WALK THROUGH SURVEY REPORT OF THE CENTRAL BRASS MANUFACTURING COMPANY Cleveland, Ohio

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16. Abstract (Limit: 200 words): In order to evaluate controls used to reduce or eliminate worker exposures to lead (7439921), a survey was undertaken at the nonferrous foundry, Central Brass Manufacturing Company (SIC-3432), Cleveland, Ohio. After a review of the exposure and blood lead monitoring data, along with interviews with management and union officials and a tour of the facility, the investigators conclude that there is evidence to support excessive exposures to workplace lead at the time of compensation claims made early in 1985. Since that time the company has taken steps to reduce these exposures. Some engineering controls had been installed in October of 1984, including portable flexible duct local exhaust hoods, side draft local exhaust systems and traveling hoods. Improvements or replacements were also made to existing equipment including doubling the ventilation capacity of the exhaust system on polishing equipment and replacing local exhaust hoods on all grinding machines. All new employees receive a complete physical examination including audiometry, pulmonary function test, and blood lead screening. The frequency of subsequent blood lead monitoring was based on the previous blood levels. The respiratory protection program seemed generally adequate. However, some poor practices were noted in respirator maintenance and cleaning programs. Current sources of lead exposure appeared to be from lead fumes and dust arising from the lead used in the brass alloy. With the improvements which have been made, a correlation between the decline in ambient lead and blood lead levels was noted.

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PURPOSE:	To conduct a walkthrough survey of workers' exposures to lead and to evaluate controls used to reduce or eliminate these exposures. The survey was conducted as part of the Industrywide Studies Branch research project on the followup of workers' compensation claims for occupational lead poisoning.
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SIC CODE:	3432 - Plumbing Fixture Fittings and Trim (Brass Goods)

DISCLAIMER

Mention of facility names or products in this report does not constitute endorsement by the National Institute for Occupational Safety and Health.

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The Industrywide Studies and Surveillance Branches, DSHEFS, NIOSH are conducting a study designed to determine the utility of Ohio worker's compensation claims to identify industrial sites in Ohio, particularly those previously unrecognized, in which lead continues to be an occupational hazard. As a part of this study, a series of walkthrough surveys are being conducted in order to identify site characteristics (e.g. plant size, type of operation, presence or lack of appropriate programs and/or controls) which might account for the occupational lead exposure. On March 20, 1987 a walkthrough survey of a non-ferrous foundry, the Central Brass Manufacturing Company, Cleveland, Ohio, was conducted. Based on interviews with management and union officials, review of exposure and blood lead monitoring data, and a plant tour, evidence exists to support the presumption that the compensation claims reflected excessive exposure to workplace lead at the time of the claims in early 1985. Considerable efforts have been made by the company since early 1985 to create a lead control program to limit exposures and to conduct biological monitoring. Non-ferrous foundries previously have been recognized as a potential source of occupational lead poisoning, but review of this company's history indicates that, prior to 1985, lack of awareness of the lead hazard in this process, and lack of technical expertise and knowledge at the time of the claims, contributed to the occupational lead poisoning. Recommendations are made to further reduce lead exposures and blood lead levels among the employees.

INTRODUCTION

Background

The National Institute for Occupational Safety and Health (NIOSH), Industrywide Studies and Surveillance Branches, are conducting a study of the nature and extent of worker exposures to lead in companies identified with cases of elevated blood lead levels filed in the Ohio Workers' Compensation system between 1979 and the present. This research is an attempt to determine the value of workers' compensation (WC) claims in identifying and characterizing industrial sites in which occupational lead poisoning continues to be a problem. The basic hypothesis is that the information present in the claims, e.g. the nature of the exposure, the type of industry and process, and the number of claims filed per company in recent years, will allow the identification and characterization of the companies with ongoing lead hazards, and will lead to more effective strategies for correction and (ultimately) prevention of lead poisoning.

By conducting followup surveys, NIOSH hopes to determine (1) whether lead was present in the work environment at the time of the WC claim, (2) whether previously unrecognized sources of exposure to lead exist, and if so, the nature and extent of the exposure at the time of the claim, (3) whether the sites identified have taken measures to correct the problem, (4) whether these steps have been successful or not, (5) whether problems continue to exist in controlling lead exposures, (6) what the medical and biological monitoring programs consist of, and (7) what further action NIOSH can take in the future (e.g. education, design of better engineering controls for specific processes) to further reduce occupational lead exposures. Since occupational lead poisoning continues to be a significant problem (based on the number of workers' compensation claims which continue to be filed), more complete identification of the reasons for continued occupational lead exposure will help direct future preventive efforts.

As a part of this research effort, a plant walkthrough tour of the Central Brass Manufacturing Company's facilities was conducted on March 20, 1987. This survey was conducted since this site was identified in seven separate workers' compensation claims for occupational lead poisoning in 1985. During the survey, NIOSH investigators observed the foundry and finishing operations, and noted controls currently used to reduce lead exposure. In addition, plant policies, educational materials, and medical monitoring records were reviewed. The requirements established by the Occupational Safety and Health Administration's (OSHA) Lead Standard (CFR 1910.1025) were used as the basis for evaluating the control of lead exposures and the appropriateness of the medical monitoring programs.

PLANT AND PROCESS DESCRIPTION

Central Brass Manufacturing Company is a medium-sized non-ferrous foundry located at the intersection of Bragg St. and E. 55th St. in Cleveland, Ohio. The site consists of a total of approximately two acres, including

the three buildings (a foundry, a finished goods warehouse, and a small storage/assembly area devoted to storage for tubing, cutting and machining of tubing, and assembly of bath drains) , and the parking lot. The foundry (one floor) and the main building of three floors (both attached) was originally built in 1926.

Manufacturing activities are, in general, broken down into five departments: foundry, machining, finishing, assembly, and packing/shipping. The first floor of the foundry building is devoted to foundry operations, machining, packing, and a storeroom (parts storage area for purchased and manufactured components). The second floor above is devoted to finishing operations (polishing, buffing, and plating operations) and assembly. The top floor houses a machine shop and a tool room.

Foundry Operations

The company manufactures a variety of brass plumbing fixtures, such as faucets, handles, and spigots. The plumbing-fixture casting process incorporates typical foundry operations. The company prepares molds using the green-sand molding process. Cores are made by a hot box process. The required ingredients (sand, clay, and binders) are mulled (mixed),and the mixed green sand is then transferred to the appropriate molding area. The core sand is mixed immediately adjacent to each core machine. The sand core is then made by mechanically feeding these materials into an appropriate core box (hot box). At the molding station, the required patterns are placed in the mold flask. The remaining space in the mold flask is then packed with green sand. Cores are placed in the mold after the pattern is removed. The completed molds are then transferred to the pouring area.

The raw metal charge consists of brass ingots which are composed of approximately 76% copper, 12-13% zinc, and 6-7% lead. The ingots are charged into tilting, induction electric furnaces and melted. The melted charge is then tapped when the correct temperature is reached. The molten metal is transferred to pouring stations in ladles. Large ladles are supported and tilted during pouring from a hoist, and are moved using an overhead monorail system.

