U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 77-82-463

FMC CORPORATION - BEARING DIVISION
INDIANAPOLIS, INDIANA

FEBRUARY 1978

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on June 16-17, and September 21-22, 1977 at FMC Corporation, Bearing Division, Indianapolis, Indiana. The following determinations have been made based upon environmental air samples collected on September 21-22, 1977, employee interviews concerning any symptomatology which may be attributed to the work environment, and available toxicity information.

A. Employees' exposure to airborne concentrations of oil mist, lead, antimony, fluorides, silver, cadmium, copper and chlorine did not pose a health hazard at the concentrations measured at the time of this evaluation in Department 103, 106, 108 and 131.

B. However, apparent skin dermatitis was observed on 8 of 16 screw machine operators interviewed from Department 106. The condition observed appeared to be characteristic of that caused by excessive direct skin contact with mineral oil (oil acne or folliculitis.)(1) Eye strain and headaches were also reported by 13 of 16 persons from the same subject group allegedly due to inadequate lighting.

C. Apparent skin dermatitis was observed also on 6 of 25 grinder operators from Department 131 which appeared to be characteristic of that caused by excessive skin contact with cutting oil/coolants. Occasional symptoms of throat dryness and nose irritation were also reported.

Recommendations for improved work practices and medical monitoring to improve control of dermatitis associated with exposure to cutting oil/coolants used in Department 106 and 131 have been presented in the body of the report.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

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

a. FMC Corporation - Bearing Division, Indianapolis, Indiana
b. United Steelworkers of America Local 1150 and National Office
c. U.S Department of Labor - Region V
d. NIOSH - Region V

For the purpose of informing the approximately 150 "affected employees", the employer shall promptly "post" for a period of 30 calendar days the determination report in a prominent place(s) near where exposed employees work.

I. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669 (a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by an 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of Local 1150 of the United Steel Workers of America regarding employees' exposure to silver solder, coolants, cutting oil and lead in Departments 103, 106, 108 and 131.

IV. HEALTH HAZARD EVALUATION

A. Description of Process - Conditions of Use

The FMC Corporation - Bearing Division, Indianapolis, Indiana, which began operations in 1959, currently employs approximately 1000 employees, three shifts per day, five days per week. Of the 1,000 employees, 150 employees may be exposed to the alleged potential health hazards in

Department 103, 106, 108 and 131. The FMC Corporation, Bearing Division, manufactures bearings and housings for all types of heavy equipment.

Department 131 is involved in grinding of metal parts. Approximately 105 employees work in this area, three shifts per day, five days per week. Workers in the grinding area are potentially exposed to cutting oils/coolants. Department 106 is the screw machine area. Approximately 42 employees work two shifts per day, five days per week. Workers in the screw machine area are potentially exposed to cutting oil. Department 103 is involved with the Babbitt Pourers. Approximately 8 employees work on two shifts, five days per week. The babbitt pourers are potentially exposed to metal dust and fumes. Department 108 is involved in silver soldering. This operation involved one employee who silver solders approximately four hours per week on the first shift. The operator is potentially exposed to fluoride, silver, cadmium and copper.

B. Evaluation Design

An initial survey was conducted on June 16, 1977. This survey included obtaining background information, conducting a walk-through survey in the four areas where the alleged hazards were present. No aerometric sampling was performed during the initial survey. Bulk liquid samples were collected of three coolants and a cutting oil for general qualitative and quantitative analysis and a specific determination for nitrosamines content.

Ten employees were interviewed using a non-directed questionnaire designed to elicit symptomatology possibly related to health problems arising from their work environments. Several of the employees complained about dermatitis that may be attributed to the coolants and cutting oil used in Department 131 and 106.

A follow-up survey was conducted on September 21-22, 1977 in order to more fully evaluate employee exposure to substances mentioned in the earlier portion of this report. In addition to environmental sampling, 48 employees were interviewed using a non-directed questionnaire designed to elicit symptomatology possibly related to health problems arising from their work environments.

C. Environmental Evaluation Methods

Personal and general area air samples were used to evaluate employee exposures. The personal samples were obtained by attaching a battery powered vacuum pump to the worker's belt with the sampling media (e.g., filter closed face cassette, impingers, etc.) in a holder attached to the lapel of the worker to obtain a representative sample of air in the

breathing zone of the worker. Samples were obtained for a sufficient period of time so that for all practical purposes they may be considered as eight-hour time-weighted averages. General area samples were obtained at selected fixed locations in close proximity to operations.

