400 ppm (TWA).[13] The OSHA standard is the same.

Chromium (VI) -- chromium (VI) compounds are known to cause penetrating sores of the skin, ulceration and perforation of the nasal septum, inflammation of the mucous membrane, and may cause kidney or liver damage, tooth erosion and discoloration, and perforated eardrums. Some forms of chromium (VI) may cause lung cancer.[14]

NIOSH has defined two types of chromium (VI). "Non - carcinogenic chromium (VI)" is the chromium (VI) in monochromates and dichromates of hydrogen, lithium, sodium, potassium, rubidium, cesium, ammonium, and chromium (VI) oxide (chromic acid anhydride). "Carcinogenic chromium (VI)" is any chromium (VI) material not included in the group above, such as lead, zinc, and calcium chromates.[14]

NIOSH considers all airborne chromium (VI) to comprise carcinogenic materials, unless it is demonstrated by the employer to be of the type considered to be noncarcinogenic. NIOSH recommends an exposure limit of 1 ug/m^3 for carcinogenic chromium (VI), and 25 ug/m^3 for noncarcinogenic chromium (VI).[14] The current OSHA standard is 0.1 mg/M^3.[16]

E. Evaluation Results

Results from the personal breathing zone and area samples collected are shown in Tables I-V.

Two samples from the black and blue vinyl coating process (Table IV) and seven samples from the striated white Plastisol coating process (Table V), exceeded the NIOSH recommended ceiling value of 1 ppm for benzene. Four of the nine samples, in which excessive benzene exposure was indicated, were personal breathing zone measurements. The other five samples were area samples for which no evaluating criteria exists; however, it should be noted that area samples are a good indicator of a potentially hazardous condition and substantiate the personal exposure results.

There were two samples also indicating an excessive exposure to methyl ethyl ketone. One sample from the reclaimed solvent area in the 2111 Pratt building (Table I) exceeded the ACGIH Threshold Limit Value - Short Term Exposure Limit of 250 ppm. The other, a personal sample taken during the clean-up process of the blue strippable Plastisol process (Table III) exceeded the ACGIH Threshold Limit Value of 200 ppm.

When two or more hazardous substances are present, their combined effect, rather than that of either individually, should be given consideration. In the absence of information to the contrary, the effects of the different hazards should be considered as additive. The sum of the fractions, measured atmospheric concentration over the corresponding threshold limit ($C_1/T_1 + C_2/T_2 + ...Cn/T_n$), should not exceed unity.[5] Using the previously mentioned relationship, it was determined that two personal samples (Table IV) taken from an employee indicated an excessive ($C_1/T_1 + ...Cn/T_n > 1$) exposure to the mixture of solvents encountered while cleaning metal coating machinery. Exceptions to the above rule may be made when the toxicological properties of the toxic substances are not in fact additive, but independent.[5] Thus carcinogenic substances, such as benzene, are excluded from this relationship.

F. Recommendations

1) Employee exposure to benzene should be reduced to the lowest extent possible, through engineering modifications of ventilation systems, enclosure of paint drum pumps and agitators, and/or the use of a paint which will contain a reduced amount of benzene impurities. A respiratory protection program, utilizing NIOSH approved respirators, could be implemented to reduce employee exposure to benzene until other suitable methods could be put into effect. Employees should be instructed in how to use respirators, clean respirators, and leak test respirators if a respiratory protection program is utilized.

2) Medical and environmental monitoring of benzene exposure, as well as certain recordkeeping requirements, should be conducted according to procedures contained in the OSHA emergency

temporary standard and the final OSHA standard when promulgated.[15]

3) Action should be taken by management to reduce employee exposure to methyl ethyl ketone and other cleaning solvents, when clean-up is being performed in the reclaimed solvent rooms and on the coating lines. The use of a water based cleaning agent and/or the use of a NIOSH approved organic vapor respirator is recommended. Employees should be instructed in how to use respirators, clean respirators, and leak test respirators.

4) A lateral type local exhaust ventilation system should be installed on all solvent tanks in both reclaimed solvent rooms.

5) Contaminated air from the baking ovens at the 2111 Pratt building should not be exhausted at ground level at the rear of the building, since this might allow the recirculation of the contaminated air into reclaimed solvent room. It is recommended that air from the baking ovens be exhausted on the plant roof in a position that will minimize the possibility of recirculation into the plant.

6) An educational program should be instituted in which the employees are informed of the hazardous nature of the toxic substances used, including good work practice necessary for the use and safe handling of these toxic substances.

7) Flammable liquids, such as methyl ethyl ketone, should not be used from open buckets or used as a cleaning solution for mopping up paint spills on the floor.

