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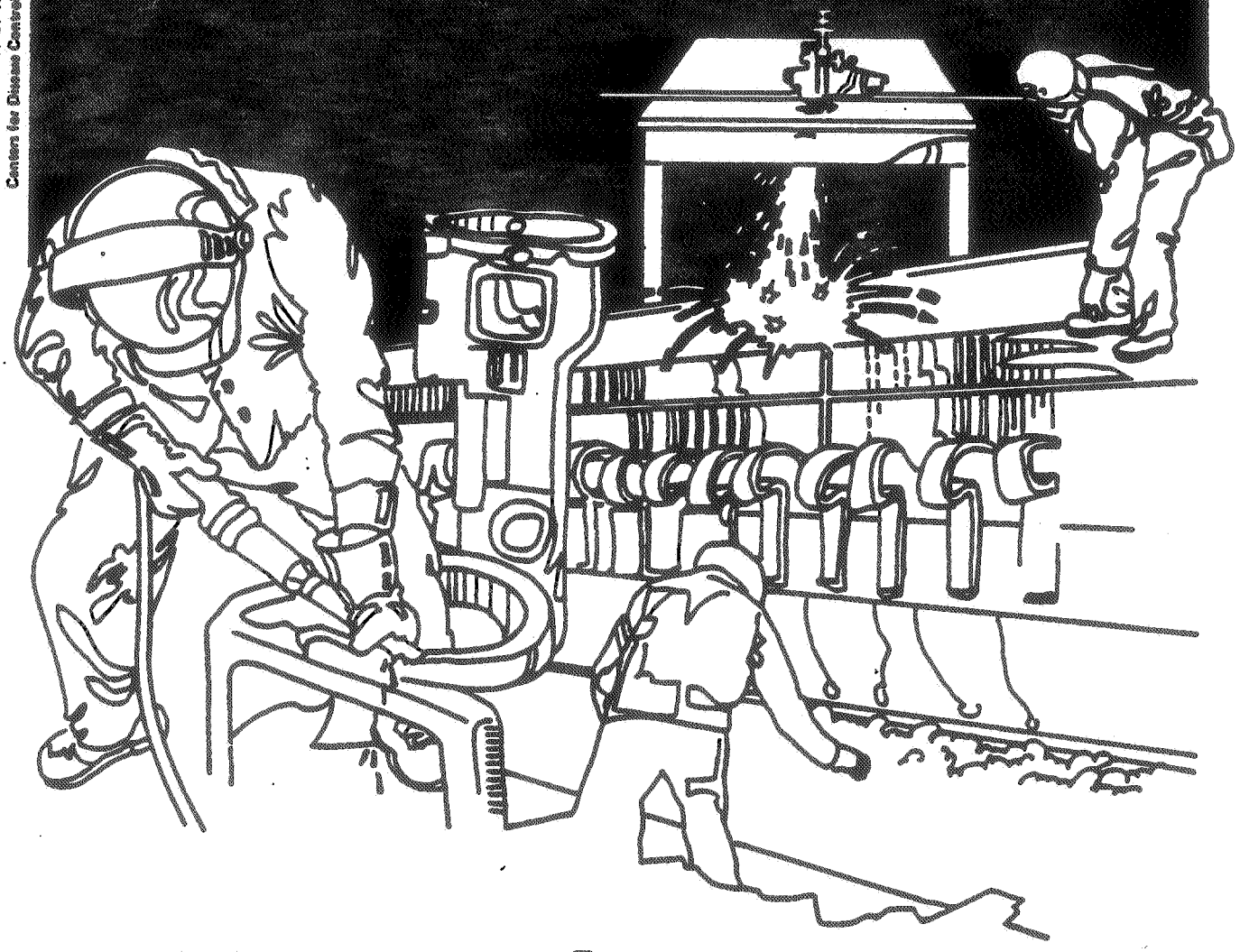

# Health Hazard Evaluation Report

HETA 84-368-1624
FMC CORPORATION
SAN JOSE, CALIFORNIA

HETA 84-368-1624
SEPTEMBER, 1985
FMC CORPORATION
SAN JOSE, CALIFORNIA

NIOSH INVESTIGATORS
Pierre L. Belanger, IH
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## I. SUMMARY:

In May 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate an apparent increased number of cancers and other illnesses among employees at FMC Corporation, San Jose, California. The request to conduct a health hazard evaluation was divided into five areas in order to characterize the workers concerns and these are machining, assembly, welding, maintenance, and paints and processes.

On July 17 and 18, 1984 NIOSH investigators conducted an initial environmental and medical survey. On September 10-13, and December 7, 1984, a follow-up environmental survey was conducted. Environmental air monitoring was conducted at the main facility which included plants 6 and 12, in addition to plants 21, 22, 7, and the Julian Street facility.

In plant 6, the following operations were monitored: electroplating, paint spraying, machining, degreasing, tool grinding, styrene impregnation, and the gear room. No cadmium, chromium, or nickel was detected in the electroplating operation. At the paint spray booth, no exposures to benzene, hexane, acetone and toluene were measured. One bulk sample of M-801 tapping fluid and a bulk sample of the TRIM-SOL™ cutting fluid was analyzed for nitrosamines but none was detected. Air samples were analyzed for naphthalene, but none was detected. No air sampling was conducted to measure cutting fluid concentrations because no method exists. The liquid degreaser (methyl chloroform) air concentration was measured to be well below the evaluation criteria. At tool grinding, chromium VI and total dust air concentrations were below the evaluation criteria. At the styrene impregnation process air samples were measured below the evaluation criteria. No definite conclusion can be made about the asbestos air exposure since NIOSH was only able to collect one air sample.

In plant 3, the following operations were monitored: "monkey island", and vehicle assembly. Seven air samples were collected during the welding operation along monkey island. Two air samples evaluated for chromium VI (1.2 and 1.8 ug/$m^3$) were above the evaluation criteria. The total dust air concentrations (10.4 mg/$m^3$) were at the evaluation criteria. Five filters were analyzed for cadmium, copper, manganese, and zinc, but no overexposures were measured. At vehicle assembly (gluing operation), eight air samples were evaluated for benzene, hexane, acetone, and toluene concentrations. Benzene (none detected to 0.93 ppm) air concentrations exceeded the evaluation criteria, but hexane, acetone, and toluene air concentrations were below the evaluation criteria. At station 710, solvent air concentrations were measured for toluene, MEK, MBK, and ethyl acetate, but all were below the evaluation criteria. Also, one air sample collected during Thiokol sealing was evaluated for butanethiol, but none was detected.

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16. Abstract (Limit: 200 words)

Environmental and breathing zone samples were analyzed for metals, total dust, asbestos (1332214), organic solvents, methylene-bisphenyl-diisocyanate, (101688), and cutting and cooling oils at the FMC Corporation (SIC-9999) in San Jose, California in July, September, and December, 1984. The evaluation was requested by a union representative because of concern about an increasing number of occupationally related cases of cancer and other illnesses. Noise monitoring was also performed. Twenty two workers were interviewed. Benzene concentrations ranged from nondetectable to 0.93 part per million in the vehicle assembly area NIOSH recommends the lowest feasible limit for benzene. Asbestos sampling results were inconclusive. Noise exposures were 82.5 to 90.7 A-weighted decibels (dBA) The OSHA standard for noise is 90dBA. All other substances were nondetectable or below their relevant standards. Employees exposed to cutting oils and machine coolants reported varying degrees of dermatitis Symptoms of eye irritation, headache, and fatigue were reported The authors note that negotiations are underway for conducting a mortality survey They conclude that workers are overexposed to benzene and noise, and potentially overexposed to Trim/Sol machine cooling oil Recommendations include using local exhaust ventilation to reduce machine coolant exposures and implementing an OSHA approved respirator program

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# 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.

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On July 17 and 18, 1984 NIOSH investigators conducted an initial environmental and medical survey. On September 10-13, and December 7, 1984, a follow-up environmental survey was conducted. Environmental air monitoring was conducted at the main facility which included plants 6 and 12, in addition to plants 21, 22, 7, and the Julian Street facility.

In plant 6, the following operations were monitored: electroplating, paint spraying, machining, degreasing, tool grinding, styrene impregnation, and the gear room. No cadmium, chromium, or nickel was detected in the electroplating operation. At the paint spray booth, no exposures to benzene, hexane, acetone and toluene were measured. One bulk sample of M-801 tapping fluid and a bulk sample of the TRIM-SOL™ cutting fluid was analyzed for nitrosamines but none was detected. Air samples were analyzed for naphthalene, but none was detected. No air sampling was conducted to measure cutting fluid concentrations because no method exists. The liquid degreaser (methyl chloroform) air concentration was measured to be well below the evaluation criteria. At tool grinding, chromium VI and total dust air concentrations were below the evaluation criteria. At the styrene impregnation process air samples were measured below the evaluation criteria. No definite conclusion can be made about the asbestos air exposure since NIOSH was only able to collect one air sample.

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In plant 10 (seam welding) and plant 4 (pick-up area for grinding and welding) the following air samples were collected. At the pick-up area, air samples were evaluated for chromium VI and total dust, but both were below the evaluation criteria. Five air samples were collected during seam welding for cadmium, copper, manganese, and zinc,but all were below the evaluation criteria.

In plant 22, one air sample was collected during the application of Carbomastic and evaluated for toluene and xylene, but no overexposures were measured. One air sample was collected during the Thiokol application and evaluated for butanethiol, but none was detected. Two air samples were collected from the armor area during the plasma arc cutting operation. The samples were evaluated for chromium, nickel, and manganese, but all were below the evaluation criteria.

At the Martin Avenue facility, four air samples were collected during the grinding and numerical controller operation. One air sample collected during steel grinding was analyzed for chromium, nickel, and manganese, and all were below the evaluation criteria. No aluminum oxide dust was measured during the numerical controller operation.

At plant 21, four air samples were collected at the foam injection operation and analyzed for methylene bisphenyl diisocyanate, but none was detected. Also, six noise dosimetry measurements were collected at the paint spray booth and in adjacent work areas. Two of the dosimetry measurements exceeded the evaluation criteria (85 dBA) based on actual exposure period (seven hours)

On August 30, 1984 a follow-up medical survey was conducted during which time twenty-two employees were interviewed. Employees working with solvents (methyl chlororform) or adhesives reported symptoms consistent with solvent exposures. Employees working at the pick-up weld and grinding area reported bronchitis or chest tightness. Finally, employees exposed to the mixture of cutting oil and machine coolant reported some degree of dermatitis (folliculitis, defatting and cracking of the palms and finger, mild acne or comedones on the face and neck). Many workers reported symptoms of eye irritation, headache and fatigue, and in a few cases, workers reported upper respiratory irritation.

On the basis of this evaluation, health hazards were found to exist in certain areas based on the environmental and medical data. Overexposures were measured to benzene and noise. A potential exposure to chromium VI was measured based on the inadequacy of the respiratory protection program. The medical study found a health hazard based on symptoms of workers exposed to TRIM-SOL™ machine coolant, solvents used for cleaning and those found in adhesives. Recommendations to decrease the worker exposures described are included in Section VIII of this report.

KEYWORDS: SIC 9999 (Manufacturing Military Vehicles) aluminum and steel welding and grinding, machining, methyl chloroform degreasing, gluing, paint spraying.

