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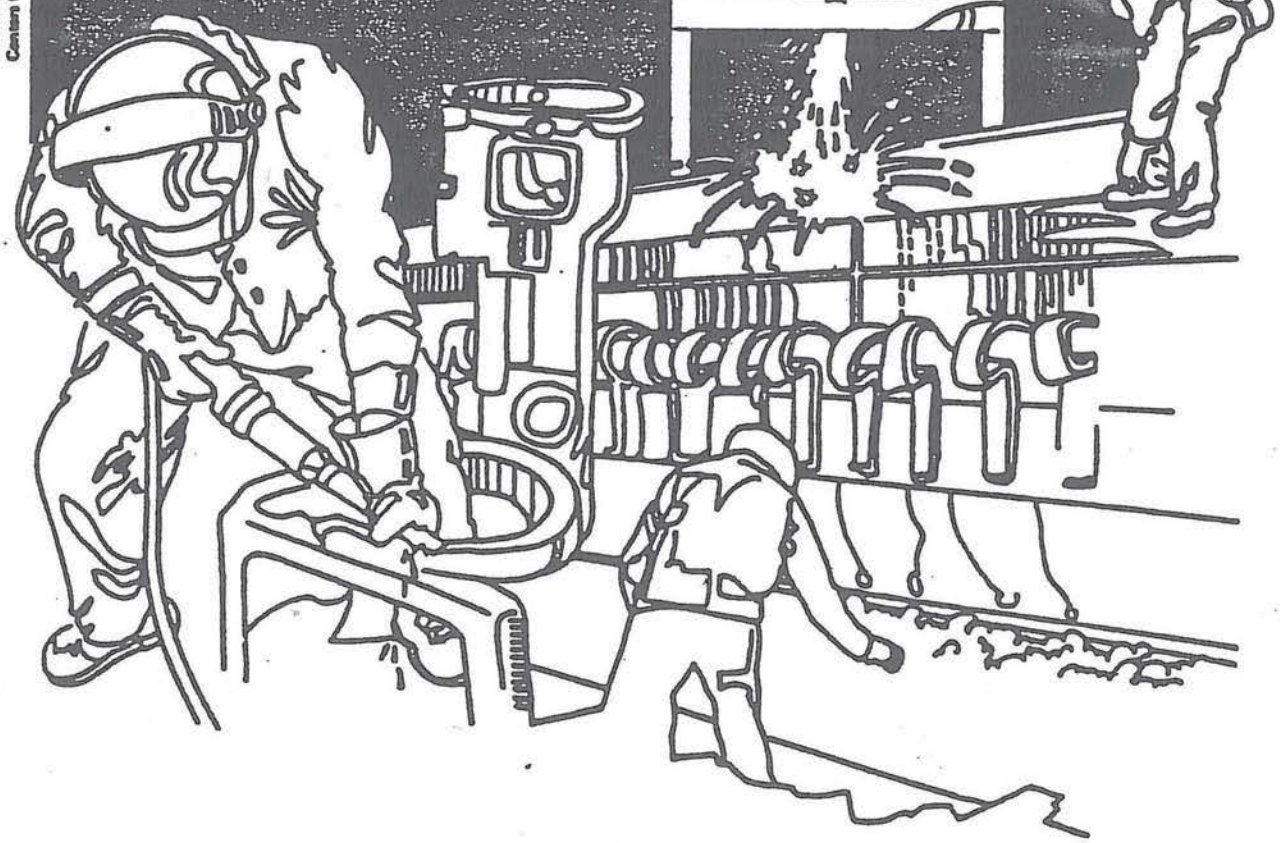

Health Hazard Evaluation Report

HETA 84-011-1567
KP INDUSTRIES
DELPHOS, OHIO

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 84-011-1567
FEBRUARY 1985
KP INDUSTRIES
DELPHOS, OHIO

NIOSH INVESTIGATORS:
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I. SUMMARY

In September 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate potential health hazards at KP Industries in Delphos, Ohio. The plant employs about 90 workers to manufacture automotive products.

On January 25-26, 1984, NIOSH investigators conducted an environmental and medical survey at the plant. Twelve air samples were collected to evaluate occupational exposure to ethyl cyanoacrylate, lead, copper, beryllium, vinyl chloride, azodicarbonamide, and xylene. The medical survey included biological monitoring for blood lead (PbB), free erythrocyte protoporphyrin (FEP), and zinc protoporphyrin (ZPP) in 5 workers; analysis for specific IgE and IgG antibodies to azodicarbonamide in 1 worker; the administration of a questionnaire to the 16 workers ever exposed to ethyl cyanoacrylate and the 5 lead-exposed workers.

