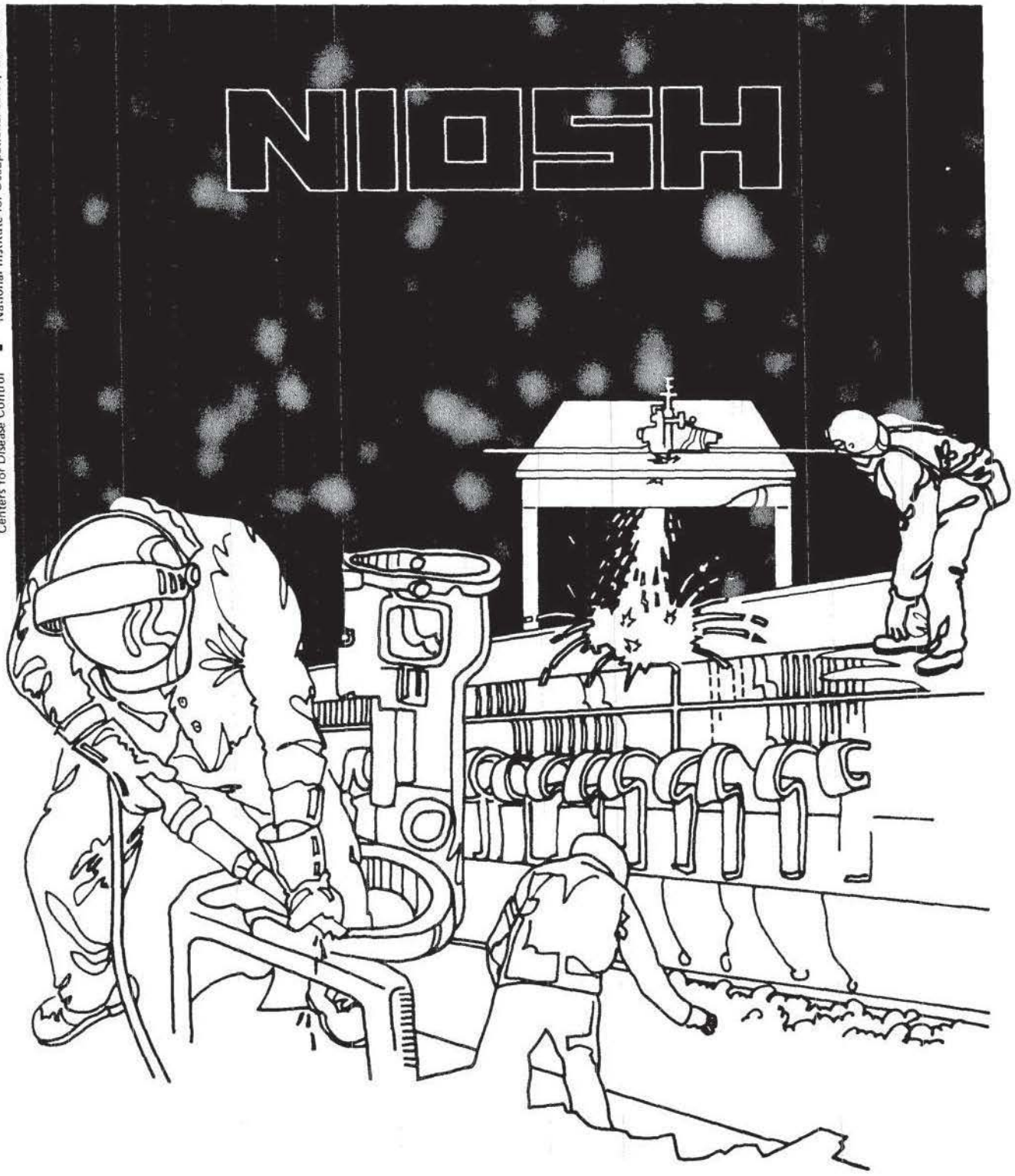
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health



Health Hazard Evaluation Report

HHE 80-094-840
FORD MOTOR COMPANY
SAN JOSE, CALIFORNIA

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.

HE 80-094-840
MARCH 1981
FORD MOTOR COMPANY
SAN JOSE, CALIFORNIA

NIOSH INVESTIGATORS:
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I. SUMMARY

In March 1980 the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation at Ford Motor Company, San Jose, California. The request originated from an employee's concern for potential health effects, both short and long term, to approximately 60 workers from carbon monoxide, sulfur dioxide, nitrogen dioxide, benzene, ozone, dibutyl phthalates, and oil mist. The jobs evaluated were: Truck and Passenger Tow-in Operators, Road Test Operators, Start-Up Operators, Top-Off Operators, and Hood Adjustors. The health concerns mentioned in the request were lung damage, emphysema, petrochemical sensitivities, upper respiratory tract irritation, and heart disease.

