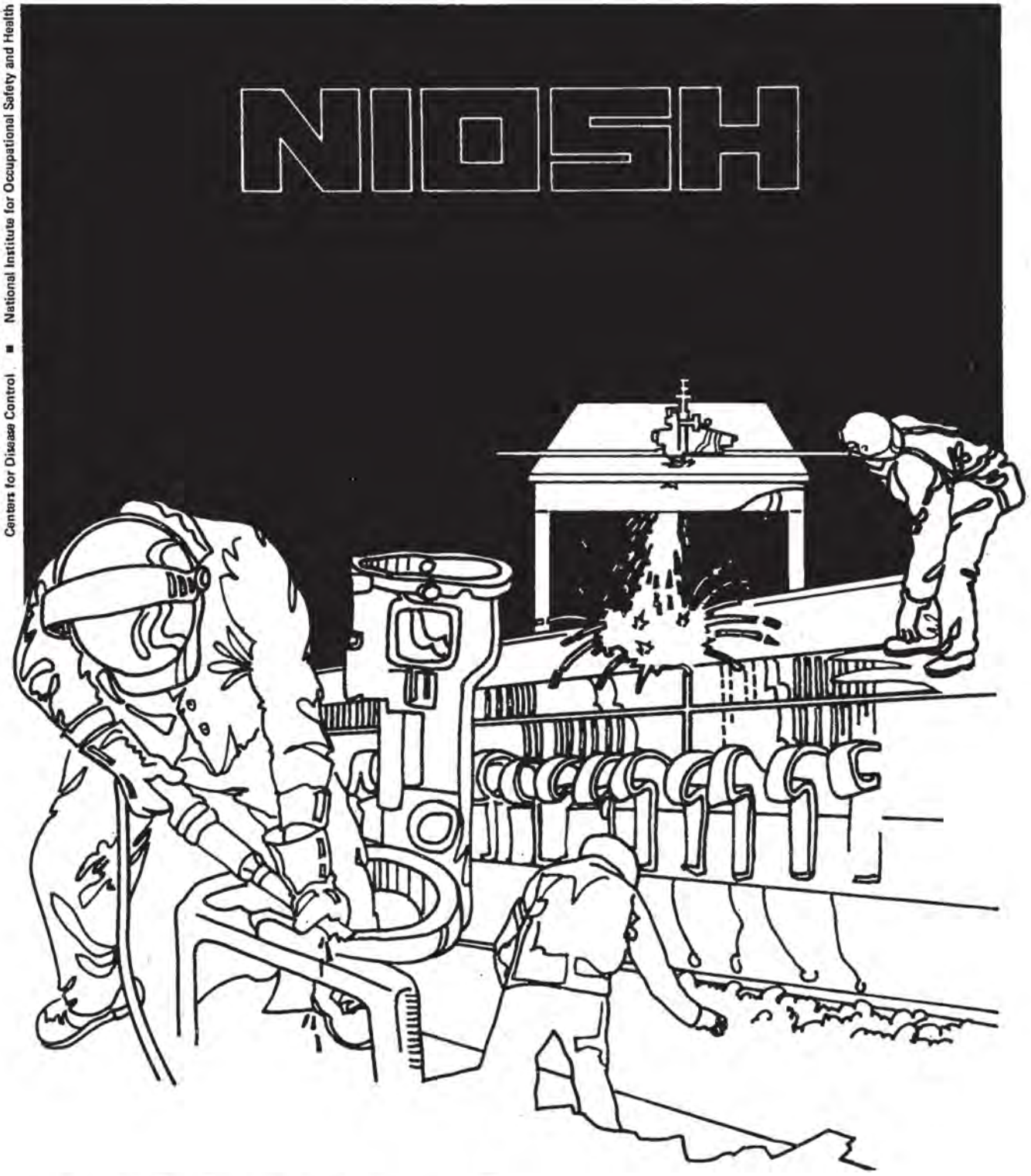
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HE 79-102-1073
UNION CITY BODY COMPANY
UNION CITY, INDIANA

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.