There are two pouring lines. Both are manual pour. One line services the pallet car system and weights and jackets must be manually shifted. Small travelling local exhaust hoods are situated over the ladles. On the other line, which services an automatic molding machine, the molten metal is poured into molds under a side-draft local exhaust system with weights and jackets manually shifted.

After pouring, the molds are allowed to cool for a pre-determined period of time, after which they are transferred to the shake-out area, where the castings are separated from the mold and sand. After shakeout, cast parts are broken off or cut off and then placed in an automated, enclosed sand blasting system. Castings are then inspected and good castings are then

transferred to the rough grinding area, where casting surfaces are ground to remove gross imperfections, such as gates and flashing, and other casting appendages.

Machining

Machining, which is one of the major operations at the company, is performed in three distinct locations: First floor for most long run jobs, third floor, and in building three. All castings and tubing must pass through one of these locations. Machining operations include spindling, bending, drilling, etc.

Finishing, Assembly, and Packing

At the conclusion of machining, cast parts are brought to the second floor where finish polishing, buffing, and plating operations (if the product is to be plated) are performed. Medium to fine grind operations are done using belts of various roughness. The parts are then buffed prior to plating. Certain parts are sold rough and thus do not pass through the finishing operations. Completed parts, if plated, are transferred to assembly from plating. Rough products are transferred directly to assembly from the machine shop. In the assembly area, the parts are hand-assembled into complete fixtures. The parts are then transferred to the packing department on the first floor, where they are placed into individual boxes and master cartons, and from there are transferred to the finished goods warehouse directly across from the main facility.

WORKFORCE DESCRIPTION

Central Brass employs 160 hourly and 40 salaried employees, on one shift, Monday through Friday, 7:00 a.m. to 3:30 p.m. Of the hourly employees, 156 (97.5%) are male. The average age of hourly employees is 46. Approximately 40% are White, 30% are Hispanic, and 30% are Black. Employees are represented by the United Auto Workers (UAW) Local 1196. Table 1 presents the job titles, job descriptions, and potential for direct lead exposure for hourly employees.

POTENTIAL LEAD EXPOSURES

The potential for lead fume exposure begins with the melting of the brass ingots in the furnace, and continues through the charging of the furnaces, tapping of the melted charge, and pouring the charge into molds. Exposure to lead dust may occur in all subsequent operations where the metal surface is cleaned or polished, including shakeout, rough grinding, sand-blasting, and buffing and polishing.

LEAD PROGRAMS AND EXPOSURE CONTROLS

History

The management of Central Brass became aware of the OSHA Lead Standard in late 1984 following a visit to another brass foundry in search of ideas for equipment to modify some of the foundry's processes. At that time the representatives of Central Brass were informed by the manager at the visited plant about regulations prohibiting smoking in lead-exposed environments, and certain other provisions of the Standard. Coincidently, the union became aware of the potential lead hazard at a Plumbingware's Council meeting and asked the company president for an inspection by the Ohio Division of Safety and Hygiene (DSH), which occurred in October 1984, results of which were received in January 1985.

Following the DSH inspection, the company obtained a copy of the OSHA Lead Standard from DSH along with the results of air monitoring conducted at Central Brass indicating excessive exposures. A lead program was initiated in January 1985 with blood lead (PbB) monitoring (begun in February 1985) followed by the provision of work clothes and respirators, and training concerning the hazards of lead.

Seven workers' compensation claims for lead poisoning were filed between January 5 and April 7, 1985 as a result of blood lead monitoring carried out at the company's direction. The company used private consultants and industrial hygienists from DSH in establishing the medical monitoring, hygiene, and respirator programs, and in engineering the environmental changes necessary to reduce lead exposures. In 1986, the company received an OSHA inspection and a serious violation was issued on June 25, 1986.

Summary of Air Monitoring for Lead

Personal air monitoring for lead was begun in 1984. The results of the company's monitoring in both the foundry and finishing area are shown in Appendix A, Figure 1. The results shown represent the trend over time since October 1984 through January 1987. Each data point is the geometric mean (GM) of breathing-zone concentrations obtained in either the foundry or the finishing area for the time indicated.

As shown, the overall trend in concentrations is downward. In the foundry, GM concentrations decreased from approximately 130 ug/m3 in October, 1984, to under 50 ug/m3 in January, 1987. Similarly, the decrease in GM concentrations in the finishing area was even more dramatic, decreasing from 300 ug/m3 to approximately 10 ug/m3. For polishers in the finishing area, a direct correlation between air lead exposure and blood lead levels was observed demonstrating the impact of the reduction of airborne lead exposure on PbBs (Appendix A, Figure 2). Each of the six points is the geometric mean of 3 to 24 air concentrations in polishers vs. the geometric mean of blood lead levels measured in polishers, grouped by quarter, between June 1985 and January 1987. Sufficient data did not exist to make similar statistical comparisons for other jobs.

For the two-year period, 1985 through 1986, exposure to lead in the foundry was greatest among furnace tenders (GM exposure = 90 ug/m3), followed by pourers, rough grinders, deck laborers, sandblasters, molders, and coremakers (79.1, 61.4, 55.1, 53.3, 38.7, and 27.6 ug/m3 respectively, Appendix A, Figure 3).

Summary of Blood-Lead Monitoring

Observation of the data plotted in Figures 4, 5, and 6 (Appendix A) suggests that blood lead levels have declined in both the foundry and finishing departments. In finishing, the mean PbB has declined from a GM of 51 ug/dl during the first quarter of 1985 to 39 ug/dl during the last quarter of 1986 (Appendix A, Figure 4). Declines in blood lead levels (PbBs) were observed among both polishers and buffers (Appendix A, Figure 5).

A similar, but less dramatic change has occurred in the foundry with PbBs declining from 45 ug/dl to 41 ug/dl over the two year period (Appendix A, Figure 6). Declines in PbBs were observed in all job categories (Appendix A, Figures 7, 8, and 9).

Safety and Industrial Hygiene Programs

Prior to 1984, there were essentially no safety and health programs in place to control lead exposures in the plant, nor was there a formal policy to make employees aware of the lead hazard. As a result, smoking and eating in lead-contaminated areas was not controlled. There were also no programs related to respiratory protection. Facilities were available for change of clothes or showers. Some engineering controls were in place prior to 1984, which included: 1) semi-circular slot-hoods on the furnaces, 2)a baghouse for the foundry, 3) separate dust collection units for grinding hoods, automated sand-blasting equipment, and tumblebarrels, 4) travelling hoods for the manual pouring line, and 5) dust collection system for polishing and buffing stations. No lead exposure monitoring or blood lead monitoring were conducted prior to 1984.

In late 1984, a personal protective equipment program was instituted in which all lead-exposed employees (everyone exposed to >50 ug/m3, the OSHA Action Level; the Permissible Exposure Limit for non-ferrous foundries is 200 ug/m3) were required to wear either a powered air-purifying respirator or a negative pressure, air-purifying respirator during work in contaminated areas.

