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 HHE 79-4-598

LENOX CHINA, INC.
POMONA, NEW JERSEY

JUNE 1979

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at the Lenox China, Inc., Pomona, New Jersey on February 28, and March 1, 1979. At the time of this evaluation, breathing zone and general area samples were collected for hydrochloric acid, inorganic lead, and total particulates (dust).

On the basis of environmental sampling in the work place on February 28, and March 1, 1979, it has been determined that 3 of 6 die makers were exposed to levels of inorganic lead above the prescribed health criteria health criteria of 50 ug/m^3. However, five blood lead determinations were below the current accepted safe level of 40 ug/100 ml.

The plaster mixer operators were exposed to excessive levels of total particulate above the prescribed health and safety criteria. Hydrochloric acid concentrations approached but did not exceed recommended criteria.

Recommendations designed to aid in providing a safe and healthful working environment are included in Section V of this determination report.

II. DISTRIBUTION AND AVAILABILITY

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

Copies have been sent to:

a) Lenox China, Inc., Pomona, New Jersey
b) Authorized representative of employees -
   International Brotherhood of Pottery and Allied Workers (Local 236)
c) U.S. Department of Labor - Region II
d) NIOSH - Region II

For the purpose of informing the approximately 30 "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.

III. 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 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 National Institute for Occupational Safety and Health received such a request from an authorized representative of employees from Local 236, International Brotherhood of Pottery and Allied Workers. Regarding workers exposures to hydrochloric acid, inorganic lead, total particulates (dust) and expressed concern regarding etched windows in the mold shop of the Lenox China, Inc., Pomona, New Jersey.

IV. HEALTH HAZARD EVALUATION

A. Plant Process

Lenox China, Inc. is engaged in the manufacture of a distinctive quality of fine china and crystal at the Pomona, New Jersey plant.

The mold shop is located at the north end of the plant, the mold shop contains rows of tables 15 feet long, with concrete tops set with cases. One person works at each table, plus buckets, carts, sponges, soap water and bags of plaster.

Taking a design model, the blockers pour a green plaster slurry which, when hardened, becomes the negative shape of the model. The case maker then reproduces this negative with a special mix, producing a shape, in sections, just like the model. These cases are then turned over to the mold maker and from that point he produces the finished molds which, after inspection, are ready to join together with slip in either the cast or jigger shops to form Lenox China.

B. Evaluation Design

An environmental-medical survey was conducted on February 27 through March 1, 1979. This survey included obtaining background information and conducting a walk-through survey of the mold shop.

Aerometric sampling was performed. Airborne samples were collected for hydrochloric acid, inorganic lead, and total particulates. Bulk samples were collected of materials used in the mold shop together with scrapings from the etched windows.

The medical survey was conducted in conjunction with the walk-through survey. The Lenox Company's blood lead and x-ray screening programs were addressed. Questionnaires were distributed by a NIOSH Physician's Assistant to twenty-five employees in the mold shop and one administrative employee. Blood samples were taken from four hourly employees and one unexposed management employee for lead determinations.

A SHEFS I Report was distributed on March 20, 1979, reporting the findings to date and the future action to be taken.

C. Environmental Evaluation Methods

1. Environmental

Personal 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 in a closed face cassette) in a holder attached to the shirt lapel of a 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.

a. Total Particulate

Personal breathing zone samples were collected by using MSA*, Model G. battery-operated vacuum pumps with tared 0.8µ pore diameter copolymer polyvinyl chloride acrylonitrile filters at flow rates of 1.5 liters per minute. The sample weights were taken from a Perkin-Elmer Balance AD-2 to an accuracy of 0.01 mg.

The weight of the sample is determined by subtracting the tare pre-sample weight from the total post sample weight.

b. Inorganic Lead

The sampling method for inorganic lead consisted of using MSA Model G battery-operated vacuum pumps at flow rates of 1.5 liters per minute (LPM); 37-millimeter (mm) three-piece cassette filter holders; and 37-mm 0.8µ mixed-cellulose-ester membrane filters supported by cellulose back-up pads.

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

The filter samples were wet ashed in distilled nitric acid and brought to a volume of 25.0 milliliters with deionized water. An aliquot of the sample was analyzed by an atomic absorption spectrophotometer.

c. Hydrochloric Acid

Samples for hydrochloric acid were collected at 1.0 LPM in impingers containing sodium acetate. The samples were analyzed by specific ion electrodes.

2. Medical

A total of twenty-five mold shop workers participated in this study. These employees worked on the first shift. Each person was queried via a standard respiratory questionnaire. The questionnaire included an occupational history, a current employment history, a medical history, and a smoking history. Symptoms that the individual thought may be job related were also sought.

