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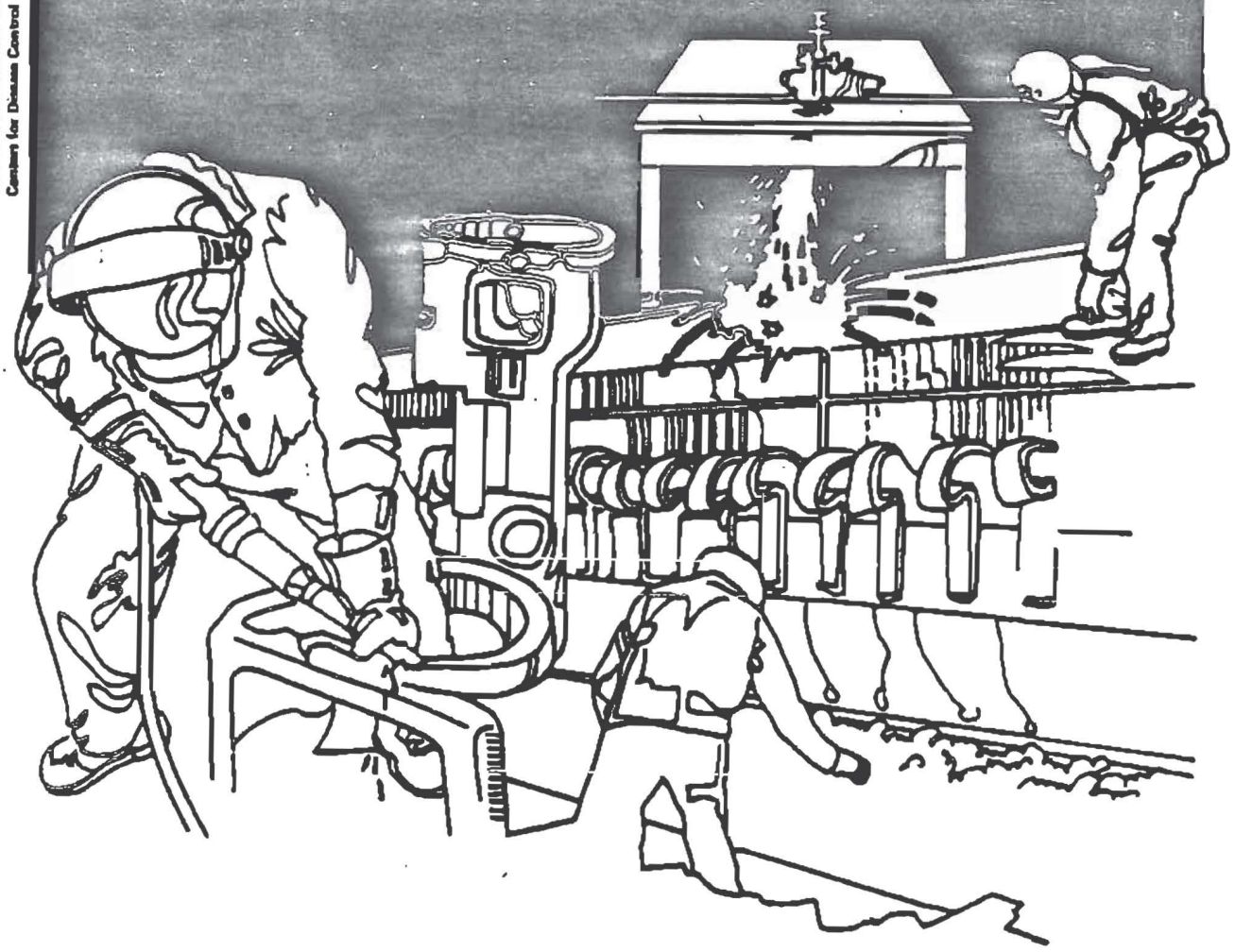

Health Hazard Evaluation Report

HETA 85-165-1605
ST. LOUIS POLICE AUTO BODY SHOP
ST. LOUIS, MISSOURI

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 85-165-1605
July, 1985
St. Louis Police Auto Body Shop
St. Louis, Missouri

NIOSH INVESTIGATOR:
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I. SUMMARY

In January 1985, the National Institute for Occupational Safety and Health (NIOSH) was requested to evaluate working conditions and provide recommendations to reduce occupational exposures at the St. Louis Police Auto Body Shop. The site had been visited by the City of St. Louis Health Department, and they indicated that a health hazard may exist. Because of employee complaints, the Police Department was interested in developing information to deal with some of the exposure problems.