1. Oil Mist

Personal berathing zone and area samples were collected by using MSA, Model G battery-operated vacuum pumps with AA 0.8μ pore density cellulose membrane filters at sampling rates of 1.5 liters per minute. Samples were analyzed by fluorescence spectroscopy at a lower limit of detection of 50 microgram/sample.

2. Lead and Antimony

These metals were concurrently collected on a preweighed AA 0.8μ pore density cellulose membrane filter at a flow rate of 1.5 LPM using an MSA vacuum pump. The metals were analyzed by digesting and solubilizing the filter in a nitric acid solution and then aspirating the analyte into an atomic absorption spectrophotometer. The lower limit of detection of the method is 5 microgram/sample. Prior to digestion of the filters, a total dust determination was performed gravimetrically.

3. Fluoride

A known volume of air is drawn through a midget bubbler containing 15 ml of 15% sodium acetate at a flow rate of 1.0 LPM using an MSA vacuum pump. The resulting solution is diluted to 25 ml with 0.1N sodium hydroxide and buffered with an equal volume of total 10 NIC strength activity buffer (TISAB). The sample is analyzed using a fluoride ion specific electrode and an expanded scale millivolt/pH meter. The lower limit of detection of the method is 1 microgram/sample.

4. Silver, Cadmium and Copper

These metals were concurrently collected on a AA 0.8 pore density cellulose membrane filter at a flow rate of 1.5 LPM using an MSA vacuum pump. The samples were dissolved in a mixture of concentrated hydrogen chloride and nitric acid and analyzed for cadmium, silver and copper by direct aspiration atomic absorption. The lower limits of detection were: silver - 1.0 μg/sample; cadmium - 2.0 μg/sample; and copper - 0.5 μg/sample.

5. Chlorine

General area samples were collected using a Drager sampling pump with appropriate chlorine detector tubes (Range 0.2-3.0 parts per million).

D. Evaluation Criteria

1. Physiological Effects

The following is a brief summary of the adverse effects that may result from excessive exposure to Each of the substances of concern.

a. Cutting Oils

The changes in the skin due to the use of cutting oils take several forms and have been called oil boils, folliculitis, dermatitis and acne. This skin condition due to direct contact with cutting oils is one of the most common forms of industrial dermatitis, and can cause extensive medical problems and loss of work. The boils occur more frequently on the backs of the forearms and the hands where the hair is located, and will also occur on the thighs--wherever the oil comes in contact directly or through oil-soaked clothing.[2]

The base of the hair becomes plugged with the oil and this forms blackheads (comidones). When the base of the hair follicle becomes infected, then boils, and perhaps carbuncles, can develop. The metal slivers in the cutting oil are also a cause of irritation and infection of the skin; therefore, boils develop and extensive swelling of the tissues can occur.

The reaction and effect on the skin depend on the types of cutting oil, whether "insoluble" or "soluble", the chemical composition of the oils, the chemicals which may be added to the oils, the working conditions of the machine operators, the extent of proper protective clothing/ washing facilities, and the type of skin.

b. Oil Mist

The health standard for oil mist (mineral) of 5 mg/M^3 refers to airborne mist of petroleum-base cutting oils or white mineral petroleum oil. Experimental findings indicate that heat-decomposed oil fumes are irritant but do not result in changes in the lungs at 5 mg/M^3. It has been alleged but not proven that the inhalation of extremely high levels of oil mist could result in lipid pneumonitis.

c. Lead

Lead poisoning may occur through the inhalation and/or ingestion of lead fumes or dust. This results in the deposition of lead in the bones and tissue of the body and alterations in normal physiological function. No single sign or symptom may be considered diagnostic of lead poisoning. Lead poisoning may present such symptoms as a metallic taste in the mouth, loss of appetite, indigestion, nausea, vomiting, constipation, abdominal cramps, nervousness, insomnia, colic and also loss of kidney function which may be irreversible.[3]

