This Health Hazard Evaluation (HHE) report and any recommendations made herein are for the specific facility evaluated and may not be universally applicable. Any recommendations made are not to be considered as final statements of NIOSH policy or of any agency or individual involved. Additional HHE reports are available at http://www.cdc.gov/niosh/hhe/

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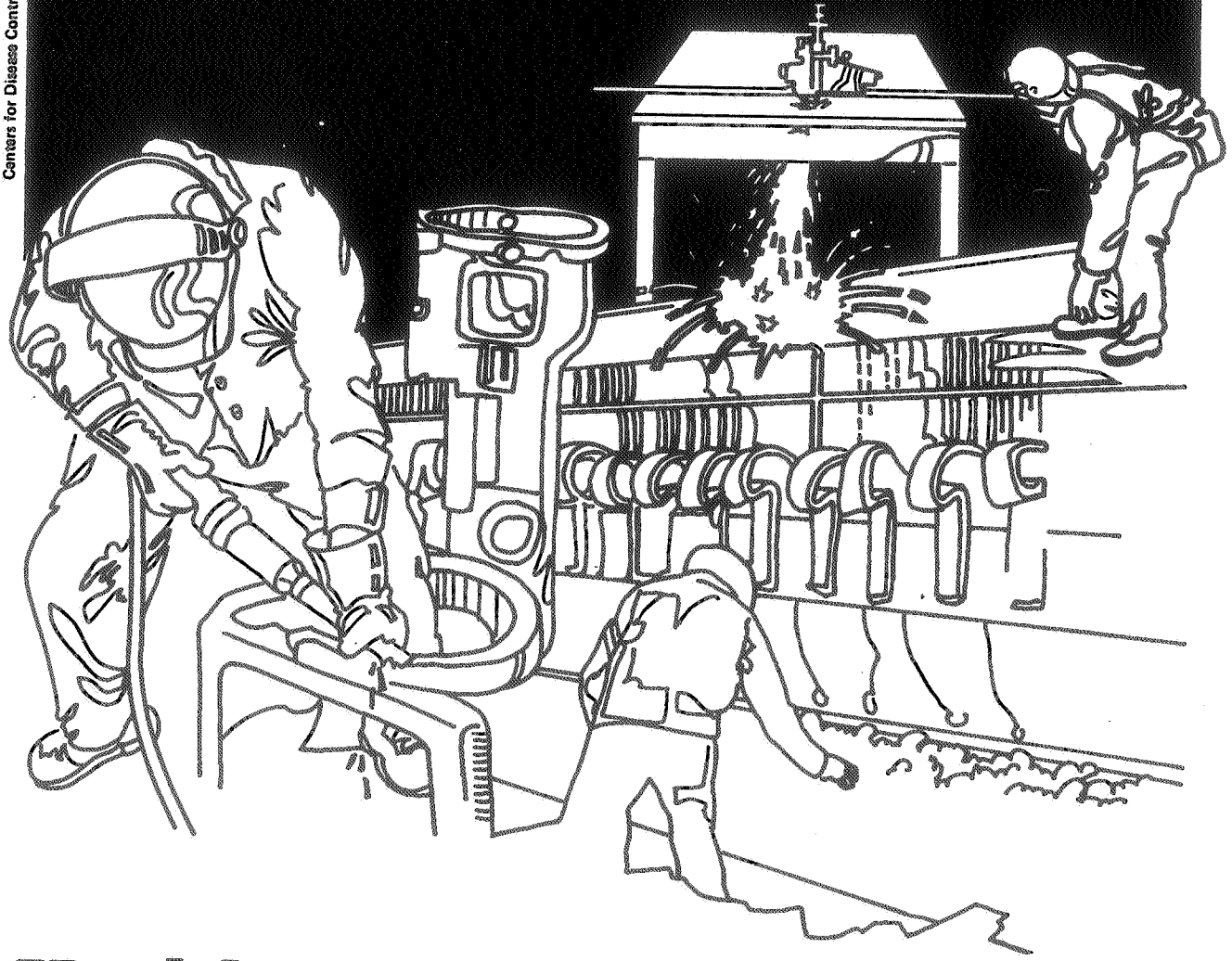