An initial site visit was conducted on January 23, 1985. On February 21 and 22, 1985, NIOSH conducted an environmental survey of the Auto Body Shop. Area and personal samples were taken for toluene, lead and total dust. Toluene area samples ranged from none detected to 4.3 mg/m^3, well below the ACGIH and NIOSH recommended level of 375 mg/m^3. Three personal total dust samples were analyzed for lead after being weighed; and all were non-detectable, at a level of less than 3.0 ugm/sample. Total dust area samples ranged from none detected to 2.9 mg/m^3, and total dust personal samples ranged from .44 to 13. mg/m^3. One personal sample exceeded the ACGIH TLV for total dust of 10 mg/m^3. However, all workers have the potential for a similar exposure if they are performing the same tasks as the over-exposed worker.

Based on the information gathered during this investigation, it is concluded that conditions in the Auto Body Shop are such that a potential health hazard exists due to over-exposure to total dust while performing certain repair tasks. Recommendations to remediate these working conditions are included in the report.

KEYWORDS: SIC 7531 (Automotive Repair Shops/Top and Body Repair Shops), toluene, lead, total dusts, respiratory protection, ventilation

II. INTRODUCTION

On January 24, 1985, the National Institute for Occupational Safety and Health (NIOSH) received a letter from the Health Commissioner, City of St. Louis, requesting assistance in evaluating working conditions at the St. Louis City Police Auto Body Shop. A preliminary investigation had been made of the shop by health department staff, and they indicated that there may be health hazards in the shop area. Therefore, the request for technical assistance was initiated. Preliminary discussions also revealed that the employees had been complaining about the conditions for some time and that the Police Department needed guidance on what corrective actions were necessary.

On January 23, 1985, the NIOSH investigator conducted an initial site visit to the facility to gather information and discuss the scope of the problem with employees of the Police Department. The formal request actually came after this initial site visit. On February 21 and 22, 1985, the NIOSH investigator returned to the facility to conduct a health hazard evaluation and to gather additional information so that definitive recommendations could be developed.

III. BACKGROUND

The Auto Body Repair Shop for the St. Louis City Police Department is located within the Police Garage Complex at 3929 Laclede, St. Louis, Missouri 63103. It is located on the northwest corner of the complex and is approximately 50 by 120 ft., as shown in Figure 1. The west (120 ft.) and north (50 ft.) walls are outside walls, and the area is accessed through another part of the overall structure from Laclede Street. The roof is supported by wooden trusses and the clear ceiling height is approximately 15 ft., with an additional six-foot height between each of the trusses. Within the space, there is a 9 X 12 ft. office, an 11 X 12 ft. storage area and a 14 X 30 ft. spray booth. The floor area is divided into six work areas that are defined by painted lines on the floor. Four of the 20 X 30 ft. work areas are located along the west wall and two are along the east wall. A spray booth is located in the northeast corner of the shop and was not being used during the initial site visit but was cleaned up and being used as a paint storage area during the follow-up survey.

The space is heated by overhead gas heaters located along the east wall directly below the ceiling trusses. Five propeller-type exhaust fans are located along the west and north walls. These fans are operated by individual controls and are run the year round during working hours. There is no conditioned make-up air provided to the space. Most of the make-up air comes