V. References

1. NIOSH Revised Recommended Standard for Occupational Exposure to Benzene, NIOSH, Cincinnati, Ohio (1976)

2. NIOSH Recommended Standard for Occupational Exposure to Toluene, NIOSH Cincinnati, Ohio (1973)

3. NIOSH Recommended Standard for Occupational Exposure to xylene, Cincinnati, Ohio (1975)

4. Industrial Hygiene and Toxicology, second edition, Frank Patty (editor), Interscience Publishers, 1967, Vol. II, page 1732.

5. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended changes for 1977, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio (1977).

6. American Conference of Governmental Industrial Hygienists: Documentation of the Threshold Limit Values for Substances in Workroom Air, third edition, 1971, page 127.

7. NIOSH/OSHA Draft Technical Standard, Set A, Hexone.

8. American Conference of Governmental Industrial Hygienists: Documentation of the Threshold Limit Values for Substances in Workroom Air, third edition, 1971 page 140.

9. NIOSH/OSHA Draft Technical Standard, Set A, Cyclohexanone.

10. NIOSH/OSHA Draft Technical Standard, Set D, 2-Ethoxyethyl Acetate.

11. NIOSH/OSHA Draft Technical Standard, Set E, n-Butyl Alcohol.

12. NIOSH/OSHA Draft Technical Standard, Set F, 2-Butoxyethanol.

13. NIOSH Recommended Standard for Occupational Exposure to Isopropyl Alcohol, NIOSH, Cincinnati, Ohio(1976)

14. NIOSH Recommended Standard for Occupational Exposure to Chromium (VI). NIOSH, Cincinnati, Ohio (1976)

15. DOL/OSHA Emergency Temporary Standard for Occupational Exposure to Benzene: Title 29, Section 1910: 1028 issued April 29, 1977 - Effective May 21, 1977.

16. Federal Register, Volume 39, No. 125, Title 29, Code of Federal Regulations, Part 1910, 23541-23543, June 27, 1974.

VI. Authorship and Acknowledgments

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TABLE I
SUMMARY OF ENVIRONMENTAL RESULTS FROM THE RECLAIMED SOLVENT AREAS
PRE FINISH METALS, INC. 2300 AND 2111 PRATT BUILDINGS SEPTEMBER 19 & 20, 1977

				TWA EXPOSURE IN PPM										
Sample Number	Location	Time	Type of Sample	Benzene	Toluene	m-Xylene	Methyl Ethyl Ketone	Methyl Isobutyl Ketone	Isophorone	Cyclohexanone	2-Ethoxyethyl Acetate	n-Butyl Alcohol	2-Butoxyethanol	Isopropyl Alcohol	Combined Exposure Weighting
C-12 & C-13	Reclaimed solvent Area (2300 Pratt Building, across the room from solvent tanks)	08:31-14:38	General Area	*	1.8	*	16.7	1.6	*	*	*	*	*	11.5	0.12
C-11 & C-10	Reclaimed solvent Area (2300 Pratt Building, near the solvent tanks)	08:32-14:28	General Area	0.7	9.4	0.5	28.2	3.5	*	*	*	*	*	2.9	0.31
C-23	Reclaimed solvent Area (2300 Pratt Building, across the room from solvent tank)	09:00-10:00	General Area	*	27.5	0.9	66.5	7.8	*	*	*	-	-	-	0.69
C-40**	Reclaimed solvents Area (2111 Pratt Building, during clean-up operation)	12:53-13-12	General Area	*	13.5	2.2	325	4.0	1.0	*	0.6	-	-	-	1.64
Evaluation Criteria				1	100	100	200	100	5	50	100	100	50	400	

PPM = Parts of vapor or gas per million parts of contaminated air by volume at 24°c and 760 mm Hg pressure
NIOSH Limit of Detection = 0.01 mg of each compound per tube
* = below the NIOSH limit of detection
** = Short Term Exposure Limit values used as evaluating criteria

Note: The combined exposure weighting value should not exceed unity

Benzene was not included in calculation of combined exposure weighting

TABLE II
ATMOSPHERIC CONCENTRATIONS OF CHROMIUM (VI)
PRE FINISH METALS, INC.
SEPTEMBER 19-20, 1977

Sample Number	Location	Job Classification	Type of Sample	Time of Sample	Chromium(VI) ug/M^3	Comments
P-1	Line #4	Finish Coater	Personal	8:39-14:37	*	
P-2	Line #4	Prime Coater	Personal	8:44-14:38	*	
P-3	Line #4	---	General Area	8:44-14:48	*	Prime Coat Area
P-4	Line #4	---	General Area	8:46-14:48	*	Finish Coat Area
P-6	Line #4	---	General Area	9:04-14:34	*	Prime Coat Area
P-7	Line #4	---	General Area	9:05-14:31	*	Finish Coat Area
P-8	Line #4	Finish Coater	Personal	9:11-14:39	*	
P-10	Line #4	Prime Coater	Personal	9:08-14:38	*	