## II. INTRODUCTION

In May 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from representatives of the International Association of Machinists and Aerospace Workers, Local 562, San Jose, California. The representatives were concerned that employees at the FMC plant may have an increasing number of cancers and other illnesses as a result of their workplace exposures. The request to conduct a health hazard evaluation was divided into five areas in order to characterize the workers concerns and these are machining, assembly, welding, maintenance, and paints and processes.

On July 17 and 18, 1984 NIOSH investigators conducted an initial environmental and medical investigation at FMC Corporation. Subsequent to the opening conference, a walk through survey was conducted at the main facility which included plant 6 and 12, in addition to plants 21, 22, 7, and the Julian Street facility. An industrial hygiene sampling protocol was designed and provided to the company industrial hygienist. Contents of the protocol were discussed with the local union. A follow-up environmental survey was conducted by NIOSH industrial hygienists on September 10-13, and December 7, 1984. On November 8, 1984 the environmental air and bulk sample results were sent to the union and company representatives. A telephone call was made to the president of the local union to discuss the results. The environmental air sampling results collected in December were telephoned to the requestor when they became available.

On August 30, 1984 a follow-up medical survey was conducted. In October, 1984 Dr. Coye met with the National Director of Environmental Health and Safety for FMC to discuss the feasibility and desireability of conducting a Standardized Mortality Rate (SMR) study at FMC in San Jose. On March 7, 1985 Dr. Coye sent a letter to the local union president to advise him that FMC would probably be contracting a university-based epidemiologist to conduct a SMR study.

## III. BACKGROUND

FMC Corporation is a manufacturer of military track vehicles. The company employs about 6000 workers throughout various sites in San Jose, California. Employees generally work 8 hours a day 5 days a week during one of the three shifts. The areas which were monitored during the environmental survey include the following:

1. Plant 6: This plant consists of several departments. Those areas included in the investigation were paints and process, machine shops, deburring operation, styrene impregnation process, baker line, inspection area, tool crib, air tool room, and the gear room.

The paints and process department houses dip tanks and electroplating processes used for chromium, nickel and cadmium plating. The electroplating process is simply a chemical or electrochemical process of surface metal treatment whereby a metallic layer is deposited on the base material. All plating tanks had good rim exhaust ventilation.

The paint shop is located adjacent to the electroplating shop. Paint spraying is done in paint spray booths which have air filters and a water face to collect paint overspray. Parts are passed through the booth on a chain conveyer and sprayed. Employees wear coveralls with a hood and an airline supplied respirator.

There are three machine shops (A,B,C) where aluminum and steel parts are bored, milled, and drilled. Also located in the adjacent area is the deburring operation. All of the machines are cooled with a water soluble coolant called TRIM-SOL™. The concentrated coolant contains petroleum oil, chlorinated wax, emulsifiers, odorants and dye. It is diluted at a rate of 1 part TRIM-SOL to 30 parts of water. One operator is responsible for draining and refilling TRIM-SOL from each of the machines once a week. The coolant is inspected for color, contamination etc. and either recycled or rejected. About 25 percent of the coolant is usually recycled. The machine operators are responsible for topping off the coolant at the beginning of each shift.

Three tapping fluids were used during this survey. Material safety data sheets were provided for each. One type is M-801 which contains naphthanic mineral oil, organic additives, and about 30 percent chlorinated paraffins. A second type is Cutmax™ which is essentially mineral oil. The third type is Universal Tapping Compound which appears to be a paraffin material.

Each of the machine shops have specialized equipment. "A" shop is the turning section where lathe and grinding work is done. No tapping fluids are used in this area. "B" shop consists of multi and single spindle drill presses and radial drills. Cutmax is the only tapping fluid reportedly used in this area. "C" shop contains the computer operated machines. One area of "C" shop called the "cold room" contains 7 machines and each has local exhaust ventilation. This room was designed to keep machinery cool during close tolerance machining. The tapping fluid used in "C" shop includes any of the three described above. It should be noted that machine coolant can be sprayed in the mist or continual mist mode. In the mist mode, the coolant is applied during the boring or drilling operation, whereas in the continual mist mode the mist is sprayed even though the machine is not drilling or milling a part.

Deburring of steel and aluminum parts is done in an area adjacent to A and B shops. Parts are usually deburred at a work bench which has slot exhaust ventilation. In some instances, the parts are too large to be placed on the work bench thus deburring is done on the floor. Employees wear a face shield, apron and gloves.

The styrene impregnation section is a catalyst-resin process. An autoclave is filled with aluminum parts and put under 30 inches of mercury vacuum. A valve connected to a styrene reservoir is opened which allows the styrene to be pulled into the autoclave. Once filled, the autoclave is pressurized for 45 minutes. Afterwards, the valve to the styrene reservoir is opened allowing the tank pressure to push the styrene back to the reservoir. After about 15 minutes, the aluminum parts are removed from the autoclave and washed. The operators exposure time averages about 3-4 minutes for each load, and there are about 8 loads per day. No personal protective equipment is worn by the operator.

The baker milling line is an automated system in which vehicles are placed on a conveyor line, and hull drilling is performed at pre-programmed places.

The tool crib/ tool grinding room and the inspection area are located in C and B shop respectively. Each work area has a liquid degreaser (methyl chloroform) which is used to clean small parts. Small parts are dipped in the degreaser for 20 to 30 seconds. It was reported that 10 to 12 parts are degreased daily. The degreaser is not ventilated; however, gauntlet gloves and a face shield were observed next to the degreaser for removing parts. The lid to the degreaser is kept closed when it is not being used.

The air tool room is located across from the baker line. One employee works in this area repairing pnuematic tools.

The gear room is where asbestos brake lining friction pads are riveted to the brake shoes. Only one operator works at this job, and the job may last several hours a day several days a week. The operator bends the asbestos pad to the configuration of the brake shoe in order to rivet the assembly together. The operator does not wear respiratory protection during this operation.

2. Plant 3: Several operations were evaluated in this plant and these include: "Monkey Island", station 420 (trunyon area), station 430 (pick-up line) and M-113 vehicle assembly area which includes station 710 (gluing of rubber pads inside the vehicle), and station 720 (application of Koppers Lacquer and Thiokol Sealant).

Once the vehicles leave Baker line, described above, the vehicles are washed and directed to monkey island (station 410). Employees in this area perform about 90 percent metal inert gas shielded welding and 10 percent grinding. Welders are required to wear coveralls, welding helmet, hearing protectors, and a respirator for welding fumes. Afterwards, the vehicles are moved by the crane operator to one of the other stations such as trunyon welding, pick-up grinding, or red line and blue line pick-up area. It should be noted that several electrostatic precipitators (smog hogs) are positioned over monkey island in order to help control welding fumes. All workers are required to wear hearing protection.

Two work stations (710 and 720), along the M-113 vehicle assembly area, were evaluated. Employees working at station 710 (gluing area) use a 3-M adhesive (# 2141) to glue rubber pads to the inside of the vehicle. In 1982, an industrial hygiene survey was conducted by the company industrial hygienist to evaluate concentrations of airborne solvents emanating from the adhesive which included: acetone, toluene, petroleum distillates and hexane. It should be noted that the manufacturer recommends that proper respiratory protection be worn when applying the adhesive. Subsequent to the industrial hygiene survey, it was recommended that an organic vapor cartridge respirator be worn by the workers whenever they use this adhesive inside the vehicle. Employees working along this work station do not wear respiratory protection.

The second work area evaluated was station 710 where two particuliar chemicals (Koppers™ and Thiokol™) were observed to be used inside the vehicle. Koppers is a fuel resistant nitrocellulose lacquer which is poured down a tube to coat the surface around the fuel tank in case of fuel leakage. Thiokol is a sealant used to coat fuel tank welding seams to prevent leakage. Employees who apply the sealant to the fuel tanks inside the vehicles do not wear respiratory protection due to the space limitations.

3. Plant 10 and 4: Employees in these plants work on the Bradley Fighting Vehicle (BFV). Seam and hull welding is done in plant 10, afterwhich the tank is sent to plant 3 to be dipped (i.e. washed and alodine coated). The BFV is then sent to plant 4 to be inspected for cracks. All repairs (pick-up welding and grinding) are done in this plant.

4. Arm Shop: This shop is located adjacent to the heat treat area. Two automatic machine tool chuckers are located in this area and there is no local exhaust ventilation to control machine coolant exposures during the operation. It should be noted that the the company industrial hygienist recommended that the machine be enclosed to control coolant exposures.

5. Plant 22: Two work areas (station 710 and the armor area) were evaluated during this survey. The paint area (station 710) was monitored during the application of carbomastic #15. This is a two part epoxy which is mixed in equal parts and applied by brush or roller to the steel plating and the tank surface where the steel plating is applied. The carbomastic is used as a coat between the steel and aluminum to prevent galvinization. Usually 2 to 3 vehicles are coated with the mastic which takes from 40 minutes to 1 hour to apply. Another operation observed in this area was the application of Thiokol to fittings and welds to prevent corrosion.

The other operation evaluated was at the armor area where the pentagraph plasma arc cutting is performed. The pentagraph is used to cut steel which can range in size from 0.25 of an inch up to 3.0 inches thick.

6. Plant 21: Two work areas (foam injection and the paint department) were evaluated at this plant. The foaming injection process consists of a two part mixture (diisocyanate and resin). Each of the chemicals are stored in an enclosed 300 gallon container which feeds two 7 gallon storage tanks located at the foam table. The foam is used to inject different panels, transfer cases and gear boxes. Methylene chloride is used to purge the gun and hose after each use which is then dispensed into a waste tank. An exhaust booth (water flow type) is used to catch vapors when injecting small parts. Industrial fans are used in the room when the parts are too large to be injected in the exhaust booth. Generally, there is one foamer and one assistant working in this area. The personal protective equipment worn by the workers includes disposable coveralls, gloves, shoe coverings, safety glasses, and respirator.

Noise measurements were collected from several employees working along a packing line adjacent to the curing ovens and inside a paint spray booth through which parts are passed on a conveyor system. The source of noise appears to be the curing ovens through which the painted parts pass.

7. Martin Avenue Facility: Several machining operations were monitored during the survey and these include: the computer numerical controller machines such as the Wiedematic Machine II which is a computerized punch press with a plasma burner attachment. This machine is used to cut hole patterns and various contours and configurations. The operator wears hearing protectors while operating this machine. Also, the deburring and grinding of aluminum and steel parts was monitored.