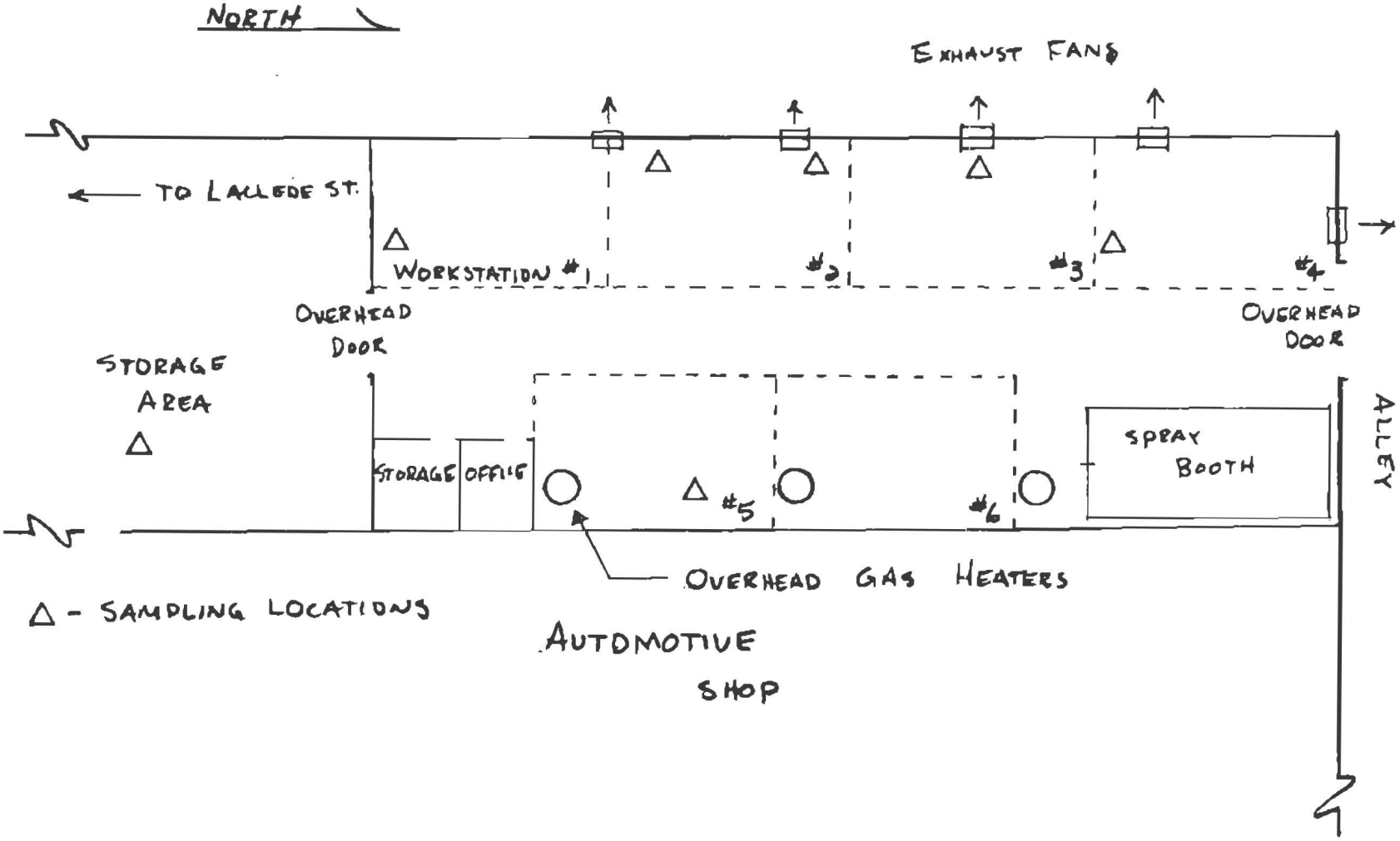

Figure 1 FLOOR PLAN AUTOBODY REPAIR

in through the overhead door from the storage area. The remaining comes through various cracks in the rather old structure.

Both people and vehicles enter the space through a ten ft. wide overhead door from an adjacent space used for parking and tire storage. Five people work in the body shop, including the foreman. However, during the time of the survey, only three workers and the foreman were present.

IV. PROCESS DESCRIPTION

Damaged vehicles are brought into the shop from a parking lot across the street and placed in various work stations throughout the shop. The principal activities at this facility center around the repair of wrecked police vehicles. Damaged parts are removed with various tools, including, where appropriate, oxyacetylene cutting torches. Damaged parts are then replaced or hammered into shape, using a variety of hand and air driven tools, before preparing the surface for filling or painting. The shaping and sanding of the body filler continues until the desired contour is obtained, and then a primer coat is applied using standard spray guns. Spot putty is applied to small imperfections over the primer coat, and a final sanding prepares the surface for the finish coat. Several layers of the finish coat may be applied so that the old and new colors blend. The color blending process continues after the paint dries, using polishing compound and a buffer.