In addition to the questionnaire, five employees were sampled for blood lead determinations.

D. Evaluation Criteria

1. Environmental

To assess the potential toxicity of air contaminants, in the place of employment, three primary sources of criteria are generally consulted: (1) NIOSH criteria for recommended standards for occupational exposure to substances (criteria documents); (2) recommended and proposed Threshold Limit Values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) 1978; and (3) Occupational Health Standards as promulgated by the U.S. Department of Labor (29 CFR Park 1910.1000).

These criteria are tabulated as follows:

Substance	NIOSH	ACGIH	OSHA
Lead	0.10 *mg/m^3	0.15 mg/m^3	0.20 mg/m^3
OSHA Standard Effective February 1, 1979			0.05 mg/m^3
Total Particulate		10.0 mg/m^3	15.0 mg/m^3
Hydrochloric Acid		5.0 ppm	5.0 ppm

*Milligrams of substance per cubic meter of air (mg/m^3).
**Parts per million parts of air sampled (ppm).

TLV's or occupational health standards for substances are usually established at levels designed to project workers occupationally exposed

for an 8-hours 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 workplace can not be based entirely upon comparisons made against such TLV's or standards, as various TLV's and standards do not represent absolute protection of all workers. Setting of legal standards and enforcement is a responsibility of the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA).

2. Physiological

a. Inorganic Lead

Although capable of causing acute toxicity when absorbed in large amounts, lead is usually associated with chronic toxicity due to much smaller exposures repeated over a period of time. Lead and its inorganic compounds can be absorbed by inhalation of vapors, fumes, or dust. Oral intake can also lead to poisoning but absorption is not as complete. The three systems must commonly affected by lead are: the nervous system, the bone marrow (red blood cell producer), and the kidneys. Classic symptoms of lead toxicity are wrist drop, anemia, lead lines on the gums, abdominal pain, and constipation. The muscles that raise the ankles may also be weakened.

b. Total Particulate (nuisance dust)

This is a term that is applied to the total dust in the air. It is very non-specific, however, at levels that exceed 10 mg/m^3, work conditions are very dusty and uncomfortable and can lead to coughing, sneezing, and respiratory irritation.

c. Hydrochloric Acid

Hydrochloric acid and high concentrations of hydrogen chloride gas are highly corrosive to eyes, skin, and mucous membranes. The acid may produce burns, ulceration, and scarring on skin and mucous membranes, and it may produce dermatitis on repeated exposure, eye contact may result in reduced vision or blindness. Dental discoloration and erosion of exposed incisors occur on prolonged exposure to low concentrations. Ingestion may produce fatal effects from esophageal or gastric necrosis.

E. Evaluation Results and Discussion

1. Environmental

Results of environmental samples collected for total particulates are given in Table I. The concentrations ranged from 1.4-16.5 mg/m^3. Three samples exceeded the current ACGIH TLV of 10 mg/m^3.

The results of the lead samples collected are presented in Table II. The concentrations ranged from 0.01-0.87 mg/m^3. Three of the ten samples exceeded the current OSHA standard 0.05 mg/m^3.

The results of the samples taken to evaluate hydrochloric acid are given in Table II. Levels of hydrochloric acid ranged from less than detectable limits to 4 ppm. All levels were below the 5 ppm OSHA standard. The concern expressed with regard to the etched windows in the mold shop may be attributed to the malfunctioning of the incinerator adjacent to the mold shop. The incinerator burns used solvent rags etc. Recommendations are included in Section V. of the Report.

2. Medical

Blood lead levels are important in helping to make the diagnosis of lead intoxication. Values of blood lead up to 40 ug/100 ml. whole blood are considered normal values. From 40 ug/100 ml. to 60 ug/100 ml. indicate increased lead absorption, and, values from 60 ug/100 ml. to 100 ug/100 ml. represents an unacceptable elevation which may cause health problems, values over 100 ug/100 ml. are considered dangerous. Until recently, lead levels up to 80 ug/100 ml. were considered acceptable by most authorities. One problem with determination of blood lead levels is that levels are subject to laboratory error of up to 10 ug/100 ml., even in well run laboratories.

Five employees of the Lenox China Company were sampled for blood lead determinations. Results of analysis of these samples all were within the upper limits of "normal." Table III details this information.

A total of twenty-five mold shop workers were interviewed during the course of this hazard evaluation. Eight workers (32%) complained of excessive sneezing and coughing while at work. All eight felt the dust in the mold shop was responsible for their synptoms. Two workers complained of headache and eye fatigue while at work. The above mentioned ten workers (100%) all felt their symptoms dissipated when they left work.

