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 79-132-673

LANCE CORPORATION
HUDSON, MASSACHUSETTS

March 1980

I. SUMMARY

On August 20, 1979, the Hazard Evaluation and Technical Assistance Branch of the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation from an employer's representative of the Lance Corporation. The request alleged an exposure to lead, methyl ethyl ketone peroxide (MEKP), and styrene. The Lance Corporation is a manufacturer of pewter, bonded porcelain, and ceramic giftware. Both personal and general area samples were obtained with personal samples being worn throughout most of the 8-hour work shift. Swipe samples taken from the table tops in the cafeteria were analyzed for the presence of lead.

Of the forty samples analyzed for lead, 39 were personal and one was general area; five of the personal samples were over the NIOSH recommended criteria of 0.10 milligrams of lead per cubic meter of air (mg/M^3), while 12 personal samples were also over the Occupational Safety and Health Administration (OSHA) level of 0.05 mg/M^3. Analysis for other airborne contaminants, MEKP, styrene, acetone, toluene, xylene, and nuisance particulate were all below their respective NIOSH recommended criteria.

On the basis of the data obtained in this investigation, NIOSH determined that in the finishing (clean-up) and buffing areas a hazard of exposure to lead existed at the time of the survey with a potential hazard in the toolroom. No hazard at the time of the survey to lead existed in the pewter casting, dipping, or soldering areas; also no health hazard to any organic materials or nuisance particulates existed in any areas. Workplace observations indicate that the exposures to lead were due to a combination of inhalation and possibly ingestion. Recommendations on improvement to local exhaust ventilation and personal hygiene were developed by NIOSH and are incorporated in detail in the main body of this report on pages 8, 9 and 10.

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970*, NIOSH invesitgates the toxic effects of substances found in the workplace. An authorized employer's representative of the Lance Corporation requested such an investigation from NIOSH to determine the hazards presented by lead, methyl ethyl ketone peroxide, and styrene. Environmental and personal breathing zone samples were taken and analyzed. On January 11, a preliminary copy of the results was sent to the employer with the results of the environmental testing.

III. BACKGROUND

The Lance Corporation is a manufacturer of pewter, bonded porcelain, and ceramic giftware. The pewter is cast in molds of various sizes and shapes which are made in the plant in the toolroom. After casting, the pieces are cleaned of excess pewter in the finishing area by the use of grinders. Small additional parts are soldered onto the main body (e.g., tails onto mice) as needed.

If additional pieces are not needed to be added on, then from finishing, the pieces are run through an oxidation process. This oxidation process consists of a fluoroboric acid bath with corresponding water washes. After cleaning the pewter in the oxidation area, the pieces are buffed to provide a bright glossy appearance. A coating is applied to the pewter to seal the pieces after which they are packed and shipped.

Several processes which are used only on parts of the manufactured pewter are an antiquing process, and two assembly processes. The antiquing is used to produce a weathered, old looking effect, while the assembly processes are used to add on accessories both before and after the spray sealant is added.

The bonded porcelain resin is poured into molds which are then put under pressure to remove bubbles. After removing the bubbles these pieces are then painted, using either an oil or water base paint. Some of the bonded porcelain pieces are painted by artists outside of the plant and are then brought back to be sealed, packed, and shipped. The rest are painted inhouse.

Molds used in the making of the pewter and porcelain figures are made by hand in the toolroom area of the plant.

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*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 total number of employers in the building is 189, 133 are production with the remaining 56 administration. The breakdown of the number of workers by department is shown on Table V. Workers are frequently substituted from one department to another, as the need arises, so that normal work descriptions are not practical.

IV. EVALUATION DESIGN AND METHODS

Personal breathing zone samples along with several area samples were taken using MSA Model G* sampling pumps operated at 1.0, 1.5, and 2.0 liters per minute (lpm), along with Sipin* personal sampling pumps operated at 0.1 lpm. Sampling media consisted of mixed cellulose ester fiber filters in a 3-piece cassette, charcoal tubes, and 2 impingers in series containing dimethyl phthalate.

Flow rates varied according to sampling media and substance being sampled for. When using the 3-piece cassettes, flow rates of 1.5 lpm and 2.0 lpm for lead/nuisance post and fluoroboric acid, respectively were used. The impingers, operated in series, were run at 1.0 lpm and charcoal tubes using Sipin pumps were at 0.1 lpm.