Any or all of these operations take place at the individual workstations. Bulk paints, solvents and other chemicals are stored in the spray booth. Paints are thinned and mixed in the booth and placed in the spray guns and carried to the various work stations. Other materials are also mixed in the spray booth and carried to the job site.

V. METHODS

Area environmental samples were collected throughout the shop in the locations shown in Figure 1. One set of samples was also collected from the adjacent storage area for background comparison purposes. A wide variety of chemicals and materials are used in these operations. However, the most common contaminant is dust from the sanding and painting procedures. Some solvent odor was present but very limited. Based on this information and observations during the initial site visit, it was decided that total dust would be the best indicator of the workers exposure. Charcoal tube area samples were also collected and analyzed for toluene to obtain some indication of the presence of solvents.

Personal samples were collected for total dust determinations from all workers. Morning and afternoon samples were collected for the area and personal samples to prevent overloading during sanding operations.

The charcoal tube samples were analyzed in accordance with NIOSH Method 1501 (3rd Edition). Three total dust filters were ashed and analyzed for lead (Pb), using NIOSH Methods 7082 and 7300. This was done because one of the workers thought that the paint he was using contained lead. The other filters were weighed for total dust collected.

Work practices were observed during the shift to ascertain their influence on exposure and to aid in developing meaningful recommendations. A CFM flow hood was used to measure air flow through the exhaust fans under various room conditions. Smoke tubes were also used to try and evaluate flow patterns within the room.

VI. EVALUATION 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. 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 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.

Toluene[1] can affect the body if it is inhaled, if it comes in contact with the eyes or skin, or if it is swallowed. Toluene may cause irritation of the eyes, respiratory tract, and skin. Toluene may also cause fatigue, weakness, confusion, headache, dizziness, and drowsiness. Peculiar skin sensations may be produced, such as "pins and needles feeling" or numbness. The liquid splashed in the eye may cause irritation and temporary damage. Inhalation may also cause difficulty in seeing in bright light. Repeated or prolonged exposure to liquid toluene may cause drying and cracking of the skin. The NIOSH[2] and ACGIH[3] recommended guideline TWA for toluene is 375 mg/m^3, and the OSHA[4] personal exposure limit (PEL) is 750 mg/m^3.

Exposure to inorganic lead usually occurs via inhalation or ingestion. These exposures may result in physical abnormalities that may be characterized by anemia, headache, anorexia, weakness and occasional weight loss. More serious reactions as a result of long-time exposure include peripheral neuritis, colic that can stimulate acute appendicitis and bone marrow changes. The TLV recommended by ACGIH is 0.15 mg/m^3, while the OSHA PEL and the NIOSH recommended criteria is 0.05 mg/m^3.

Total dust exposures in a body shop is a very complex mixture without any specific toxicity. Street dust can be brought into the shop on the vehicles in need of repair. Removal and shaping of damaged parts may cause the dust to become dislodged and airborne. Various fillers are used, including a fiberglass resin, and more often an auto body filler. When these materials harden and are shaped and sanded, large quantities of the dust become airborne. Some individuals become sensitized to these particular materials, but they generally select themselves out of

these types of jobs. Overspray from painting further complicates the exposure of workers in an auto body shop. Therefore, for exposures to these types of materials, the total dust exposure criteria is the most appropriate. The American Conference of Governmental Industrial Hygienists' (ACGIH) recommended TLV of 10 mg/m^3 of total dust will be used as the most critical evaluation criteria, although a level of 15 mg/m^3 is used by OSHA.

VII. RESULTS

The area air sample results for toluene are shown in Table I. The levels ranged from none detected to 16. mg/m^3. None of these concentrations approached the recommended TLV of 375 mg/m^3. However, it should be noted that there was no toluene detected in the adjacent storage area, which indicates that some toluene is present in the materials and paints being used in the body shop.