HE 79-102-1073
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Union City Body Company
Union City, Indiana

NIOSH INVESTIGATORS:
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I. SUMMARY

On May 12, 1979, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Union City Body Company, Union City, Indiana, to evaluate reports of headache, high blood pressure, and nosebleed in workers exposed to Anchor Tuflex^R #23, a weldable sealer.

On July 16-18, 1979, NIOSH conducted an industrial hygiene and medical evaluation at the plant. Samples for qualitative chemical analysis of Tuflex^R were obtained, and short term area air samples were obtained for the major substances identified (calcium, naphtha-like solvent) and for other substances used or found in the work environment (welding fumes, 1,1,1-trichloroethane, toluene, butyl acetate, butyl alcohol, xylene, and cellosolve acetate). The environmental measurements did not detect workplace exposures that exceeded the relevant environmental criteria used for this study. However significant potential short term exposure to 1,1,1-trichloroethane (highest 180 mg/M^3 - criterion, 1910 mg/M^3), toluene (highest 74 mg/m^3 - criterion, 750 mg/M^3), and xylene (highest 117 mg/M^3 - criterion, 868 mg/M^3) were found in some of the Tuflex^R spraying operations. High amounts of calcium (which is an irritant) were also found from the welding of Tuflex^R.

The medical evaluation found a high prevalence of symptoms of upper respiratory irritation among the workers exposed to Tuflex^R. In addition, four of the 14 examined workers were found to have erythema or mucous congestion of the nose or oropharynx. No evidence of a relationship between Tuflex^R exposure and hypertension was found. Five of the 14 examined workers were found to have a slight intention tremor. Follow-up medical evaluation in May 1980 found a slight intention tremor in four of the thirteen examined workers examined at this visit but in only two of the five workers noted to have a tremor at the first evaluation. Although a causal link between Tuflex^R or other workplace exposures and tremors is difficult to establish, these findings may be related to solvent exposure at the plant. Neurological examinations in these individuals were otherwise normal.

Based upon the information gathered during this investigation, NIOSH determined that some employees were experiencing occasional irritative effects in these welding operations. No other definite health hazards were found. Recommendations for improving the workplace environment and work practices are detailed in Section VIII of this report.

KEYWORDS: SIC 3713 (Truck and Bus Bodies) Solvents, 1,1,1-Trichloroethane, Tuflex^R.

II. INTRODUCTION

On May 12, 1979 NIOSH received a request from the Union City Body Company, Union City, Indiana to evaluate employee reports of headache, high blood pressure, and nosebleed. On July 16-18, 1979 medical and industrial hygiene surveys were performed by a NIOSH industrial hygienist and two physicians from the Division of Occupational Medicine, Cook County Hospital, Chicago, Illinois. An Interim Report was issued in January 1980. On May 28, 1980 a NIOSH physician performed a follow-up medical survey.

III. BACKGROUND

Union City Body Company manufactures truck bodies for delivery vehicles. The plant has been in the same location since the early 1900's, although it has grown considerably. At the time of the request it employed about 1500 people; however, lay-offs had greatly reduced this number by the spring of 1980.

The processes of concern involve the use of an anti-corrosive weldable sealer, Anchor Tuflex^{R} 23 (hereafter, Tuflex^{R}), which government contract required to be applied on mail delivery cabs made by the company. Tuflex^{R} is described by the manufacturer as a metallo-organic complex with 42% aliphatic solvents and less than 1% aromatic solvents. It has 56% non-volatiles which were not identified. It is a phosphate resin. A NIOSH semi-quantitative analysis identified the following components, listed in order of decreasing concentration: calcium, sulfur, phosphorus, chlorine, potassium, and strontium. The solvent vehicle is nonchlorinated.