Health Hazard Evaluation Report

HETA 82-110, 172-1288
KALAMAZOO STAMPING
AND DIE COMPANY
KALAMAZOO, MICHIGAN

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 82-110, 172-1288
APRIL 1983
KALAMAZOO STAMPING AND DIE COMPANY
KALAMAZOO, MICHIGAN

NIOSH INVESTIGATORS:
William J. Daniels
Kern E. Anderson

I. SUMMARY

On January 25, 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate occupational exposures at Plant Number 1 of the Kalamazoo Stamping & Die Company, Kalamazoo, Michigan. NIOSH received an additional request on March 22, 1982, for an evaluation at Plant Number 3 of the same firm. The requestor was concerned with exposures to petroleum oils, welding fumes, and airborne dust in the production areas.

In March 1982, NIOSH investigators conducted an initial survey, followed by additional environmental surveys in May and July, 1982. During these surveys, personal breathing zone and area air samples were collected for measurement of exposures to oil mist, welding fumes, total particulate, and trichloroethylene (TCE). In addition, confidential medical questionnaires were administered to the employees in both plants.

Of the personal breathing zone air samples collected in Plant No. 1, time weighted average (TWA) concentrations of oil mist among stamping machine operators were 0.09 and 0.12 milligrams per cubic meter of air (mg/M^3) (the OSHA standard is 5 mg/M^3), concentrations of total airborne particulate among workers in the assembly area were 0.01 and 0.03 mg/M^3 (ACGIH TLV 10 mg/M^3), and concentrations of total welding fumes among welders were 0.15 and 2.7 mg/M^3 (ACGIH TLV 5 mg/M^3). Of the personal breathing zone air samples collected in Plant No. 3, concentrations of total welding particulate ranged from 0.48 to 0.64 mg/M^3, with a mean of 0.57 mg/M^3 (ACGIH TLV 5 mg/M^3), and concentrations of iron oxide ranged from 0.08 to 0.15, with a mean of 0.10 mg/M^3 (ACGIH TLV 5 mg/M^3). Concentrations of all contaminants in the personal breathing zone samples were below the recommended evaluation criteria used in this report.

Concentrations of TCE were below the limit of detection in 2 short term personal breathing zone air samples, and concentrations in 3 long term samples ranged from below the limit of detection to 1.1 ppm. Through infrequent operation of the process (< once per month) and the use of engineering controls and personal protective equipment, efforts are made to limit TCE exposure as much as possible. (NIOSH recommendation - lowest level feasible; OSHA TWA 100 ppm).

No major health problems were reported during the employee interviews; however, instances of occasional mucous membrane and skin irritation were reported by some employees related to the various production operations.

On the basis of the data obtained in this investigation, NIOSH has determined that no health hazard from exposures to oil mist, welding fumes, trichloroethylene, or total airborne particulate existed at the time of this survey. Recommendations related to this evaluation are included in the full body of the report.

Key Words: SIC 3714, welding, iron oxide, nuisance dust, oil mist, trichloroethylene.

II. INTRODUCTION

On January 25, 1982, a representative of the United Auto Workers, Local 740, requested a NIOSH health hazard evaluation at Plant Number 1 of the Kalamazoo Stamping & Die Company, Kalamazoo, Michigan. NIOSH received an additional request on March 22, 1982, for an evaluation of Plant Number 3 of the Kalamazoo Stamping & Die Company. The requestor was concerned with employee exposures to petroleum oils, welding fumes, and airborne dust in the production areas of these facilities.

On March 9, 1982, NIOSH investigators conducted an initial survey of Plant No. 1. This included an opening conference with representatives of management and the local union, followed by a walk-through inspection of the area of concern. On May 4, 1982, an environmental survey was conducted at Plant No. 1, and a combined initial/environmental survey was conducted at Plant No. 3. During these surveys, personal and area air samples were collected and confidential medical questionnaires were administered to the employees. On July 15, 1982, a follow-up environmental survey was conducted at Plant No. 1. Notification of the results of the initial survey were transmitted by letter to the union and management on March 16 and June 3, 1982. Initial results of the environmental survey were discussed with union and management representatives during a meeting on July 15, 1982.