Engineering Controls

Beginning in October 1984, engineering controls installed included: the side-draft local exhaust system on the automated pouring line; portable, flexible-duct local exhaust hoods at the tapping stations; and traveling hoods to control emissions from ladles during transfer from furnaces to slag stations. In addition, improvements or replacements to existing equipment included: doubling the ventilation capacity of the exhaust system on

polishing equipment; and replacement of local exhaust hoods on all grinding equipment in the rough-grind, finish-grind, and buffing areas. Additional air make-up units were also installed in the foundry and finishing areas, as was a carbon monoxide monitoring-alarm system.

Since late 1984, through the end of 1986, the company has spent approximately $224,000 on outside contractors for its lead control program. These expenses do not include the time and expenses incurred by company employees in the creation and installation of engineering and ventilation controls. Table 2 presents a breakdown of expenditures for the lead control program.

Medical Programs

All new employees in lead-exposed job categories receive a complete physical examination, including audiometry, pulmonary function tests, and blood lead screening. The frequency of subsequent blood lead monitoring is based on the employees previous PbB's. All PbB determinations are made by the Southgate Laboratory in Cleveland which is a CDC/OSHA proficiency tested and approved laboratory. The frequency of PbB determinations is as follows:

PbB >40 - tested every month
PbB between 30 and 40 - tested every three to four months
PbB <30 - tested every five to six months (unless the new worker is in foundry/polishing, in which case he is tested more frequently)

At the time of the walkthrough, there were five employees on Medical Removal Protection who were assigned to packing and assembly areas (non-lead exposure areas) and were receiving PbB level determinations monthly.

SURVEY OBSERVATIONS

As described above, many program improvements have been made at this company in the past several years. However, at the time of the survey, the company did not have a change-room/shower facility arrangement which would meet the compliance requirements of the lead standard. However, company representatives indicated that they were evaluating compliance options regarding the change-room/shower facility. Protective clothing was laundered weekly as required by the lead standard. At the time of the survey, the lunchroom did not appear to be in compliance with the lead standard. Specifically, there were no provisions for a temperature controlled, positive pressure, filtered air supply for the lunchroom.

The respiratory protection program appeared to be generally adequate in terms of the requirements of the lead standard. However, some poor practices in the respirator maintenance and cleaning programs were observed. Specifically, individual employees were responsible for determining when respirators needed replacement, cleaning, or repair; no designated individual was in charge of respirator maintenance and cleaning. In addition, no quantitative fit-testing was performed initially for

employees required to wear negative pressure, air purifying respirators; the OSHA lead standard requires that quantitative fit testing be performed initially and semi-annually thereafter.

Cursory ventilation measurements were made at several of the exhaust hoods enclosing the grinding wheels. It appears that ventilation effectiveness still could be enhanced by optimizing the grinding wheel diameter or belt width with the hood enclosure in a manner which would minimize unnecessary enclosure openings (although improvements in this aspect were made in 1985 when the hoods were replaced). This could be improved by minimizing (to the extent possible) the use of belts which are too narrow for the enclosure.

During the survey, it appeared that the microswitch system which activates the exhaust ventilation for the automatic pouring line was malfunctioning. This led to escape of significant amounts of emissions from the molds during pouring.

CONCLUSIONS

1. At the time of the workers' compensation claims there was exposure to lead in the work environment which was poorly controlled. This exposure very likely accounted for the elevated blood lead levels. Opportunities for excessive exposure to lead occurred from the melting and casting of the brass, through the shakeout, grinding, polishing, and buffing of the brass components.

2. Although it is well known that non-ferrous foundries are a potential source of occupational lead poisoning, it appears that the main reason for the poorly controlled historical exposures identified during this survey was the lack of awareness on the parts of both management and employees that a lead hazard existed.

3. The source of lead exposure was from the lead used in the brass alloy. Lead fumes and dust were the primary forms of exposure.

4. Since early 1985, the company has made efforts to improve source ventilation, and worksite and personal hygiene. In addition, powered air purifying respirators (PAPR's) and half-facepiece, negative pressure, air purifying respirators have been supplied and blood monitoring of lead levels has been required, yielding measurable reductions in ambient lead exposures and in blood lead levels.

5. Although efforts have been apparently successful in reducing exposure and blood lead levels, it is impossible to know which components of the lead control program have resulted in the greatest proportion of decline in PbBs. Undoubtedly, changes and improvements in personal protection (e.g. respirators) and ventilation both had significant impact. A correlation between the decline in ambient lead and PbBs was observed.

RECOMMENDATIONS

Based on the walkthrough visit, the following recommendations are made:

1. Improvement of recordkeeping of exposure and biologic monitoring data. Records are best maintianed for each employee, and should include:

   - dates and results of the blood lead monitoring.
   - dates and results of exposure monitoring.
   - when employee was informed of the results of the above monitoring.
   - when employee received education and periodic refreshers on the hazards of lead.
   - a place for the employee to sign indicating receipt of monitoring results and training sessions.

2. Consideration should be given to more frequent provision of laundered work clothing, perhaps daily to the most heavily exposed employees (e.g. foundry workers).

3. Consideration of the redesign of the shower/locker facility to minimize the potential of contamination of street clothing (see attached diagram, Appendix B). A similar design has been observed in other plants with lead hazards. Although space limitations at this location may limit the size of the facility, such a design is still desirable from a lead exposure standpoint.

4. Improvement of the respirator program to insure proper function, fit, and maintenance.

5. Creation of a lunchroom facility which is isolated from the foundry work areas and which has a separate air supply and temperature control system.

6. The company should continue its previous efforts at improvement of local exhaust ventilation systems, and maintenance of existing systems to insure their proper operation.

7. Environmental sampling and blood lead monitoring should be continued in accordance with frequencies specified in the OSHA Lead Standard. The current biologic monitoring program is adequate for following blood lead levels.

Table 1
Lead Exposed Job Titles and Description of Duties*
Central Brass Manufacturing Company

Job Title	No. employed	Duties
FOUNDRY		
Furnace Tender	2	Charges furnace with ingots and tends furnace.
Muller operator	2	Tends muller; mixes mold and core sands
Molder	5	Packs molds, adding sprues, gates,risers, etc.
Coremaker	6	Operates machinery designed to prepare cores
Sprue Cutter	2	Cutting off castings from gates
Pour off man	2	Transports ladles, pours molten charge into packed molds at molding stations
Deck Labor	2	Shifts weights and jackets
Shakeout Tender	1	Operates shakeout machinery
Tumblebarrel Op.	1	Operates tumblebarrel
Sandblaster	4	Operates Wheelabrator (tm)
Rough Grinder	1	Removes gross casting imperfections using a grinding wheel with coarse grit
Touchup Grinder	1	Similar to Rough grinder; removes irregularly shaped casting imperfections
General Labor	12	Housekeeping, assists other foundry operators, may move materials as needed
Towmotor	1	Operates lift trucks in foundry and finishing areas.
PACKING & SHIPPING	15	Load parts in boxes/cartons, label, and ship
MACHINE SHOP	24	Operate bending, drilling, spindling equipment
FINISHING		
Plating	10	Operate plating equipment
Polisher	12	Fine polishing using polishing belts with abrasive grit.
Buffer	3	Buffing using compounds
Auto-buffer	4	Operates automatic buffing machine
ASSEMBLY		
Assembler	21	Assembles cast parts into finished products
Total:	131	

* This table lists job categories for which sampling has been conducted by the company, and represents the company's judgement regarding which jobs are exposed to lead.