Tuflex^{R} was being used primarily in three areas. The first area involves the fitting and noise-proofing of the cab interiors. In this process Tuflex^{R} is applied by spray gun to interior walls, and fibrous glass is manually applied over it. Two men may be involved in the spraying, each of whom wears a chemical cartridge respirator, Walsh #7400 organic vapor type. There is an exhaust hood at the head of the cab which is intended to draw any mist or vapor out of the assembly area.

In the second area, doors for small mail vans are sprayed with Tuflex^{R} in an enclosed spray booth, allowed to dry, and then spot-welded to connect the interior and exterior halves of each door together.

The third area involves applying Tuflex^{R} by brush to seams in large side panels of trucks. These are subsequently torch-welded using oxyacetylene. This area involves four employees and is done in an open area with no local exhaust ventilation.

In addition to Tuflex^{R} application these operations utilize a solvent (LS-255), consisting primarily of 1,1,1-trichloroethane. This solvent has also been used on hands and arms to wash off Tuflex^{R}.

IV. METHODS

Environmental:

The strategy for the industrial hygiene survey was to analyze Tuflex^R in the laboratory and to measure as many of the ingredients in Tuflex^R as possible in the workroom air. Specifications of the steel, primers, and solvents in use were obtained so that contaminants from these sources could be identified.

Twenty seven air samples were collected July 16, 17, and 18, 1979 in the Tuflex^R spray application area, in the primer drying ovens and in the paint drying ovens where Tuflex components may be volatilized, and in the door and side panel (high cube) welding areas where Tuflex components may be oxidized. Sampling devices were inserted into primer and paint drying oven ports and hand-held samples were obtained during Tuflex^R application and in the door welding and side welding operations, and when the paint drying oven door was opened. The environmental samples were primarily short term high volume area samples intended to screen for chemical substances present in the air. The intermittent nature and short duration of the task performed make quantification of exposure difficult. The sample location, volume, analytical method, and result are given in Tables 2 and 3.

Data from area samples such as these is not a measure of worker exposure, but can be used to identify substances present and assess the need for further personal exposure monitoring. Since samples were taken as close to the point of contaminant generation as possible, and only during times when the contaminant was being generated, the results would tend to overestimate exposure in the breathing zone.

Bulk samples of solvents in common use throughout the plant were collected to identify the materials in them.

Medical:

On the first medical survey, blood pressure readings were taken and a questionnaire administered to all employees in the assembly area (six), in the finishing area (two), and in the side panel area (four). Blood pressure readings from preplacement examinations were noted and nose and throat examinations performed.

During the follow-up survey in May, 1980, thirteen employees, including some of the available participants from the previous study, were interviewed and examined for neurologic abnormalities.

V. EVALUATION CRITERIA (Table I)

Solvents:

1,1,1-Trichloroethane is a solvent that is irritating to the eyes. Like many solvents, it can defat the skin and can cause central nervous system depression. Severe exposures may result in liver or kidney damage. The Threshold Limit Value (TLV) set by the American Conference of Governmental Industrial Hygienists (ACGIH) for this substance is 350 ppm for an 8-hour exposure. Both the Occupational Safety and Health Administration (OSHA) and NIOSH also use this value to evaluate exposure. However the NIOSH criteria specifies a 15-minute ceiling.

Toluene is also a solvent and can cause symptoms similar to those caused by 1,1,1-trichloroethane. The NIOSH recommended standard and the ACGIH TLV is 100 ppm.[1] The regulatory standard is 200 ppm.

The standard for xylene is 100 ppm as an eight hour time weighted average. The compliance (OSHA) Standard for butyl alcohol is 100 ppm, for butyl acetate is 1500 ppm, and for cellosolve acetate is 200 ppm.

Tuflex:

The manufacturer states that Tuflex^R is "nontoxic orally, nonirritating to the skin, and nonirritating to the eye" (within the meaning of the Federal Hazardous Substances Labeling Act).

Tuflex^R does contain small amounts of aliphatic and aromatic hydrocarbons which can be central nervous system depressants, causing symptoms such as headache, dizziness, anxiety, and drowsiness. Many hydrocarbons are local irritants, especially to the eyes, nose, and upper respiratory tract, and they can cause skin irritation and dermatitis due to defatting of the skin.