The analytical methods[1,2] used in the analysis of the samples are NIOSH P&CAM 127 for organics, NIOSH S-341 for lead, with pre and post weighing of filters for particulate.

A total of 41 filter samples were collected in the following areas: finishing, buffing, pewter casting, soldering, dipping and toolroom areas. These were analyzed for lead and/or nuisance particulates (see Table I and II). Sixteen charcoal tube samples were obtained in the following departments: antique process, sebastion clean-up, both spray booths, porcelain casting, toolroom and instapack area for general organic compounds, including, but not limited to, acetone, alcohol and styrene. (Table III) Two swipe samples were taken in the lunchroom to determine if any lead residue could be present in the eating area. The six impinger samples which were taken in the porcelain casting area for MEKP were analyzed onsite by a NIOSH chemist. Exposure criteria for the various substances analyzed for can be found in Table IV.

Company blood lead data was obtained and reviewed by a NIOSH physician.

V. EVALUATION CRITERIA

Lead exhibits toxic effects on the kidneys, the peripheral and central nervous systems, and the hematopoietic system. These effects are felt as weakness, tiredness, irritability, digestive disturbances, high blood pressure, premature aging, nephritis, metal deficiences, and other changes detected by testing.[3,4,5]

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*Mention of manufacturer's name does not constitute a NIOSH endorsement.

Although lead can be acutely toxic in high doses, it is also a bioaccumulative toxin and a chronic illness from considerably small but repeated exposures is much more likely in the industrial setting. Lead may be absorbed by inhalation or ingestion and is excreted very slowly by the kidneys.

Blood levels of lead up to 40 micrograms per deciliter whole blood (40 ug/dl) are found in the general population with no history of occupational exposure to lead, but the average level is much below this. NIOSH has recommended that a blood lead value of 60 ug/dl be the maximum tolerated occupational blood lead level. The new OSHA standard has dictated that at the end of four years, after its passage, 50 ug/dl will become the level at which a worker must be removed from further lead exposure until his blood lead level has dropped to normal values. OSHA's aim is to keep as many workers' blood lead levels as possible below 40 ug/dl, the upper limit of blood leads in unexposed individuals.

Women are probably slightly more susceptible to the ill effects on the blood forming organs, and in the case of pregnancy, the developing fetus is more sensitive to lead than is an adult. It is therefore considered a good idea for pregnant women to maintain their blood lead levels below 30 ug/dl of whole blood.

The evaluation criteria for airborne particulate or "nuisance dust" is based on its ability to reduce workship visibility; create unpleasant deposits in the eyes, ears, and nasal passages; or cause injury to the skin or mucous membranes by chemical or mechanical action per se or by the rigorous cleansing procedures necessary for its removal. The American Conference of Governmental Industrial Hygienists (ACGIH) has recommended a concentration of 10 milligrams per cubic meter of air (mg/M^3) as a maximum acceptable level for particulate in air.[6]

VI. RESULTS

A. Environmental

1. Ventilation[7,8,9,10,11,12,13]

Exhaust ventilation measurements were taken on most hoods, grinders, buffers, and ducts in the plant. In the buffing area, the velocity at the face of the hoods ranged from a high of approximately 600 feet per minute (FPM) to a low of approximately 200 FPM. These figures represent flows for only the operating hoods. Maintenance and design of this system were observed by NIOSH Industrial Hygienists to be inadequate. Many of the hoods had some type of obstruction or mechanical difficulty connected with its operation. Holes in lines, loose connections, and/or obstruction in lines were some of the major problems found. Also, inadequate or non-existent guarding was frequently observed in both the buffing and grinding areas.

The exhaust duct inlet velocities for the soldering hoods were measured at the back of the hoods, these values ranged from about 300 FPM to 700 FPM. However, at the face of the hoods the air velocity was measured to be between 0-10 FPM. This series of hoods appeared to be wasting energy as they were exhausting heated air, but were not effectively capturing the intended pollutants. The minimum required amount of ventilation for soldering is 100 FPM at the source. Since the source of soldering is approximately 8-12 inches from the face of the hood, the capture velocity at the source could not be the recommended minimum of 100 FPM.