Table 2
Expenditures - Lead Control Program
Central Brass Manufacturing Company

Control Measure	Cost
Respirators (air helmets)	$75,485.16
Air make-up unit	$28,395.89
Exhaust system for polishers	$24,798.53
Molding exhaust travel hood for furnace	$16,768.00
Sheet metal work for ventilation	$11,644.57
Engineering/safety consulting	$ 9,962.80
Uniforms	$ 9,914.99
Air monitoring	$ 9,511.15
Medical laboratory - blood leads	$ 8,353.32
Physical examinations	$ 7,522.30
CO monitoring system	$ 4,339.00
Nilfisk vacuum	$ 4,266.98
Pulmonary function/audiometric testing	$ 1,700.00

APPENDIX A

FIGURE 1.

LEAD AIR CONCENTRATIONS

CENTRAL BRASS, 10/84 TO 1/87

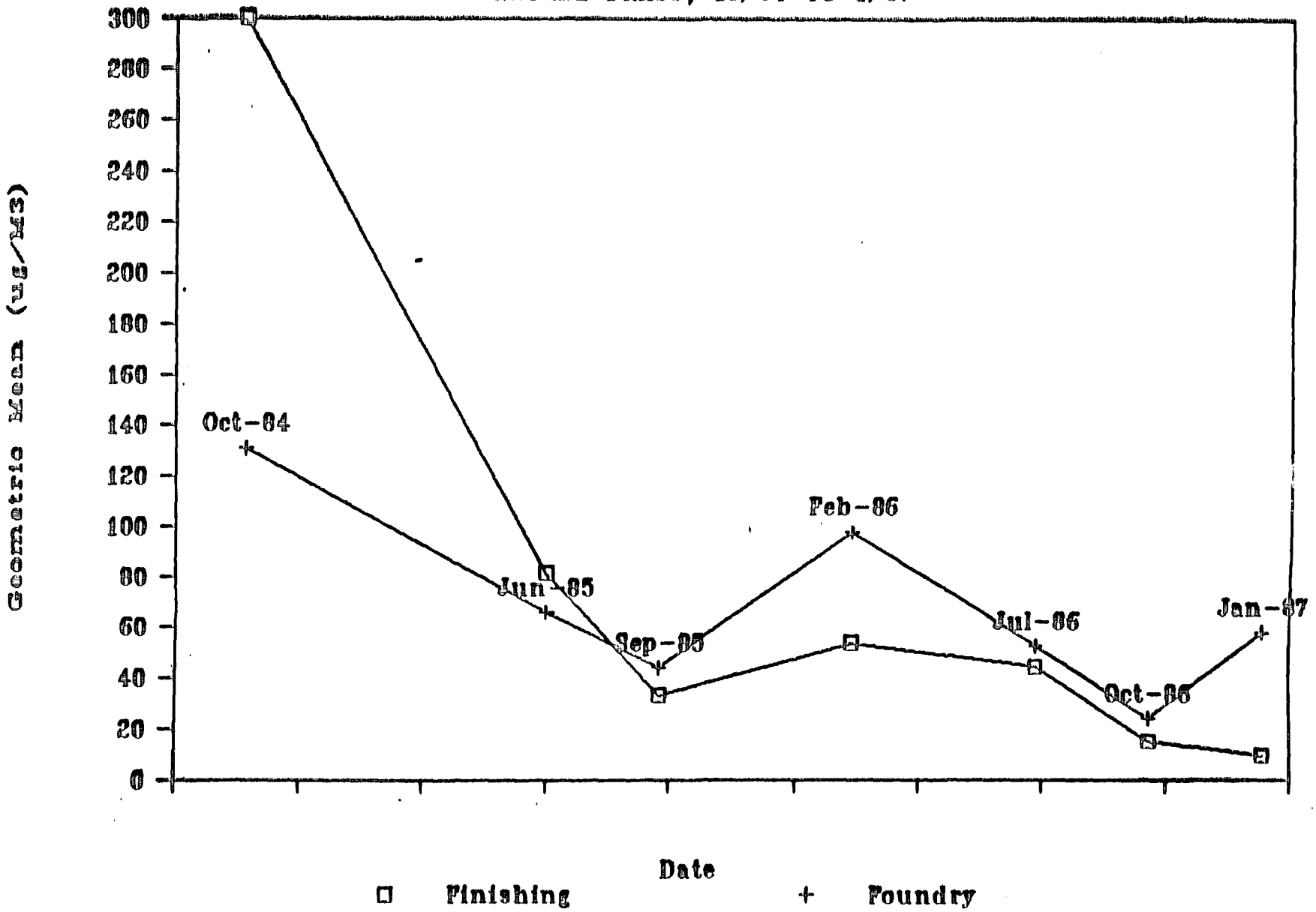


FIGURE 2.