## IV. DESIGN AND METHODS

### A. Environmental

Plant 21

1. Nine personal and area air impinger samples were collected from the foam area and analyzed for methylene bisphenyl diisocyanate (MDI) according to NIOSH method 5500, with modification. The analytical limit of detection was 0.3 microgram per sample (ug/sample). (1)

Plant 6

1. Two bulk samples of cutting fluids (M-801 and Recirculated TRIM-SOL Coolant) were collected from containers in machine shop and analyzed for nitrosamines by gas-chromatograph-Thermo electron analyzer (GC-TEA). The samples were extracted by three washings of dichloromethane. One milliliter (ml) of ethanol was used as a retaining solvent and the dichloromethane was evaporated gently using a Kudurna-Kanish/Snyder column apparatus. The samples were evaporated to 1 ml and an aliquot was injected into a GC equipped with a TEA detector in the nitrosamine mode. All bulk samples were submitted for mass spectrometric analysis. The detection limit for N-nitrosodimethylamine was 100 nanogram per milliliter (ng/ml)

2. One bulk sample of Tapping fluid (M-801) and several air samples were collected. The bulk sample was analyzed for naphthalene by gas-chromatography (GC) using NIOSH Method Physical and Chemical Analytical Method (P&CAM) 127 with modifications. The limit of detection is 0.2 percent by weight. The air sample was collected on a charcoal tube. Each section of the tube was separated and analyzed by GC using NIOSH Method no. S-292 with modifications. The limit of detection was 0.01 milligram/sample (mg/sample).(2)

3. Personal air samples were collected from the electroplating operation and analyzed for cadmium and nickel on a 37-mm 0.8 um cellulose ester membrane filter. The filters were analyzed by atomic absorption spectroscopy. The samples were ashed according to NIOSH Method 7300, and analyzed by NIOSH P&CAM No. 173. The limit of detection for cadmium and nickel was 2 ug and 3 ug respectively.(1,3)

4. One asbestos air sample was collected from the gear room on a 37-mm 0.8 um cellulose ester membrane filter. The filter was analyzed according to NIOSH Method P&CAM 239 utilizing Phase Contrast Microscopy. The limit of detection was determined to be 0.03 fibers/field or 5000 fibers/filter.(1)

5. Two air samples were collected during the degreasing operation using a charcoal tube. The tubes were analyzed for methyl chloroform. Both sections of the tube were separated and analyzed by GC according to NIOSH Method 1003 with modifications. The limit of detection was 0.01 mg/sample.(1)

6. Six environmental air samples were collected on charcoal tubes and analyzed for styrene. Both sections of the tube were separated and analyzed by GC using NIOSH Method Number S-30 with modifications. The limit of detection was 0.01 mg/sample.(5)

7. One bulk sample of TRIM-SOL and 23 air samples were collected to measure TRIM-SOL coolant mist. The bulk material was used as the source from which the standard were made. Environmental air samples were collected using a 0.8 um cellulose ester membrane filter. The filters were analyzed by NIOSH Method No. P&CAM 283, with modifications. The filters were treated with a solvent to dissolve the oil. Comparisons of samples and standards were made with an infrared spectrophotometer at 2940 cm -1.(5)

Plant 3

1. One air sample was collected from M-113 (station 720) vehicle assembly on a charcoal tube. The tube was analyzed for toluene, methyl ethyl ketone (MEK), methyl n-butyl ketone (MBK), and ethyl acetate. The A and B sections of the tube were each analyzed by GC using NIOSH Method P&CAM 127 with modifications. The limits of detection was 0.01 mg/sample for each chemical.(4)

Plant 3, 4 and 10

1. Bulk air and environmental air samples were collected for welding fumes using a 0.8 micrometer cellulose ester membrane filter. The filters were analyzed for several metals including: cadmium, chromium, copper, manganese, and zinc. The filters were ashed with nitric and perchloric acids (NIOSH Method 7300) and analyzed by NIOSH Method No. P&CAM 173.(1)

Limits of detection:
2 ug Cadmium
5 ug Chromium
2 ug Copper
1 ug Manganese
2 ug Zinc

Plant 3 and 6

1. Personal air samples were collected from the electroplating and welding areas for hexavalent chromium (Cr VI) and total particulate weight. The air samples were collected on a tared 37-millimeter (mm) 5 micrometer (um) polyvinyl chloride (PVC) filter. The total particulate weight was determined by weighing the sample plus the filter on an electrobalance and subtracting the previously determined tare weight of the filter (NIOSH Method 500). Each weighing was done in duplicate. The Cr VI was analyzed by visible spectroscopy according to NIOSH Method 7600. The limit of detection was estimated to be 0.2 ug/sample.(1)

2. Ten air samples were collected during the gluing and paint spraying operation on charcoal tubes. The tubes were analyzed for toluene, acetone, hexane and benzene. Both sections of the tube were separated and analyzed by GC using NIOSH Method P&CAM 127 with modifications. The detection limit for toluene, acetone and hexane was 0.01 mg/sample. The limit of detection for benzene was 0.002 mg/sample.(4)

Plant 6 and Martin Avenue Facility

1. Personal air samples were collected from grinding areas and analyzed for aluminum oxide dust. The air samples were collected on a 37-mm 0.8 um cellulose ester membrane filter. The filters were ashed according to NIOSH Method 7300, and analyzed by NIOSH P&CAM No. 7013. The analytical limit of detection was 15 ug Aluminum.(1)

Plant 22

1. Several air samples were collected from the armor area on 37-mm, 5 um PVC filters. The filters were analyzed for chromium, nickel, and manganese by means of atomic absorption spectroscopy. The samples were ashed according to NIOSH Method 7300 and analyzed by P&CAM No. 173.(1,3)

The limits of detection: 5 ug Chromium
3 ug Nickel
1 ug Manganese

2. Two air samples were collected during the carbomastic application using charcoal tubes. Both sections of the tube were analyzed for toluene and xylene by GC according to NIOSH Method P&CAM 127 with modifications. The limit of detection was 0.01 mg/sample.(4)

Plant 3 and 22

1. Two air samples were collected during the thiokol application using charcoal tubes. The tubes were analyzed for butanethiol by GC using NIOSH Method P&CAM 127 with modifications. The limit of detection was 4 mg/sample.(4)

B. Medical

During the initial site visit, the NIOSH medical officer interviewed workers at their job stations regarding their health and safety concerns and symptoms which they felt were associated with their work. Workers reporting dermatitis on the hands, forearms, face and neck were examined. Medical care, emergency care and pre-employment and periodic examinations were discussed with the medical unit staff. Material Safety Data Sheets were subsequently reviewed with the NIOSH industrial hygienist. Workers were informed prior to the follow-up visit that if they wished to speak with the NIOSH medical officer privately they could do so through arrangements with the IAM representatives. Twenty-two workers requested private interviews.

## V. EVALUATION CRITERIA

A. Environmental

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 life time 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 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 at 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 8-10-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 exposure.

TABLE A

| SUBSTANCE | Permissible Exposure Limit 8-Hour Time-Weighted Exposure Basis | Source |
|---|---|---|
| Methyl Chloroform | 350 ppm(1) | NIOSH, Cal-OSHA, ACGIH |
| Chromium VI | 1.0 ug/m$^3$(2)<br>0.05 mg/m$^3$(3) | NIOSH<br>Cal-OSHA, ACGIH |
| Total Nuisance Dust | 10 mg/m$^3$ | Cal-OSHA, ACGIH |
| Cadmium Oxide Fumes | 40 ug/m$^3$<br>0.05 mg/m$^3$C4 | NIOSH<br>Cal-OSHA, ACGIH |
| Copper Fumes | 0.2 mg/m$^3$ | Cal-OSHA, ACGIH |
| Manganese Fumes<br>Manganese Dust | 1.0 mg/m$^3$<br>5.0 mg/m$^3$ | Cal-OSHA, ACGIH<br>CAl-OSHA, ACGIH |
| Zinc Oxide Fumes | 5.0 mg/m$^3$ | Cal-OSHA, ACGIH |
| Nickel Dust | 15.0 ug/m$^3$<br>1.0 mg/$^3$ | NIOSH<br>Cal-OSHA, ACGIH |
| Asbestos | LFL (CA)5<br>2.0 Fibers/cc | NIOSH<br>Cal-OSHA, ACGIH |
| Styrene | 50 ppm<br>100 ppm | NIOSH, ACGIH<br>Cal-OSHA |
| Toluene | 100 ppm | NIOSH, Cal-OSHA, ACGIH |
| Xylene | 100 | [illegible] |

B. Medical

Symptoms reported by the workers were evaluated for consistency with the nature and extent of exposure to chemicals or other hazards in that job. Dermatologic examinations noted irritation and/or sensitization in association with chemical exposures or mechanical abrasion.

C. Toxicological

1. Solvents: Methyl Chloroform (1,1,1-Trichloroethane), styrene, toluene, xylene, MEK, MBK, hexane, benzene, ethyl acetate, and acetone are all solvents. They are primarily absorbed by inhalation or through the skin in workplace exposures. Excessive exposure to solvents may result in neurologic effects and dermatologic effects, including: eye and upper respiratory tract irritation, sleepiness, fatigue, headache, memory disturbance, difficulty concentrating, nausea, vomiting, abdominal cramps, loss of appetite, weight loss, flushed skin, skin defatting and irritation, and folliculitis (inflammation of hair follicles). The intoxicating effects of alcohol are frequently increased when alcohol is consumed after exposure to solvents.(6,7,8,9,10,11,12,13,14)

Extreme exposures may result in tremor, loss of coordination, mental confusion, loss of consciousness, coma and death. In addition, excessive or prolonged exposure to some of these solvents may result in chronic or delayed-onset effects including visual disturbances, loss of the sense of smell, impaired coordination and sense of touch, decreased nerve conduction velocity, neurobehavioral changes, and kidney and liver damage. Recent reports indicate that exposure of workers to MBK has been associated with the developement of peripheral neuropathy. Also, the most significant toxic effect of exposure to benzene is an insidious and irreversible injury to the bone marrow. Long term exposure to low concentrations of benzene have been observed to have an initial stimulant effect on the bone marrow, followed by aplasia and fatty degeneration.(14)

2. Chromium VI: In some workers, chromium compounds act as allergens which cause dermatitis to exposed skin. They may also produce pulmonary sensitization. In the hexavalent state, chromium compounds are corrosive irritants, which can enter the body by ingestion, inhalation and through the skin. Acute exposures to dust or mist may cause coughing and wheezing, headache, dyspnea, pain on deep inspiration, fever, and loss of weight. NIOSH recommends that carcinogenic chromium VI and its compounds be regulated as occupational carcinogens.(15)

3. Total Nuisance Dust: These dusts have little adverse health effects on the lungs and do not produce significant organic disease or toxic effect when exposures are kept under reasonable control. Excessive exposure may reduce visibility and may result in deposits in the eyes, ears, and nasal passages or cause injury to the skin or mucous membrane by chemical or mechnical action.(7)

4. Cadmium Oxide Fumes: Cadmium is a respiratory tract irritant which is poorly absorbed by the skin and intestinal tract, but it is well absorbed by inhalation. Once absorbed, cadmium has a very long half life and is retained by the kidney and liver.(16)

5. Copper Fumes: Copper dust exposure may cause nose, throat, and eye irritation, a metallic taste in the mouth, and a direct, non-allergic irritation of the skin.(12)

6. Manganese (Fumes and Dusts): Manganese inhalation affects the central nervous system and intoxication occurs mostly in the chronic form. Inhalation of high concentrations of nascent manganese oxide causes an influenza-like illness called metal fume fever.(12,14)

7. Zinc Oxide Fumes: Inhalation of zinc oxide fumes causes influenza-like illness called metal fume fever. Exposures to these fumes may produce dryness and irritation to the throat, a sweet or metallic taste, substernal tightness and constriction in the chest, and a dry caugh.(14)

8. Nickel Dust: Nickel and its compounds may produce skin sensitization (nickel itch) among the general workforce. Also, these compounds are irritants to the conjunctiva of the eye and the mucous membrane of the upper respiratory tract. Elemental nickel and nickel salts are probably carcinogenic, producing an increased incidence of cancer of the lung and nasal passages.(14,20)

9. Asbestos: Overexposure to asbestos fibers can cause asbestosis as well as other lung ailments. Asbestosis is a chronic lung ailment which can result in shortness of breath due to fibrotic changes and scarring of lung tissue. Usually, there is a period of 10 to 35 years before this chronic lung ailment will become manifest. Other effects from inhalation of asbestos fibers are the asbestos-related neoplasms.(17)

10. Noise: Noise, commonly defined as unwanted sound, covers the range of sound which is implicated in harmful effects. Noise can be classified into many different types, including wide-band noise, narrowband noise, and impulse.