To evaluate these problems, NIOSH conducted an industrial hygiene and medical evaluation. Personal and area environmental samples were obtained during May and July 1980. Exhaust and make-up ventilation systems, as well as information collected from personal interviews with the employees, were also evaluated. The medical evaluation consisted of reviewing medical and personnel records and interviews.

NIOSH's environmental evaluation determined that carbon monoxide, sulfur dioxide, and nitrogen dioxide exposure levels exceeded the criteria of 35 ppm, 0.5 ppm, and 1.0 ppm, respectively. None of the other chemicals evaluated produced exposures above the recommended criteria. The carbon monoxide levels ranged from non-detectable to 70 parts per million (ppm); sulfur dioxide ranged from 1.0 to 2.5 ppm; and nitrogen dioxide ranged from 0.5 to 1.0 ppm. These levels were found at the Tow-In and Road Test operations. After the first day's evaluation, exhaust ventilation and make-up air systems were improved and/or designed to reduce the carbon monoxide levels below the NIOSH 35 ppm criteria.

The medical evaluation showed no consistent patterns of cardiovascular or respiratory tract disease among any of the groups evaluated. This was also true for the concern regarding allergic sensitivities of the population in question. However, there does appear to be opportunities for individuals with pre-existing respiratory tract problems to suffer mild irritation effects on any given day.

Based on the data obtained in this investigation, NIOSH determined that a health hazard did exist from carbon monoixde, sulfur dioxide, and nitrogen dioxide to a portion of those employees evaluated during the survey at Ford Motor Company, San Jose, California. The carbon monoxide levels were reduced substantially after engineering controls were improved in the areas of concern. Finally, there does not appear to be any correlation between those medical problems described in the request and those contaminants found in the work environments evaluated. Recommendations are included on page 7-8 of this report to assist in resolving the concerns mentioned.

KEYWORDS: SIC 3710 (Motor Vehicles and Motor Vehicle Equipment), carbon monoxide, sulfur dioxide, nitrogen dioxide, hydrocarbons, ozone, dibutyl phthalate, oil mist and exhaust ventilation.

II. INTRODUCTION

On March 24, 1980, an authorized representative of the employees at Ford Motor Company, San Jose, California submitted a Health Hazard Evaluation request. The request stated that a number of potential health hazards existed to approximately 60 employees working in the final production areas of the passenger car and commercial truck assembly lines. The jobs included the start-up operators, tow-in operators, road test operators, top-off operators, and hood adjustors. Another issue raised in the request was the concern for the suspected excess cases of lung damage, emphysema, chemical sensitivities, respiratory problems, and heart disease in the population in question. An environmental and medical survey was conducted during May and July 1980 to evaluate the concerns stated in the request. After each evaluation recommendations were given during the closing conferences and these are included in this report.

III. BACKGROUND

Ford Motor Company, San Jose, California, is an assembly plant for compact automobiles and light trucks, and has been producing these vehicles since 1955 at this facility. During the NIOSH survey only one work shift was operating at the plant on both assembly lines; however, the work periods for these two groups were somewhat different, i.e., the truck line operated from 6:00 a.m. to 2:30 p.m. and the passenger assembly line ran from 6:30 a.m. to 3:00 p.m. The primary areas and/or jobs evaluated were those at the final phase of the assembly process and these consisted of the tank-fill area, start-up area, tow-in areas, and the road test areas. Both the truck and passenger assembly areas in question had approximately 10-12 employees working in these areas with a total of 20-25 in all. The actual number of workers would vary with production rates. Normally, the truck assembly section would produce about 25 trucks per hour and the car assembly section would produce approximately 56 cars per hour. However, a complicating factor was the decline in automobile sales which resulted in a reduced production rate during the survey period.

The following is a brief description of the operations in question and the potential chemical contaminants produced.