The airborne concentration of ethyl cyanoacrylate at the adhesive work area was 4.6 milligrams per cubic meter. No exposure limits have been developed for ethyl cyanoacrylate. A similiar compound, methyl cyanoacrylate, has an ACGIH threshold limit value of 8 mg/M^3. Air levels of lead, copper, beryllium, vinyl chloride, azodicarbonamide, and xylene were all below the limit of detection. The biological monitoring results for lead were all within the normal range for each parameter measured. Testing of the azodicarbonamide worker's serum found no IgG, and IgE levels lower than 4 out of 5 laboratory controls. The results of the questionnaire survey indicated that lead-exposed workers had a higher incidence of skin rashes than cyanoacrylate-exposed workers, while the cyanoacrylate workers had a higher incidence of upper respiratory symptoms. The respiratory symptoms described by some cyanoacrylate workers could be indicative of an asthmatic response. Use of the product was discontinued before that relationship could be confirmed.

On the basis of the data collected in this evaluation, it was determined that exposure to ethyl cyanoacrylate caused acute mucosal irritation and possible pulmonary sensitization.

KEYWORDS: SIC 34 (Fabricated Metal Products). cyanoacrylate, ethyl cyanoacrylate, lead, copper, beryllium, vinyl chloride, xylene, respiratory symptoms, asthma.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

NIOSH investigators collected 12 area and personal breathing-zone (pbz) air samples on January 26, 1984, to evaluate worker exposure to ethyl cyanoacrylate, lead, copper, beryllium, vinyl chloride, azodicarbonamide, and xylene.

Four area air samples for ethyl cyanoacrylate were collected at the adhesive work area. Two of the samples were placed about one foot from the workers' breathing zones and two were placed about three inches from the adhesive applicator. The applicators are about two feet from the operators' breathing zones. The samples were drawn at a flow rate of 1.0 liters per minute through midget impingers containing 15 ml of 0.5 N sodium hydroxide. The samples were analyzed for ethyl cyanoacrylate by visible spectroscopy.[1]

The sampling and analytical methods used to collect other contaminants are summarized in Table I.

The performance of local exhaust ventilation systems was assessed by smoke tube observations and linear air velocity measurements using a Kurz Model 441.

B. Medical/Epidemiologic

A questionnaire was administered to all 16 employees who had ever worked with ethyl-2-cyanoacrylate at KP Industries, and also to the five individuals who had potential lead exposure in their current job at KP. This questionnaire included a work history, smoking history, questions concerning gastrointestinal and neurologic symptoms commonly associated with lead exposure, and questions concerning mucosal irritation, dermatologic conditions, and respiratory symptoms which have been associated with cyanoacrylate exposure.

Biological monitoring was performed on those five people with possible lead exposure. Zinc protoporphyrin (ZPP) was measured with a hemafluorometer, providing immediate results. Sera were also sent to the laboratory to be analyzed for blood lead (PbB) and free erythrocyte protoporphyrin (FEP).

Blood was drawn from the primary individual who works with azodicarbonamide on the first shift. The serum was sent to the University of Cincinnati where the following tests were run: analysis for specific IgE antibody to azodicarbonamide (AZ) conjugated to human serum albumin (AZ-HSA) by the radioallergosorbent test (RAST)[2,3]; and specific IgG antibody to AZ-HSA by the enzyme-linked immunosorbent assay (ELISA)[4,5].

Because the results of the questionnaire indicated the need to investigate a possible asthmatic reaction among some of the cyanoacrylate workers, a second questionnaire was developed. This was administered via telephone to all who had worked with cyanoacrylate, and included a more extensive assessment of respiratory history and symptoms, and an allergy history. One person who had not reported any symptoms in the initial questionnaire was never reached for this second survey.

Additionally, private medical records for many of the workers were obtained and reviewed.

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 on 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 primarily 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 refers 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.

B. Lead

Inhalation (breathing) of lead dust and fume is the major route of lead exposure in industry. A secondary source of exposure may be from ingestion (swallowing) of lead dust deposited on food, cigarettes, or other objects. Once absorbed, lead is excreted from the body very slowly. Absorbed lead can damage the kidneys, peripheral and central nervous systems, and the blood forming organs. Chronic lead exposure is associated with infertility and with fetal damage in pregnant women.