Exposure to intense noise causes hearing losses which may be temporary, permanent, or a combination of the two. These impairments are reflected by elevated thresholds of audibility for discrete frequency sounds, with the increase in dB required to hear such sounds being used as a measure of the loss. Temporary hearing losses, also called auditory fatigue, represent threshold losses which are recoverable after a period of time away from the noise. Such losses may occur after only a few minutes of exposure to intense noise. With prolonged and repeated exposures (months or years) to the same noise level, there may be only partial recovery of the threshold losses, the residual loss being indicative of a developing permanent hearing impairment.

Temporary hearing impairment has been extensively studied in relation to various conditions of noise exposure. Typical industrial noise exposures produce the largest temporary hearing losses at test frequencies of 4,000 and 6,000 Hertz (Hz).

The actual pattern of loss depends upon the spectrum of the noise itself. The creates portion of the loss occurs within the first two hours of exposure. Recovery from such losses is greatest within one or two hours after exposure.

The amount of temporary hearing loss from a given amount of noise varies considerably from individual to individual. For example, losses at a given frequency due to noise intensities of 100 dBA may range from 0 to more than 30 dB.(7,18)

11. Methylene bisphenyl diisocyanate (MDI): Diisocyanates irritate the respiratory tract and can act as respiratory sensitizers, producing asthma-like symptoms in sensitized individuals with exposure at very low concentrations. Exposure to diisocyanates may also result in chronic impairment of pulmonary function.(12,19)

12. TRIM-SOL: A review of the TRIM-SOL toxicity testing information and data supplied by Master Chemical Corporation, Perrysburg, Ohio does not indicate any unusual (unique) or untoward (life-threatening) toxicities associated with normal use of TRIM-SOL cutting fluid.

TRIM-SOL is a mixture of materials which provide for its desirable properties. Namely, it is comprised of petroleum oil, chlorinated waxes, emulsifiers, and odorants. In the course of normal usage, various components of TRIM-SOL either degrade or are expended. It then becomes necessary to replenish these components so that product integrity is restored. These additives include: TC-143-a mixture of amine oleates, emulsion stabilizers, pine oil, and wax; TC-150- polydimethylsiloxane; TC-154- aniline-base dye; A herbicide (bacteriocide) consisting of sodium salt of 2-pyridinethiol-1-oxide and hexahydro-1,3,5-tris-2-hydroxyethyl-s-triazine. These products were

evaluated by the producer for toxic effects. No literature could be found relating to toxicity studies of TRIM-SOL. Of the additives used to replenish TRIM-SOL, the herbicidal mix TC-183, has the potential to act as a dermal sensitizer.

A review of the information supplied will show that the TRIM-SOL concentrate is a strong conjunctival irritant when placed in the eye and not removed. The concentrate is a direct dermal irritant when applied and not removed. Human study (rarely performed with materials of this class) indicates that in certain susceptible individuals (atopic), as opposed to people in general, may react with an allergic-type reaction when challenged continuously via the dermal route.

## VI. RESULTS AND DISCUSSION

### A. Environmental

On September 10-13, NIOSH collected numerous environmental air samples from different operations in order to determined whether employees were being overexposed to specific chemicals identified by the union. On December 7, a follow-up environmental survey was conducted at plant 21 to evaluate the foam injection operation.

1. Plant 6: Electroplating: Five personal air samples were collected in the electroplating shop for cadmium and nickel. The limit of detection was 2 and 3 ug respectively. Neither of these metals were detected during this survey. Also, one air sample was collected for chromium VI and total particulate weight (Table I). No chromium VI was detected.

Paint Spray Booth: Two personal air samples were collected in the paint booth which is adjacent to the electroplating process. The air samples were evaluated for benzene, hexane, acetone and toluene (Table II). The benzene air concentrations were measured to be 0.3 and 0.4 parts of a vapor or gas per million parts of contaminated air by volume (ppm). Hexane and acetone were not detected. Toluene concentrations were 1.6 and 1.9 ppm. Employees working in the paint spray booth were not overexposed to any of these chemicals since employees wear an air line supplied respirator while doing their job.

Machine Shops: One bulk sample of tapping fluid (M-801) was collected and analyzed for nitrosamines and naphthalene. This tapping fluid was reported to be the most frequently used. Also, three charcoal tube air samples were collected for naphthalene. No nitrosamines or naphthalene were detected in the bulk samples, and no naphthalene was detected on the charcoal tubes. One bulk sample of TRIM-SOL (recirculated coolant) was collected and analyzed for nitrosamines, but none was detected. A bulk sample of coolant was collected and submitted to the laboratory to

prepare test standards in evaluating oil mist. Also, 23 environmental air samples were collected for oil mist analysis. Eventhough a significant proportion of the TRIM-SOL coolant contains petroleum oil, the TRIM-SOL was not completely miscible with the solvent. A weighed portion of the coolant was shaken vigorously with the solvent to extract oil. The solvent layer was removed, dried and diluted to make the standards. An attempt was made to evaluate the oil mist fraction of the coolant; however, the correlation between the bulk sample and the air samples are tenuous. Based on the chemists report, the TRIM-SOL coolant does not meet the definition of an oil based on its appearance, its immiscibility with the solvent, and its very high limit of detection. Thus, the air sample results cannot be used to evaluate workers° oil mist exposures given the chemists findings. Also, it should be noted that all the oil mist air samples collected from the Baker line, the deburring area and the tool repair room were not evaluated.

The cold room was the only area where all but one piece of equipment has local exhaust ventilation. This work area was judged to be the best work area based on discussions with several workers, the visible amount of oil mist observed in the air and the cool room air temperature. Some of the workers pointed out that some of the local exhaust ventilation systems are not working properly because moisture was condensing on some of the pedestal fans in the room. It is believed that the coolant is condensing due to the cool room air temperature as compared to the temperature of the fugitive coolant mist.

In general, the machines observed to produce some of the worst coolant mist was the radial drill press and the automatic chucker. Recommendations were reportedly made by the company industrial hygienist to completely enclose the automatic chucker, but this recommendation has not yet been implemented .

Inspection Department/ Machine Shop B: One air sample was collected in machine shop B for methyl chloroform during the degreasing of small parts (Table V). The air concentration was measured to be 45 ppm which is well below the evaluation criteria.

Tool Crib/Tool Grinding Area: One dust air sample was collected during tool grinding (table I). The filter was analyzed for Chromium VI and total particulate weight. The air concentrations were found to be 0.5 $ug/m^3$ and 3.3 $mg/m^3$ respectively. One air sample was collected to evaluate methyl chloroform exposures during degreasing of small parts (Table V). The air concentration was measured to be 0.5 ppm. No overexposures were measured based on the evaluation criteria.

Styrene Impregnation: Six air samples were collected during styrene impregnation of the parts (Table III). The air concentrations ranges from non-detectable to 1.1 ppm. No overexposures to styrene were measured during the dates of this survey based on the exposure criteria presented in Table A.

Lear Room: NIOSH was only able to collect one air sample while the employee riveted asbestos brake linings to the brake shoes (Table IV). The air concentration was measured to be 0.08 fibers per cubic centimeter of air (fibers/cc). This is an intermittent operation which may not be done for several weeks, or which may only be done one day a week for several hours, or several days a week for eight hours. It was not possible to characterize whether the employee was overexposed to asbestos based on this one sample. NIOSH recommends that occupational exposure to asbestos be kept to the lowest feasible level that can reliably be determined. This recommendation is based on the proven human carcinogenicity of asbestos and on the absence of a known threshold exposure level below which there is no risk of cancer. For most industrial settings, the lowest feasible limit for reliable detection of asbestos corresponds to a level of 0.1 fibers/cc. Since the air concentration was measured to be below this reliable detection limit, further monitoring is necessary. It should be noted that the employee does not wear respiratory protection while performing this operation. On occasion, some of the pads are broken while pressing the pad to the configuration of the shoe. Thus, dust appears to come from the breaking of the pad as well as riveting the pad to the shoe. Pads which are broken are placed into a receptacle; however, the bag is not identified as having asbestos products. Thus, there is a potential for contamination of others handling the broken asbestos material.

2. Plant 3: Monkey Island: Seven air samples were collected during the welding operation along monkey island. Two air samples were analyzed for chromium VI and total particulate weight (Table I). The chromium VI air concentrations were measured to be 1.2 and 1.8 ug/m$^3$ which is above the NIOSH evaluation criteria. The total dust air concentrations were measured to be 10.4 mg/m$^3$ which is below the evaluation criteria. Five filters were analyzed for cadmium, copper, manganese, and zinc welding fumes (Table VI). No cadmium or copper metal was detected on the filters. Manganese air concentrations ranged from none detected to 5 ug/m$^3$, and the zinc air concentrations ranged from 3 to 29 ug/m$^3$. Both of these metal fumes were below the Cal-OSHA standard listed in table A.

All welders are required to wear respirators to prevent overexposures to welding fumes. However, it does not appear that the employees know how to properly inspect or maintain their respirators. One of the welder's respirator was spot checked to evaluate its condition, and the inhalation valve was found missing. Another problem reported by the

welders was the welding fume build-up due to lack of servicing or infrequent servicing of the smog hogs. The investigator tried to determine the last time the electrostatic precipitators had been cleaned, but it could not be determined. It was reported that the smog hogs are suppose to be serviced by a contract company once a week, but there is no sign off card on the equipment to verify that the equipment was serviced. Lack of maintenance was evidenced by the continual electric arcing of many of the electrostatic precipitators.

M-113-Assembly/Gluing Operation) Eight environmental air samples were collected to evaluate benzene, hexane, acetone, and toluene exposures (Table VII). Benzene air concentrations ranged from none detected to 0.93 ppm. Hexane air concentrations ranged from none detected to 8 ppm. Acetone air concentrations ranged from none detected to 7.5 ppm, and toluene air concentrations ranged from 0.1 to 71.5 ppm. Benzene was the only chemical measured to be above the evaluation criteria listed in Table A. The employees working in the area reported eye irritation and slight headaches whenever they work inside the vehicles gluing the rubber pads which is consistent with solvent exposures. Based on the company's industrial hygiene survey, it was recommended that a respiratory protection program be implemented for employees working in this area; however, no respirator was being worn by any employee. Furthermore, several workers noted that it is too warm during the summer months to wear respirators while working inside the vehicles.

M-113-Assembly/Station 710: One air sample was collected during the application of Koppers lacquer and evaluated for toluene (34.8 ppm), MEK (182 ppm), MBK (none detected), and ethyl acetate (27.7 ppm) concentrations (Table VIII). It was reported that the lacquer is usually applied three times per day which takes about 40 minutes per application. No overexposures were measured during the monitoring period. Also, one air sample was collected during the Thiokol sealant application and evaluated for butanethiol, but none was detected.

3. Plant 10 and 4: Two environmental air samples were collected in Plant 4 (pick up area) after the vehicle is washed and alodine dipped. These air samples primarily represent dust generated during grinding. The filters were analyzed for chromium VI and total particulate (Table I). The chromium VI air concentrations were none detected and 0.7 $ug/m^3$ which is below the NIOSH evaluation criteria. The total particulate weight was 5.0 and 2.3 $mg/m^3$ which is below the CAL-OSHA standard.