First, the finished vehicle is filled with gasoline which is lead-free gas. Therefore, the only potential contaminants thought to be produced here are hydrocarbons of which benzene is the primary concern. After the vehicle is filled with gas, it is then started and driven to either a waiting area or directly to the next station which is the tow-in area. If the vehicle is driven to the waiting area, the engine is required to be turned off until it can be driven into the tow-in area. Once in the tow-in area, the actual time required to adjust the vehicle's front wheels is from 2-3 minutes. There are two tow-in stations for the passenger section and one tow-in station for the truck section and each of these areas requires the tow-in operator to perform his job in a submerged room, i.e., the vehicle is driven onto surface level ramps while the operator does the adjustment below. Also, during this time another operator adjusts the headlights on the vehicle. The potential contaminants in these areas are those associated with normal vehicle exhaust emissions, e.g., carbon monoxide, sulfur dioxide, nitrogen dioxide, and ozone. Oil mist and phthalates were also mentioned in the request and thought to be potential contaminants in these areas. After the initial walk through oil mist did not appear to be present at either of the assembly lines, and therefore, it was omitted as a potential contaminant from our investigation. Phthalates, however, were considered because of a sweet smell mentioned in the request and the potential for burning plastic was thought to be the source of this concern.

The last stage of this assembly process requires the vehicles to be driven to the road test areas where the wheels of the vehicle are placed on rollers. The engine is then raced at various speeds to determine if the engine, as well as various aspects of the vehicle are functioning properly. The truck area has one road test station and the passenger assembly section has two such areas. Again, the same potential contaminants suspected in the start-up and tow-in areas were also evaluated at the road test stations.

The exhaust and make-up air systems were somewhat the same for the truck and passenger line assembly areas that were evaluated in this study. The gas fill areas used primarily general room ventilation, which for a plant of this size is considerably large. However, the passenger assembly area also uses a vapor recovery system on the gasoline nozzle that is used to fill the cars' tanks while the truck gas fill area does not have such a vapor recovery system. The only reason given for this difference was that California law does not require the truck gas fill area have such a device.

Each of the start-up areas have only general room ventilation systems to circulate the exhaust which comes off the vehicles for the short time that they are running in these areas. The tow-in and road test areas had sufficient general and local exhaust systems in both the truck and passenger departments.

Personal protective devices are only worn by those employees who work in the tow-in pits where the wheels are adjusted and this consists only of ear protection. Ford Motor Company in San Jose did not have a respiratory protection program during our investigation; however, no respirators are required and/or used voluntarily by any of the employees in the areas we evaluated.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

A variety of sampling techniques were used to evaluate the suspected contaminants in the various departments surveyed. Personal and area samples were taken on a portion of the population from each of the departments of concern. The following is a description of the techniques used:

1. Carbon monoxide -- Spot sampling was performed for carbon monoxide via gas detector tubes during the inital survey in each of the areas of concern. Areas that indicated levels greater than 25 parts per million (ppm) on the detector tubes were further evaluated during the follow-up survey periods using a portable direct-reading carbon monoxide analyzer equipped with a recorder. These areas included the tow-in, road test, and start-up sections in both the truck and passenger departments.

2. Dibutyl pthalates -- Samples were taken for dibutyl pthalates in the start-up areas of both the truck and passenger sections. These areas were evaluated using AA filters and high flow pumps which operated at 1.5 liters per minute (lpm). The filter samples were analyzed according the NIOSH Method S-33 with minor modifications.

3. Benzene -- Personal and area samples for benzene were taken at the gasoline tank fill (top-off) areas at the truck and passenger sections using charcoal tubes and low flow pumps. The pumps drew the air through the charcoal tubes at a flow rate of 50 cc per minute. The charcoal samples were analyzed by gas chromatography.

4. Other -- Sulfur dioxide, nitrogen dioxide, and ozone were evaluated using colorimetric gas detection devices. These tubes were also used in the initial carbon monoxide sampling as described above. Each detector tube has an accuracy of ±35 percent at one-half the exposure limit and an accuracy of ±25 percent at one to five times the exposure limit.

B. Medical

The NIOSH medical evaluation included:

1. General dicusssions with company and union representatives;
2. Review of OSHA inspection records;
3. Observation of production processes and work practices;
4. Discussions with the company's physician, and
5. Review of the company's medical records.

Information contained in the Company's medical records included pre-employment history, physical, various test results (audiogram, urinanalysis, and chest x-ray), clinic notes from episodic visits, return to work notes from personal physicians (generally with diagnoses), Doctor's First Report of Work Injury (DFRWI), reports from consultant physicians, and medical reports of worker's compensation claims. Finally, certain monitoring results such as blood leads are also kept and these were briefly reviewed.

V. EVALUATION CRITERIA AND TOXICOLOGY

In this study numerous sources of environmental exposure criteria and existing research data were used to assess the worker's exposure to the suspected chemicals evaluated in the workplace at Ford Motor Company.

The exposure limits to toxic chemicals are derived from existing human and animal data, as well as industrial experience, to which it is believed that nearly all workers may be exposed for an 8-10 hour day, 40-hour work week, over a working lifetime with no adverse effects. However, due to variations in individual susceptibility, a small percentage of workers may experience effects at levels at or below the recommended exposure limit; a smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by development of an occupational illness.