Exposure to pyrolysis products of Tuflex^R was possible and given the composition of Tuflex^R listed previously, could include exposure to calcium oxide, sulfur dioxide, chlorine gas and hydrochloric acid, all of which are irritants.

VI. RESULTS

A. Environmental:

General Solvent Exposure

Two bulk samples, one of material used throughout the plant (LS-255) and one of a solvent of more restricted use (Anchor 91), were analyzed. LS-255 was essentially pure 1,1,1-trichloroethane The Anchor 91 contained aliphatic hydrocarbons in the C_{11} - 15 range plus some xylene and higher molecular weight aromatics such as trimethyl and tetramethylbenzene isomers.

Welding Exposure

The metals in air generated by welding on Tuflex treated metals were determined by a semi-quantative analysis (Table II). It is not valid to calculate concentrations for comparison with enforcement standards from such results. It is, however, possible to estimate if the results are high and warrant further evaluation.

In the door welding area major amounts of iron were detected on two samples. Copper was present in major quantities on one sample and in minor quantities on a second.

Results in the side panel area differed only slightly from those in the door area. Copper was also found here. The trace of arsenic found in one sample is most likely spurious. The potassium found is consistent with qualitative analysis of Tuflex^R.

Tuflex Spraying

Anchor-Tulfex^R weldable sealer contained a naptha-like solvent and some aromatics. In the Tuflex^R spraying area, a sample for solvents showed about 3.4% of the TWA concentrations of 1,1,1-trichloroethane (probably from LS-255 solvent) and 53.2 mg/M^3 of total alkanes.

A filter placed near the right-hand door of a truck being sprayed with Tuflex^R showed major amounts of calcium (more than 100 ug per sample).

Drying Ovens

Toluene and xylene and some other organic compounds at low concentrations were present in the primer and paint drying oven areas (Table III).

B. Medical:

In the first medical survey 14 employees potentially exposed to Tuflex[R] participated. All were male and included two sprayers, four employees working near the sprayers, three at the end of the primer paint oven, two in door welding, and three on the side panel welding. Ages ranged from 22 to 43 (mean 30.3 years). Seniority ranged from two to 18 years. Table 4 indicates each employee's age, job, pre-placement blood pressure level, blood pressure readings in right and left arm prior to exposure on the day of the survey, and blood pressure readings at the end of the shift. Abnormal results are marked by an asterisk. Participant number eight is a known hypertensive under medical treatment. Four of the 14 (29%) had abnormal blood pressures. The mean pressures for the entire group were normal and did not differ significantly between pre-shift and post-shift readings.

Symptoms were limited to the spraying operation, the primer drying oven, and the spotwelding operation. No workers in the side panel area, where Tuflex[R] was applied by brush, had symptoms.

Symptoms noted with contact with Tuflex[R] included the following:

Symptoms	Frequencey
watering of eyes	2 person(s)
nausea	1
lightheadedness	4
sore throat	3
fatigue	1
unpleasant odor	3
sensation of being "high"	1
chest tightness	1
gastrointestinal upset	1

In the door welding operation, where possible health effects had been noted to be most prominent, the following symptoms were associated by one employee with inhalation of fume from welding (both oxyacetylene and spot) over Tuflex[R] coated doors: "headache, drunken feeling, trembling, chills, unusual taste in mouth." The symptoms developed after welding on four to five doors, and lasted up to one and one-half hours, with chills persisting up to three to four hours. No eye irritation, nose bleeds, nausea, or vomiting were noted. A second employee reported stomach upset, trembling, weakness in the legs, fatigue, mild nausea, feeling like "three beers" had been consumed, dizziness, and lightheadedness. The symptoms were stated to develop after 10 to 15 minutes and persist for one and one-half hours.

One individual reported episodic numbness and tingling of the hands which he had associated with solvent exposure used in cleaning Tuflex[R] from the skin of the hands and arms.