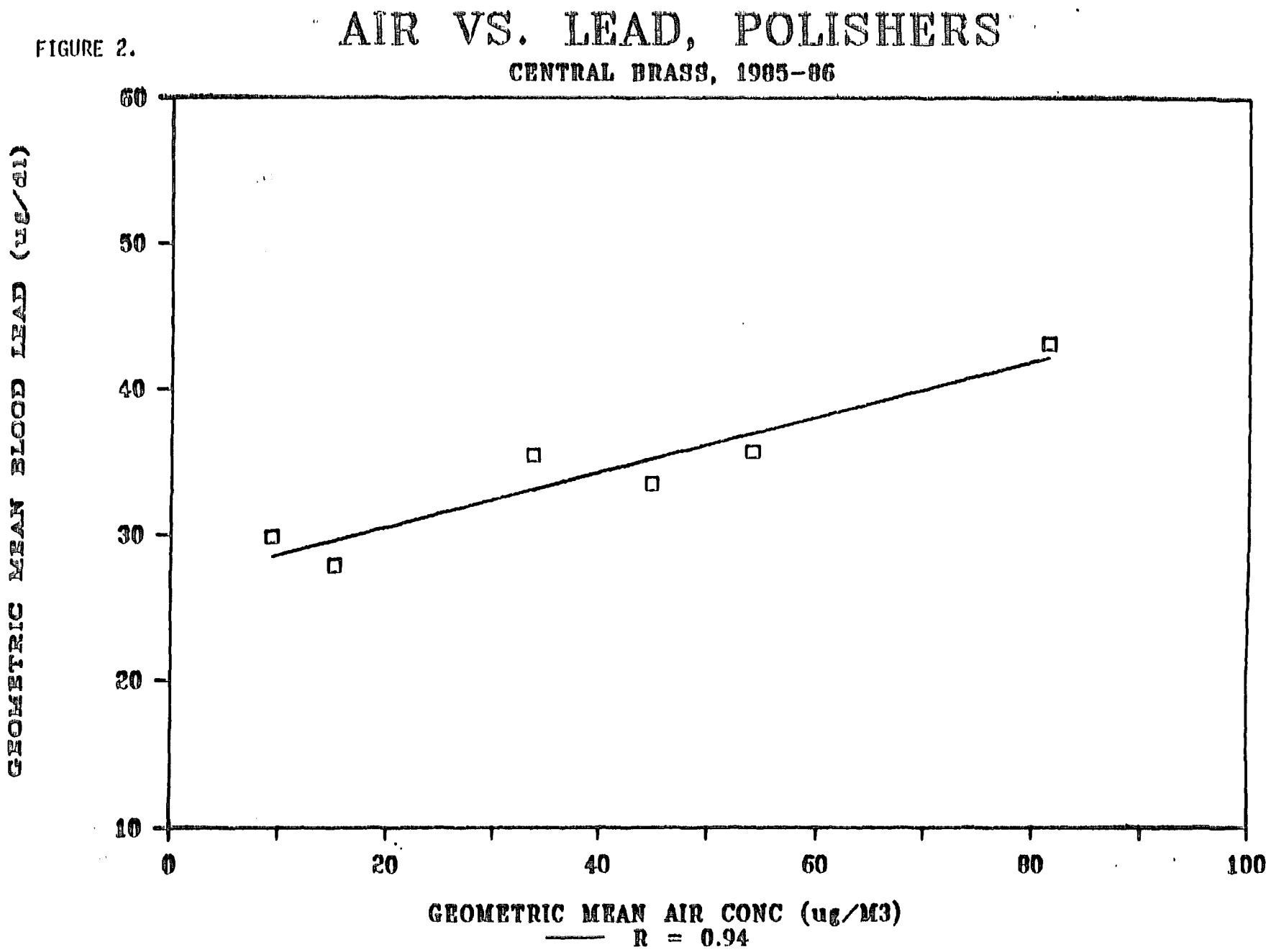
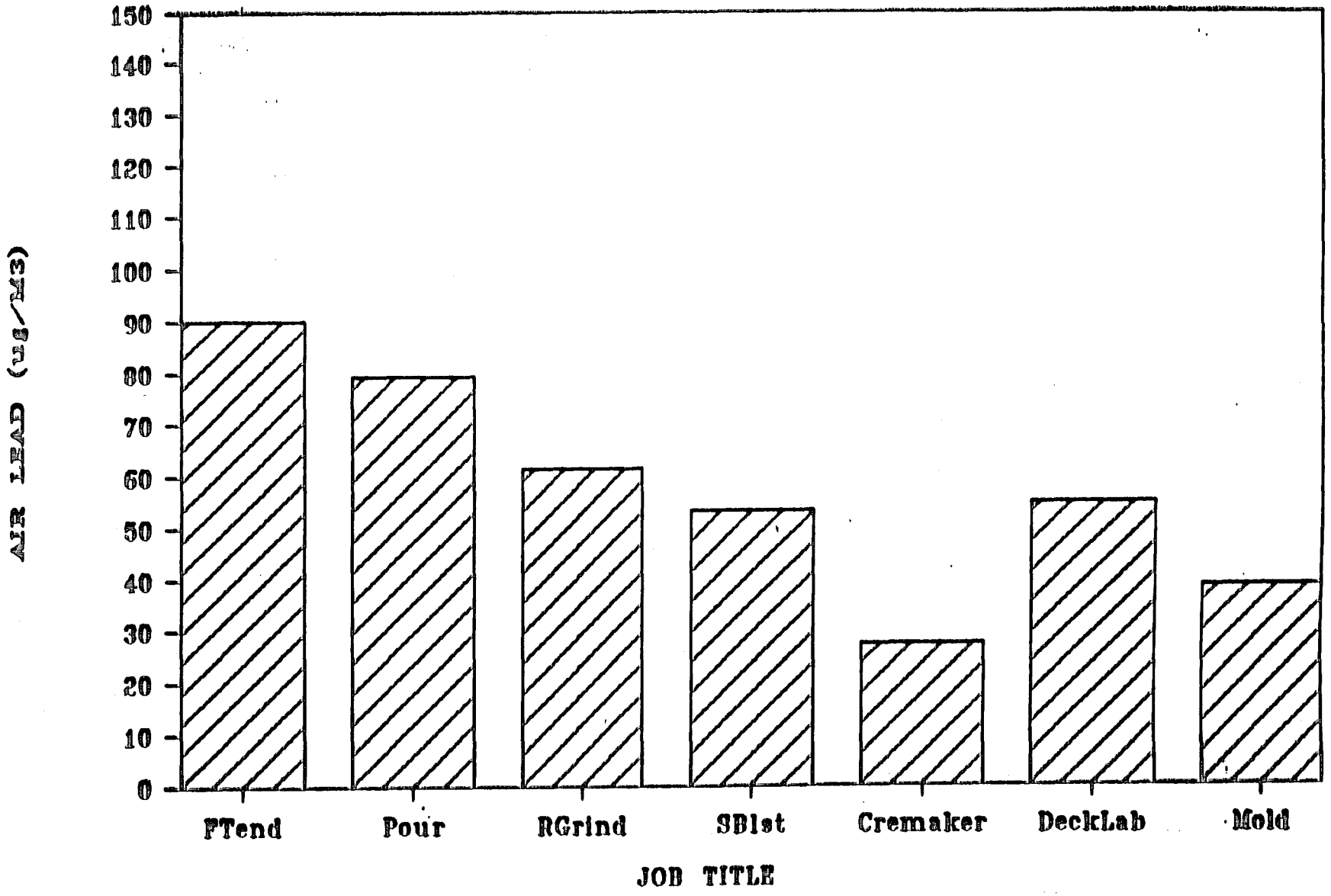

AIR VS. LEAD, POLISHERS
CENTRAL BRASS, 1985-86
GEOMETRIC MEAN BLOOD LEAD (ug/dl)
60
50
40
30
20
10
0
20
40
60
80
100
GEOMETRIC MEAN AIR CONC (ug/M3)
R = 0.94

FIGURE 3.