The environmental and medical (toxicological) evaluation criteria used for this investigation are presented in Table 1. Recommended environmental limits and/or general information concerning each substance are listed, i.e., the source of the recommended limits; the present OSHA standard, and a brief description of the primary health effects known to date.

VI. RESULTS AND DISCUSSION

A. Environmental

Employee exposure to suspected airborne concentrations of benzene, dibutyl phthalates, sulfur dioxide, nitrogen dioxide, ozone, and carbon monoxide were evaluated. An evaluation of the general and local ventilation systems were also assessed in the plant during the survey periods. The following are the results and conclusions of NIOSH's evaluation:

1. Benzene

A total of 11 personal samples were collected during the May 1980 and July 1980 investigations. (Refer to Table 2.) These samples were collected for the gas fill and hood adjustors in both the passenger and truck assembly areas. The levels ranged from 0.004 milligrams per cubic meter of air (mg/M^3) to 0.04 mg/M^3 which is less than one-hundredth the present NIOSH standard of 3.2 mg/M^3. Therefore, these results indicate that a health hazard did not exist to the employees who work in these areas.

2. Dibutyl phthalates

A total of nine personal and five area type samples were taken in the passenger and commercial truck areas. (Refer to Table 3.) These samples were collected in the alignment and tow-in stations and all of the results showed non-detectable levels. Also, it was reported to NIOSH during our second investigation by management and union representatives that a burning plastic type smell had been occurring in the past. However, this odor was traced to plastic tags that were placed on the muffler of the new cars and trucks and these were removed once the problem was identified.

3. Sulfur dioxide, Nitrogen dioxide, and Ozone

A total of 36 samples were taken for sulfur dioxide, nitrogen dioxide, and ozone during the two survey periods. (Refer to Tables 4 and 5.) These chemicals were sampled in the tank fill, start-up, tow-in, and road test areas. None of the ozone sample results exceeded the 0.1 ppm criteria. The sulfur dioxide and nitrogen dioxide results ranged from 1.0 - 2.5 ppm and 0.5 - 1.0 ppm respectively. These results indicate that the criteria established for sulfur dioxide (0.5 ppm,) and nitrogen dioxide (1.0 ppm) was exceeded during the survey periods.

4. Carbon monoxide

A total of 35 area type samples were collected at the four separate assembly stations, i.e, Tank Fill, Start-up, Tow-in, and Road Test. (Refer to Tables 4 and 5.) The results received during the May 1980 survey ranged from non-detectable (ND) levels to 70 parts per million (ppm) in the various areas evaluated. Those values exceeding the NIOSH recommended criteria of 35 ppm were found in the Tow-in and Road Test stations in both the Passenger Car and Truck assembly areas. The range of carbon monoxide in these areas was 45-70 ppm. These results indicate that a potential health hazard did exist during these sampling periods. However, on the follow-up evaluation (July 1980) these same areas were again evaluated for carbon monoxide and the levels received during this sampling period were reduced below the recommended criteria, i.e., between 5-30 ppm with an average of 25 ppm in the Tow-In and Road Test areas. This reduction was attributed to a more efficient local exhaust system which was operating at the Road Test stations and the use of large industrial fans which were being used in the Tow-In stations. The local exhaust duct systems being used in the road test areas were operating at a flow rate of 50-100 feet per minute (fpm) and during the first survey it was recommended that these operate at a flow rate of at least 100 fpm. During our second evaluation these exhaust systems were operating at levels of 100 fpm or greater, and therefore, it was felt that this contributed to the reduced levels found during our follow-up survey.

B. Medical

The following are the results and conclusions of the medical investigation performed by NIOSH on those employees who work in the departments and areas in question.

Of the 32 employees whose records were reviewed (13 passenger-car and 19 truck-line workers), none had worked at Ford for less than 5 years. Table 6 shows the distribution of ages and years worked for Ford. The mean age was 42 years and the mean time employed at Ford was 14.75 years. Thus, all were individuals who had worked a substantial time for Ford.

The types of diagnoses obtained from the charts are shown in Table 7. One should note that not all of these injuries or diseases are occupational in origin. All employees had had, at one time or another, some minor musculoskeletal injuries. One-third of the employees had had some type of back injury with three requiring surgical intervention. Other significant traumatic diagnoses included three carpel tunnel syndromes, four fracture or joint injuries, and nine eye injuries (generally minor).