Five air samples were collected from Plant 10 during seam welding for cadmium, copper, manganese, and zinc welding fumes (Table VI). No cadmium oxide fume was detected on the filters. Copper fume concentrations ranged from none detected to 4 $ug/m^3$. Manganese fume concentrations ranged from 2 to 6 $ug/m^3$, and zinc oxide concentrations

ranged from 9 to 20 ug/m$^3$. None of these metal fumes exceeded the evaluation criteria for Table A. It should be noted that one welder was wearing a respirator over a beard thereby preventing the possibility for a good face seal.

4. Arm Shop: Two air samples were collected from this area for oil mist, but these samples could not be evaluated for reasons mentioned earlier.

5. Plant 22: One air sample was collected during the application of Carbomastic #15 and evaluated for toluene and xylene (Table IX). No xylene was detected, and the toluene air concentration (1.3 ppm) was well below the evaluation criteria. Additionally, one sample was collected during the Thiokol application and evaluated for butanethiol, but none was detected. Since this employee was working in the same area where the carbomastic was being applied, the charcoal tube also was analyzed for toluene and xylene. The toluene concentration was 0.3 ppm and the xylene concentration was 0.1 ppm.

Armor Area: Two air samples were collected during the plasma arc cutting operation and analyzed for chromium, nickel and manganese fumes (Table X). No chromium or nickel was detected, and the manganese fume concentration was reported to be 7.2 ug/m$^3$ which is below the evaluation criteria. It should be noted that the operator uses several pedestal fans to direct fumes away from his work area. Although this appears to be a very effective way of preventing the operator from being exposed to cutting fumes, this method does not preclude the possibility for workers in the adjacent work areas from being exposed.

6. Martin Avenue Facility: Four air samples were collected during sheet metal cutting and the numerical controller operation. Workers were concerned about excessive exposures to the aluminum oxide dust, but none was detected during the dates of this survey.

One air sample was collected during the steel grinding operation and analyzed for chromium, nickel and manganese metallic dusts (Table XI). No chromium was detected, and nickel and manganese dusts air concentrations were measured to be 14.8 and 3.3 ug/m$^3$ respectively. No overexposures were measured; however, the nickel concentration was very close to exceeding the NIOSH evaluation criteria.

7. Plant 21: Four environmental air samples were collected during the foam injection operation for MDI. The samples were analyzed by the laboratory and found to have a very high limit of detection due to the leaching out of chemicals in the vials during shipment. Therefore, on December 5, 1984, a follow-up environmental survey was conducted. Four environmental air samples were collected to evaluate MDI air concentrations. The samples were transferred to clear glass

scintillation vials and shipped to the laboratory for analysis. No MDI was detected during the dates of this survey.

Six noise dosimeter measurements were collected from employees working in the paint spray booth along the packing line and at the pinear grinding station (Table XII). The sampling periods ranged from 2 hours to 7 hours. Two of the personnel samples (7 hours) exceeded the NIOSH recommended criteria of 85 dBA based on actual time measurements. It should be noted that the source of noise in this area is the curing ovens which were recently installed.

B. Medical

The medical department at FMC consists of eight permanent and four temporary R.N.s, two L.V.N.s, one full-time physician and two other physicians on contract as needed, and a workers° compensation coordinator. Approximately 170 physical examinations are conducted each month, of which two-thirds are periodic examinations of current employees. Approximately 310 audiometric examinations are conducted each month. There is an employee assistance program for substance abuse and counseling, a smoking cessation program, a pilot program for stress management, and an emergency response system with a hot line for requests for assistance from the plant floor. Employees are provided with copies of their laboratory test results to take to their own physicians upon request.

The most common injuries are strains and sprains, lacerations, and contusions. Occasional cases of flashburn occur in the welding areas. The most common work-related illnesses are dermatitis, particularly for workers in the machining area. Periodic examinations are provided for all workers having exposures above the action levels for Cal-OSHA regulated substances including asbestos, inorganic arsenic, PCBs, lead, noise, and acrylonitrile, and for painters, maintenance workers, foamers, welder/grinders, crane/vehicle operators, chemical handlers, spill team, security, platers, forklift operators, and grit blast area workers.

Tests conducted include blood counts, urinalysis, chemistry panels, pulmonary function tests, chest radiographs, vision checks, audiograms and blood lead tests. All cases of blood leads greater than 10 ug/dl are investigated by the industrial hygienist. The "foamers" who handle polyurethane foam injection receive pulmonary function testing at 8 AM (pre-shift) every year.

Twenty-two workers from various work areas of the plant requested private interviews with the NIOSH physician. Some of the medical symptoms reported are as follows:

a. During shutdown (few weeks) for maintenance, workers reported that methyl chloroform is used with rags for cleaning without the use of respirators. Workers reported nausea and headaches in association with the use of this solvent.

b. One employee, working in M-113 vehicle assembly area, i.e. gluing area, reported one incident of sharp chest pains in the past while working with the glue; he had to go home because of the severity of the pains. Reportedly another worker had been transferred off this job because of cardiac arrhythmias resulting from his work. Workers stated that in the summer it is frequently too hot in the tanks to wear respirators.

c. Employees working in the steam clean area reported that the mixture of soap and steam causes eye irritation, and they wanted to know what is in the cleaning mixture. They are very concerned about the potential effects on their eyes, skin and lungs.

d. Employees on the "red line/ blue line" peform pick up welding on vehicles which have been alodine dipped. Several workers reported that they developed bronchitis which persisted for several months or chest tightness.

e. Plastisol in masking area: Workers reported that use of plastisol thinner causes their tongues to be numb, headache, appetite suppression and sleepiness. They stated that the supervisor required anyone with solvent symptoms to wear a respirator. All workers are provided respirators if they are requested. Plastisol is not a biologically active compound.

f. Several employees who work in the cold room (machine shop C) complained about eye and respiratory irritation when the doors to the room are closed.

g. Machine shop: Employees working in the machine shops complained about the mixture of cutting oil and machine coolant. Almost all workers in this area reported some degree of dermatitis in association with coolant exposure, and many had findings of irritation. Many workers also reported symptoms of eye irritation, particularly when the oil has not been changed recently. Workers commonly reported headache and fatigue after a full day of working with the oils when the shop is closed and ventilation is poor.

Several workers had marked folliculitis of the forearms, defatting and cracking of the palms and fingers, and mild acne or a large number of comedones in areas where the oils accumulated on the face and neck. One worker reported that the stagnant pools of oil under some of the

machines provoked nausea occasionally. Many workers complained of chest tightness or asthma in association with prolonged exposure to TRIM-SOL coolant mixture.

Workers on the baker line reported eye and upper respiratory irritation, headache and fatigue when coolant accumulated in the air, particularly in the winter when the large doors were shut and ventilation was decreased. One of the workers stated that some of them go home early when this situation is very bad.

## VII. CONCLUSIONS

Based on the environmental air sample results collected from numerous areas identified during the initial survey, a health hazard existed due to personnel overexposures measured in the following areas: benzene exposures were measured in the M-113 vehicle assembly area during gluing of rubber parts inside the vehicle; noise exposures were measured to two painters in plant 21. There is a potential exposure to Chromium VI which was detected along monkey island, particuliarly for those welders' whose respirator is missing valves or respirators which are not properly fitted. Also, a potential exposure to nickel dust was measured during steel grinding at the Martin Avenue facility.

Medical interviews revealed a health hazard existed due to the following: employees exposed to TRIM-SOL machine coolant reported one or more symptoms including: dermatitis, eye and upper respiratory irritation, headache, and fatigue; employees who use methyl chloroform and other solvents used in glues and thinners reported symptoms consistent with solvent overexposure; employees working at the wash rack (steam cleaning) complained that the soap causes eye irritation; and employees working on the pick-up line adjacent complained about bronchitis and chest tightness.

## VIII. RECOMMENDATIONS

1. It is recommended that local exhaust ventilation be used to control machine coolant exposures based on medical symptoms reported by the workers.

2. Better personal hygiene by all workers exposed to cutting oils would assist in the control of folliculiar dermatitis, chloracne, and other forms of dermatitis.

3. Workers should be made aware of the potential for dermal sensitization by TRIM-SOL AND TC-183.

4. Employees should receive training regarding the potential hazards of the chemicals used in their work area, including the symptoms of exposure, and instructed to report any symptoms immediately to the supervisor. Symptomatic employees should be removed from further exposure until the exposures can be controlled.

5. Employees who use solvents of any type for cleaning of parts or vehicle surfaces should wear personal protective equipment including protective gloves and eye protection.

6. Workers are unable to wear respirators when applying Thiokol sealant to the fuel tanks inside the vehicles due to space limitations, thus it is recommended that fans or some other air supply device such as a piccolo tube be used to supply fresh air, to prevent the build-up of solvents emanating from the sealant and prevent symptoms of solvent (ketone) exposure.

7. The company respirator program should be in accordance with the Occupational Safety and Health Act (OSHA) requirements outlined in 29 CFR Part 1910.134. The respirator program should include the following: proper respirator selection, training and education of the user, fit testing, maintenance of equipment, proper and adequate storage, periodic inspection, surveillance of work area condition, periodic inspection of program to determine continued effectiveness and medical determination of user.

8. It is recommended that additional air monitoring be conducted by the company industrial hygiene staff during the riveting of asbestos pads to brake shoes in order to better characterize the potential exposure. In the interim, the operator should use respiratory equipment to prevent inhalation of fibers generated during the operation. Also, the plastic bag, into which the broken pads are discarded, should be properly labeled to warn others of the contents.

9. Employees working along the pick-up area should wear respirators to prevent exposure to welding fumes and dust from alodine dipped parts.

10. It is recommended that eye protection be provided for employees working on the wash rack to prevent the eye irritation which was reported by workers during medical interviews.

11. It is recommended that the oven in Plant 21 (Gear Room) used to heat oily castings and bearings for press fittings be ventilated to the outdocrs as opposed to ventilating the fumes inside the general work area.

12. It is recommended that periodic air monitoring be conducted in plant 22, armor area, during the plasma arc cutting operation to evaluate potential exposures to metal fumes. It is recommended that the industrial fans be turned off while monitoring the operation since these fans are not considered an acceptable engineering control.

13. A device, e.g. plastic sign off card, should be attached to the electrostatic precipitators along monkey island so that supervisors and employees can see whether the filters are being serviced according to schedule thereby preventing fume build-up along monkey island as is reported by the workers.

14. Employees working in plant 21 (foam injection operation) and those handling the polyurethane paints should have full pulmonary function testing (PFT) as follows:

    a) During the pre-placement examination

    b) If currently working in these areas, PFT should be administered at the start of shift upon return to work after vacation, a three-day weekend, or an extended period without exposure, and then at the end of shift after two or more consecutive days of exposure (i.e., Monday at start of shift after a week off, and Tuesday at end of shift, or at end of shift any day that week if the whole week is worked)

    c) Yearly at the start of shift upon return to work after vacation, a three-day weekend or an extended period without exposure, and then at the end of a shift after two or more consecutive days of exposure

    The results of these tests should be graphed over time and reviewed related to criteria for the developement of pulmonary abnormalities.

15. It is recommended that noise measurements be performed periodically in plant 21 along the curing ovens and adjacent work areas to determine the time-weighted average exposures.

## IX. REFERENCES

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17. Criteria for a recommended standard...Occupational Exposure to Asbestos, Revised, 1977, DHEW (NIOSH) Publication No. 77-169.