In the finishing area the velocities at the face of the hoods ranged from 0 FPM to 960 FPM. Many of the polishers (buffers, grinders) used had some type of obstruction in line (e.g. loose connections between hose and duct, sharp angles in hose, large amounts of dust in line, etc.). These restrictions which were causing a reduction in the hood velocity should be corrected, with an emphasis placed on preventive maintenance. Recommended velocities, a minimum of 200 FPM, are approximately 300-500 FPM with an enclosed hood, other type hoods are not applicable for lead dust (class III contaminant).

The hood in the toolroom was evaluated with measurements ranging from about 60 FPM to 150 FPM. Also, the sebastion spray booth was measured and the air velocities ranged from 100 FPM to 200 FPM with no observable dead spots. The pewter spray booth had a dead air area, with airflows in the other areas ranging from 50 FPM to 150 FPM. The minimum required air flow rate is 150 FPM for an air spray operation with a face area of over 4 square feet with a range from 125-175 FPM with no dead air areas.

2. Noise

Sound level measurements were taken at various places in the plant. These readings were all below the OSHA standard of 90 dBA (decibels on the A scale with slow response). The sound level measurements were taken with General Radio* 1565-B Type 2 sound level meter.

3. Styrene and NOx

Drager* indicator tube samples for styrene and nitrous fumes were taken at various time and areas in the plant. All samples taken were below the limit of detection which were 50 parts of substances per million parts of air (ppm) and 0.5 ppm, respectively.

4. MEKP and Photographs

MEKP air samples were taken in the porcelain casting room with MSA model G personal sampling pumps with impingers containing dimethyl phthalate and analyzed by spectrographic methods. These samples were analyzed onsite with all samples below the limit of detection. Photographs were taken of the various areas and work practices. These were used to help in the process descriptions of the final report. A copy of all photographs have been forwarded to the Lance Corporation for denotation of confidential or trade secrets.

5. Lead

Air samples taken for lead concentrations are shown on Table I. Five samples meet or exceeded the NIOSH recommended criteria of 0.10 milligrams of lead per cubic meter of air (mg/M^3). The OSHA permissible exposure limit (PEL) shall assure that no employee is exposed to lead at concentrations greater than 0.05 mg/M^3, of which 12 met or exceeded. The total number of air samples taken for lead was 40. The finishing (clean-up) Department had ten samples taken of which seven equaled or exceeded the OSHA PEL of 0.05 mg/M^3.

Levels in the buffing department were the highest found in the building. Four out of seven samples taken in this area were above the OSHA PEL as shown in Table 1. The mean value for this department, 0.131 mg/M^3, was above the NIOSH standard of 0.10 mg/M^3 with the standard deviation of 0.137. Workers in this department should be advised of the levels of their exposure. Again any measures taken should also be in conjunction with the correction of the inadequate ventilation system.

Buffing sample #5 for lead is a weighted average of two samples, each was taken for approximately one-half day. Build-up on the filter by such large amounts of particulate, might have caused a drop in air volume drawn through the sample, causing a lowered reading. For this reason, half-day samples were taken on this person. Recommendations for improving working conditions will be included at the end of this report.

The pewter casting, soldering, dipping, and toolroom departments were well below the NIOSH and present OSHA standards for lead. Only one sample in these four departments was over either criteria, which was 0.12 mg/M^3 and in the toolroom. This value might have been caused by a difference in individual work practice, a different type of job in the same department, or proximity to lead exposure. These four departments otherwise had no high exposure as can be seen in Table #1.

Two swipe samples were taken in the lunchroom for determination of residual lead. Both samples were found to have significant amounts of lead present. These samples were taken using filters, wetted in distilled water and rubbed over approximately a one square foot area of table top. Since lead can be considered hazardous if ingested; some program for isolating the work area from the lunchroom should be instituted immediately to stop any further possibility of ingestion of lead.

6. Particulate

The total number of samples taken for nuisance particulate was 34, with an average value of 2.14 mg/M^3. Values for nuisance particulate are shown on Table #2. None of the particulate samples taken exceeded either the American Conference of Governmental Industrial Hygienists (ACGIH) or OSHA standards of 10 mg/M^3, respectively. One sample was close to ACGIH standard of 10 mg/M^3 at 8.4 mg/M^3, in the finishing department.