FOUNDRY, AIR LEAD LEVELS

CENTRAL BRASS, 1985-86



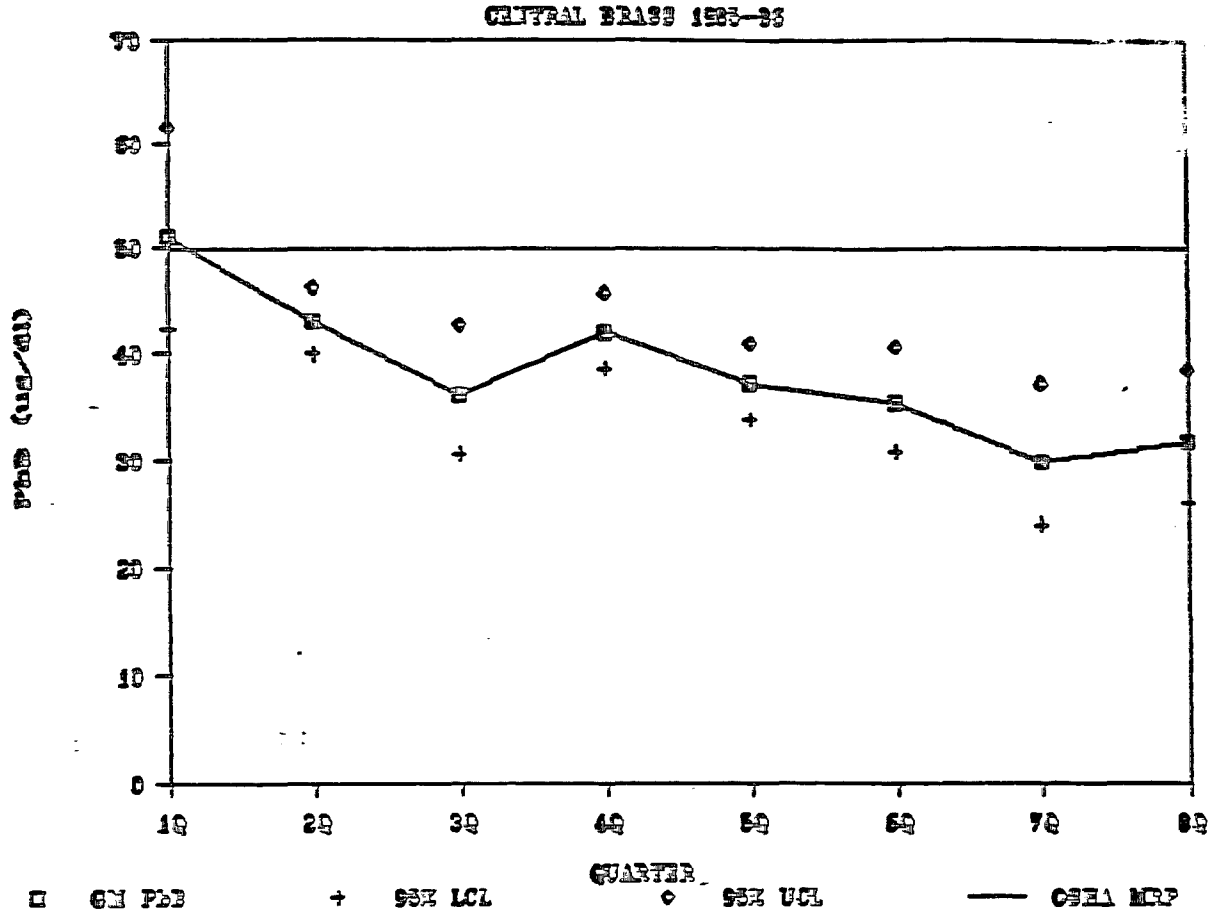
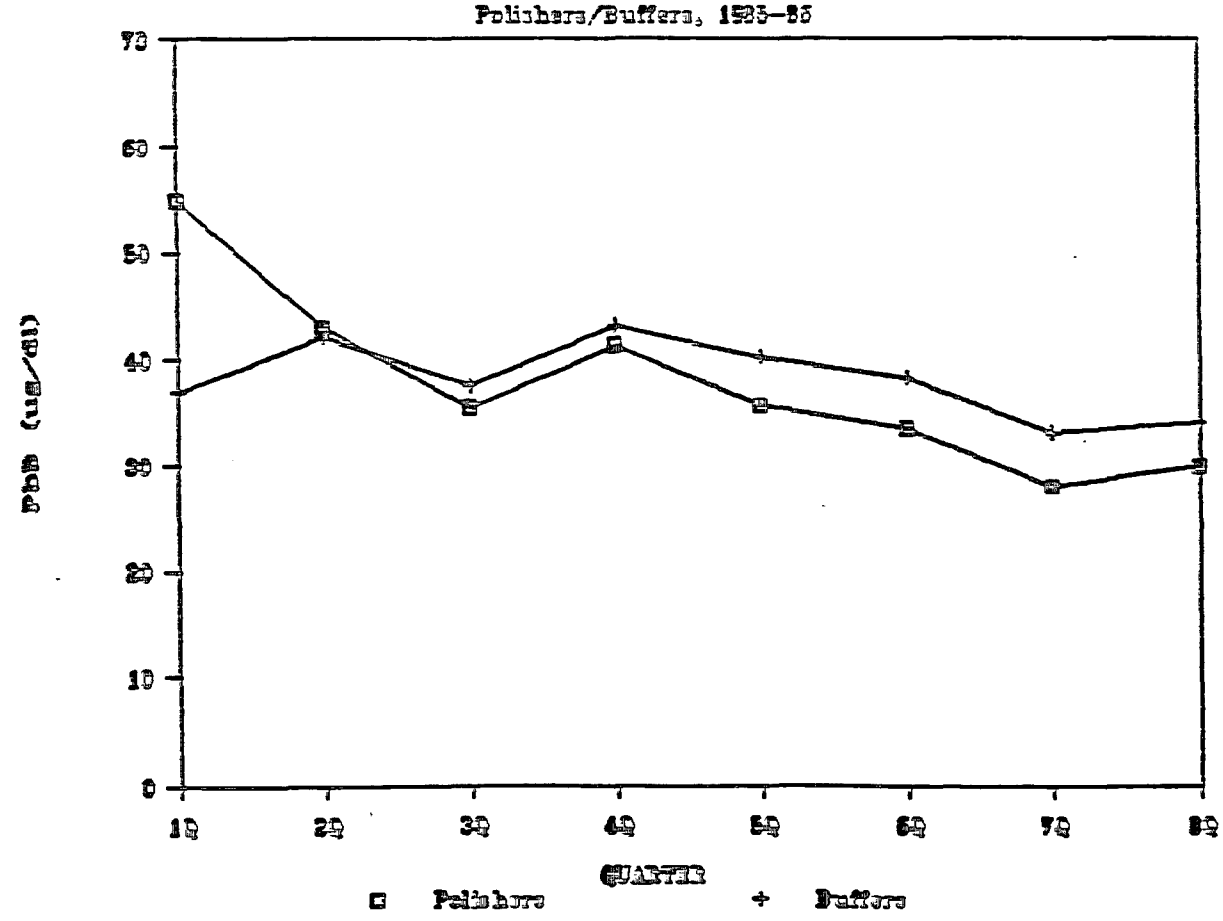


FIGURE 5.