Of the three respiratory diagnoses, two involved acute bronchitis that had resolved. One person had reported sinus headaches. Of the three cardiovascular diagnoses, each was for a different problem: myocardial infarction, hypertension, and aortic stenosis. In the aoritic stenosis case, the individual had had symptoms for four years before a diagnosis was made. Most of the eight gastro-intestinal problems were peptic ulcer disease. The dermatitis cases consisted of both contact allergic and contact irritant types, most of which appeared to be occupational in origin. The syncopal episode from gas fumes was not further explained.

There were thirteen names listed in the NIOSH request as having cardiovascular (8) or pulmonary (5) problems. According to the request, the names of these individuals were gathered from conversations during break time. Medical records for each of these employees were evaluated. One of the men was interviewed on the shop floor at the request of the union representative. All employees whose medical records were evaluated were males. The mean age was 44.6 years and the mean time worked for Ford was 17.5 years. Two of the men were currently working in the areas noted on the request.

Of the men with pulmonary problems, one each reported the following: adult onset asthma, chronic rhinitis, chronic lung disease attributed to multiple accidental exposures to nitrogen dioxide in another facility; two episodes of pneumonia (none during the last eight years); and reversible small airway obstruction diagnosed as consistent with pollution-induced asthma. Of the men with cardiovascular problems, one each reported the following: aortic stenosis, mycocardial infarction with coronary artery bypass surgery and eventual worsening of condition; hypertension with no cause found on hospitalization; and severe diffuse arteriosclerosis with angina pectoris and periodic syncope. Of the three men with no diagnosis referable to the cardiovascular or respiratory systems, one reported a single episode of chest pain associated with fatigue and another reported chest pain relieved by valium therapy for anxiety.

Of the men and women who were working on the truck and passenger-car line, the most common medical problems were various minor traumas. In addition, one-third had some history of back injury with three requiring surgery. There were no consistent patterns of illness involving either the respiratory or cardiovascular systems among these employees. Because these employees work in areas where vehicle motors are run intermittently, some mild symptoms of irritation of the eyes and upper respiratory tract can be anticipated, depending on the state of the ventilation on any particular day. These effects could prove bothersome to individuals with pre-existing conditions. The men with asthma and chronic rhinitis are two such examples.

Of the men listed in the request, only two regularly work in the area. In addition, there is no consistency of diagnoses which suggests the absence of a common etiological factor(s). Three men had severe coronary artery disease; another was severely hypertensive, while another had symptomatic aortic stenosis. Since ischemic heart disease is the number one cause of death among U.S. males, the significance of heart disease among these five men cannot be assessed without conducting a thorough mortality and/or morbidity study of the plant. However, nothing in this investigation would indicate that such a study is necessary or desirable.

VII. RECOMMENDATIONS

In view of NIOSH's environmental and medical study the following recommendations are made to ameliorate potential health hazards and to provide a better work environment for the employees covered by this determination.

A. Environmental

Whenever possible, engineering controls are the preferred method for decreasing potential exposures to toxic substances for the protection of the employees' health. Therefore, based on the evaluation of the present data and the environmental problems discussed in Section VI, the following recommendations should be implemented as soon as possible if they have not been already.

1. Ventilation

a. Local Exhaust Ventilation

The local exhaust systems being used at the commercial truck and passenger assembly lines to collect exhaust emissions from these vehicles should be operating at a minimum of 100 fpm at the source. These local exhaust systems are excellent because they have the ability to move or extend closer to the vehicles' exhaust pipe once the vehicle has been moved into the appropriate position for alignment or road testing. However, when the operator of the vehicle accelerates the engine in the road test areas, emissions from the exhaust pipe blow around the face of these exhaust hoods. This reduces their overall objective, i.e., the capture efficiency of these collection systems is then overridden. Therefore, if accelerating the engines in this manner is essential, a flange should be added to the face of these hoods in order to decrease the entry loss. This will then increase the capture velocity of the hoods. (Refer to Figure 1 for an example of the flanged exhaust ventilation design.)

b. General Room Ventilation

There are numerous general make-up and exhaust air systems in both the truck and passenger areas in question. However, during the first day of our investigation one of the general room make-up air systems was not on and this can easily effect the pollutants in the immediate area, as well as those departments in the surrounding area. Therefore, in order to reduce the emissions in these areas it is recommended that each of the general make-up and exhaust air systems be on continually while vehicles are operative.

c. Gas Vapor Recovery Systems

The use of the gas vapor recovery system in the passenger assembly area is an excellent means of reducing the vapors that come off of this gas filling process. Therefore, it is recommended that a similar system be used at the commercial truck gas fill area in order to reduce the potential exposure to these fumes.

d. Environmental Monitoring

Environmental sampling should be conducted routinely for carbon monoxide, sulfur dioxide, and nitrogen dioxide in those areas where exposures were found. If the exposure levels exceed the appropriate criteria then further engineering controls should be instituted, i.e., more local exhaust ventilation and/or increased exhaust flow rates for existing systems.