III. BACKGROUND

The Kalamazoo Stamping & Die Company produces commercial metal stampings for the auto industry. At the time of the survey, covers for automobile transmissions and catalytic converters constituted the major production items. Plant No. 1 has been in operation since 1937 and employs approximately 35 production workers over two work shifts, while Plant No. 3 has been in operation since 1978 and employs approximately 18 production workers over 1 shift. Welding, metal stamping, and assembly operations comprise a major portion of the production activity at both of the plants.

There are 2 spot welding stations in Plant No. 1, with 4 spot welding machines at each station. On a normal workday, only one station is operated. Each welding station is equipped with local exhaust ventilation. The only other welding activity conducted in this plant is occasional maintenance welding in the machine shop area.

Plant No. 1 houses six automatic punch presses for metal stamping operations; however, not all machines are used during a normal production day. There are two major petroleum oils used for lubrication at these machines; Tuf-Draw 2806M-100™ and Tuf-Draw 2806M™. These fluids are either automatically sprayed on the parts, or at some machines, manually applied with rollers. Two other lubricants are used infrequently, Gil-Lube 1863™ (an emulsion containing tallow and soaps), and Ferrocote 5684-N-5-D™ (a combination of mineral oils and petroleum sulfonates), both of which are manually applied with rollers.

Degreasing of metal parts is conducted less than one day per month. This operation utilizes a vapor degreasing tank containing trichloroethylene. The tank is equipped with a slot exhaust ventilation system around the perimeter of the tank. Three employees conduct degreasing operations; one employee, located approximately 5 feet from the degreaser, loads the parts onto the conveyor for transport through the degreaser, a second employee lubricates the parts using a hand roller, and a third employee stacks the parts for removal from the area. An overhead fan is located directly behind the employees to direct any vapors escaping from the tank away from them. (Smoke tube testing revealed that this did not appear to impede the efficiency of the local exhaust system.) The use of neoprene protective gloves with cotton liners is required for all employees at this operation. In addition, the employees are trained to deal with any trichloroethylene spills which might occur. Use of a nearby spot welding station is prohibited during degreasing operations.

Operations at Plant No. 3 are similar to those at Plant No. 1, with the exception of the use of a number of wire arc welders coupled with assembly tables. All of the welding machines, with the exception of two spot welders, are equipped with local exhaust ventilation attached to a central duct system which is exhausted on the roof of the building.

All employees at both plants are required to wear safety glasses and hearing protection, and a hearing conservation program is in place. Welding helmets and aprons are provided as necessary. Cotton and neoprene gloves, and NIOSH approved dust, fume, and mist respirators are available to all employees, although their use is not mandatory. Employees are rotated among the various machines within each plant on a hourly, daily, or weekly basis.

IV. MATERIALS AND METHODS

A. Environmental

Following the initial survey, records of previous inspections conducted by the Michigan Occupational Safety and Health Administration (MIOSHA) were obtained. A review of these data indicated that high concentrations of welding fumes had been detected in Plant No. 3 during an inspection in April 1980 (11.3 mg/M^3 total particulate, and 5.3 mg/M^3 iron oxide). These levels had subsequently been reduced through improvements in local exhaust ventilation as noted during a follow-up inspection in May 1980 (7.4 mg/M^3 total particulate, and 4.98 mg/M^3 iron oxide). No significant concentration of oil mist (less than 1.35 mg/M^3) was detected during these surveys.

In order to assess any changes in the levels of contaminants present in the plants, an environmental survey was conducted by NIOSH investigators on May 4, 1982. Personal samples collected near the breathing zone of the employees, and area air samples were obtained using battery powered sampling pumps operating at 1.5 liters per minute. The pumps were

attached via tygon tubing to the collecting media. The number of samples, collecting media, and analytical method for the various contaminants were as follows:

Two mixed cellulose ester membrane filters analyzed by fluorescence spectroscopy for oil mist (NIOSH Method P&CAM 159)[1],

Two pre-weighed polyvinyl chloride (PVC) filters analyzed by gravimetric weighing for total particulate weight,

Four pre-weighed PVC filters, analyzed by gravimetric weighing and atomic absorption spectroscopy for total welding particulate and iron oxide (NIOSH Method P&CAM 173)[1].