Many of the sources of lead poisoning are industrial, but man also absorbs lead in small amounts from his food and water, and from the air. These sources lead to the "normal" body burden of lead, not normally leading to poisoning. Goldwater and Hoover have reported a worldwide blood lead mean of 0.017 milligrams of lead per 100 milliliters of whole blood (0.017 mg/100 ml).[4] The National Institute for Occupational Safety and Health defines the unacceptable level of lead to be 60 micrograms of lead per 100 milliliters (60 µg/100 ml) of whole blood or greater,[5] or at levels of 0.20 mg of lead per liter of urine or greater.[6]

d. Fluoride

The toxic effects of fluoride have been placed in three groups by Roholm[7]: (a) acute systemic intoxication (usually by ingestion); (b) local corrosion and irritation of the mucous membranes and skin; and (c) chronic bone changes ranging from mottling of tooth enamel to crippling skeletal abnormalities. The limit of 2.5 mg F/m^3 is sufficiently low to prevent irritative effects and to protect against disabling bone changes.

e. Silver

Argyria is a cosmetic defect which consists of an unsightly, permanent blue-gray discoloration of the skin, mucuous membranes and eyes; appears to be the main pathologic effect from accumulation of silver in the body.[8] This may results from inhalation or ingestion of silver salts, such as nitrate or fulminate, while localized arcyria may be caused by penetration of the skin by fine particles of metallic silver.

f. Cadmium

Acute cadmium fume poisoning, with lung edema being the outstanding sign, has been reported relatively frequently. Non-fatal pneumonitis has been reported from concentrations between 0.5 and 2.5 mg/m^3 and relatively mild cases have been attributed to even lower concentrations. It has been reported for chronic exposures that there is an increase in urinary protein (Beta-2 microglobulin) and moderate anemia in workers exposed to cadmium fume in concentrations ranging from 0.075 to 0.24 mg/m^3.

g. Copper

Inhalation of copper either as a dust, fume, or mist may result in congestion of the nasal mucous membrane which can lead to ulceration and perforation of the nasal septum. In chronic exposures, the liver, kidneys, and spleen may be injured and can cause anemia. Acute exposures to copper cause gastrointestinal irritation, mainly to the nerve endings in the stomach, and immediately cause vomiting. The evaluation criteria of 1 mg/m^3 has a large safety factor, and worker exposures maintained at or below this level should eliminate any physiological damage.

h. Chlorine

Chlorine vapor irritates the mucous membranes, the respiratory system, and the skin. Strong concentrations irritate the eyes and cause coughing and labored breathing. If a person is exposed to a large dose, he will become generally excited, as shown by his becoming restless, having an irritated throat, sneezing, and salivating excessively. Symptoms of high exposure are retching and vomiting, followed by difficult breathing.[9]

Chlorine vapor has such an intense smell that concentrations of 3-5 ppm in air are easily noticed; however, men rapidly lose their ability to detect the odor of chlorine in small concentrations. Higher concentrations are so severely irritating that no one will remain in a chlorine-contaminated area unless he is either unconscious or trapped.

Chlorine produces no known systemic effect. All symptoms and signs result directly or indirectly from the local irritant action. Low concentrations of chlorine gas in the air may have a minor irritating effect or may produce slight symptoms after several hours exposure, but careful examination of persons repeatedly exposed by such conditions reportedly have shown no chronic effect.[10]

The NIOSH 1976 criteria document recommends exposure to chlorine shall be controlled so that no worker is exposed to chlorine at an airborne concentration greater than 0.5 parts of chlorine per million parts of air (0.5 ppm) for any 15-minute sampling period. This shall be designated as a ceiling concentration.

2. Environmental Evaluation Criteria

To assess the potential toxicity for the concentrations of air contaminants found in the place of employment, three primary sources of criteria were used: (a) NIOSH Criteria for Recommended Standards for Occupational Exposure to Substances (Criteria Documents); (b) recommended and proposed threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) 1977; and (c) Occupational Health Standard as promulgated by the U.S. Department of Labor (29 CFR Part 1910.1000).

In the following tabulation of criteria, the most appropriate values in the opinion of the author are presented with reference:

Substance	Permissible Exposures (8-Hour Time Weighted Average) mg/m^3 *
Oil Mist, Particulate (Mineral)	5.0 (b,c)**
Fluorides, Inorganic	2.5 (a,b,c)
Lead	0.1***
Silver, Metal and Soluble Compounds (as A_2)	0.01 (b,c)
Cadmium	0.04 (a)
Copper - Dust and Mists	1.0 (b)
Antimony and Compounds (as Sb)	0.5 (b,c)
Chlorine	3 (a,b,c)

* Approximate milligrams of substance per cubic meter of air sampled.
** Reference letters in parentheses refer to the source(s) from the above discussion from which the standard was obtained.
*** OSHA has proposed a standard for lead of 0.10 mg/m^3 as of October, 1975. Edward J. Baier, Deputy Director for the National Institute for Occupational Safety and Health, before the Department of Labor (OSHA) Public Hearing on Occupational Lead Standard, March, 1977 supporting the proposed standard.