7. Acetone, Toluene and Xylene

Charcoal tube samples were taken for acetone, toluene, and xylene, with the results shown on Table #3. The values for acetone ranged from 2.3 mg/M^3 to 225.5 mg/M^3. The mean for the 15 samples taken was 30.3 mg/M^3 with a standard deviation of 56.3 mg/M^3. NIOSH's recommended standard for acetone is 1780 mg/M^3 and OSHA's enforceable standard is 2400 mg/M^3. All employee's exposure to acetone were well below the limits, and since it is used only on occasions, it can be viewed as not constituting a health hazard for this situation.

Toluene was sampled for and the results are shown in Table #3. The NIOSH recommended standard for toluene is 375 mg/M^3 with the OSHA enforceable standard at 751 mg/M^3. None of the air samples taken were more than 15% of the NIOSH criteria. Values for toluene ranged from 0.6 mg/M^3 to 52.9 mg/M^3 with an average of 7.7 mg/M^3. No hazard due to toluene can be expected, since its use is limited in both quantity and duration.

Exposure results to all isomers of xylene are shown on Table #3. The values for xylene ranged from 2 mg/M^3 to 45.3 mg/M^3 with an average of 10.4 mg/M^3. The NIOSH recommended criteria is 435 mg/M^3 and the OSHA limit is 435 mg/M^3. None of the samples exceeded more than 10% of the NIOSH or OSHA standards. As with toluene and acetone, no hazard to xylene can be found at this time.

B. Medical

A NIOSH Medical Officer reviewed the company's blood lead monitoring data of the 115 employees for whom results were provided. All test results for which there were dates were from 1978 and 1979. Almost all of the 115 persons were tested in the past year, and many had two or three tests during this period. The blood lead analyses were done by Smith Kline Laboratories* of Waltham, Massachusetts. This laboratory participates in the Center for Disease Control's blood lead proficiency testing program and meets the criteria for satisfactory performance described on OSHA's final standard for occupational exposure to lead.

There was only one person with a blood lead level above 59 ug/dl (micrograms per deciliter); this person's level were 74 ug/dl in October 1979 and 60 ug/dl in November 1979. This person, and one other (who had a blood lead of 54 ug/dl in October with no repeat results provided), were the only two who would have required medical removal under OSHA's ultimate criteria (effective during the 5th year of the lead standard). The employee with the highest blood lead was a sebastain department employee who had substituted in finishing, and the other employee was a sebastian department clean-up worker.

There were three other employees whose most recent blood lead level was above 49 ug/dl, and there were four others whose blood lead level was less than 50 ug/dl on the most recent test but above 49 ug/dl on a previous test. All seven of these has average blood lead levels of less than 50 ug/dl.

Four of these seven were from pewter clean-up, one from buffing, one from quality control, and one from shipping-receiving.

Pewter casting, pewter clean-up, sebastian department, and finished goods-distribution all had more than one employee with a blood lead level greater than 30 ug/dl at some time. Three of the four in pewter casting (all of which were less than 50 ug/dl) were less than 40 ug/dl on subsequent testing, and in the other case the result greater than 39 ug/dl is the most recent. Each of the two in the finished goods-distribution (both less than 50 ug/dl) was less than 40 ug/dl on subsequent testing. In addition to the two cases from sebastian department already discussed, there was a person (who substituted in pewter clean-up) who had a blood lead level of 45 ug/dl. Of the 15 pewter clean-up workers, nine had at least one blood lead greater than 39 ug/dl, and of those whose most recent blood lead were between 40 ug/dl and 50 ug/dl, two had previous blood lead levels above 39 ug/dl (both were above 49 ug/dl).

NIOSH has no data to determine whether employees in areas without obvious lead exposure (such as finished goods-distribution and shipping-receiving) were working elsewhere when they had elevated blood lead levels. Considering this possibility, as well as the data discussed above, it would seem that the major source of substantial lead exposure at Lance Corporation is pewter clean-up. Sebastian department, pewter casting, and buffing might also be sources of appreciable high lead exposures.