FINISHING, PbB LEVELS



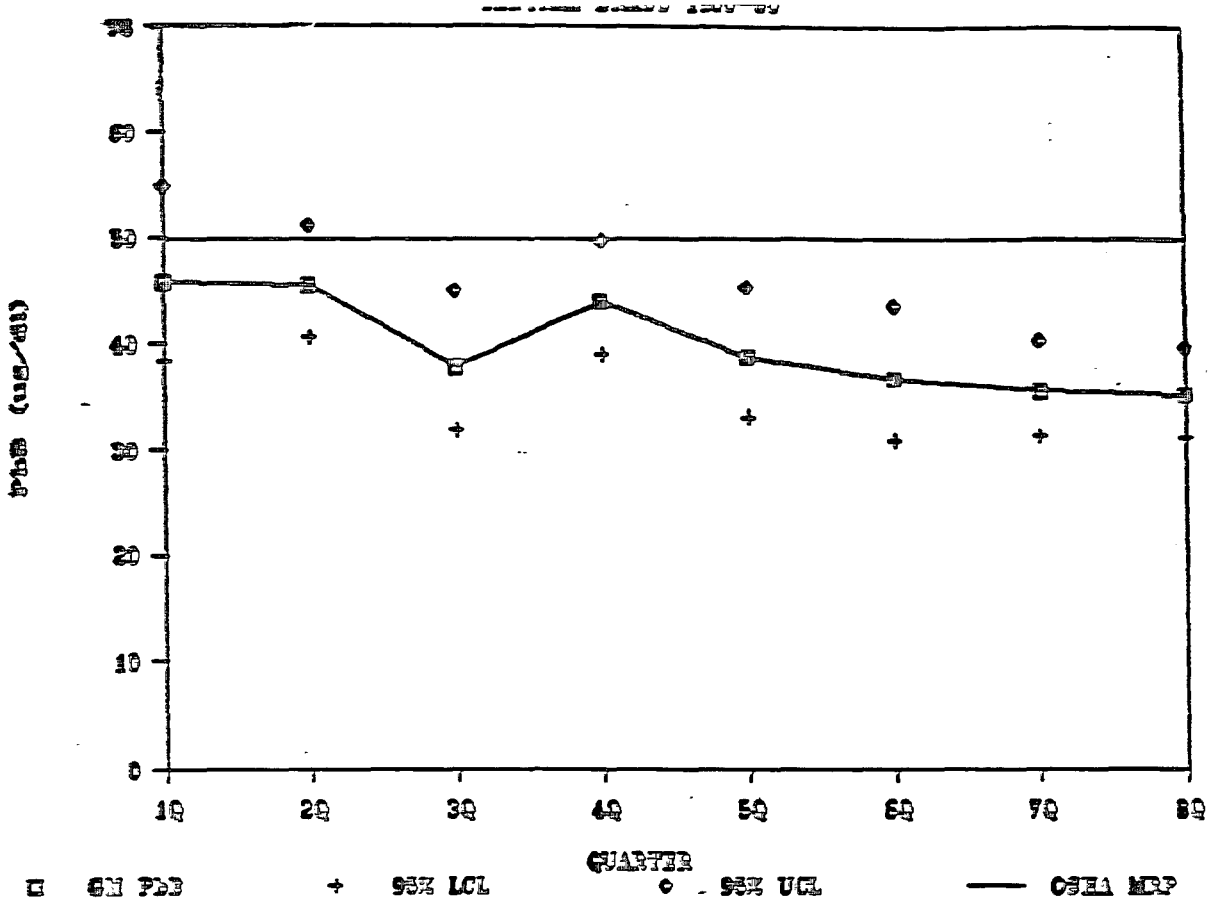
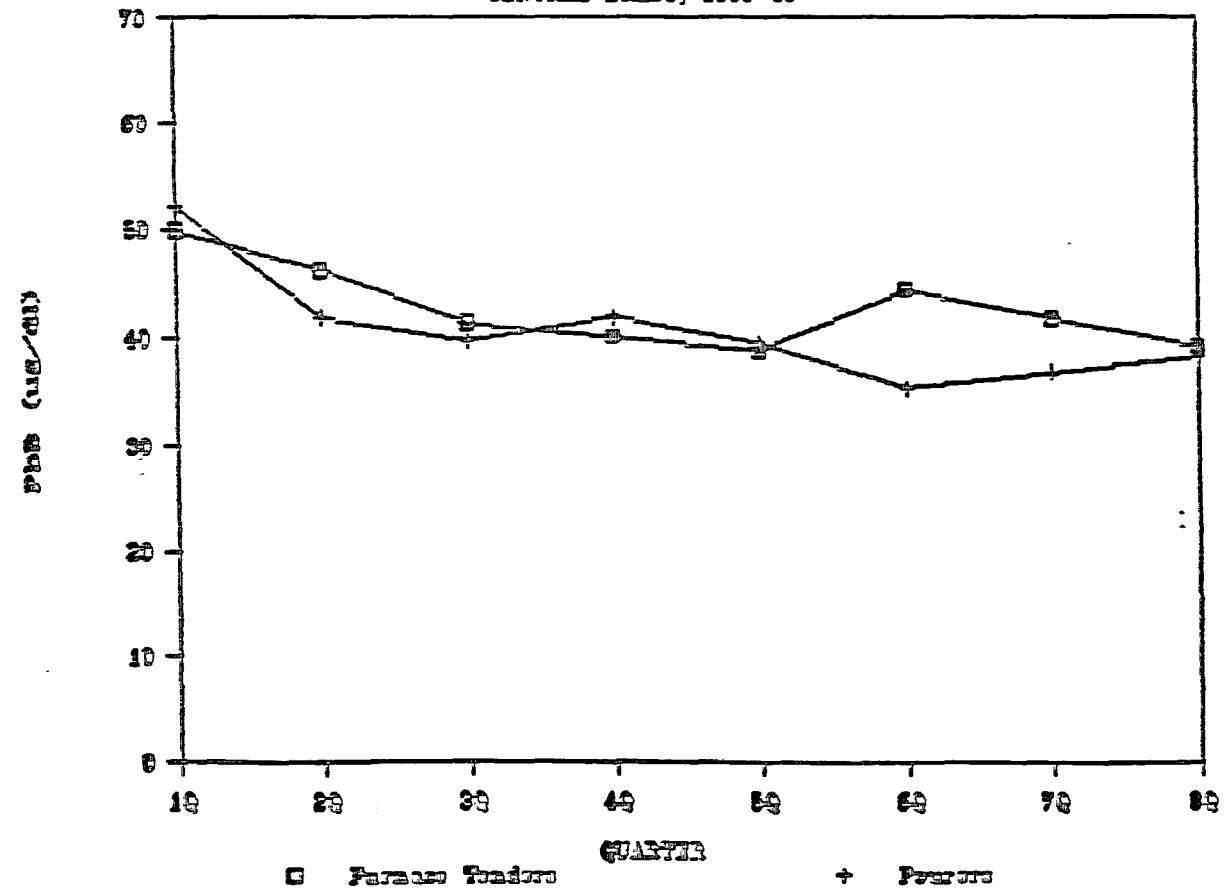


FIGURE 7.