TLV's or occupational health standards for substances are usually established at levels designed to protect workers occupationally exposed on an 8-hour per day, 40 hours per week basis, over a working lifetime. Because of a wide variation in individual susceptibility, some workers may experience ill effects at or below the designated levels. Thus, an evaluation of the work place cannot be based entirely upon comparisons made against such TLV's or standards, as varioous TLV's and standards do not represent absolute protection of all workers. Federal standards are the legal standards and enforcement is a responsibility of the U.S Department of Labor, OSHA.

E. Evaluation Results and Discussion

1. Environmental

The results of environmental sampling in the four work areas covering seven substances on September 21-22, 1977 indicate that none of the samples exceeded the recommended criteria used in this evaluation. For a detailed description of all environmental samples, process operations and locations, please refer to Tables 1 through IV.

Twenty-three personal samples were collected in the grinding room (Dept. 131) for oil/coolant mist. All samples were less than 40% of the criteria.

Fourteen personal and one general area samples were collected in the screw machine area (Dept. 106) for oil mist. All samples were less than 10% of the criteria except for one personal sample which was 60% of the criteria.

Seven personal samples were collected in the babbitt area (Dept. 103) for lead and antimony. All levels were found to be below the analytical limit of detection (5 µg/sample).

Two personal and two general area samples were collected in the silver soldering area (Dept. 108) for fluoride, silver, cadmium and copper. All levels were below the criteria.

The levels of chlorine in the two areas monitored (Dept. 131 and 106) were less than 0.2 ppm, below the NIOSH recommended level and the Federal standard.

Qualitative test for the presence of nitrites in eight bulk samples of cutting oil and coolants was performed by the NIOSH Measurements Support Branch in Cincinnati, Ohio. The presence of nitrites (a necessary component in the formation of nitrosamines) was not detected, consequently, nitrosamines would not be present in the cutting oil and coolants.

2. Employee Interviews - Visual Observations

Apparent skin dermatitis was observed by the NIOSH Industrial Hygienists on 8 of 16 screw machine operators and 6/25 grinder operators. The dermatitis observed appeared to be characteristic of that caused by excessive skin contact with mineral oil known as oil acne or folliculitis.

Eye strain and headaches were reported by 13/16 screw operator in Department 106.

Symptoms of throat dryness and nose irritation were also reported.

3. Conclusions

It has been determined on the basis of environmental sampling that employees' exposure to airborne concentrations of oil mist, lead, antimony, fluorides, silver, cadmium, copper and chlorine did not exceed recommended environmental criteria within the worksite areas.

However, fourteen of the 41 interviewed employees gave a history of development of dermatitis which appeared to be at least partly occupational in origin. The dermatitis appeared to be related to direct skin exposure to cutting oils used in the screw machine (Dept. 106) and the grinder (Dept. 131) areas.

Thirteen of sixteen interviewed employees in Department 106 complained of eye strain and headaches attributed to bad lighting.

V. RECOMMENDATIONS

1. Unless there are urgent reasons to the contrary, cutting oil/coolants should be used according to the manufacturer's directions. One employee should be responsible for all changes in coolant composition and all alterations in composition should be recorded. Coolant should not be allowed to become heavily contaminated with metal chips or other materials or to become rancid.

2. Gloves should be used when there will be significant exposure of the hands to cutting oils and coolants. Such gloves should be impervious, should be changed if ever they become contaminated, and should not be allowed to become wet or soggy on the inside. The use of a cotton inner liner may help.

3. Barrier creams may be used but it must be remembered that these are useful only to enable contaminating materials to be easily washed off the skin.

4. Contaminating materials on the skin should be washed off as quickly as possible. The use of harsh abrasive soaps for this purpose should be minimized. The use of soft disposable paper toweling is often less irritating than the use of an air dryer.

5. Employees should wash and shower carefully and thoroughly at the end of their shift and change into clean street clothes.

6. The use of an emollient cream after washing hands is often helpful to workers exposed to cutting oil and coolants.

7. Subjects who develop dermatitis must be made aware that several months are necessary after dermatitis has apparently resolved for the skin to return to normal. Until this occurs, even minor insults will more likely damage the skin than at other times.