Since the employee participation rate in the company's blood lead surveillance program is reportedly high, since the laboratory results are presumably reliable, and since, with infrequent exceptions, employees' blood lead levels are within currently acceptable occupational health criteria, there will be no need for NIOSH to perform any medical testing with respect to lead. This should not imply that there is no need for environmental sampling for lead or that there is no need for improvement in the medical surveillance program.

VII. RECOMMENDATIONS

In view of the findings of NIOSH's environmental and medical study, as well as personal communications with individuals at the Lance Corporation, the following recommendations are made to lessen the potential health hazards and to provide a better work environment for the employees covered by this determination.

1) Respirators

When the limits of exposure cannot be immediately met by limiting the concentrations in the work environment, via engineering and administrative controls, the Lance Corporation should utilize a program of respiratory protection to protect those persons exposed who are working in the finishing and buffing areas, as well as during maintenance in these areas. This program must be an official written respiratory program. The following is a brief description of some of the primary concerns which should be addressed:

- There should be an established in-plant procedure with means and facilities provided to issue respiratory protective equipment, to decontaminant and disinfect the equipment, and to repair or exchange damaged eqipment. Records of these activities should be maintained.

- Employees should be given instructions on the use of respirators assigned to them, on cleaning respirators, testing for leakage and proper use.

- Respirators should be issued with caution. There might be individuals in the group for whom wearing a respirator carries certain specific danger, i.e. highly increased resistance to airflow in a person with compromised pulmonary function may be associated with acute respiratory insufficiency. Employees experiencing frequent and continuous breathing difficulty while using respirators should be evaluated by a physician to determine the ability of the worker to wear a respirator.

Further information on this topic is available in the NIOSH Publication 76-189 "A Guide to Industrial Respiratory Protection". With this information a respiratory program should be designed, if it has not been already, similar to that described in the OSHA requirements outlined in 29 CFR part 1910.134. Finally, for those individuals who are not getting a proper respiratory face mask fit alternative respirators should be made available. There are a number of different designs and sizes, both large and small, on the market today and these alternatives should be sought out.

2) Start program to educate workers as to possible health effects of all chemicals used.

3) Consult with machine guarding manuals to provide adequate machine guarding on all buffers and grinders.

4) Stop all eating, drinking and/or smoking where possible contamination or exposure to chemicals, (especially lead) is possible.

5) Isolate lunchroom from work environment to stop the possible ingestion of lead.

6) Due to the local exhaust ventilation problems described in-text, the following recommendations should be attended to as soon as possible if they have not been already:
(a) Any existing exhaust ventilation systems which are damaged e.g., hoods, ducts, and/or filters, should be restored to their original condition or replaced as necessary;
(b) Any of these systems that have hoods which are improperly located, i.e., in order to increase the capture velocity the

distance from the face of the exhaust hood to the point of particle generation, should be positioned as close to the point of particle generation as is possible; and (c) Hoods which are insufficiently designed should be redesigned in order to increase the capture velocity of these systems, i.e., in such a manner that will encompass the source point without interfering with the operators work, and thus, effectively collect the contaminant at the source.

8) Continue with blood lead evaluations, with reference to the new OSHA lead standard in regard to medical removal.

9) Upon completion of the recommendations for the ventilation systems, the respirator program, and the enclosure of the cafeteria, a technical assistance request from the company might be submitted. This should only be done after completion of all recommendations so that their effectiveness could be evaluated.

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IX. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available, upon request, from NIOSH, Division of Technical Services, Publications Dissemination, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161.

Copies of this report have been sent to:

1) Lance Corporation, Hudson, Massachusetts
2) U.S. Department of Labor, OSHA, Region I
3) NIOSH, Region I

X. REFERENCES

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3. Encyclopedia of Occupational Health and Safety, Vol II, McGraw-Hill (1974), pg. 767-771.

4. NIOSH "Criteria for a Recommended Standard . . Occupational Exposure to Inorganic Lead". Revised Criteria-1978, DHEW Publication No. (NIOSH) 78-158.

5. Federal Register, Vol 44, No. 206, Rules and Regulations, pg. 60980-60995.

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7. Industrial Ventilation, A Manual of Recommended Practice, American Conference of Governmental Industrial Hygienists, 15th ed. (1978) pg. 5-43.