FOUNDRY, PbB LEVELS

CENTRAL BRASS, 1985–86



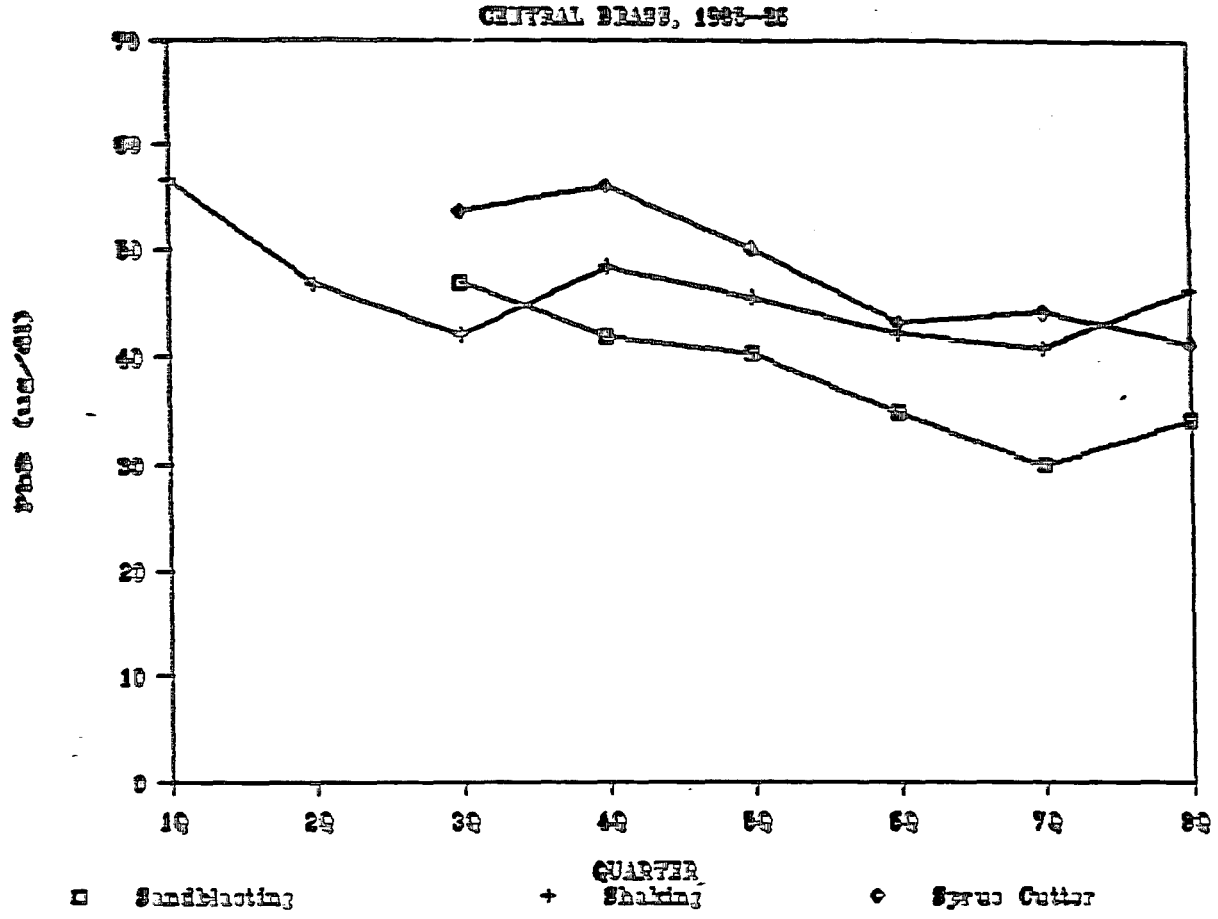
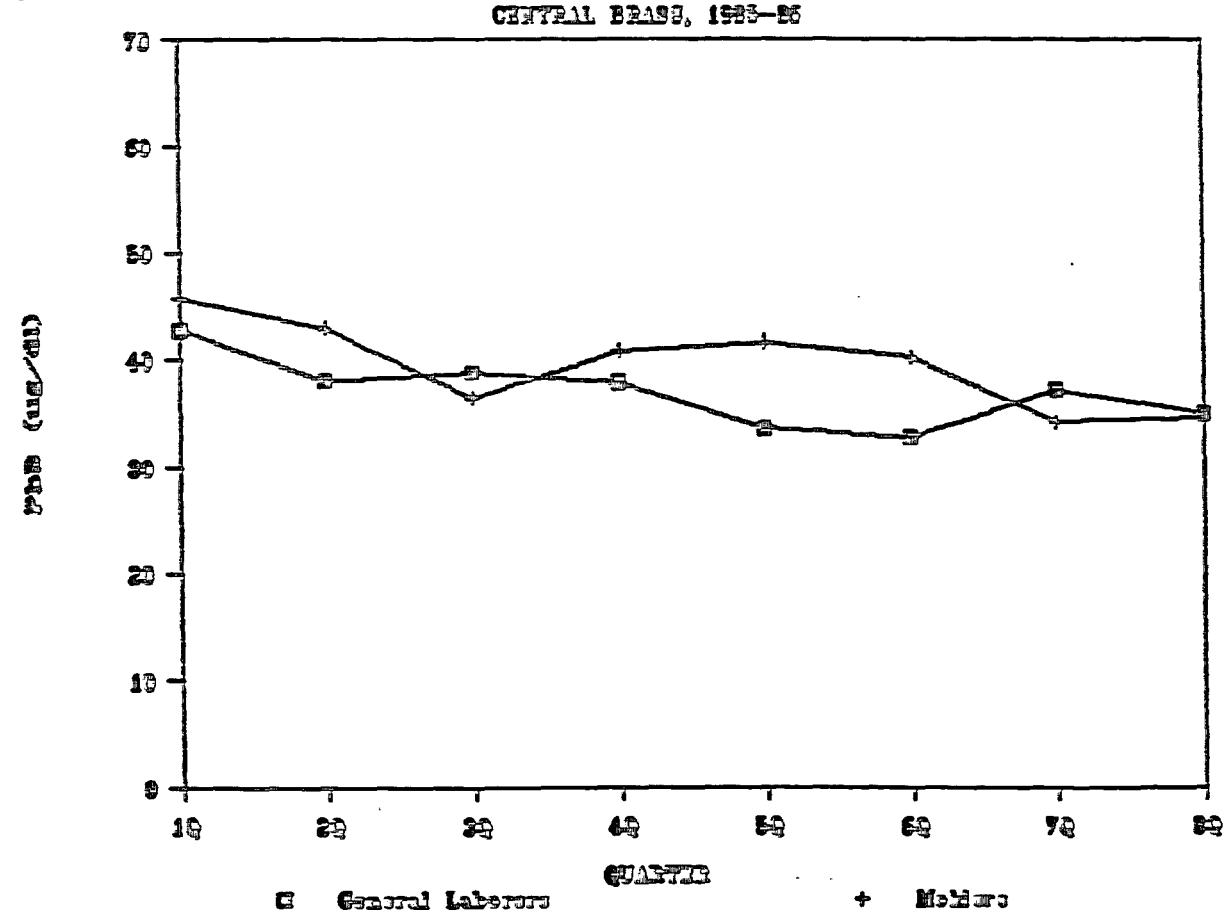


FIGURE 9. FOUNDRY, PbB LEVELS



APPENDIX B

PLAN FOR LOCKER/SHOWER FACILITY