18. Criteria for a recommended standard...Occupational Exposure to Noise, DHEW (NIOSH) Publication No. 73-11001.

19. Criteria for a recommended standard...Occupational Exposure to Diisocyanates, DHEW (NIOSH) Publication No. 78-215.

Copies of this report have been sent to:

1. International Association of Machinists and Aerospace Workers, Local Number 562.

2. FMC Corporation, San Jose, California.

3. U.S. Department of Labor-Region IX.

4. NIOSH-Region IX.

For the purpose of informing the 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.

Table I

Personal Air Samples
Results for Hexavalent
Chromium and Total Particulate

FMC Corporation
San Jose, California
HETA 84-368

September 10-12, 1984

| Date | Sample Number | Job and/or Location | Exposure Period | Volume Liters | Concentration Chromium VI ($ug/m^3$)[1] | Concentration Total Particulate ($mg/m^3$)[2] |
|---|---|---|---|---|---|---|
| 9/10 | 1738 | Electroplating-Alodine tank tender | 0745-1407 | 764 | N.D.[3] | ---- |
| 9/10 | 1737 | Tool Grinding | 0811-1432 | 572 | 0.5 | 3.3 |
| 9/11 | 1718 | Monkey Island-Red Blue Line | 0706-1425 | 659 | 1.2 | 10.4 |
| 9/11 | 1717 | Monkey Island-Red Blue Line | 0708-1427 | 878 | 1.8 | 10.4 |
| 9/11 | 1721 | Plating Dip Tank-Crane Operator | 0723-1429 | 724 | N.D. | 0.8 |
| 9/12 | 1762 | Plant 4 Pick-up area | 0702-1420 | 908 | N.D. | 5.0 |
| 9/12 | 1765 | Plant 4 Pick-up area | 0705-1420 | 740 | 0.7 | 2.3 |

1. $ug/m^3$- micrograms of a contaminant per cubic meter of air.
2 $mg/m^3$- milligrams of a contaminant per cubic meter of air.
3. ND.-None detected.

Evaluation Criteria:
Chromium VI- 1.0 $ug/m^3$ (NIOSH)
Total Nuisance Dust- 10 $mg/m^3$ (Cal-OSHA)

Table II

Personal Air Sampling Results Collected
At Paint Spray Booth next to Electroplating

FMC Corporation
San Jose, California
HETA 84-368

September 10, 1984

| Sample Number | Job and/or Location | Sample Period | Volume Liters | Concentration (ppm)[1] | | | |
|---|---|---|---|---|---|---|---|
| | | | | Benzene | Hexane | Acetone | Toluene |
| 2 | Paint Booth-Painter | 0728-1035 | 33 | 0.3 | ND[2] | ND | 1.6 |
| 5 | Paint Booth-Painter | 1035-1400 | 35 | 0.4 | ND | ND | 1.9 |

1. ppm- Parts of a vapor or gas per million parts of contaminated air by volume.

2. ND- None detected

Evaluation Criteria:

Benzene- Lowest feasible limit due to suspect or confirmed carcinogen (NIOSH)
Hexane - 50 ppm (Cal-OSHA)
Acetone- 250 ppm (NIOSH)
Toluene- 100 ppm (NIOSH)

Table III

Environmental Air Sample Results
Collected During Styrene Impregration

FMC Corporation
San Jose, California
HETA 84-368

September 10-12, 1984

| Date | Type Sample | Sample Number | Sample Period | Volume Liters | Concentration (ppm)[1] |
|---|---|---|---|---|---|
| 9/10 | P[2] | 3 | 0715-1045 | 35 | 0.4 |
| 9/10 | P | 6 | 1045-1410 | 47 | ND[3] |
| 9/12 | P | 30 | 0713-0940 | 26 | 0.8 |
| 9/12 | A[4] | 31 | 0715-0945 | 26 | 1.1 |
| 9/12 | A | 32 | 0940-1335 | 39 | 0.6 |
| 9/12 | A | 34 | 0943-1335 | 39 | 0.2 |

---

1. ppm- Parts of a vapor or gas per million parts of contaminated air by volume.
2. P- Personal air sample
3. ND-None detected
4. A- Area air sample

Evaluation Criteria:

Styrene 50 ppm (NIOSH)

Table IV

Personal Air Sample Result Collected for
Asbestos in the Gear Room

FMC Corporation
San Jose, California
HETA 84-368

September 11, 1984

| Sample Number | Job and /or Location | Sample Period | Volume Liters | Asbestos Conc. (fibers/cc)[1] |
|---|---|---|---|---|
| 1 | Operator rivets brake pad to brake shoe. | 0715-1149 | 411 | 0.08 |

1. fibers/cc- asbestos fibers per cubic centimeters of air and greater than 5 microns in length

Evaluation Criteria:

Asbestos- Lowest feasible limit due to suspect or confirmed carcinogen (NIOSH)

Table V
Area Air Sample Results
for Methyl Chloroform

FMC Corporation
San Jose, California
HETA 84-368

September 10, 1984

| Sample Number | Job and/or Location | Sample Period | Volume Liters | Concentration (ppm)[1] |
|---|---|---|---|---|
| 104 | Tool Crib/Tool Grinding room degreasing small parts. | 0811-1430 | 67.1 | 0.5 |
| 105 | Machine shop B, insp.area, degreasing small parts. | 0815-1433 | 64.7 | 45.1 |

1. ppm- Parts of a vapor or gas per million parts of contaminated air by volume.

Evaluation Criteria:

Methyl Chloroform- 350 ppm (NIOSH)

Table VI

Environmental Air Samples
Collected For Welding Fumes

FMC Corporation
San Jose, California
HETA 84-368

September 10-12, 1984

| Date | Type Sample | Sample Number | Job and/or Location | Exposure Period | Volume Liters | Concentration ($ug/m^3$)[1] Cadmium | Copper | Manganese | Zinc |
|---|---|---|---|---|---|---|---|---|---|
| 9/11 | P[2] | 11 | Monkey Isl. Welder-Sta.410 | 0640-1410 | 585 | ND[3] | ND | 5.0 | 3.0 |
| 9/11 | P | 12 | Monkey Isl. Crane Oper. | 0644-1330 | 812 | ND | ND | ND | 2.0 |
| 9/11 | P | 13 | Monkey Isl. Welder-Sta.410 | 0646-1330 | 606 | ND | ND | 2.0 | 29.0 |
| 9/11 | P | 14 | Monkey Isl. Welder-Trunion | 0652-1420 | 672 | ND | ND | 3.0 | 9.0 |
| 9/11 | A[4] | 112 | Monkey Isl. Sta. 410 | 0656-1417 | 882 | ND | ND | ND | 10.0 |
| 9/12 | P | 30 | Plant 10 Welder North Bay | 0640-1415 | 683 | ND | 4.0 | 3.0 | 12.0 |
| 9/12 | P | 31 | Plant 10 Welder Sta. 260 | 0646-1416 | 900 | ND | 2.0 | 6.0 | 14.0 |
| 9/12 | P | 32 | Plant 10 Welder Sta. 260/280 | 0647-1431 | 742 | ND | 4.0 | 5.0 | 20.0 |
| 9/12 | P | 33 | Plant 10 Welder Sta. 260 | 0652-1430 | 687 | ND | ND | 2.0 | 9.0 |
| 9/12 | P | 34 | Plant 10 Welder-Hull | 0659-1420 | 662 | ND | ND | 3.0 | 15.0 |

1. $ug/m^3$- micrograms of a contaminant per cubic meter of air.
2. P-Personal air sample.
3. ND-None detected
4. A-Area air sample

Evaluation Criteria:

Cadmium Oxide Fumes- 40 $ug/m^3$ (NIOSH)
Copper Fumes- 0.2 $mg/m^3$ (Cal-OSHA)
Manganese Fumes- 1.0 $mg/m^3$ (Cal-OSHA)
Zinc Oxide Fumes- 5.0 $mg/m^3$ (Cal-OSHA)

Table VII

Air Sample Results Collected
During the Gluing Operation

FMC Corporation
San Jose, California
HETA 84-368

September 12, 1984

| Sample Number | Type Sample | Job and/or Location | Sample Period | Volume Liters | Concentration (ppm)[1] Benzene | Hexane | Acetone | Toluene |
|---|---|---|---|---|---|---|---|---|
| 11 | P[2] | Gluer, Sta. 710 Mezzanine | 0745-0807 | 5 | 0.93 | 8.0 | 7.5 | 37.0 |
| 12 | P | Top Plate, Sta. 710 | 0745-1022 | 28 | ND[3] | ND | ND | 0.2 |
| 13 | A[4] | Inside vehicle, Sta. 710 | 0745-0807 | 4 | 0.3 | 17.5 | 20. | 71.5 |
| 14 | P | Gluer, Sta. 710 Mezzanine | 0815-1015 | 21 | 0.1 | 1.2 | 1.2 | 5.6 |
| 15 | A | On Post, above gluing operator | 0820-1025 | 22 | ND | ND | ND | 0.1 |
| 16 | P | Gluer, Sta. 710 Mezzanine | 1015-1400 | 41 | 0.3 | 2.2 | 3.1 | 11.4 |
| 17 | P | Top Plate, Sta. 710 | 1022-1300 | 31 | ND | ND | ND | 0.8 |
| 18 | A | On Post, above gluing operator | 1030-1250 | 25 | ND | ND | ND | 0.1 |

1. ppm- Parts of a vapor or gas per million parts of contaminated air by volume.
2. P -Personal air samples
3. ND- None detected
4. A- Area air samples

Evaluation Criteria:

Benzene- Lowest feasible limit due to suspect or confirmed carcinogen (NIOSH)
Hexane- 50 ppm (Cal-OSHA)
Acetone- 250 ppm (NIOSH)
Toluene- 100 ppm (NIOSH)

Table VIII

Personal Air Sample Results
Collected at Vehicle Assembly
During Lacquer Application

FMC Corporation
San Jose, California
HETA 84-368

September 11, 1984

| Sample Number | Job and/or Location | Sample Period | Volume Liters | Concentration (ppm)[1] | | | |
|---|---|---|---|---|---|---|---|
| | | | | Toluene | MEK[2] | MBK[3] | Ethyl Acetate |
| 19 | Station 720, vehicle ass. | 1230-1430 | 16 | 34.8 | 182 | ND[4] | 27.7 |

1. ppm- Parts of a vapor or gas per million parts of contaminated air by volume.
2. MEK- Methyl ethyl ketone
3. MBK- Methyl iosbutyl ketone
4. ND.- None detected

Evaluation Criteria:

Toluene- 100 ppm (NIOSH)
MEK- 200 ppm (NIOSH)
MBK- 1.0 ppm (NIOSH)
Ethyl Acetate- 400 ppm (Cal-OSHA)

Table IX

Personal Air Sample Results for
the Carbomastic/Thiocol Application

FMC Corporation
San Jose, California
HETA 84-368

September 12, 1984

| Sample Number | Job and/or Location | Sample Period | Volume Liters | Concentration (ppm)[1] Toluene | Xylene |
|---|---|---|---|---|---|
| 111 | Worker applying carbomastic to the vehicles | 1051-1125 | 6.1 | 1.3 | ND[2] |
| 112 | Worker applying Thiocol to the vehicles | 1026-1421 | 41.3 | 0.3 | 0.1 |

1. ppm- Parts of a vapor or gas per million parts of contaminated air by volume.
2. ND- None detected.