8. NIOSH Recommended Industrial Ventilation Guidelines, DHEW (NIOSH) Publication No. 76-162 pg. 266.

9. Ibid, pg. 106.

10. OSHA Safety and Health Standards for General Industry, 29 CFR 1910.94 (b)(3) pg. 84.

11. NIOSH Recommended Industrial Ventilation Guidelines, DHEW (NIOSH) Publication No. 76-102, pg. 104.

12. Ibid, pg. 242

TABLE I

AIR SAMPLING RESULTS FOR LEAD

LANCE CORPORATION
HUDSON, MASSACHUSETTS

Sample No.	Department	Sample Volume(l) ①	Results mg/M³ ②	$\bar{x}$ ③	s ④	Sample Type
1	Finishing #1	684	0.07			Personal
2	" #2	681	0.18			"
3	" #3	626	0.05			"
4	" #4	678	0.03			"
6	" #5	623	0.06			"
103	" #6	590	0.04			"
104	" #7	674	0.06			"
105	" #8	633	0.03			"
108	" #9	618	0.29			"
112	" #10	633	0.06			"
				0.087	0.083	
7	Buffing #1	567	0.04			Personal
8	" #2	609	0.08			"
15	" #3	449	0.27			"
101	" #4	684	0.04			"
102 & 120	" #5	674	0.38			"
106	" #6	626	0.08			"
110	" #7	308	0.03			Area
				0.131	0.137	
9	Pewter Casting #1	695	0.01			Personal
10	" " #2	714	0.008			"
11	" " #3	714	0.007			"
12	" " #4	675	0.01			"
13	" " #5	729	0.007			"
116	" " #6	709	0.007			"
117	" " #7	660	0.008			"
118	" " #8	651	0.009			"
119	" " #9	755	0.008			"
130	" " #10	689	0.02			"
146	" " #11	614	0.01			"
147	" " #12	678	0.01			"
149	" " #13	636	0.006			"
				0.009	0.004	
107	Soldering #1	666	0.009			Personal
109	" #2	626	0.02			"
111	" #3	618	0.01			"
113	" #4	657	0.02			"
				0.015	0.006	
5	Dipping #1	886	0.01			Personal
114	" #2	808	0.007			"
115	Tool Room #1	603	0.12			Personal
133	" " #2	566	N.D.⑤			"
134	" " #3	629	N.D.			"
148	" " #4	623	N.D.			"

① Sample volume measured in liters

② Approximate milligrams of substance per cubic meter of air

③ Mean value per department

④ Standard deviation per department

⑤ Non-detectable - below limits of detection which is 3 ug /sample (micrograms per sample)

TABLE II

AIR SAMPLING RESULTS FOR NUISANCE PARTICULATE

LANCE CORPORATION
HUDSON, MASSACHUSETTS

Sample No.	Sample Volume (L)	Description	Results① mg/M^3	$\bar{x}$②	S③
1	684	Finishing Department	3.45		
2	681	" "	4.58		
3	626	" "	1.12		
4	678	" "	2.01		
6	623	" "	1.27		
103	590	" "	1.00		
104	674	" "	1.08		
105	633	" "	0.52		
108	618	" "	8.40		
112	633	" "	1.45		
				2.49	2.43
7	567	Buffing Department	0.63		
8	609	" "	2.02		
15	449	" "	4.88		
101	684	" "	0.75		
102 & 120	674	" "	6.58		
106	626	" "	1.31		
110	308	" "	0.16		
				2.33	2.44
9	695	Pewter Casting	1.97		
10	714	" "	1.79		
11	714	" "	1.79		
12	675	" "	2.59		
13	729	" "	1.41		
116	709	" "	2.57		
117	660	" "	1.51		
118	651	" "	2.44		
119	755	" "	3.07		
				2.13	0.56
107	666	Soldering	0.30		
109	626	"	0.56		
111	618	"	0.61		
113	657	"	0.46		
				0.48	0.14
5	886	Dipping	0.38		
114	808	"	0.40		
115	603	Tool Room	2.82		