Blood lead (PbB) levels below 40 ug/deciliter whole blood are considered to be normal levels which may result from daily environmental exposure. The Occupational Safety and Health Administration (OSHA) standard for lead in air is 50 ug/m^3 calculated as an 8-hour time-weighted average for daily exposure.[10] The standard also dictates that workers with blood lead levels greater than 60 ug/deciliter must be immediately removed from further lead exposure and, in some circumstances, workers with lead levels of less than 60 ug/deciliter must also be removed. Removed workers have protection for wage, benefits, and seniority for up to 18 months until their blood levels decline to below 50 ug/deciliter and they can return to lead exposure areas.

In addition to blood lead (PbB), zinc protoporphyrin (ZPP) and free erythrocyte protoporphyrin (FEP) levels were also measured. PbB is considered the best indicator of recent lead exposure, providing that, prior to exposure, the tested individual was in a steady state with his/her environment. PbB values will drop progressively once one is removed from exposure.

ZPP is a substance that accumulates in red blood cells as a result of lead's interference with heme synthesis. The direct measurement in whole blood of ZPP offers a simple, sensitive test for excessive lead absorption.

FEP is an expression of ZPP determined by a different method. Elevated FEP values reflect a history of excessive exposure to lead. FEP values rise significantly and remain elevated if PbB values attain or exceed 30-40 ug PbB/dl.

A referent, or normal value for both FEP and ZPP is considered to be 50 ug/dl.

C. Azodicarbonamide

Few toxicity studies addressing the health effects of azodicarbonamide (CAS #123-77-3, 1,1'-azobisformamide, hereafter referred to as ABFA) have been published. Two reports in the literature discuss a decrease in pulmonary function[6,7]. One of them also describes the occurrence of occupational asthma among workers handling powdered ABFA[6]. The exposure levels reported in these two articles ranged from 700 ug/m^3 to 5000 ug/m^3.

D. Ethyl-2-cyanoacrylate

Ethyl-2-cyanoacrylate (CA) is another substance for which little toxicity information exists. Alkyl-2-cyanoacrylate adhesives, as a group, are described as strong irritants, affecting the eyes, nose and throat[8]. Of these substances, most of the reports concern methyl-2-cyanoacrylate. Studies have indicated an odor threshold for methyl-2-cyanoacrylate ranging from 4 to 20 milligrams per cubic meter (mg/M^3). The threshold for throat and nose irritation is reported at 8 to 12 mg/M^3 followed by eye irritation and burning at about 16 mg/M^3 [8]. There is an assumption that the other cyanoacrylates (ethyl and butyl) are equally irritating, but they are somewhat less volatile and therefore evaporate more slowly[8]. The ACGIH TLV for methyl cyanoacrylate is 8 mg/m^3.

There have been no published accounts of CA causing asthma, or other allergic reactions. However, we are aware of an individual recently seen at the University of Cincinnati[9], who presented with symptoms indicative of asthma. CA was the putative asthmagen, and this was confirmed by inhalation challenge testing. If, in fact, CA is an asthmagen, an individual can react to minute concentrations once sensitization has occurred.

The evaluation criteria and adverse health effects of these and other substances investigated during this evaluation are presented in Table II.

E. Questionnaire

For each questionnaire-elicited symptom, the prevalence among cyanoacrylate-exposed people was compared with that among the lead-exposed people. The Fisher's Exact Test was the statistical test used to compare the two groups.

Additionally, all symptoms were divided into a number of categories for analysis: gastrointestinal; neurological; mucosal irritation; dermatologic; respiratory; muscular; and constitutional. The categories included the following symptoms: gastrointestinal - symptoms 1-5 (listed in Table V); neurological - symptoms 6-9; mucosal irritation - symptoms 10-16; dermatologic - symptom 17; respiratory - symptoms 18-20; muscular - symptoms 21-23; and constitutional - symptoms 24-25. The Fisher's Exact Test was used to compare the two groups for the symptom categories.

When considering these symptom categories, it is known that overexposure to lead can cause gastrointestinal, neurological, muscular, and constitutional symptoms, as well as other health problems not investigated here[10].

Exposure to cyanoacrylate has been associated with mucosal irritation[1, 8] and dermatitis[11].

VI. RESULTS

A. Environmental

The airborne ethyl cyanoacrylate concentration at the adhesive work area was 4.6 milligrams per cubic meter (mg/M^3) (Table III). This concentration was very uniform throughout the area.