Evaluation Criteria:

Toluene- 100 ppm (NIOSH)
Xylene- 100 ppm (NIOSH)

Table XI

Personal Air Sample Collected at
the Martin Avenue Facility for
Metal dusts

FMC Corporation
San Jose, California
HETA 84-368

September 12, 1984

| Sample Number | Job and/or Location | Sample Period | Volume Liters | Concentration ($ug/m^3$)[1] | | |
|---|---|---|---|---|---|---|
| | | | | Chromium | Nickel | Manganese |
| 1727 | Grinder, Martin Ave. Facility | 0800-1445 | 607 | ND[2] | 14.8 | 3.3 |

1. $ug/m^3$- micrograms of a contaminant per cubic meter of air.

2. ND- None detected.

Evaluation Criteria:

Nickel Dust- 15.0 $ug/m^3$ (NIOSH)

Manganese Dust- 5.0 $mg/m^3$ (CAl-OSHA)

Table XII

Plant 21
Noise Dosimetry Results

FMC Corporation
San Jose, California
HETA 84-368

September 11, 1984

| Sample Number | Job and/or Location | Sample Period | Noise Exposure dBA[1] |
|---|---|---|---|
| 1 | Painters Assistant | 0700-1400 | 89.6 |
| 2 | Packing | 0830-1400 | 82.5 |
| 3 | Painter | 0700-1200 | 89.8 |
| 4 | Painter | 0700-1400 | 90.7 |
| 5 | Packing | 0830-1400 | 83.3 |
| 6 | Pinear Grinding | 1200-1400 | 85.3 |

1. dBA-decibels A weighted

Evaluation Criteria:
Noise 85 dBA (NIOSH) time-weighted average.

# ADDENDUM TO HETA 84-368-1624

This Addendum contains letters detailing;

(a) FMC'S concerns regarding the NIOSH HETA report issued in September, 1985

(b) NIOSH's response which clarifies the basis for our conclusions.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
National Institute for
Occupational Safety & Health
Robert A. Taft Laboratories
4676 Columbia Parkway
Cincinnati OH 45226

February 11, 1986

Mr. Ron Baptist
FMC Corporation
Supervisor - Health and Safety
1125 Coleman Avenue
San Jose, California

Dear Mr. Baptist:

This letter is a follow-up to my meeting with you, Tom Yeater and Steve Brisbane on January 10, 1986 in which you expressed certain concerns regarding our recently published health hazard evaluation report (84-368-1624) for FMC Corporation, San Jose, California. As we understand it, your concerns related mainly to two sections of the report (1) the phrasing utilized in the summary (pages 1 and 2) of the report and (2) the specific recommendations which we made for reducing hazardous exposures in Section VIII (pages 23-25) of our report. The purpose of this letter is to clarify the statements we made in our report on these two issues.

Section I. Summary

As we understand it your specific concerns regarding this section were as follows. You objected to our use of the word "overexposure" when referring to one sample in which we measured an airborne benzene exposure level of 0.93 ppm. Secondly, you believed we should not have concluded that your respiratory protection program was inadequate based on a problem with one respirator. Thirdly, you objected to our concluding that there was a hazard from exposure to TRIM-SOL™ (and recommending local exhaust ventilation) purely on the basis of a non-random sample of employee complaints. Finally, you believed we should have highlighted in our summary that FMC had initiated (contracted with the University of Minnesota for) a mortality study of employees in the Ordnance Division to address the workers' concerns about the "apparent" (suspected) increased numbers of cancers and other illnesses.

Regarding our use of the word "overexposure" to benzene, benzene exposures were measured in four air samples which ranged in concentration from 0.1 to 0.93 ppm. As you can see from the enclosed table, (page 11 of the report) NIOSH recommends that worker exposures to benzene be controlled to the lowest feasible level. Thus, while an exposure to benzene of 0.93 ppm might not exceed current Federal or State regulatory standards, we believe (and you agree that) this level is sufficiently high, given the human and animal evidence available regarding the carcinogenicity of benzene, that efforts should be made by you to further reduce your workers' exposures to benzene.

Secondly, our references to "inadequacy" of your respiratory protection program were not based solely on one respirator missing a valve, but on the NIOSH industrial hygienists' observations during the study. The NIOSH industrial hygienists' concerns regarding the respiratory program were initially related to the FMC staff and union representatives at the closing conference conducted at the conclusion of the initial survey. Some of the other observations not specifically noted in the health hazard determination report which were observed by NIOSH and their escorts included: one worker wearing a respirator over a beard, workers only fastening one of the two respirator straps, workers when questioned stating that they did not clean their respirator daily after each use, and one worker observed trying to wear safety glasses in conjunction with wearing a half-mask respirator. It is these types of descrepancies which precipitated recommendation #7 on page 24 of the health hazard determination report.

Regarding our drawing conclusions purely on the basis of employee interviews, we would agree with you that it would have been preferable for us scientifically in this situation, to have performed objective medical tests on TRIM-SOL exposed and unexposed employees and have objectively measured airborne concentrations of and possibly skin exposures to TRIM-SOL™ in deriving our conclusions. As you know, for a variety of reasons we were unable to do this. Notwithstanding the above, it is still our professional (medical and industrial hygiene) judgement that the symptoms reported by the employees do in fact represent the resultant effects of exposure to this machine coolant. Recommendations for local exhaust were made because those employees who worked in the "cold room", where local exhaust ventilation is used, did not complain about the coolant mist vapors like those employees working in the machine shop where the machinery was not ventilated. In addition, good industrial hygiene practices suggest that local exhaust ventilation is one of the recommended methods of preventing worker exposure in addition to chemical substitution and wearing personal protective equipment.

Section VIII. Recommendations

With respect to FMC's other "general responses to NIOSH recommendations," NIOSH wishes to clarify the following recommendations:

NIOSH recommendation #8 recommends that the company conduct additional asbestos air monitoring because the company had no environmental air sampling data to review at the time of the survey. Additionally, NIOSH could not make any determination about employee exposure to asbestos air concentration because the riveting of asbestos brake lining to the shoe was only monitored for several hours.

Recommendation #9 recommends that employees wear a respirator to prevent chromium VI exposures due to working (grinding and welding) on alodine dipped parts. Since only grinding is done at the pick-up area on alodine dipped

parts, NIOSH concurs that no respirator is required based on the environmental air monitoring data collected during this survey. NIOSH does recommend that periodic air monitoring be done of this operation since chromium VI is carcinogenic.

Number 11 recommends that the oven used in Plant 21 (Gear Room) used to heat oily castings and bearings be ventilated outdoors. At the time of the survey, the NIOSH investigator asked one of the supervisors in the work area what they called the device used to heat the oily castings and bearings in order to properly describe the device in the final report. The supervisor called the heating device an "oven".

Number 12 recommends that air monitoring be done in plant 22, armor area, to evaluate metal fumes and that the pedestal fans be turned off during the air sampling. Based on discussions with the FMC staff at the time of the survey, air monitoring had never been done during the plasma arc cutting operation. During the survey, the ambient air temperature was quite warm, consequently the fans were left on to cool the operator. It was understood that during cooler periods, the fans may not be used, thus the worker may be exposed to metal fumes. For this reason, NIOSH recommended that air monitoring be conducted by the company industrial hygienist with the fans turned off. If the air monitoring data is above any of the specified standards for those metal fumes sampled, then proper steps should be taken to insure the worker is not exposed. It should be noted that pedestal fans should be used for general ventilation. Properly used, general ventilation can be very effective for removing large volumes of heated air, or for the removal of low concentrations of non-toxic or low toxicity contaminants from minor and decentralized sources.

In reviewing, the report, it was discovered that one recommendation was inadvertently left out. This pertains to the steel grinding operation at the Martin Avenue facility in which only one air sample was collected. The air sample detected nickel at a concentration of 14.8 ug/$m^3$. The NIOSH recommended criteria is 15.0 ug/$m^3$. Since this air concentration is very close to the NIOSH evaluation criteria, it is recommended that additional air monitoring be performed by the company industrial hygienist to further evaluate the operation.

Finally, we wish to apologize for not mentioning in the health hazard determination report summary that FMC is commissioning an epidemiologic study to determine if the reported increasing number of cancers and other illnesses among FMC workers is as a result of their workplace exposures. It should be noted that in March 1985, Dr. Coye sent a letter to the IAM local 562 union president regarding the union's concern about the suspected increase in cancer cases and deaths among employees and retirees at FMC Corporation. Dr. Cove advised the union that she met with the FMC Director of Environmental Health and Safety to discuss the desirability and feasibility of a Standardized Mortality Rate (SMR) study at FMC in San Jose. Dr. Coye advised the union that FMC will probably proceed with an SMR study, to be contracted to a

university-based epidemiologist, and that FMC was favorable to oversight of the study by a tripartite (labor, management, and governmental) committee to review the study protocols etc. Since Dr. Coye wrote the union regarding this issue, it was decided to exclude this from the summary. In retrospect NIOSH should have left the information regarding the epidemiolgic study which is being conducted by FMC in the determination report since this was one of the questions addressed in the health hazard evaluation request which becomes part of the public record.

I hope that this letter helps to clarify the main issues you raised during our meeting. We would expect that you will post this letter along with the final report of our evaluation. We plan to include this letter along with the copies of the report which we submit to the National Technical Information Service.

Sincerely yours,

John K. Bainbridge
Chief
Hazard Evaluations and Technical
Assistance Branch
Division of Surveillance, Hazard
Evaluations and Field Studies

Enclosure

TABLE A

Permissible Exposure Limit
8-Hour Time-Weighted

| Substance | Exposure Basis | Source |
|---|---|---|
| Methyl Chloroform | 350 ppm(1) | NIOSH, Cal-OSHA, ACGIH |
| Chromium VI | 1.0 ug/$m^3$(2)<br>0.05 mg/$m^3$(3) | NIOSH<br>Cal-OSHA, ACGIH |
| Total Nuisance Dust | 10 mg/$m^3$ | Cal-OSHA, ACGIH |
| Cadmium Oxide Fumes | 40 ug/$m^3$<br>0.05 mg/$m^3$C[4] | NIOSH<br>Cal-OSHA, ACGIH |
| Copper Fumes | 0.2 mg/$m^3$ | Cal-OSHA, ACGIH |
| Manganese Fumes<br>Manganese Dust | 1.0 mg/$m^3$<br>5.0 mg/$m^3$ | Cal-OSHA, ACGIH<br>CAl-OSHA, ACGIH |
| Zinc Oxide Fumes | 5.0 mg/$m^3$ | Cal-OSHA, ACGIH |
| Nickel Dust | 15.0 ug/$m^3$<br>1.0 mg/$^3$ | NIOSH<br>Cal-OSHA, ACGIH |
| Asbestos | LFL (CA)[5]<br>2.0 Fibers/cc | NIOSH<br>Cal-OSHA, ACGIH |
| Styrene | 50 ppm<br>100 ppm | NIOSH, ACGIH<br>Cal-OSHA |
| Toluene | 100 ppm | NIOSH, Cal-OSHA, ACGIH |
| Xylene | 100 ppm | NIOSH, Cal-OSHA, ACGIH |
| Methyl ethyl ketone (MEK) | 200 ppm | NIOSH, Cal-OSHA, ACGIH |
| Methyl butyl ketone (MBK) | 1.0 ppm<br>5.0 ppm | NIOSH<br>Cal-OSHA, ACGIH |
| Ethyl Acetate | 400 ppm | Cal-OSHA, ACGIH |
| Benzene | LFL (CA)<br>10.0 ppm | NIOSH<br>Cal-OSHA, ACGIH |
| Hexane | 50.0 ppm | Cal-OSHA, ACGIH |
| Acetone | 250 ppm<br>750 ppm | NIOSH<br>Cal-OSHA, ACGIH |
| Methylene bisphenyl Isocyanate (MDI) | 0.55ug/$m^3$<br>0.02 ppm C[4] | NIOSH<br>Cal-OSHA, ACGIH |
| Noise | 85 dBA<br>90 dBA[6] | NIOSH, ACGIH<br>Cal-OSHA |