The area sample results for total dust are shown in Table II. The levels range from none detected to 2.9 mg/m^3. None of these concentrations approach the total dust TLV of 10 mg/m^3 of total dust. The variability in the data are indicative of the type of work going on during the sampling period. The higher numbers and location of samples coincide with the sanding of body filler material.

The personal total dust concentrations are shown in Table III. The levels range from .44 to 13. mg/m^3. One of these levels exceeded the nuisance particulate ACGIH TLV of 10 mg/m^3 of total dust. This occurred during the a.m. work cycle when a large area of hardened body filler was being sanded. Another technician was doing a similar operation in an adjacent work station, and his level was 5.7 mg/m^3. In contrast, the third technician was only removing body parts during the same period, and his level was .96 mg/m^3.

Three of the total dust samples were analyzed for total lead. No lead was detected in these samples at a limit of detection of three micrograms per sample.

Ventilation measurements were taken using a CFM flow hood that was fitted over the 3' by 3' propeller exhaust fans. The measurements obtained were as follows:

EXHAUST VOLUMES (cfm)

	Overhead Door to Adjacent Space	
	OPEN	CLOSED
Fan #1	1900	1400
#2	1900	1400
#3	1900	1400
#4	1700	1100
#5	1800	1100
Total	9200 cfm	6400 cfm

The exhaust air volume was measured under two conditions to evaluate their effect on the flow rate. The data show a 30% reduction in exhaust flow when the overhead door was closed.

VIII. DISCUSSIONS AND CONCLUSIONS

The results from this investigation indicate that certain sanding operations involved with the repair of damaged automobiles results in worker exposures that exceed recommended guidelines. A variety of factors contribute to these exposures. These factors include the physical facility, the nature of the work and the work practices. The ventilation system for the facility is inadequate. Since no make-up air is provided within the shop, air coming into the space is uncontrolled. Under certain conditions, contamination from adjacent spaces could be drawn into the space and might cause more problems than the contaminants within the space. Also, because most of the make-up air is coming in through the overhead door between the building spaces, there is a potential for air exchange between work stations because of exhaust fan location. The overhead heaters further exacerbate the problem by blowing air and continuously stirring up the dust.

Since the survey was conducted during the winter months, it is difficult to predict what may be happening in the summer. However, with the overhead door open to the outside, the problem of dust and vapor control would be improved, although the temperature factor may make the situation even worse.

IX. RECOMMENDATIONS

The control of worker exposures in an auto body shop requires the implementation of several procedures. Ideally, it would be best to control the dust at its source. However, because of the

nature and unpredictability of the work, this is not feasible for this type of structure. Therefore, it is necessary to use a number of control techniques, including dilution ventilation, work practices, personal protective equipment and good housekeeping.

In order to minimize worker exposures to the variety of vapors and dusts in the space, the following is recommended:

1. A supply air ventilation system should be installed to provide make-up air for the existing exhaust fans. This system should be capable of providing 10,000 cubic feet per minute (cfm) of air to the space at the St. Louis design winter temperature. The supply diffusers for this system should be spaced evenly along the east wall and discharge toward the exhaust fans at a height of 8-10 ft.

2. Vehicles brought into the shop for repair should be oriented so that the technicians are always working upstream of the airflow created by the new supply air system. The shop supervisor should participate and enforce these decisions.

3. Proper respiratory protection should be provided for the workers when it is not possible to control dust emissions because of the nature of the work. The respirator must be used only as a part of a total respirator program that is in compliance with OSHA General Industry Standard 29 CFR 1910.134, which includes the following general provisions:

   A. Written instructions for use of equipment

   B. Training on the selection of appropriate respiratory protection and their limitations

   C. Quantitative and qualitative fit testing

   D. Proper donning and doffing techniques

   E. Proper cleaning and maintenance of devices

4. Periodic housekeeping should be performed, using vacuum cleaners or wet sweeping techniques.

5. The paints and chemicals placed in the spray booth should be relocated to a space or cabinet that is ventilated continually. The spray booth should then be used whenever possible during major painting operations to reduce overspray.