The workers involved with the lead melting operations expressed their concerns regarding their potential for adverse health effects due to their exposure to lead, cleaning solvents, and excessive heat. These concerns have been addressed in the recommendation section and environmental sections of this report.

At the time of this health hazard evaluation the Lenox China Company employed two individuals in its medical program: a registered nurse who staffs the plant dispensary during the day shift, and the plant physician (a cardiologist) who was vacationing and unavailable for consultation. He was later contacted by phone.

Currently there are no provisions for pre-employment nor termination physical examinations. Employees are designated by the plant physician as being "directly" or "indirectly" exposed to lead and/or silica dust. "Direct exposure" workers are given semi-annual blood lead tests, and a CBC (complete blood count), while annual chest X-rays are given to "direct exposure" silica workers. "Indirect exposure" classified workers are assigned sporadic medical monitoring.

To date blood lead results have been deemed normal if below 60 ug/100 ml. of whole blood. Chest X-rays have been interpreted by the plant physician. Lenox plans to contract the services of a "B-reader."

In assessing the Lenox Company's medical data, two problems were evident. First, blood chemistry results were not being reviewed on a regular and timely basis by the company physician. This was evidenced by a lack of "initialed" (connotates reviewed by physician/physician extender) blood chemistry data sheets. Secondly, direct or indirect exposure ratings are not based on environmental measurements, but rather on company estimates.

3. Conclusions

Based on the results of environmental evaluations conducted by NIOSH on February 28, and March 1st, 1979, it has been determined that the die makers were exposed to levels of inorganic lead above the prescribed health and safety criteria. The plaster mixer operators were exposed to excessive levels of total particulate (dust) above the prescribed health and safety criteria. All other environmental measurements were within the most recent evaluation criteria.

V. RECOMMENDATIONS

1. Investigate the possibility of constructing a new incinerator in a location remote from the mold shop. Solvent rags etc. should be contracted to another incinerator until the problem is solved.

2. Any blood lead determination over 40 ug/100 ml. whole blood should be considered as showing increased absorption. A repeat test should be done on any individual with a high blood result. If the blood lead findings remain high, immediate corrective steps to isolate the worker from lead exposure should be taken. The new OSHA lead standard is a good guide for handling blood lead results.

3. Direct vs. indirect exposure should be ascertained using environmental monitoring data supplied by company industrial hygienists. This would reduce the incidence of X-ray exposure in the workers population.

4. Management is encouraged to continue developing detailed written health and safety programs and instruct all employees of the hazards associated with the chemicals used in the facility and the proper usage of personal protective equipment.

5. Personal protective equipment should be provided for employees exposed to hazards which cannot be adequately abated by engineering controls; at no time should personal protective equipment preclude engineering controls.

6. Pre-employment physical exams and a thorough history should be given all new employees. This data will institute a viable baseline for continued medical monitoring. Termination physical exams should be given all workers to insure completeness of all medical records. Medical records should be reviewed and initialed prior to their insertion into a worker's medical file.

7. Good personal hygiene and work practice should be observed by all employees. Washing of hands before smoking, eating and drinking will help reduce possible contamination. Food, drinks, and cigarettes should not be kept at work locations or near the production area.

8. To prevent skin irritation workers should wear long sleeved, loose fitting clothing provided at company expense. Workers should rinse exposed skin areas frequently during the work day, and shower at the end of the day.

9. Heat stress prevention can be accomplished by acclimatizing workers using a break-in schedule for 1 to 2 weeks. Normal salt intake with meals is advised. Ample drinking water should be available at all times and should be taken frequently during the working day.

10. The present procedure of using air hoses to clean equipment and personal clothing should be discontinued and replaced with vacuum cleaning methods.

11. Better housekeeping is needed throughout the mold shop.

12. All local exhaust ventilation systems should be serviced regularly to insure that they are operating at maximum efficiency.

13. Provide adequate ventilation at the plaster mixing and the powder formulation areas.

14. Establish a respiratory protection program in accordance with the minimal OSHA requirements as outlined in 29 CFR 1910.134. A NIOSH publication titled "A Guide to Industrial Respiratory Protection," will serve as a reference source with information for establishing and maintaining a respiratory program.

15. Respirators used should be those certified under the NIOSH Respirators Standard, 30 CFR, Part II. No individual with compromised lung function should be compelled to wear a respirator.

16. Industrial vacuum cleaners should be used throughout the mold shop instead of brooms.

17. Replace the inadequate 1/4 horsepower motor used to exhaust pottery fumes and odors at the die kiln.

18. Batch mixing of hydrochloric and sulfuric acids does not appear to be a problem, however, storage of the containers is not adequate. All containers used in the die making area should be properly marked and stored in a ventilated enclosure.