① Approximate milligrams of substance per cubic meter of air

② Mean value per department

③ Standard deviation of values per department

TABLE III

AIR SAMPLING RESULTS FOR ACETONE, XYLENE, AND TOLUENE

LANCE CORPORATION
HUDSON, MASSACHUSETTS

November 1979

Sample #	Time	Description	Results (mg/M^3)* Acetone①	Toluene②	Xylene③
1	1000 - 1538	Personal Sample (P.S.) Antique Process	1.96	0.73	2.62
2	0835 - 1537	P.S. Sebastian Clean-Up	39.86	15.26	15.89
3	0821 - 1431	Area Sample (A.S.) By Instapack	9.16	2.77	6.41
4	0828 - 1546	A.S. By Pewter Spray Booth	42.89	5.17	21.90
5	0827 - 1527	P.S. Pewter Spray Booth	24.17	6.10	20.41
6	0834 - 1533	P.S. Sebastian Clean-Up	51.30	4.38	8.56
7	0901 - 1539	A.S. Porcelain Casting	6.21	1.86	3.94
8	1001 - 1534	P.S. Packing	2.31	0.60	2.09
9④	0841 - 1500	P.S. Sebastian Clean-Up	225.45	52.94	45.32
10	1005 - 1454	P.S. Porcelain Casting	5.07	1.47	3.73
100	0726 - 1519	P.S. Tool Room Mold Maker	8.33	3.06	4.25
101	0738 - 1517	P.S. Tool Room Mold Maker	8.36	2.47	3.66
108	0710 - 1452	A.S. Bonded Porcelain	10.77	2.07	2.61
114	0929 - 1426	P.S. Sebastian Spray Booth	11.41	13.30	11.78
115	0743 - 1520	P.S. Pewter Spray Booth	6.67	3.19	3.48

* Approximate milligrams of substance per cubic meter of air.

① Limit of Detection is 0.010 milligrams/sample.

② Limit of Detection is 0.008 milligrams/sample.

③ Limit of Detection is 0.010 milligrams/sample (all isomers).

④ Sample Suspect.

TABLE IV

EXPOSURE CRITERIA FOR SUBSTANCES

Substance	NIOSH①	OSHA②	ACGIH③
Lead	0.10 mg/M^3*	0.05 mg/M^{3}④	0.15 mg/M^3
Nuisance Particulate	—	15 mg/M^3	10 mg/M^3
Acetone	1780 mg/M^3	2400 mg/M^3	2400 mg/M^3
Toluene	375 mg/M^3	751 mg/M^3	375 mg/M^3
Xylene	435 mg/M^3	435 mg/M^3	435 mg/M^3

① National Institute for Occupational Safety and Health. Criteria for a Recommended Standard . . . Occupational Exposure to Various Substances.

② Occupational Safety and Health Administration. Safety and Health Standards 29 CFR 1910 (Tables Z-1, Z-2).

③ American Conference of Governmental Industrial Hygienists. Threshold Limit Values.

④ Permissible Exposure Limit (P.E.L.)

*Approximate milligrams of substance per cubic meter of air.

Table V

Demography Data of Lance Corporation

Department	Total Employees	Number Males (%)	Number Females (%)	Average[1] Age (Mean)
Tooling	16	11 (69)	5 (31)	30.0
Milling	1	1	0	27.0
Pewter Casting	15	7 (47)	8 (53)	23.6
Investment Casting	2	1 (50)	1 (50)	26.5
Pewter Clean-Up	15	1 (7)	14 (93)	51.5
Soldering	14	1 (7)	13 (93)	41.9
Dipping	1	0	1	50.0
Pewter Bead Blasting	1	0	1	54.0
Buffing	5	0	5 (100)	49.0
Pewter Spray Booth	1	0	1	25.0
Porcelain	5	1 (20)	4 (80)	34.2
Assembly	1	0	1	48.0
Quality Control	2	0	2 (100)	48.0
Polychrome	1	0	1	31.0
Sebastian Clean-Up	9	0	9 (100)	48.4
Feature Painter	13	0	13 (100)	35.7
Sebastian Spray Booth	1	1	0	20.0
Driver (Painters)	1	0	1	25.0
Warehouse	14	5 (36)	9 (64)	31.9
Pre-Pack	7	0	7 (100)	47.5
Shipping	5	5 (100)	0	25.6
Maintenance	3	2 (67)	1 (33)	42.7

[1]Average (mean) age in years