Eight of the 14 individuals, including both sprayers and door welders, felt that they had a health problem related to work and, specifically, to exposure to Tuflex^{R}.

Examination of the nose and oropharynx revealed erythema (reddening) or mucous membrane congestion in four individuals.

Because of the incidental finding of tremor in five employees, a follow-up visit was made by a NIOSH physician on May 28, 1980. Thirteen employees were interviewed, including all five noted to have tremor on the previous visit. Of these 13 workers, 12 had worked with Tuflex^{R}; seven of these had worked with it during the previous week. (During the period of this second visit, the plant functioned only two or three days each week.) When asked about the presence of various symptoms during the previous two working days, the seven workers exposed to Tuflex^{R} were more likely to report tiredness (57% vs 17%), dizziness (29% vs 0%), and headache (43% vs 17%), although none of these differences was significant statistically.

Of the 13 workers examined, four had a tremor. All of these had worked with Tuflex^{R}, although only two had worked with it during the preceeding week. The tremor in these four individuals was a very slight intention tremor (that is, a tremor noted when the hand is in motion). There was no tremor at rest and neurological examination was otherwise normal. No group totally lacking in past exposure was examined. Average age of those with tremor was 32.2 years as compared with 32.6 years for those without tremor.

Of the five individuals felt to have tremor on the first visit, only two had a tremor on the second visit; these two workers had not worked with Tuflex^{R} for one month.

VII. DISCUSSION

A. Environmental:

General Solvent Exposure

The 1,1,1-trichloroethane found in LS 255 can be absorbed through the intact skin[2], and multiple observations of its use without skin protection were made.

Skin protection is recommended when prolonged or repeated contact with trimethyl and tetramethyl benzene isomers such as were found in Anchor 91.

Welding

The iron and copper found in the door welding area air samples is reasonable since steel containing iron and small amounts of copper are being spot welded with copper contacts. The results suggest that hygienically significant exposure to copper might occur if production is at high levels. The presence of calcium is consistent with the

composition of Tuflex^R and did not exhibit the hygienically significant crystalline species. The trace amounts of sulfur are compatible with both the composition of Tuflex^R and the steel used. The origin of titanium, nickel, aluminum, chromium, magnesium, platinum and tin is unknown.

In both welding areas the results of the welding fume samples were quite low, and would not be expected to induce adverse health effects. However, one worker did describe symptoms consistent with metal fume fever while welding. This may relate to occasional overexposure to copper fumes.

Tuflex Spraying

The alkanes detected in the Tuflex^R spraying area probably represent the solvent vehicle in the Tuflex^R. The solvent and alkane levels are well below applicable environmental criteria.

The filter placed near the right-hand door of a truck being sprayed with Tuflex^R showed major amounts of calcium (more than 100 ug per sample) which is consistent with the composition of Tuflex^R. This also indicates that the installed hood at the front of the truck does not capture and remove all fumes generated during spraying. Probably those fumes directed parallel to the hood face towards the open cab door escape.

The source of the trace (1-10 ug per sample) of iron is uncertain. Since phosphorus was given as a constitutent of Tuflex^R, we looked for this element and found only trace amounts.

Drying Ovens

In the primer drying oven areas xylene, toluene, alcohols, and acetates were present, but not at levels that would be expected to produce permanent health effects. However, the possibility of temporary, reversible eye irritation in some individuals exposed to these substances is not eliminated.

B. Medical:

While this investigation involved too few participants for firm conclusions to be drawn, no relationship between exposure to Tuflex^R and hypertension was suggested.

Many workers described irritative effects, affecting the eyes and throat. On both visits some workers also noted tiredness, headache, and lightheadedness. Three of the 13 interviewed on the second visit noted a nervous or shaky feeling. Since Tuflex^R is used in conjunction with a solvent containing aliphatic hydrocarbons, which are known

to have such effects, it is difficult to separate the effects of exposure to Tuflex^R from exposure to the solvent. Pyrolysis products might also play a role in these effects.