VI. REFERENCES

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6. Davidson, I. & Henry, J.B., ed. Todd-Sanford Clinical Diagnosis by Laboratory Mehtods. 15th ed. W.B. Sanders, Philadelphia, 1974.

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TABLE I

Results of Environmental Sampling in the Mold Shop

Lenox, Inc.
Pomona, New Jersey

February 28, and March 1, 1979

Job and/or Location	Date	Sampling Period	Sample Volume (Liters)	Type	Total Particulate *mg/m^3
Plaster Mixer	2-28-79	0756-1443	610	**BZ	15.0
Plaster Mixer	2-28-79	0759-1500	631	BZ	2.9
Mold Maker	2-28-79	0803-1502	628	BZ	1.4
Mold Maker	2-28-79	0805-1503	627	BZ	3.4
Mold Maker	2-28-79	0818-1503	607	BZ	3.9
Mold Maker	2-28-79	0815-1505	615	BZ	6.5
Block Cases	2-28-79	0817-1500	604	BZ	3.2
Block Cases	2-28-79	0821-1459	597	BZ	1.8
Mold Maker	2-28-79	0823-1458	592	BZ	5.0
Mold Maker	2-28-79	0826-1458	522	BZ	4.7
Plaster Mixer	3-1-79	0720-1457	685	BZ	5.0
Plaster Mixer	3-1-79	0723-1457	681	BZ	16.5
Die Maker	2-28-79	0729-1452	604	BZ	2.0
Die Maker	2-28-79	0730-1451	601	BZ	1.6
Block Caser	2-28-79	0733-1453	660	BZ	2.8
Block Caser	2-28-79	0734-1451	592	BZ	3.3
Block Caser	2-28-79	0736-1454	657	BZ	15.6
Block Caser	2-28-79	0738-1455	654	BZ	2.6
Block Caser	2-28-79	0740-1456	654	BZ	2.8
Block Caser	2-28-79	0744-1455	646	BZ	5.4
Block Caser	2-28-79	0746-1457	646	BZ	2.1
Mold Maker	2-28-79	0749-1459	645	BZ	3.3
Mold Maker	2-28-79	0752-1500	642	BZ	3.0
Mold Maker	2-28-79	0753-1500	640	BZ	5.2
Environmental Criteria (TLV)					10.0

*mg/m^3 milligrams of substance per cubic meter of air
**BZ - Breathing Zone

Total particulate - Limit of detection 0.01 mg/m^3

TABLE II

Results of Environmental Sampling in the Mold Shop

Lenox, Inc.
Pomona, New Jersey

February 28, and March 1, 1979

Job and/or Location	Date	Sampling Period	Sample Volume (Liters)	Type	Inorganic Lead *mg/m^3	Hydrochloric Acid **PPM
Die maker	3-1-79	0708-1452	625	***BZ	0.20	—
Die maker	3-1-79	0710-1452	622	BZ	0.03	—
Die maker	2-28-79	0708-1443	623	BZ	0.04	—
Die maker	2-28-79	0714-1443	673	B2	0.06	—
Die maker area	2-28-79	0718-1443	667	****GA	0.01	—
Die maker area	2-28-79	0718-1443	667	GA	0.01	—
Die maker	3-1-79	0714-1452	607	BZ	0.87	—
Die maker	3-1-79	0716-1455	612	BZ	0.04	—
Die mixing area	3-1-79	0705-1505	721	GA	0.01	—
Die mixing area	3-1-79	0705-1505	721	GA	0.01	—
Die maker	2-28-79	0706-1443	625	BZ	—	2
Die maker	2-28-79	0713-1443	675	BZ	—	3
Die mixing area	2-28-79	0717-1443	669	GA	—	4
Die mixing area	2-28-79	0718-1443	667	GA	—	2
Die maker	3-1-79	0715-1455	613	BZ	—	*****LD
Die maker	3-1-79	0713-1452	609	BZ	—	2
Die mixing area	3-1-79	0704-1505	721	GA	—	LD
Die mixing area	3-1-79	0704-1505	721	GA	—	LD
Environmental Criteria					0.05	5.0

*mg/m^3-milligrams of substance per cubic meter of air
**PPM-parts of organic vapor per million parts of air by volume
***BZ-Breathing zone
****GA-General Area
*****LD-less than detectable limits

Inorganic lead - Limit of detection 5 ug/sample
Hydrochloric acid - Limit of detection 2 PPM/sample

TABLE III

Blood Lead Determination

Lenox, Inc.
Pomona, New Jersey

February 28, and March 1, 1979

Sample No.	ugPb/100 ml. whole blood
1	25
2	27
3	35
4	27
*5	15

*subject from management population