Since spot welding and vapor degreasing in Plant No. 1 were not conducted during the initial environmental survey, a follow-up survey was conducted on July 15, 1982. This survey included the collection of personal breathing zone air samples in the manner previously stated. The number of samples, collecting media, and analytical method for the various contaminants were as follows:

Two pre-weighed PVC filters analyzed by gravimetric weighing and atomic absorption spectroscopy for total welding particulate and iron oxide (NIOSH Method P&CAM 173)[1],

Five charcoal tubes analyzed by gas chromatography for trichloroethylene (NIOSH Method S-336)[2].

The location and duration of sample collection is provided in Tables 1, 2, and 3.

B. Medical

During the NIOSH survey visit of May 4, 1982, medical questionnaires were confidentially administered to 22 production employees in Plant No. 1, and 8 production employees in Plant No. 3. The questionnaires solicited information regarding the workers' employment, medical histories, and the presence of any work related health problems. In addition, the employees were questioned on the frequency of their experience with a list of symptoms related to skin, eye, and mucous membrane irritation.

V. 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).[3]

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.[4] Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based solely on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet only those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure 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.

A. Nuisance Particulates

In contrast to fibrogenic dusts which cause scar tissue to be formed in the lungs when inhaled in excessive amounts, so-called "nuisance" dusts are stated to have little adverse effect on lungs and do not produce significant organic disease or toxic effect when exposures are kept under reasonable control. ACGIH recommends a TLV of 10 milligrams per cubic meter of air (mg/M^3) for an 8-hr TWA for total dust[3]. The OSHA standard is 15 mg/M^3 for an 8-hr TWA[4].

B. Total Welding Particulate

A consideration of the constituents of welding fume is of primary importance in assessing worker exposure to toxic agents. The more toxic compounds will have a greater effect in small quantities than will the less noxious compounds. However, since the effects of exposure to many

different compounds at the same time is considered cumulative, total fume concentration is also measured. Conclusions based on total fume concentration are generally adequate in the absence of the identification of the specific toxic constituents.[5] Bronchitis, a disease resulting in a chronic bronchial cough, may develop after long term exposure to welding fumes. Variations in individual susceptibility and exposures may make this apparent in some workers and not others. ACGIH recommends a TLV of 5 mg/M^3 for an 8-hr TWA for total welding particulate.[3] The OSHA standard for total airborne particulate is 15 mg/M^3 for an 8-hr TWA.

C. Iron Oxide

Long term occupational exposure to iron oxide fume or dust may cause a condition known as siderosis, noted by the literature to be a non-progressive, non-disabling lung disease. There is no information in the literature on the combined effects of iron and other industrial dusts on the lungs.[6] ACGIH recommends a TLV of 5 mg/M^3 for an 8-hr TWA for iron oxide fume, measured as iron[3]. The OSHA standard for iron oxide is 10 mg/M^3 for an 8-hr TWA[4].

D. Oil Mist

Metalworking fluids as a whole are among the leading causes of industrial dermatitis, causing both follicular inflammation and irritative or hypersensitivity skin reactions. These reactions may be stimulated by the fluid itself, metal parts or other impurities in dirty oil, or additives, such as biocides, used to prevent fluid decomposition and odor formation[7]. Basic principles of control, personal protection, good housekeeping, and personal hygiene should be implemented when working with these fluids.

There are conflicting reports in the literature concerning the pulmonary effects of the inhalation of mineral oil mist. In high concentrations it appears to cause some pulmonary effects[8]; however, a review published in 1962 of oil mist exposures of all types found a lack of reported cases of illness at concentrations below 15 mg/M^3.[9] The current OSHA standard for oil mist is 5.0 milligrams per cubic meter of air (mg/m^3) for an 8 hour time weighted average (TWA)[4].

E. Trichloroethylene (TCE)

Exposure to TCE may cause irritation of the eyes, nose, and throat. Acute exposures may also cause depression of the central nervous system; exhibiting such symptoms as headache, dizziness, nausea, and vomiting. Alcohol may increase the intensity of overexposure to TCE. The current OSHA standard is 100 ppm as 8-hr TWA with a ceiling level of 200 ppm with a maximum peak of 300 ppm allowed for 5 minutes duration in any two hour period.[4]

Preliminary evaluation of the carcinogenic activity of TCE by the National Cancer Institute indicates that this material is a potent liver carcinogen in laboratory rodents. NIOSH recommends that it is prudent to handle any suspect carcinogen as though it were a human carcinogen and that all exposures be limited as much as possible.[10]