B. Medical

There were no consistent patterns of cardiovascular or respiratory tract disease among any of the groups evaluated at the Ford, San Jose Plant. There are opportunities for individuals with pre-existing respiratory tract problems to suffer mild irritation effects, i.e, this would depend on the state of pollutants and/or emissions both inside and outside the plant. Therefore, assuming that the exhaust and make-up air systems are operating effectively there are no medical recommendations to be made regarding the population NIOSH evaluated.

There is, however, two benefits that would accrue from organization of the medical information within each employee's medical file by chronological sequence: (1) easier readability and (2) reduction in lost papers. In addition, each employee's medical information should be contained in one file. Therefore, if Ford wished to review these files for special studies the information would be easier to evaluate in this form.

VIII. REFERENCES

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2. Industrial Toxicology, third edition, Hamilton and Hardy, Publishing Service Group, Inc., 1974.

3. "Threshold Limit Values for Chemical Substances in Workman Air", American Conference of Governmental Industrial Hygienists, (1979).

4. Encyclopedia of Occupational Health and Safety, International Labor Office, McGraw-Hill Book Company, New York.

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X. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. United Auto Workers, Local 460.
2. United Auto Workers International Union.
3. Ford Motor Company, Milipitas, California.
4. U.S. Department of Labor/OSHA - Region IX.
5. NIOSH - Region IX.
6. California Department of Health Services
7. State Designated Agency.

For the purpose of informing affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

To Union and Management:

NIOSH is thankful to the employees and management for their cooperation and assistance with this Health Hazard Evaluation. The information gathered from this study will not only assist in maintaining the health and safety of those persons working in this company, but also other auto industries that we investigate.

TABLE 1

Evaluation Criteria and Toxicology

Ford Motor Company
San Jose, California

Substance	Recommended Environmental Limit[1]	Reference Source	Primary Health Effects	OSHA Standard
Carbon monoxide	35 ppm (C) 200 ppm	NIOSH	Headaches; nausea; weakness; dizziness; confusion; loss of consciousness.	50 ppm
Sulfur dioxide	0.5 ppm	NIOSH	Irritation to eyes, nose, throat; choking; cough.	5 ppm
Nitrogen dioxide	(C) 1 ppm	NIOSH	Cough; mucoid frothy sputum; dyspnea; chest pain; pulmonary edema; eye irritation.	5 ppm
Benzene	1 ppm (C)	NIOSH	Irritation to eyes, nose, respiratory system; giddy; headache; nausea; blood changes, leukemia.	10 ppm
Ozone	0.1 ppm	ACGIH[2]	Irritation to eyes, muscular membrane; pulmonary edema; chronic respiratory disease.	0.1 ppm
Dibutyl phthalates	5.0 mg/M^3	ACGIH	Irritation to nasal passages, upper respiratory; stomach irritation; potential sensitivity.	5.0 mg/M^3

1 All air concentrations are expressed as time-weighted averages (TWA) exposures for up to a 10-hour workday unless designated (C) for ceiling which should not be exceeded.
2 American Conference of Governmental Industrial Hygienists.
ppm = parts of vapor per million parts of contaminated air by volume.
mg/M^3 = approximate milligrams of substance per cubic meter of air.
C = ceiling level which should not be exceeded even instantaneously.

TABLE 2

Breathing Zone Samples for Benzene from Gas Fill Operations
Commercial Truck and Passenger Car Assembly

Ford Motor Company
San Jose, California

Job/Area Description	Sample Number	Sampling Time (Minutes)	Benzene mg/M^3	Type of Sample
May 1980				
Gas Fill - Truck	1	420	0.01	Personal
Gas Fill - Truck	2	420	0.04	Personal
Hood Adjustor - Truck	3	420	0.02	Personal
Gas Fill - Passenger	4	420	0.02	Personal
Gas Fill - Passenger	5	420	0.01	Area
July 1980				
Hood Adjustor - Truck	1	240	0.02	Personal
Gas Fill - Truck	2	240	0.01	Personal
Gas Fill - Passenger	3	240	0.01	Area
Hood Adjustor - Truck	10	240	0.01	Personal
Gas Fill - Truck	11	240	0.004	Area
Gas Fill - Passenger	12	240	0.01	Personal
EVALUATION CRITERIA (NIOSH)			(c) 1.0 ppm (3.2 mg/M^3)	
LABORATORY LIMIT OF DETECTION PER SAMPLE			0.003 mg	