Ventilation of the adhesive applicators consisted of a one-inch slot exhaust hood located about six inches under each applicator. The exhaust hoods had a measured slot velocity of 800-1000 feet per minute (Fpm). The capture velocity of these systems was about 90 Fpm.

Air samples for lead, copper, beryllium, vinyl chloride, azodicarbonamide, and xylene were all below the limits of detection (Table IV).

B. Medical/Epidemiologic

Biological monitoring results for lead on each of the five lead-exposed individuals are presented in Table VII. These results are all well within the normal range for each parameter measured. These ranges are generally accepted as being: PbB < 40 ug/dL; FEP < 50 ug/dL; and ZPP < 50 ug/dL.

Analyses for specific IgE and IgG antibodies to azodicarbonamide conjugated with human serum albumin (AZ-HSA) were performed for the primary individual potentially exposed. IgG was not detected. For IgE, the optical density of the sample at 405 milimicrons (1:10 serum dilution) was 2.8. This IgE level was lower than four of the five laboratory controls analysed, and is therefore not considered elevated.

With the questionnaire, analysis was made primarily in terms of a comparison between two distinct groups, five lead-exposed workers and 21 cyanoacrylate-exposed workers. Based upon the available literature, it was assumed that adverse health effects due to one material would be different from those resulting from the other (see Section V, Evaluation Criteria). Of the 25 symptoms inquired about, the cyanoacrylate workers reported a significantly ($p < .05$) higher incidence within the previous year of three symptoms: stuffed nose; irritated or sore throat; and fatigue. The lead-exposed workers reported a significantly ($p < .05$) higher incidence within the previous year of one symptom - skin rash (Table V).

When the symptoms were grouped into categories for further analysis (see Evaluation Criteria - Questionnaire), it was found that the cyanoacrylate-exposed workers reported a significantly ($p < .05$) higher incidence of constitutional symptoms, and the lead-exposed workers reported a significantly ($p < .05$) higher incidence of dermatologic symptoms (Table VI).

To assess whether selected demographic differences between the two groups of workers may have contributed to differences in reported health effects, comparisons were made. No significant differences were found between the lead-exposed and cyanoacrylate-exposed workers when age, gender, and years worked at KP Industries were compared (Table VIII).

When comparing current smoking status with the occurrence of selected symptoms, it was found that current cigarette smokers were significantly more likely to report respiratory symptoms, but were not more likely to report mucosal irritation (Table IX).

VII. DISCUSSION/RECOMMENDATIONS

As discussed, biological monitoring for lead showed levels well within the normal range (Table VII). However, the fact that more than 50% of the lead-exposed workers reported mucosal irritation and skin rashes (Table V) is of some concern. As confirmed during our inspection of the work area, a large amount of soldering smoke is generated and not properly exhausted. Although lead fume was not detected in the smoke, improved local exhaust ventilation is recommended for reducing irritant effects among solderers.

Ethyl-2-cyanoacrylate (CA), as previously discussed, has been described as causing irritative effects[7, 8, 11]. This was observed at KP Industries, as well, as at least 50% of the CA workers reported each of the irritative symptoms inquired about: eye irritation; tearing of the eyes; irritated nose; runny nose; stuffed nose; bloody nose; and irritated or sore throat. The fact that only two of the symptoms were at a statistically significant excess when compared with the lead-exposed workers is probably more a result of the fact that four of the irritative symptoms were reported by more than 50% of the lead-exposed workers, as well (Table V).

While irritative effects are unpleasant enough, there is additional concern here. A number of workers described shortness of breath, often occurring in the evening or during the night, after having worked with CA during the day. For some, sleep patterns were disrupted. Many of these people worked with the CA when it was first introduced to the plant. From all descriptions, the adhesive process was ventilated less well at that time, and exposures were presumably higher. A number of people who worked with the glue at that time now state that even peripheral contact can trigger the irritative effects and the shortness of breath. This suggests

sensitization and an allergic reaction. It should be stated that while there is not conclusive proof that an allergic reaction to CA has actually occurred, the reports from the workers are suggestive of that.

CA is no longer used in the plant. Given the reported health effects, that is commendable. However, the only way to test the hypothesis that the CA caused asthma at KP Industries would be to subject the individuals to bronchial challenge testing in a hospital setting. That appears infeasible and inappropriate, within the scope of this hazard evaluation.