EVALUATION CRITERIA	1 ug/M^3
NIOSH LIMIT OF DETECTION	0.2 ug/sample

ug/M^3 = micrograms of substance per cubic meter of air

* = below the NIOSH limit of detection

TABLE III
SUMMARY OF ENVIRONMENTAL RESULTS FROM THE 2111 BUILDING
PRE FINISH METALS, INC.
SEPTEMBER 20, 1977

Sample Number	Location	Job Classification	Type of Sample	Time of Sample	TWA EXPOSURE IN PPM Benzene	Toluene	m-Xylene	Methyl Ethyl Ketone	Methyl Isobutyl Ketone	Isophorone	Cyclohexanone	2-Ethoxyethyl Acetate	Combined Exposure Weighting	Comments
C-29	Line #3	Prime Coater	Personal	12:07-13:15	*	1.4	6.0	245	4.7	1.5		1.0	1.66	Clean-Up Process
C-30	Line #3	Finish Coater	Personal	12:06-13:44	*	2.3	3.3	107	10	0.97		0.6	0.89	Clean-Up Process
C-32	Line #3	------	General Area	12:07-13:25	*	*	1.9	6.3	0.82	*	*	*	0.06	Clean-Up Process In Prime Coat Area
C-33	Line #3	------	General Area	12:08-13:28	0.87	0.37	1.6	20.4	0.68	*	*	*	0.13	Clean-Up Process Finish Coat Area
C-34	Rewind Area	------	General Area	13:30-18:18	*	*	0.27	0.7	*	*	*	*	0.006	
C-35	Slitting Dept.	------	General Area	13:23-18:20	0.41	0.46	0.3	4.1	0.64	*	*	*	0.03	
C-36	Line #3	Finish Coater	Personal	13:45-18:05	0.48	0.40	0.59	5.5	0.87	*	*	1.6	0.06	
C-37	Line #3	------	General Area	13:26-18:14	*	0.36	0.31	5.7	0.47	*	*	*	0.04	Prime Coat Area
C-38	Line #3	------	General Area	13:30-18:16	0.97	0.10	0.27	2.1	0.09	*	*	*	0.01	Finish Coat Area
C-42**	Line #3	Unwind Operator	Personal	18:15-18:36	*	*	3.5	37.0	*	*	*	*	0.17	Clean-Up Process Prime Coat Area
C-43**	Line #3	Rewind Operator	Personal	18:21-18:37	*	3.8	2.3	191	3.5	*	*	*	0.83	Clean-Up Process line and In Reclaimed Solvent Area
C-44**	Line #3	Finish Coat Operator	Personal	18:07-18:40	*	*	5.5	48.7	*	*	*	*	0.25	Clean-Up Process in Finish Coat Area
Evaluation Criteria					1	100	100	200	100	5	50	100		

PPM = Parts of vapor or gas per million parts of contaminated air by volume at 24°c and 760 mm Hg pressure
NIOSH Limit of Detection = 0.01 mg of each compound per tube
* = below the NIOSH limit of detection
** = Short Term Exposure Limit values used as evaluating criteria

Note: The combined exposure weighting value should not exceed unity
Benzene was not included in calculation of combined exposure weighting