While some mild erythema or mucous membrane congestion was found in four workers, no evidence of chronic irritation was noted. The slight degree of the intention tremors found is probably of minor clinical significance. The present study cannot be considered as demonstrating either a connection or lack of connection between Tuflex^R and tremor. Once again, the solvent is as likely as Tuflex^R to be causing any nervous system effects.

VIII. RECOMMENDATIONS

1. Skin contact with solvents should be avoided by wearing impermeable gloves. This should apply to LS-255 as well as to Tuflex^R.

2. Local exhaust ventilation applied at the point of contaminant generation would help minimize irritative symptoms. Such ventilation should be installed where Tuflex^R is sprayed and Tuflex^R coated materials are welded.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. REFERENCES

1. Procter, N. and Hughes, J., Chemical Hazards of the Workplace, pages 482 and 509, Lippincott, 1978.

2. Department of Health and Human Services, NIOSH Criteria for a Recommended Standard ... Occupational Exposure to 1,1,1-Trichloroethane, 1976.

3. American Conference of Governmental Industrial Hygienists, Documentation of the TLV's for Substances in Workroom Air, Cincinnati 1972.

XI. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report have been sent to:

1. United Auto Workers, Social Security Department, 8000 East Jefferson Avenue, Detroit, Michigan 48214.

2. United Auto Workers, Local 494, P.O. Box 173, Union City, Indiana 47290.

3. Union City Body Compoany, Union City, Indiana 47390.

4. NIOSH, Region V.

5. OSHA, Region V.

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 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.

For the purpose of informing the affected employees the employer shall promptly post for a period of 30 calendar days this determination report in a prominent place(s) near where the exposed employees work.

TABLE 1

ENVIRONMENTAL CRITERIA FOR AIRBORNE CONTAMINANTS

UNION CITY BODY COMPANY
UNION CITY, INDIANA
HE 79-102
JULY 16-18, 1979

COMPOUND	AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS		OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION			NATIONAL
	TWA	STEL	TWA	CEILING	PEAK	TWA
	All Units are Expressed in mg/M^3.					
Aluminum (Al metal and Al_2O_3)	D	20.0				
Aluminum (as Al. and Fumes)	5.0					
Arsenic and Soluble Compounds as As	0.2	0.01				
N-Butyl Acetate	710.0	950.0	710.0			
N-Butyl Alcohol	710	950	300			
Sec-Butyl Alcohol	305	455	450			
Tert-Butyl Alcohol	300	450	300			
Calcium Oxide CaO	2.0	5.0				
Chrome Metal & $Cr^{+2,+3}$	0.50	1.0				0.05
Chrome VI	0.05					0.001
Chrome VI(Mono & di-forms H,Na,K,Rb,Cs,NH_4 & Acid)	0.05			0.5		0.025
Copper Fume, Dusts, and Mists as Cu	1.0	2.0	1.0			
Iron Oxide	5.0	10.0	10.0			
Isobutyl Alcohol	150.0	225.0	300.0			
Magneseum Oxide Fume	10.0		15.0			
Manganese compounds as Mn	C 5.0			C 5.0		
Manganese Fumes as Mn	1.0	3.0				
Manganese and Manganese Compounds as Mn	5.0		5.0			
Manganese Fume as Mn	1	3				
Tin, Inorganic Compounds, Except SnH_4 and Sn_2	2.0	4.0	2.0			
Toluene	375.0	560.0	750.0	1120.0	1870.0	375.0
1,1,1-Trichloroethane	1900.0	2450.0	1900.0			
Xylene(o-,m-,p-isomers)	435.0	655.0	435.0			435.0
Zinc Oxide Fumes	5.0	10.0	5.0			5.0

NOTES: There are no specific standards for unspecified cellosolve acetate, silica without specifying its crystalline state, or pho
C indicates that that value given is a ceiling level.