1. ppm-Parts of a vapor or gas per million parts of contaminated air by volume
2. ug/$m^3$-Micrograms of a substance per cubic meter of air
3. mg/$m^3$-Milligrams of a substance per cubic meter of air
4. C-Ceiling level which should never be exceeded
5. LFL (CA)-Lowest feasible limit due to suspect or confirmed carcinogen, use best control technology
6. dBA-decibels, A weighted

FMC Corporation

March 17, 1986

FMC

J. Donald Millar, M.D.
Director
National Institute of Occupational
Safety & Health
U. S. Department of Health & Human Resources
1600 Clifton Road, NE
Atlanta, Ga. 30333

Re: NIOSH Health Hazard Evaluation
#HETA 84-368-1264
FMC Corporation
San Jose, CA

Dear Dr. Millar:

FMC Corporation regards NIOSH as a valuable ally in occupational health research and a major proponent of safety and health in the workplace. NIOSH has conducted several Health Hazard Evaluations in FMC operations at considerable expense to both the Institute and FMC. For the most part, we have regarded these evaluations as beneficial to all parties. FMC is an advocate of the Institute and does not wish to be viewed as being otherwise; however, our most recent experience indicates that the Hazard Evaluations and Technical Branch (HETA) is digressing toward the inflexible and unrealistic policies and practices that burdened the agency prior to 1982. This letter is to register our concerns about a Health Hazard Evaluation conducted at FMC's San Jose, California operation in '84 -'85, and to request your assistance.

The subject Health Hazard Evaluation was highly unprofessional (particularly the medical section) and contains both factual as well as procedural errors. Moreover, the written report drew erroneous, subjective conclusions (stated as factual findings) about the health status of our workforce. What's more, NIOSH recommends implemention programs that are already in place and/or the recommendation bears little relevance to the findings or to reasonable application.

The attached letter dated March 13, 1985, to J.K. Bainbridge from R. Baptist outlines our position with greater specificity and represents our latest attempt to resolve our differences. We are not optimistic.

We realize honest disputes occur. However, the complete and accurate understanding of the findings of this substandard report by our employees is far too important of an issue. Attempts by FMC to resolve our differences (by telephone and a meeting in Cincinnati) have met with unsatisfactory results. Indeed, the outcome of our Cincinnati meeting resulted in the HETA adding a new recommendation and disavowing our other points of concern (see attached Bainbridge to Baptist letter). The HETA refuses our request to revise the report on the basis of the attached letter and on the grounds the report is published. Frankly, if a formal mechanism existed to challenge the findings of this study, we would be in that forum today. However, in the absence of such a mechanism we are requesting your thorough review and consideration of our position.

Specifically, FMC is requesting that the HETA revise the report to conform to the factual findings of the study. As a minimum, FMC requests that NIOSH & the HETA add an addendum detailing the company's position to the written report. Such an addendum would become a permanent part of the study and issued to all concerned parties and the NTIS.

Thank you for your consideration and early response.

Very truly yours,

Thomas R. Yeater
Director
Occupational Safety & Health

cc: James Miller, III, OMB
R. M. Curtis

FMC Corporation

Ordnance Division
1125 Coleman Avenue Box 367
San Jose California 95103
(408) 289 0111

March 13, 1986

John K. Bainbridge, Chief
Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations and Field Studies

Dear Mr. Bainbridge:

We have reviewed your February 11, 1986 correspondence regarding the Health Hazard Evaluation (HHE 84-368-1624) of FMC Ordnance Division. The peer review of that report conducted by your staff and the subsequent clarification of statements made is appreciated. However, we continue to have major concerns with statements made in the HHE that were not adequately addressed in the above referenced correspondence. Specifically, we feel additional analysis is warranted in four areas:

1. Representation of benzene exposures as "overexposures";

2. Conclusion that health risks exist based on complaints from a nonrandom sampling of employees and subsequent recommendations for engineering controls without medical or industrial hygiene test/data to support such recommendations;

3. Lack of any conclusion on the primary allegation which prompted the Health Hazard Evaluation (i.e. "an apparent increased number of cancers among employees at FMC");

4. Representation that the respiratory protection program at FMC is inadequate.

We would like to take this opportunity to again provide basic reasons why we feel the above four areas require additional review.

**BENZENE**

The HHE summary (page 2) states that an "overexposure to benzene was measured". The HHE conclusions (page 23) state that "a health hazard existed due to personnel overexposure to benzene".

The term overexposure, as it is used in training of FMC employees in chemical safety aspects as well as it is used in general industrial

hygiene practice, refers to exposures that exceed OSHA and CAL OSHA permissible exposure levels.

A time weighting of the NIOSH monitoring data as reported in table VII indicated the Gluer at Station 710 had a benzene exposure of 0.27ppm, time weighted for the sampling period, and 0.21ppm for an 8 hr TWA. The benzene exposure in question (whether based on a single short term sample or a full shift TWA) is well below the OSHA PEL. That PEL is currently 10ppm.

NIOSH utilizes a "lowest feasible limit (LFL)" concept to evaluate benzene exposures. Implied in that concept is that engineering controls be used where feasible. The job in question requires an employee to apply glue inside of a vehicle hull. The feasibility of implementing local exhaust ventilation to that task is highly suspect.

FMC has an overall concern on this issue as follows:

1. Benzene exposures are well below OSHA limits; yet, they are listed in the two most prominent HHE report sections as "overexposures" without qualification as to what criteria. This is very misleading to the average employee.

2. With a benzene TWA of 0.2ppm compared to a current PEL of 10ppm, are engineering controls actually necessary?

3. The NIOSH report implies that feasible controls are not in use. Has any actual feasibility analysis been conducted by NIOSH?

EMPLOYEES COMPLAINTS - MACHINE SHOPS

The HHE summary (page 2) indicates that "The Medical study found a health hazard based on symptoms of workers exposed to Trim Sol coolant".

The Medical section of the report (page 21) indicates that 22 workers from various work areas requested private interviews with the NIOSH physician.

There was no random sampling of employees for the interviews from which the NIOSH physician drew conclusions as to health hazards existing due to machine coolant exposures.

No medical tests were conducted by the NIOSH physician to substantiate alleged worker complaints.

No statement was made in the report as to how many machine shop employees complained of respiratory problems.

No FMC medical files were reviewed on the machine shop employees who alleged respiratory problems.

No mention was made in the report as to which specific machines in the shops were alleged to be a health problem by employees nor which areas are, according to the NIOSH physician, resulting in an alleged health

hazard due to Trim Sol exposure.

No industrial hygiene assessment of coolant exposures could be made by the NIOSH industrial hygienists. The coolant is over 90% water as used in normal operations.

The medical section of the HHE (page 13) states that symptoms reported by the workers were evaluated for consistency with the nature and extent of exposure to the chemicals. That appears not to be the case for the complaints of respiratory problems from coolant exposures. Again, no evaluation of the extent of exposure was effected by NIOSH. As to the nature of exposure, the toxicological evaluation listed for Trim-Sol deals only with dermatitis, dermal sensitization and conjunctival irritation.

The HHE states (page 17) that Trim-Sol does not meet the definition of an oil based on several factors.

It is unclear to the reader what basis the NIOSH physician used to deduce the existance of a health hazard (specifically a respiratory system hazard) for those employees using Trim-Sol.

When considering the lack of objective information listed above the recommendation that "local exhaust ventilation be used to control machine coolant exposures" is questionable. Again, where are the problems alleged to exist? To what extent are controls necessary?

CANCER

The primary concern of the International Association of Machinists and Aerospace Workers leading to their request for an HHE was their perception of "an apparent increased number of cancers and other illnesses among employees at FMC".

The HHE and your subsequent clarification letter do not present any NIOSH conclusions to address the union concern.

We understand that the type of study conducted by NIOSH might not facilitate resolution of the union concern. However, it seems reasonable that the HHE summary or conclusions should address the issue.

RESPIRATORY PROTECTION PROGRAM

The HHE summary describes the Ordnance Division respiratory protection program as inadequate. Further clarification is provided in the February 11, 1986 NIOSH correspondence. FMC recognizes that periodic problems exist with employees use of respirators as they do with other types of personnel protective equipment. We are continually looking for new means to educate employees into proper care of their respirators and to add emphasis and enforcement when isolated problems occur. We do not feel that observations by NIOSH pertaining to employees wearing safety glasses with half-face respirators is indicative of a problem with the respiratory protection program. Overall, the Ordnance Division Respiratory Protection Program is

effective and does comply with Federal and State OSHA requirements.

SUMMARY:

It is recognized that the spirit of the HHE summary, conclusion and recommendations is to assist FMC in providing a healthy working environment. The assistance provided by your industrial hygienists in the form of workplace monitoring and employee education has proven valuable to date.

Our comments above are provided in the interest of eliminating confusion or misinterpretation among employees, to effect a report which is based on scientific and medical fact and to solicit recommendations which are specific, obtainable and more constructive for both the employer and employees.

FMC would have no problem with recommendations for investigating additional controls for benzene exposures and for investigating all complaints of machine coolant exposures to determine if controls are necessary. Again, it does not seem responsible to recommend extensive engineering controls without feasibility and necessary analysis above and beyond the type of analysis that was conducted by NIOSH.

We once again request that you consider our point of view. We request that the report be revised and reissued in line with factual findings and that the conclusions be modified accordingly.

Sincerely,

R. Baptist
Supervisor
Safety & Industrial Hygiene

cc: R. Huckaby
International Association of Machinists and Aerospace Workers
District Lodge #93

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
Atlanta GA 30333

APR 14 1986

Mr. Thomas R. Yeater
Director
Occupational Safety and Health
FMC Corporation
200 East Randolph Drive
Chicago, Illinois 60601

Dear Mr. Yeater:

This is in response to your letter of March 17 in which you expressed concerns about the health hazard evaluation we conducted at FMC's San Jose, California plant in 1984-1985. I appreciate your expressing these concerns. Feedback, both positive and negative, is always helpful to us in maintaining the quality of our program.

I have discussed your letter with Dr. Melius and Mr. Bainbridge. They have no objections to including an addendum to the written report detailing the company's concerns and clarifying the basis for our conclusions. You, Ron Baptist, the requestor, the Occupational Safety and Health Administration, and NTIS should be receiving this addendum shortly. However, you should understand that we believe the report and Mr. Bainbridge's letter of February 11, 1986, accurately reflect the conditions and potential problems found at the plant at the time of our survey.

Given the time which has elapsed since this survey was conducted, it seems to us that further discussion over the words used to describe events which are several years old is not very productive. However, if you or the original requestor of the health hazard evaluation believe it would be appropriate, we would be prepared to have Mr. Belanger and Dr. Gunter (the original industrial hygienists), and a physician from our Cincinnati office return to the San Jose plant to evaluate current benzene exposures, the current FMC respirator program, and current exposures to TRIMSOL. Given that you have an ongoing epidemiologic study to address the employees' cancer concerns, we see no point in duplicating your efforts at this stage.

Once again I appreciate your notifying me of your concerns.

Sincerely yours,

J. Donald Millar, M.D.
Assistant Surgeon General
Director