TABLE IV
SUMMARY OF ENVIRONMENTAL RESULTS FROM THE 2300 BUILDING
PRE FINISH METALS INC.
SEPTEMBER 19-20, 1977

Sample Number	Location	Job Classification	Type of Sample	Time of Sample	TWA EXPOSURE IN PPM Benzene	Toluene	m-Xylene	Methyl Ethyl Ketone	Methyl Isobutyl Ketone	Isophorone	Cyclohexanone	2-Ethoxyethyl Acetate	Combined Exposure Weighting	Comments
C-1	Line #4	---	General Area	08:44-14:48	0.1	0.17	0.14	11.0	0.3	0.11	*	*	0.08	Prime Coat Area
C-2	Line #4	---	General Area	08:46-14:48	0.17	0.07	0.74	27.8	0.06	0.14	0.06	4.7	0.22	Finish Coat Area
C-3	Line #4	---	General Area	08:18-14:37	*	*	*	6.9	*	*	*	*	---	Rewind Area
C-4	Line #4	Prime Coat Operator	Personal	08:44-14:38	0.18	0.16	0.14	17.1	0.72	*	*	0.33	0.10	
C-5	Line #4	Finish Coat Operator	Personal	08:39-14:37	0.19	0.08	0.21	32.0	0.52	*	*	1.0	0.18	
C-6	Line #2	---	General Area	08:52-14:34	0.12	*	0.17	10.5	0.36	*	*	*	0.06	Finish Coat Area
C-7	Line #2	---	General Area	08:58-14:36	*	*	*	1.4	*	*	*	*	----	Rewind Area
C-8	Line #2	Finish Coat Operator	Personal	08:54-14:33	*	0.2	4.1	160	11.3	0.74	*	0.92	1.11	
C-16	Line #2	Finish Coat Operator	Personal	10:17-11:27	*	*	4.9	168	15.2	0.75	*	0.78	1.2	Changing Colors
C-17	Line #4	Finish Coat Operator	Personal	09:11-14:39	0.21	0.18	0.23	10.4	0.41	*	*	0.86	0.07	
C-18	Line #4	Prime Coat Operator	Personal	09:08-14:28	0.21	0.27	0.08	4.5	1.2	*	*	0.13	0.04	
C-19	Line #4	---	General Area	09:04-14:34	0.24	0.20	*	4.5	0.48	*	*	*	0.03	Prime Coat Area
C-20	Line #4	---	General Area	09:05-14:31	*	*	0.23	14.6	*	*	*	1.03	0.08	Finish Coat Area
C-21	Line #4	---	General Area	09:08-14:41	0.1	*	0.07	3.2	*	*	*	*	0.02	Rewind Area
C-25	Line #2	---	General Area	09:19-14:00	2.7	*	0.8	29.0	8.0	*	*	2.9	0.26	Finish Coat Area
C-26**	Line #2	Finish Coat Operator	Personal	11:47-12:05	*	*	3.0	80.3	14.5	*	*	1.2	0.55	Cleaning Rollers
C-27**	Line #2	Finish Coat Operator	Personal	12:26-12:52	1.35	*	*	19.0	1.0	*	*	*	0.10	Cleaning Floor
C-28**	Line #2	Roll Grinder	Personal	13:01-13:26	*	*	*	*	*	*	*	*	----	
Evaluation Criteria					1	100	100	200	100	5	50	100		

PPM = Parts of vapor or gas per million parts of contaminated air by volume at 25°c and 760 mm Hg pressure
NIOSH Limit of Detection = 0.01 mg of each compound per tube
* = below the NIOSH limit of detection
** = Short Term Exposure Limit values used as evaluating criteria

Note: The combined exposure weighting value should not exceed unity.
Benzene was not included in calculation of combined exposure weighting

TABLE V
SUMMARY OF ENVIRONMENTAL RESULTS FROM THE 2111 BUILDING
PRE FINISH METALS, INC.
NOVEMBER 1, 1977

					TWA EXPOSURE IN PPM									
SAMPLE NUMBER	LOCATION	JOB CLASSIFICATION	TYPE OF SAMPLE	TIME OF SAMPLE	BENZENE	TOLUENE	m-XYLENE	METHYL ETHYL KETONE	METHYL ISOBUTYL KETONE	ISOPHORONE	CYCLOHEXANONE	2-ETHOXYETHYL ACETATE	COMBINED EXPOSURE WEIGHTING	COMMENTS
C-50	Line #3	Crew Chief	Personal	10:46-17:14	0.89	1.44	1.07	7.20	0.38	0.64	0.13	0.48	0.19	
C-51	Line #3	Finish Coater	Personal	10:49-17:13	1.15	1.27	0.52	4.60	0.28	0.80	*	0.21	0.21	
C-52	Line #3	Prime Coater	Personal	10:50-17:11	2.24	5.68	2.43	26.6	0.77	1.31	0.14	1.32	0.50	
C-53	Line #3	Unwind Operator	Personal	10:53-16:40	1.92	2.03	0.91	3.00	0.45	1.24	*	0.45	0.30	
C-54	Line #3	------	General Area	10:56-17:12	3.54	3.28	1.63	32.9	0.69	3.37	0.09	0.72	0.90	Prime Coat Area
C-55	Line #3	------	General Area	10:58-17:13	1.57	1.82	0.72	3.70	0.30	1.22	*	0.29	0.29	Finish Coat Area
C-56	Slitting Dept.	------	General Area	11:05-17:10	1.16	1.47	0.57	1.78	0.30	0.93	*	0.23	0.22	
C-57	Reclaimed Solvent Area	------	General Area	11:07-17:08	0.49	1.17	0.29	20.4	0.31	1.08	*	0.17	0.34	
C-58	Mezzanine	------	General Area	12:45-17:13	1.38	2.13	0.92	4.90	0.39	1.20	*	0.30	0.30	
	Evaluation Criteria				1	100	100	200	100	5	50	100		

PPM = Parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760 mm Hg pressure
NIOSH Limit of Detection = 0.01 mg of each compound per tube
* = below the NIOSH limit of detection

Note: The combined exposure weighting value should not exceed unity
Benzene was not included in calculation of combined exposure weighting