8. Preplacement examinations should be continued to insure that the workers "predisposed to dermatitis" are not placed in the screw machine and grinder areas where they are exposed to cutting oil and coolants.

9. The occupational medical services made available to the plant should include services directed at prevention and not just individual therapy. Where dermatitis occurs, an investigation is recommended to determine the causal agents and circumstances. Following this, advice regarding appropriate preventive measures should be given to the plant management and affected employees. There should be subsequent monitoring as to the success of these resulting measures. Where possible a determination as to the occupational nature or otherwise of the condition should be made promptly.

10. A lighting survey should be conducted in the screw machine area.

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3. Hygienic Information Guide No. 8-Lead: Commonwealth of Pennsylvania, Department of Health, Division of Occupational Health, 1969

4. Goldwater, I., and Hoover, A: An International Study of "Normal" Levels of Lead in Blood and Urine, Arch. Environ. Health, 15;60-63, 1967

5. Statement of Edward J. Baier, Deputy Director for the National Institute for Occupational Safety and Health, Before the Department of Labor (OSHA) Public Hearing on Occupational Lead Standard, March, 1977

6. Criteria for a Recommended Standard...Occupational Exposure to Lead, NIOSH, HEW, Washington, D.C., 1972

7. Roholm: Fluorine Intoxication, H.K. Lears and Co., London (1973)

8. Pillsbury, D.M., Nile, W.R.: Argyria, The Pharmacology of Silver, Williams and Wilkins, Baltimore (1939)

9. National Safety Council: "Chlorine" (Data Sheet 207, Revised) 1966, pp. 7-8

10. Manufacturing Chemists Association: "Chlorine" (Chemical Safety Data Sheet SP-80, Revised), 1970, pp. 23-24

Table 1

OIL MIST CONCENTRATIONS - DEPARTMENT 131 GRINDING ROOM

FMC CORPORATION - BEARING DIVISION
Indianapolis, Indiana

Job and/or Location	Date	Sampling Period	Sample Volume (Liters)	Type	Concentration (mg/M^3)**
Grinder Operator	9-22-77	0659-1447	549	BZ*	2.0
Blanchard Operator	9-22-77	0703-1450	701	BZ	1.6
Roller Grinder	9-22-77	0704-1442	606	BZ	0.6
Grinder Operator	9-22-77	0707-1450	695	BZ	0.6
Bore Grinder	9-22-77	0708-1452	621	BZ	0.7
Grinder Operator	9-22-77	0709-1449	690	BZ	0.9
Grinder Operator	9-22-77	0710-1444	681	BZ	1.6
Machine Operator	9-22-77	0711-1448	686	BZ	0.7
Grinder Operator	9-22-77	0712-1449	686	BZ	0.7
Grinder Operator	9-22-77	0713-1440	671	BZ	0.4
Operator Group Chief	9-22-77	0715-1452	686	BZ	1.5
Grinder Operator	9-22-77	0717-1443	578	BZ	1.0
Bore Grinder	9-22-77	0720-1445	584	BZ	1.9
Roller Grinder	9-22-77	0723-1441	657	BZ	0.9
Grinder Operator	9-22-77	0726-1454	582	BZ	0.2
Set-up Operator	9-22-77	0727-1442	564	BZ	0.9
Grinder Operator	9-22-77	0729-1455	669	BZ	0.1
Asst. Operator Group Leader	9-22-77	0730-1442	560	BZ	1.3
Honing Operator	9-22-77	0731-1448	566	BZ	0.4
Bore Grinder	9-22-77	0733-1455	569	BZ	1.1
Honing Operator	9-22-77	0735-1458	575	BZ	0.6
Bore Grinder	9-22-77	0735-1455	550	BZ	0.4
Outer Ring Grinder	9-22-77	0737-1454	548	BZ	0.2

The 1977 ACGIH TLV and the current OSHA Standard 5 mg/M^3

* Personal Breathing Zone
** mg/M^3 - Milligrams of Substance per cubic meter of air