VI. RESULTS

A. Environmental

Of the personal breathing zone air samples collected in Plant No. 1, concentrations of oil mist among stamping machine operators were 0.09 and 0.12 mg/M^3 (OSHA standard 5 mg/M^3), concentrations of total airborne particulate among workers in the general assembly area were 0.01 and 0.03 mg/M^3 (ACGIH TLV 10 mg/M^3), and concentrations of total welding fume were 0.15 and 2.7 mg/M^3 (ACGIH TLV 5 mg/M^3). Of the personal breathing zone air samples collected in Plant No. 3, concentrations of total welding particulate ranged from 0.48 to 0.64 mg/M^3, with a mean of 0.57 mg/M^3 (ACGIH TLV 5 mg/M^3), and concentrations of iron oxide ranged from 0.08 to 0.15, with a mean of 0.10 mg/M^3 (ACGIH TLV 5 mg/M^3). Concentrations of all contaminants in the personal breathing zone samples were below the recommended evaluation criteria. A complete listing of the environmental results is provided in Tables 1 and 2.

Concentrations of TCE in 2 short term personal breathing zone air samples were below the limit of detection (0.01 mg per sample), and in 3 long term samples ranged from below the limit of detection to 1.1 ppm. (NIOSH recommends lowest level feasible, OSHA TWA 100 ppm). The complete results are provided in Table 3.

B. Medical

Analysis of the medical questionnaires revealed no major health problems among the employees; however, some transient symptomatology associated with the production processes were noted. Occasional eye irritation, most commonly associated with welding smoke and flashburns, was reported by 18 employees. Dermatitis and skin irritation, most commonly attributed to contact with the cutting oils, metals, and need for frequent and vigorous scrubbing of the hands, was reported by seven employees. Occasional sore or dry throat was reported by 15 employees, and occasional nasal congestion was reported by 13 employees; these symptoms were often associated with dry air in the work environment. In addition to the information obtained through the questionnaires, the company reported 2 cases of dermatitis among current employees.

VII. DISCUSSION AND CONCLUSIONS

The concentrations of oil mist, total welding particulate, iron oxide, and nuisance particulate, evaluated during this survey, were well below the recommended environmental criteria. No general dust problem was present in the plant as evidenced by the low levels of total airborne particulate, nor were there significant levels of oil mist generated during the metal stamping operations. The levels of total welding particulate and iron oxide measured at the various welding operations indicated that the local exhaust ventilation was effectively controlling the concentrations of welding fumes. These conditions would not be expected to significantly change provided that the ventilation systems are properly maintained.

Although low levels of TCE were detected in two of three long-term, personal breathing zone samples, efforts are made to reduce exposure to the lowest possible level through infrequent operation of the process (< once per month) and the use of engineering controls and personal protective equipment.

The employee questionnaires did indicate some mucous membrane irritation, however, this was noted to occur on an infrequent basis, and generally related to specific instances rather than the on-going conditions in the plants. In order to effectively eliminate these occurrences, it is important that management investigate such complaints immediately and institute any changes necessary. The two reported cases of dermatitis among the employees would not seem high in light of the total number of employees in the workforce; however, continued effort is necessary in order to maintain this incidence rate as low as possible.

VIII. RECOMMENDATIONS

A. Lubricating Fluids

Although the company currently has in place a program for dermatitis prevention and treatment, in order to further emphasize the need for ongoing efforts to effectively control the incidence of dermatitis, the following recommendations are made:

1. Employee Education - Each worker should be made aware, through regular training, of the importance of the following:

   a. Avoiding sustained contact between the lubricating fluids and the skin.
   b. Using protective clothing, gloves, splash guards, and any other devices required for the work operation.
   c. Frequently practicing personal hygiene including regular washing of hands with a non-abrasive soap, laundering of work clothes, and prompt removal of fluid soaked gloves and clothing.
   d. Avoiding contamination of lubricating fluids with any type of waste matter.
   e. Immediately reporting any skin irritation or disorder to the plant medical department.

2. Fluid Maintenance - The company should adhere to the following guidelines for maintaining the lubricating fluid supplies:

   a. Regular inspection of the fluid at the individual machines for contamination, and replacement when necessary.
   b. The toxicity of any fluid or additive should be examined prior to introduction into the plant.