mg = milligrams
mg/M^3 = milligrams of substance per cubic meter of air

TABLE 3

Summary of Air Samples for Dibutyl Phthalates

Ford Motor Company
San Jose, California

Job/Area Description	Sample Number	Sampling Time (Minutes)	Dibutyl Phthalate mg/M3	Type of Sample
July 1980				
Truck Alignment	1	400	ND	BZ
Truck Alignment	2	400	ND	BZ
Truck Tow-In	3	420	ND	BZ
Truck Tow-In	4	420	ND	BZ
Truck Alignment	5	410	ND	Area
Truck Tow-In	6	410	ND	Area
Commercial Alignment	7	410	ND	Area
Commercial Alignment	8	410	ND	Area
Commercial Tow-In	9	350	ND	Area
Commercial Tow-In	10	350	ND	BZ
Commercial Tow-In	11	350	ND	BZ
Commercial Tow-In	12	350	ND	BZ
Commercial Alignment	13	425	ND	BZ
Commercial Alignment	14	425	ND	BZ
EVALUATION CRITERIA (OSHA, NIOSH)			5 mg/M3	
LABORATORY LIMIT OF DETECTION PER SAMPLE			0.01 mg	

mg = milligrams
mg/M3 = milligrams of substance per cubic meter of air
ND = non-detectable
BZ = breathing zone

TABLE 4

Atmospheric Samples at Commercial Truck Assembly for
Nitrogen Dioxide (NO_2), Ozone (O_3), Sulfur Dioxide (SO_2), and Carbon Monoxide (CO)

Ford Motor Company
San Jose, California

Job/Area Description	Sample Number	Time of Sample	NO_2 (ppm)	O_3 (ppm)	SO_2 (ppm)	CO (ppm)	Type of Sample
May 1980							
Tank Fill	1	During Tank Fill	ND	ND	ND	2	BZ
Tank Fill	2	During Tank Fill	ND	ND	ND	2	BZ
Tank Fill	3	During Tank Fill	ND	ND	ND	2	Area
Start-Up	1	Engine Check	0.5	ND	1.0	10	Area
Start-Up	2	Engine Check	0.5	ND	1.0	10	Area
Tow-In	1	Alignment	1.0	ND	1.0	55	BZ
Tow-In	2	Alignment	1.0	ND	1.0	50	BZ
Road Test	1	Engine Test	0.5	ND	2.0	45	Area
Road Test	2	Engine Test	0.5	ND	2.5	70	Area
July 1980							
Tank Fill	1	During Tank Fill	ND	ND	ND	5	BZ
Tank Fill	2	During Tank Fill	ND	ND	ND	5	BZ
Tank Fill	3	During Tank Fill	ND	ND	ND	5	Area
Start-Up	1	Engine Check	ND	ND	ND	10	Area
Start-Up	2	Engine Check	ND	ND	ND	10	Area
Tow-In	1	Alignment	0.5	ND	1.0	30	BZ
Tow-In	2	Alignment	1.0	ND	1.0	25	BZ
Road Test	1	Engine Test	1.0	ND	2.0	25	Area
Road Test	2	Engine Test	1.0	ND	2.0	30	Area
EVALUATION CRITERIA		OSHA	5.0	0.1	5.0	50	
		NIOSH	1.0 (C)	---	0.5	35	

ppm = part per million
ND = non-detectable
BZ = breathing zone
(C) = ceiling level which should not be exceeded even instantaneously

TABLE 5

Atmospheric Samples at Passenger Car Assembly for
Nitrogen Dioxide (NO_2), Ozone (O_3), Sulfur Dioxide (SO_2), and Carbon Monoxide (CO)

