U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health
Cincinnati, Ohio 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 79-100-665

L.R.I. INDUSTRIES
CHELSEA, MICHIGAN

February 1980

I. SUMMARY

On June 10 and August 16, 1979, the National Institute for Occupational Safety and Health (NIOSH) conducted an environmental evaluation at L.R.I. Industries, a maker of ceramic tumbling media, in Chelsea, Michigan, to evaluate possible hazards from noise, from dusts containing free silica, and from asbestos. Environmental measurements were made for airborne particulates containing free silica. Bulk samples of batch ingredients were obtained for asbestos and other analyses. One noise dosimeter reading plus five noise level readings at ear level using the dBA slow response scale were taken. Informal interviews were conducted with employees regarding work histories and work conditions. The chief complaint from most employees was the poor condition and location of eating areas.

Noise measurements indicated that the abrasive chip boxing machines, salvage machine, and No. 5 pug mill exceeded recommended noise levels for operators on these machines. Dust measurements indicated that a health hazard existed for the batchware operator, special refractory operator, and pug mill operator due to excess exposure to free silica in the dust. No asbestos was detected in any of the bulk samples analyzed. Other major contents of the bulk samples were talc, Silica-Aluminum dust, and aluminum compounds. Measurements for free silica in the eating areas of both buildings were below the NIOSH recommended standard. However, the location and condition of the eating facilities in both buildings is inadequate and unsanitary.

On the basis of the data obtained in this investigation, NIOSH determined that a hazard of exposure to excessive noise, free silica, and unsanitary eating conditions exists at L.R.I. Industries. Workplace observations indicate that the exposures are due to inhalation and possibly to ingestion of dusts containing free silica. Excessive noise exposure is caused by physical interaction of machines with the ceramic chip product. Recommendations on housekeeping, ventilation, and noise control are contained in this report on page 6.

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970*, NIOSH investigates the toxic effects of substances found in the workplace. An authorized representative of the United Auto Workers, Local 437, requested such an investigation from NIOSH to determine the hazards presented by dusts containing silica and other toxic compounds at L.R.I. Industries. Noise measurements, environmental and personal breathing zone air samples, and bulk samples were collected and analyzed. Informal interviews with employees were conducted during the initial survey on June 10, 1979.

While the health hazard evaluation requested investigation of toxic agents, the chief complaint concerned the location and condition of the employee eating area. Three other government (state) agencies had been called in to evaluate the work environment at this plant within the past year.

III. BACKGROUND

L.R.I. Industries manufactures ceramic tumbling media for mass finishing of metal parts. There are two plants that manufacture the ceramic tumbling chips. Plant No. 1 contains the pug mill which contains a mueller (blender) that makes the clay by adding water to the batch ingredients, then extrudes and cuts the clay into various size chips. This plant also houses the special refractory kilns which fire-cure the clay into ceramic chips. The eating area is located near the pug mills. Plant No. 2 houses the administrative office, the batchware mixing machine, and the inspection and boxing area. The eating area is located near the inspection and boxing area. There are approximately 30 employees at this company operating three shifts, with the majority of employees working the day shift. There are basically four separate jobs in manufacturing the ceramic tumbling chips. They are: the batchware mixer, the pug mill operator, special refractory operator, and the inspection and boxing operator. The batchware mixer is a one-man, one-shift operation that involves dumping and mixing of all powdered ingredients (clay, talc, aluminum oxide, free silica) that make up the ceramic tumbling media. The hazard in this area is dust generated by dumping and mixing of powdered materials. Inadequate ventilation design in this area contributes to the dust problem.

The pug mill has four operators on the day shift and two on the night shift. Each employee operates a mueller (blender) and an extruding machine. Material is brought over from batchware and dumped into blenders. Water is then added to bind the mix into clay. The clay is conveyed to an extruding machine where it is extruded and chopped into various size chips. Each operator runs approximately seven batches per shift. The hazards here are to dusts during dumping of the mix into the blender and to noise from the chopping blocks while making clay chips.

---

*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 special refractory area has two employees per shift: one employee loads wet chips onto kiln carts and the other empties the fire cured chips into 55-gallon drums. The kilns are operated 24 hours per day. The hazard here is to dust generated by dumping cured chips into 55-gallon drums. Another potential hazard is heat stress from working next to the kiln with temperatures of 2150°F.

The inspection and boxing area has four employees: two chip inspectors, a material handler, and a salvage machine operator. The two chip inspectors operate machines that hoist and dump 55-gallon drums containing cured chips into a conveyer and vibrating screen which move the chips past the inspectors and into shipping boxes. The material handler seals and labels the boxes for shipping. There is no dust hazard here due to a well-designed slot exhaust ventilation system located next to the vibrating screen. There is a noise problem, however, which is caused by the physical interaction of the chips and the metal parts of the machine. Noise level is related to chip size: the larger the chip, the louder the noise. The salvage machine is located just outside the building. The operator dumps chips of various sizes into the hopper, which flows into a chip size separator. In principle, it operates much like a coin separator. The hazard here is to noise during the separation process.

Eating areas in both plants are of major concern among the employees. The eating area is on the plant floor, and consists of a card table and four to six folding chairs (Figures 1 and 2). There used to be enclosed eating areas, with vending machines, tables, and chairs, but these were removed within the last year because the area was not kept clean by employees using these facilities. The eating area was evaluated for airborne dusts containing free silica and the potential for ingesting settled dust in the eating area. The eating area was also evaluated for sanitary conditions because of the potential infestation from birds, rodents, and other vermin.