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1. KP Industries
2. United Auto Workers, Local 1556
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.

TABLE I
Sampling and Anayltical Methods
KP Industries
Delphos, Ohio
HETA 84-011
January 26, 1984

Contaminant	Sample Type and No. Collected	Sample Media	Flow Rate (lpm)	Analysis
Ethyl Cyanoacrylate	4-area	0.5N NaOH	1.0	Visible Spectroscopy McGee et al.[1]
Vinyl Chloride	3-area	2 charcoal tubes in series	0.05	Gas Chromatography NIOSH 178
Azodicarbonamide	1-PBZ*	Teflon Filter	1.5	Dimethylsulfoxide desorption High pressure liquid chromatography Ultraviolet detector at 276 um
Lead	2-PBZ	Cellulose membrane filter	1.5	Atomic absorption NIOSH S-341
Copper and Beryllium	1-PBZ	Cellulose membrane filter	1.5	Atomic absorption NIOSH 173
Xylene	1-PBZ	Charcoal tube	0.05	Gas chromatography NIOSH S-318

*PBZ - personal breathing-zone

TABLE II
Evaluation Criteria for Hazardous Substances
KP Industries
Delphos, Ohio
HETA 84-011
January 26, 1984

Contaminant	OSHA Permissible Exposure Limit	ACGIH Threshold Limit Value	NIOSH Recommended Standard	Principle Health Effects
Ethyl Cyanoacrylate	-	-	-	Irritation of eyes, nose, and throat, respiratory sensitization
Lead	50 ug/m^3	150 ug/m^3	50 ug/m^3	Abdominal pain, constipation, anemia, insomnia, tremor
Copper Fume	100 ug/m^3	200 ug/m^3	-	Irritation of the upper respiratory tract, metallic taste in the mouth, metal fume fever, chills, muscle aches
Beryllium	2 ug/m^3	2 ug/m^3	0.5 ug/m^3	Cough, substernal pain, weakness shortess of breath, weight loss, decreased lung function
Vinyl Chloride	2 ug/m^3	10 mg/m^3	-	Dizziness, nausea, liver damage, liver cancer
Azodicarbonamide	-	-	-	Respiratory sensitization
Xylene	435 mg/m^3	435 mg/m^3	435 mg/m^3	Dermatitis; irritation of eyes, nose, and throat; dizziness, drowsiness, excitement, nausea

TABLE III
Airborne Ethyl Cyanoacrylate Concentrations
KP Industries
Delphos, Ohio
HETA 84-011
January 26, 1984

Location	Sampling Period	Concentration (mg/M^3)
lose to breathing zone	8:20-14:30	4.4
lose to applicator	8:32-14:30	4.6
lose to breathing zone	8:30-14:30	4.6
lose to applicator	8:35-14:30	4.6
imit of Detection		0.03

TABLE IV
Air Sample Results for Vinyl Chloride, Azodicabonamide,
Lead, Copper, Beryllium, and Xylene
KP Industries
Delphos, Ohio
HETA 84-011
January 26, 1984

Job/Location	Sampling Period	Concentration (mg/M^3)					
		Vinyl Chloride	Azodicarbonamide	Lead	Copper	Beryllium	Xylene
Inside Machine #420 process area sample	8:40-14:45	ND*	-	-	-	-	-
Inside Machine #423 process area sample	8:40-14:40	ND	-	-	-	-	-
Inside storage box of PVC pellets	8:40-14:45	ND	-	-	-	-	-
Plastics Operator, personal breathing zone (PBZ)	7:35-14:45	-	ND	-	-	-	-
Soldering (PBZ)	7:25-12:30	-	-	ND[a]	-	-	-
Soldering (PBZ)	7:30-8:30	-	-	ND[b]	-	-	-
Spot Welding (PBZ)	7:45-14:45	-	-	-	ND	ND	-
Spray Painting (PCB)	7:40-14:50	-	-	-	-	-	ND+
Limit of Detection *ND - none detected		0.06	0.002	a=0.011 b=0.055	0.003	0.0008	4
Evaluation Criteria **LFL - lowest feasible level		LFL**	-	0.050	0.1	LFL	435

+Results Suspect - The stroke count on this pump showed a low sample volume, indicating that the pump did not operate for the entire shift. The actual xylene concentration may have been higher

TABLE V

SYMPTOM FREQUENCY, BY EXPOSURE CATEGORY
KP Industries
Delphos, Ohio
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January 26, 1984