TABLE II

WELDING FUME SAMPLE RESULTS
UNION CITY BODY COMPANY
UNION CITY, INDIANA
JULY 16-18, 1979

Sample Location	Spraying Tuflex		Door Welding at Source		Hi Cube (Sides) at Source	
Sample Volume M^3	0.099	0.081	0.030	0.066	0.051	0.051
Duration (min)	28	27	10	26	16	16
Al	ND	ND	T	ND	T	T
As	ND	ND	ND	ND	T	ND
C	M	M	M	M	M	M
Ca	M	M	MI	MI	MI	MI
Cr	ND	ND	T	ND	ND	ND
Cu	ND	ND	M	MI	T	ND
Fe	T	T	M	M	M	MI
Mg	T	ND	ND	T	T	T
Mn	ND	ND	T	T	T	T
Na	MI	MI	MI	MI	MI	MI
Ni	ND	ND	T	ND	ND	ND
P	T	T	T	T	T	T
Pt	ND	ND	T	ND	MI	ND
Si	ND	ND	T	ND	ND	ND
Sn	ND	ND	ND	T	T	ND
Zn	T	T	T	T	T	T

Legend: ND - Not Detected (1 ug/sample)
T - Trace (1-10 ug/sample)
Mi - Minor (10-100 ug/sample)
M - Major (100 ug/sample)

The following elements were not detected in any of the samples under the conditions used: Ag, B, Be, Cd, Li, Mo, Pb, Se, Te, Ti, Tl, V, W, Y, Zr. All samples were collected with Dupont 4000A pumps calibrated at 3 lpm. These samples were analyzed by inductively coupled plasma atomic emission spectrometry.

TABLE III

ORGANIC VAPOR SAMPLE RESULTS
UNION CITY BODY COMPANY
UNION CITY, INDIANA
JULY 16-18, 1979

Sample Location	Sample Time (min)	Sample Concentration mg/M^3 1,1,1-Tri-Chloroethane	Toluene	Butyl Acetate	Butyl Alcohol	Xylene	Cellosolve Acetate
Spray	80	-----	3.0	0.4	1.2	1.2	9.4
Painting	65	2.0	23.0	12.0	36.0	2.0	35.0
"	75	2.0	17.0	12.0	27.0	13.0	27.0
Primer	80	180.0	74.0	----	----	117.0	----
Spraying	300	65.0	----	----	----	-----	-----
Tuflex	45	-----	56.0	56.0	23.0	10.0	123.0
Spray	50	-----	----	----	----	-----	-----
Painting	75	1.0	17.0	15.0	25.0	15.0	28.0

NOTE: All Samples were collected at a flow rate of 200 cc/ minute with Dupont 4000A pumps. Organic Vapor samples were analyzed by gas chromatography/mass spectrometry.

TABLE 4

Pre-placement, and before and after exposure blood pressure measurements on employees wor
Tuflex application.

Participant Number	Age	Operation	Pre-Placement	July 17, 1979 Prior to Exposure Right	Left
1	39	Sprayer	120/80 ('61)	104/74	108/70
2	NA	Sprayer	100/60 ('71)	114/66	136/72
3	33	Line	120/80 ('67)	116/84	108/78
4	22	Line	NA	136/72	134/70
5	30	Line	120/80 ('78)	122/80	128/80
6	23	Line	NA	160/90	140/86
7	27	Oven	NA	118/72	104/60
8**	40	Oven	125/85 ('68)	138/96*	134/96*
9	28	Oven	110/65 ('69)	120/78	108/60
10	43	Doors	140/90 ('68)	154/104*	144/106*
11	29	Doors	130/80 ('68)	128/78	124/74
12	31	Slides	130/85 ('69)	126/95*	120/92
13	23	Sides	NA	128/78	128/80
14	26	Sides	126/80 ('72)	116/74	112/80
			Mean	125.3/80.2 xxx	

NA = not available
* Abnormal, see text of report
**Known hypertensive
*** = differences not statistically significant
(Student + Test)