Limit of Detection: 50 ug/sample

Table 2

OIL MIST CONCENTRATIONS - DEPARTMENT 106 SCREW MACHINE

FMC CORPORATION - BEARING DIVISION
Indianapolis, Indiana

Job and/or Location	Date	Sampling Period	Sample Volume (Liters)	Type	Concentration (mg/M^3)***
Process Inspector	9-21-77	0657-1500	645	BZ*	0.7
Machine Operator	9-21-77	0705-1503	712	BZ	0.5
Machine Operator	9-21-77	0658-1500	723	BZ	0.4
Machine Operator	9-21-77	0700-1501	638	BZ	0.4
Machine Operator	9-21-77	0702-1502	720	BZ	0.2
Machine Operator	9-21-77	0712-1510	635	BZ	0.4
Machine Operator	9-21-77	0710-1509	718	BZ	0.6
Machine Operator	9-21-77	0725-1509	696	BZ	0.1
Machine Operator	9-21-77	0716-1508	708	BZ	0.3
Dept. 106	9-21-77	0718-1507	704	GA**	0.2
Machine Operator	9-21-77	0714-1512	717	BZ	0.2
Machine Operator	9-21-77	0708-1505	716	BZ	0.2
Machine Operator	9-21-77	0707-1505	717	BZ	0.5
Machine Operator	9-21-77	0703-1502	719	BZ	3.1
Machine Operator	9-21-77	0713-1511	633	BZ	0.5

The 1977 ACGIH TLV and the current OSHA Standard 5 mg/M^3

* Personal Breathing Zone
** General Area
*** mg/M^3 Milligrams of Substance per cubic meter of air.

Limit of Detection: 50 ug/sample.

Table 3

DEPT. 103 - BABBITT AREA

FMC CORPORATION - BEARING DIVISION
Indianapolis, Indiana

Job and/or Location	Date	Sampling Period	Sample Volume (Liters)	Type	Lead ug/sample**	Antimony ug/sample
Master Mill & Boring Operator	9-21-77	0740-1519	585	BZ*	L.D.	L.D.
Drill Sander Operator	9-21-77	0742-1518	581	BZ	L.D.	L.D.
Babbitt Pourer	9-21-77	0744-1517	579	BZ	L.D.	L.D.
Deburring Operator	9-21-77	0746-1518	570	BZ	L.D.	L.D.
Slitting Operator	9-21-77	0745-1520	581	BZ	L.D.	L.D.
Building Operator	9-21-77	0748-1517	569	BZ	L.D.	L.D.
Radial Drill Operator	9-21-77	0740-1519	567	BZ	L.D.	L.D.

OSHA has proposed a Standard for Lead of 0.10 mg/M^3 as of October 1975.

NIOSH presented testimony March 1977, supporting the Proposed Standard.

The 1977 ACGIH TLV and the current OSHA Standard is 0.5 mg/M^3 for Antimony.

* BZ - Personal Breathing Zone.

** ug/sample - Microgram per sample.

Lead - limit of detection - 5 ug/sample.
Antimony - limit of detection - 5 ug/sample.
L.D. - Less than Detectable Limits.

Table 4

DEPARTMENT 108 - SILVER SOLDERING

FMC CORPORATION - BEARING DIVISION

Indianapolis, Indiana

Job and/or Location	Date	Sample Media	Sampling Period	Sample Volume (liters)	Type	Fluoride* ug/sample	Silver** mg/M^3	Cadmium mg/M^3	Copper mg/M^3
Silver Soldering Operator	9-22-77	Impinger	1255-1305	130	BZ***	L.D.	-	-	-
Silver Soldering Area	9-22-77	Impinger	1257-1305	128	GA****	L.D.	-	-	-
Silver Soldering Operator	9-22-77	Filter	1252-1505	200	BZ	-	L.D.	L.D.	.005
Silver Soldering Area	9-22-77	Filter	1257-1505	192	GA	-	.003	.007	.007
The 1977 ACGIH TLV and Current OSHA Standard						2.5	-	-	-
The 1977 ACGIH TLV and Current OSHA Standard						-	.001	-	-
The NIOSH 1976 Criteria Document						-	-	0.04	-
The 1977 ACGIH TLV						-	-	-	1.0

* ug/sample - Microgram per sample.

** mg/M^3 - Milligrams of substance per cubic meter of air.

*** Personal Breathing zone.

**** General Area

Fluoride - Limit of Detection - 1.0 ug/sample
Silver - Limit of Detection - 1.0 ug/sample
Cadmium - Limit of Detection - 2.0 ug/sample
Copper - Limit of Detection - 0.5 ug/sample
L.D. - Less than Detectable Limits