X. REFERENCES

1. NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards, Toluene. NIOSH Publication 81-123, January 1981.

2. Ibid.

3. Threshold Limit Values for 1984-85, American Conference of Governmental Industrial Hygienists, ISBN: 0-936712-54-6.

4. General Industry, Occupational Safety and Health Standards (29 CFR 1910), OSHA 2206, March 1, 1983.

XI. AUTHORSHIP AND ACKNOWLEDGEMENTS

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XII. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this 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 the NIOSH Publications Office at the above address.

Copies of this report have been sent to:

A. St. Louis Police Department

B. Employee Union

C. Health Commissioner, City of St. Louis

D. NIOSH, Region VII

E. U.S. Department of Labor/OSHA, Region VII

F. Missouri Division of Health

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TABLE I

AREA TOLUENE AIR CONCENTRATIONS

St. Louis Police Auto Body Shop
HETA 85-165
June 1985

Sample #	Sample Location	Sampling Period	Vol. m3	Lab Result mg	Concentration mg/m3	ppm
1	Top of Workbench Work Station #2	0737-1138	.029	0.48	16.	4.3
6	Top of Workbench Work Station #2	1140-1515	.025	0.12	4.8	1.3
2	Top of Workbench Work Station #5	0740-1146	.031	0.18	5.8	1.5
8	Top of Workbench Work Station #5	1148-1515	.026	0.05	1.9	0.5
3	Tire Storage Rack Adjacent Storage Area	0743-1134	.027	<0.01	--	
5	Tire Storage Rack Adjacent Storage Area	1138-1515	.025	<0.01	--	
4	Top of Workbench Work Station #3	0747-1143	.029	0.28	9.7	2.3
7	Top of Workbench Work Station #3	1145-1515	.026	0.22	8.5	2.3

TABLE II

Area Total Dust Concentrations

St. Louis Police Auto Body Shop
HETA 85-165
June 1985

Sample #	Sample Location	Sampling Period	Vol. m3	Lab Result mg	Concentration mg/m3
A_1 3487	Workbench Top Work Station #2	0723-1126	.49	1.14	2.3
A_2 3939	Workbench Top Work Station #2	1127-1512	.45	0.15	.33
D_1 3502	Tire Rack Adjacent Space	0718-1130	.47	0.00	0
D_2 3934	Tire Rack Adjacent Space	1130-1500	.50	0.03	.06
F_1 3492	Workbench Top Work Station #5	0717-1129	.48	0.40	.83
F_2 3933	Workbench Top Work Station #5	1130-1459	.40	0.06	.15
H_1 3490	Workbench Top Work Station #1	0638-1132	.59	0.09	.15
H_2 3925	Workbench Top Work Station #1	1133-1502	.42	0.26	.62
I_1 3928	Workbench Top Work Station #4	0651-1127	.54	0.69	1.3
I_2 3938	Workbench Top Work Station #4	1127-1511	.44	1.28	2.9
J_1 3927	Storage Cabinet Top Work Station #6	0655-1128	.53	0.34	.64
J_2 3937	Storage Cabinet Top Work Station #6	1129-1503	.42	0.08	.19

TABLE III

Personal Total Dust Concentrations

St. Louis Police Auto Body Shop
HETA 85-165
June 1985

Sample #	Sample Location	Sampling Period	Vol. m3	Lab Result mg	Concentration mg/m3
B_1 3493	Body Technician X Work Station #4	0708-1122	.48	0.46	.96
B_2* 3940	Body Technician X Work Station #4	1206-1506	.34	0.25	.74
C_1* 3488	Body Technician Y Work Station #2	0710-1122	.49	2.78	5.7
C_2 3931	Body Technician Y Work Station #2	1205-1506	.35	0.29	.83
E_1* 3491	Body Technician Z Work Station #3	0712-1124	.63	8.12	13.
E_2 3936	Body Technician Z Work Station #3	1212-1506	.44	0.99	2.3
G_1 3489	Supervisor Covers all areas	0715-1122	.49	0.35	.71
G_2 3935	Supervisor Covers all areas	1207-1506	.36	0.16	.44

*These filters were also analyzed for total lead. Sample E_1 contained an excess of total dust on filter and some was lost on the cassette.

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