SYMPTOM	CYANOACRYLATE-EXPOSED (# with symptom/total)	LEAD-EXPOSED (# with symptom/total)	FISHER'S EXACT TEST p value
1) Nausea	3/16	0/5	0.42
2) Vomiting	1/16	0/5	0.76
3) Diarrhea	1/16	0/5	0.76
4) Constipation	2/16	0/5	0.57
5) Abdominal pains	1/16	0/5	0.76
6) Headache	6/16	1/5	0.34
7) Tremors	1/16	1/5	0.38
8) Insomnia	2/16	0/5	0.57
9) Irritability	4/16	0/5	0.30
10) Eye irritation	10/16	3/5	0.39
11) Tearing of the eyes	8/16	3/5	0.36
12) Irritated nose	14/16	3/5	0.20
13) Runny nose	11/16	3/5	0.38
14) Stuffed nose	13/16	1/5	0.02 *
15) Bloody nose	9/16	1/5	0.16
16) Irritated or sore throat	11/16	0/5	0.01 *
17) Skin rash	1/16	3/5	0.03 ##
18) Cough	3/16	1/5	0.47
19) Shortness of breath	5/16	0/5	0.21
20) Coughing up blood	1/16	0/5	0.76
21) Muscular weakness	0/16	1/5	0.24
22) Joint pains	3/16	2/5	0.28
23) Leg cramps	2/16	1/5	0.45
24) Loss of appetite	6/16	0/5	0.15
25) Fatigue	9/16	0/5	0.04 *

* Those people with cyanoacrylate exposure had a higher incidence of this symptom than lead exposed individuals, $p < .05$.

Those people with lead exposure had a higher incidence of this symptom than cyanoacrylate exposed individuals, $p < .05$.

TABLE VI

REPORTED FREQUENCIES OF SYMPTOM CATEGORIES, BY EXPOSURE
KP Industries
Delphos, Ohio
HETA 84-011
January 26, 1984

SYMPTOM CATEGORY	CYANOACRYLATE-EXPOSED (# with symptom/total)	LEAD-EXPOSED (# with symptom/total)	FISHER'S EXACT TEST p value
Gastrointestinal	6/16	0/5	0.15
Neurological	8/16	2/5	0.36
Mucosal Irritation	15/16	4/5	0.38
Dermatologic	1/16	3/5	0.03 ##
Respiratory	6/16	1/5	0.34
Muscular	4/16	3/5	0.16
Constitutional	11/16	0/5	0.01 *

* Those people with cyanoacrylate exposure had a higher incidence of this symptom than lead exposed individuals, $p < .05$.

Those people with lead exposure had a higher incidence of this symptom than cyanoacrylate exposed individuals, $p < .05$.

TABLE VII

INDIVIDUAL LEAD LEVELS
KP Industries
Delphos, Ohio
HETA 84-011
January 26, 1984

I.D.#	BLOOD LEAD (PbB) (ug/100 g)	FREE ERYTHROCYTE PROTOPORPHYRIN (FEP) (ug/dL)	ZINC PROTOPORPHYRIN (ZPP)
001	6	23	06
002	6	23	12
003	8	19	10
004	3	23	12
005	6	36	23

TABLE VIII

COMPARISON OF SELECTED DEMOGRAPHIC FACTORS, BY EXPOSURE CATEGORY
(MEAN VALUE WITH STANDARD DEVIATION)
KP Industries
Delphos, Ohio
HETA 84-011
January 26, 1984

	CYANOACRYLATE EXPOSED, n=16	LEAD EXPOSED, n=5
AGE	40.5 ± 13.3	35.6 ± 7.1
TENURE	11.6 ± 7.5	12.4 ± 6.8
GENDER (# of WOMEN)	12	4

No statistically significant differences were found in any of the above comparisons, $p > .05$.

TABLE IX

CURRENT SMOKING STATUS VERSUS SELECTED SYMPTOM CATEGORIES
KP Industries
Delphos, Ohio
HETA 84-011
January 26, 1984

	CURRENT SMOKERS (n=6)	NON-SMOKERS (n=15)	FISHER'S EXACT TEST p value
RESPIRATORY SYMPTOMS * (n=7)	5 (83%)	2 (13%)	.01
MUCOSAL IRRITATION (n=19)	5 (83%)	14 (93%)	.43

* Those people who currently smoked cigarettes had a higher incidence of respiratory symptoms than did non-smokers, p = .01.

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