Ford Motor Company
San Jose, California

Job/Area Description	Sample Number	Time of Sample	NO_2 (ppm)	O_3 (ppm)	SO_2 (ppm)	CO (ppm)	Type of Sample
May 1980							
Tank Fill-Above	1	During Tank Fill	ND	ND	ND	ND	BZ
Tank Fill-Below	2	During Tank Fill	ND	ND	ND	ND	BZ
Tank Fill-Below	3	During Tank Fill	ND	ND	ND	ND	BZ
Start-Up	1	Engine Check	1.0	ND	ND	2	Area
Start-Up	2	Engine Check	1.0	ND	ND	2	Area
Tow-In	1	Alignment	1.5	ND	1.0	55	BZ
Tow-In	2	Alignment	1.5	ND	1.0	60	BZ
Road Test	1	Engine Test	1.5	ND	1.0	50	Area
Road Test	2	Engine Test	1.5	ND	2.0	70	Area
July 1980							
Tank Fill-Above	1	During Tank Fill	ND	ND	ND	ND	BZ
Tank Fill-Below	2	During Tank Fill	ND	ND	ND	ND	BZ
Tank Fill-Below	3	During Tank Fill	ND	ND	ND	ND	BZ
Start-Up	1	Engine Check	ND	ND	ND	ND	Area
Start-Up	2	Engine Check	ND	ND	ND	ND	Area
Tow-In	1	Alignment	1.0	ND	2.0	30	BZ
Tow-In	2	Alignment	1.0	ND	1.0	25	BZ
Road Test	1	Engine Test	1.0	ND	1.0	20	Area
Road Test	2	Engine Test	1.0	ND	2.0	20	Area
EVALUATION CRITERIA		OSHA	5.0	0.1	5.0	50	
		NIOSH	1.0 (C)	---	0.5	35	

ppm = part per million
ND = non-detectable
BZ = breathing zone
(C) = ceiling level which should not be exceeded even instantaneously

TABLE 6

Age Groupings and Years Worked for Ford Motor Company
for 32 Passenger and Truck Line Employees

Ford Motor Company
San Jose, California

Age Groups	20-29			30-39			40-49			50-60		
Years Worked	5-9	10-19	±20	5-9	10-19	±20	5-9	10-19	±20	5-9	10-19	±20
MALES	1			2	9		1	5	5		2	4
FEMALES				2			1					

SOURCE: Ford Motor Company, Milpitas, California 1980

TABLE 7

Number of Diagnoses or Body Systems Affected
for 32 Passenger and Truck Line Employees

(Based on Review of Medical Records Spanning Entire Period
of Employement for Each Individual.)

Ford Motor Company
San Jose, California

50 Musculoskeletal Injuries

- 32 Minor injuries including laceration
- 11 Back injuries (3 with laminectomies)
- 3 Carpel Tunnel syndromes with surgical repair
- 4 Major Fracture or joint injury (1 clavicle, 1 humerus, 1 hand, 1 knee)

9 Eye Injuries

3 Respiratory (2 acute bronchitis, 1 sinus headache)

3 Cardiovascular (1 myocardial infarction, 1 hypèrtension, 1 aortic stenosis)

8 Gastrointestinal (primarily peptic ulcer disease)

5 Dermatoses (probably all occupational)

1 Other (Syncope from gas fumes)

SOURCE: Ford Motor Company, Milpitas, California

FIGURE 1
INDUSTRIAL VENTILATION

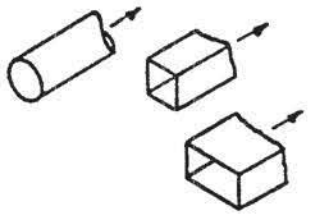
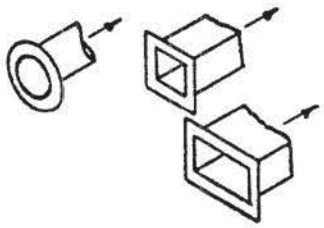
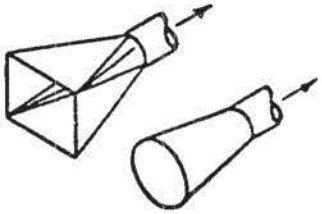
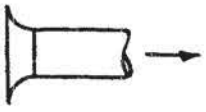
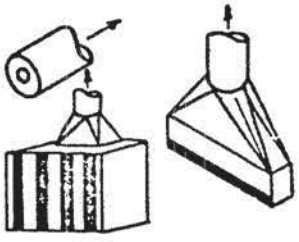
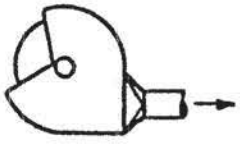
HOOD TYPE	DESCRIPTION	COEFFICIENT OF ENTRY, Ce	ENTRY LOSS
	PLAIN OPENING	0.72	0.93 VP
	FLANGED OPENING	0.82	0.49 VP
	TAPER or CONE HOOD	Varies with angle of taper or cone. See Fig. 6-10	
	BELL MOUTH INLET	0.98	0.04 VP
	ORIFICE	See Fig. 6-10	
	TYPICAL GRINDING HOOD	STRAIGHT TAKE-OFF 0.78	0.65 VP
		TAPERED TAKE-OFF 0.85	0.40 VP

Fig. 4-8