3. Personal Protective Equipment - The appropriate gloves, aprons, and other personal protective equipment should continue to be made easily available to the employees.

4. Medical Program - The company should continue to pursue an aggressive program designed to decrease the incidence of dermatitis, including the following:

   a. Log of cases, noting time, machine, oil used, type of dermatitis, and treatment.
   b. Follow-up by plant personnel to determine the cause of this problem, and recommendations for its correction.
   c. Discussions with the employee involved as to recommendations for the correction of the problem.

B. Welding Operations

In order to alleviate any potential for health hazards associated with the various welding operations, the following recommendations are made:

1. Periodic inspections should be conducted to ensure that local exhaust ventilation at the welding machines is properly operating. In addition, employee complaints of poorly functioning systems should be promptly investigated.

2. In most welding situations, use of portable fans as a means of local ventilation is not recommended. However, for repetitive welding in a fixed position (e.g., at those spot welding machines lacking local exhaust ventilation, and during occasional maintenance welding when highly toxic substances are not encountered) the use of a cross draft air flow at 90° to the welder would be beneficial (controlled at less than 100 fpm in order to maintain weld integrity).[11] For those maintenance welding operations conducted for longer periods of time or where alloy or coated metals are encountered, the proper respiratory protection should be worn.

3. The company should continue to make the appropriate personal protective equipment readily available to the employees. Use of protective sleeves, aprons, and safety glasses during welding will help prevent burns. Use of welding helmets during arc welding should be strictly enforced to prevent eye injury/burns resulting from exposure to ultraviolet radiation.

IX. REFERENCES

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X. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Prepared By:	William J. Daniels Industrial Hygienist NIOSH - Region V Chicago, Illinois
	Kern E. Anderson Public Health Advisor NIOSH Lansing, Michigan
Environmental Assistance:	Daniel Almaguer Industrial Hygienist NIOSH - Region V Chicago, Illinois
Originating Office:	Division of Surveillance, Hazard Evaluations, & Field Studies, Hazard Evaluation and Techinical Assistance Branch Cincinnati, Ohio
Laboratory Support:	Utah Biomedical Test Laboratory Salt Lake City, Utah

XI. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Services (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 the following:

1. United Auto Workers, Local 740
2. Kalamazoo Stamping and Die Company
3. U.S. Department of Labor, OSHA - Region V
4. NIOSH Regional Offices/Divisions

For the purposes of informing the affected employees, copies of the report should be posted in a prominent place accessible to the employees, for a period of 30 calendar days.

TABLE 1
RESULTS OF ENVIRONMENTAL SAMPLES COLLECTED FOR OIL MIST AND NUISANCE DUST
(May 4, 1982)

Sample Type/ Location	Sample Volume (Liters)	Sample Time (minutes)	Concentration Oil Mist (mg/M3)	Concentration Total Particulate (mg/M3)
Personal/Press 197	507	338	0.12	NA†
Personal/Press 219	498	332	0.09	NA
Area/Fork Lift #1	532	355	NA	0.01
Area/Verticle Mill	528	352	NA	0.13

TABLE 2
RESULTS OF PERSONAL SAMPLES COLLECTED FOR WELDING FUMES
(May 4, and July 15, 1982)

Job Title/ Plant Number	Sample Volume (Liters)	Sample Time (minutes)	Concentration Iron oxide (mg/M3)	Concentration Welding Particulate (mg/M3)
Welder 924/#3	362	241	0.15	0.52
Welder 902/#3	357	238	0.09	0.48
Spot Welder/#3	350	233	0.08	0.63
Spot Welder/#3	328	219	0.08	0.64
Spot Welder/#1	270	180	NA	2.7
Spot Welder/#1	270	180	NA	0.15

TABLE 3
RESULTS OF PERSONAL SAMPLES COLLECTED FOR TRICHLOROETHYLENE
(July 15, 1982)

Job Title	Sample Volume (liters)	Sample Volume (minutes)	Concentration Trichloroethylene
Loader	5.0	287	1.1 ppm
Stacker	5.3	286	0.36 ppm
Oil Applicator	3.3	183 .08	ND*
Loader	2.8	14	ND
Oil Applicator	2.6	13	ND

NA† - Particular analysis not conducted on this sample
ND* - Sample below the limit of detection (0.01 mg per sample for TCE)

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