IV. EVALUATION DESIGN AND METHODS

General area and personal breathing zone air measurements were taken in all areas where dust was generated or could settle. These samples were collected on pre-weighed FWSB millipore filters using battery powered sampling pumps operated at 2.0 liters per minute for most of the first shift. Analysis of air samples containing free silica was by X-ray diffraction. Bulk samples of batch ingredients were taken and analyzed for asbestos fibers. The bulk samples were analyzed by electron and optical microscopy. Noise measurements were taken at ear level on chip inspection machines 1 and 2, the salvage machine, and pug mill machines. A noise dosimeter was connected to a chip inspector on machine no. 2. The noise dosimeter readout is in percentage, and is based on the OSHA criteria of a 90 dBA, 8-hour workday.

The eating areas were observed during work and lunch breaks for dust contamination, personal hygiene, and the potential for vermin to infest this area.

V. EVALUATION CRITERIA

Silicon dioxide in the free state can cause a pneumoconiosis called silicosis. Many factors play a role in the development of silicosis: the level of exposure, duration of exposure, synergistic action of other ions, individual susceptibility, and the presence of infection such as tuberculosis. Silicosis may be acute or chronic. The acute form can be recognized as early as 8-18 months after the beginning of examination.(1) Symptoms are severe shortness of breath and rapid breathing. Chest X-rays often show fibrosis. Chronic silicosis occurs after 15-30 years of exposure to silica dust.(1) The danger of chronic silicosis is that many cases progress to an advanced stage while producing symptoms of only moderate shortness of breath. The chief complications of silicosis are pulmonary tuberculosis, respiratory insufficiency, and acute pulmonary infection. The health effects of ingestion of dusts containing silica have not been fully documented. Some animal research indicates that silica particularly up to 100 microns in size can be absorbed in the gut. Data from dog experiments indicate that a significant increase in kidney lesions and other diseases of the kidney (nephropathy) were seen when the animals were given silica in their diet. (Telephone conversation with Dr. Irving Selikoff 7/17/79.) The best preventive methods in eliminating silicosis are insuring that levels of free silica are below Federal Standards, annual chest X-rays, and pulmonary function testing. The NIOSH recommended standard for free silica exposure is less than or equal to 0.05 milligrams per cubic meter.(2)

Exposure to intense noise causes hearing losses which may be temporary or permanent.(3) Industrial noise exposures produce the largest temporary hearing losses at frequencies of 4,000 to 6,000 Hertz. The amount of temporary hearing loss varies from individual to individual. Permanent hearing loss is seen in workers who have been exposed to daily noise for many years and does not respond to any known treatment or cure. The physiologic effects of noise are an increase in blood pressure, heart rate, and sweating; change of breathing; and constrictions of the muscles over the whole body. The long-term effects of noise-induced losses usually first affect frequences slightly above the speech range (≈4000Hz). Impairments in the perception of speech may not become noticeable until losses for speech frequencies are 20 dBA or more. An effective audiometric testing program and maintaining industrial noise below the 85 dBA NIOSH recommended standard (for new installations) will greatly reduce the incidence of job-related hearing loss.

The Occupational Safety and Health Standards presented in the Code of Federal Regulations, Title 29, Subsection 1910-141, address sanitation in the work environment. Regulations on eating and drinking areas state that "No employee shall be allowed to consume food or beverages in a toilet room nor in any area exposed to a toxic material." Additional regulations in Subsection 1910.141 address vermin control.

VI. RESULTS

Analyses of air samples taken for total and respirable dusts measurement indicate that the batchware operator, special refractory operator, and the pug mill operator were marginally overexposed to respirable free silica (Table I). Analyses of other dust samples indicate lower levels of silica exposure.

Table II shows the results of noise measurements. All measurements taken in noisy areas exceeded the NIOSH recommended standard of 85 dBA for an 8-hour workday and the OSHA standard of 90 dBA for an 8-hour workday. In the abrasive chip boxing area, noise levels correlated with machine vibration and chip size. The salvage machine was the noisiest of all machines monitored.

VII. DISCUSSION

Although the employees' representative requested a health hazard evaluation of toxic substances at L.R.I. Industries, the actual complaint centered on the location and condition of the lunchroom. During the past year, three state government agencies have been called in to assess this problem with no fruitful results. Silica is considered a toxic substance and its potential for ingestion is great, either through poor personal hygiene practices such as not washing hands before eating, or from dust collecting on food from dirty table tops. The kidney diseases reported in animal studies suggest a potential health hazard for humans ingesting this same compound. Another concern is a sanitary eating environment free of vermin. Wild birds were observed in the plant and over the eating areas. Bird droppings can cause in humans a disease called psittacosis if these droppings are inadvertantly consumed or inhaled. Enclosed eating areas usually prevent such unpleasant problems.

This is the second health hazard evaluation performed by NIOSH at L.R.I. Industries, formerly known as Fortune Industries. The first survey was conducted in January and March of 1973. The results of that survey indicated excess exposure to asbestos, free silica, and noise. Recommendations made in that report included the elimination of talc containing asbestos, and the reduction of dust and noise exposure through ventilation and other engineering controls. Most recommendations incorporated at L.R.I. have eliminated or sharply reduced contaminant exposure. Continued application of recommendations will further reduce contaminant exposure and make L.R.I. a safe and healthful work environment.

VIII. RECOMMENDATIONS

.The recently installed local exhaust ventilation system for the batch-ware operator is inadequate for protecting workers from excessive dust exposure. Redesigning the hood and duct work to exhaust laterally rather then vertically should significantly reduce dust exposure to employees during this operation.

.Housekeeping should be improved throughout the plant. Routine vacuuming with a heavy-duty industrial vacuum cleaner of equipment and floors should significantly reduce ambient dust exposure.

.Replacement and repair of worn gaskets around existing duct work should be performed immediately and maintained on a routine basis.

.Engineering controls should be utilized to reduce noise in the inspection and pug mill areas. The major source of noise in the inspection area is the vibrating screen and movement of ceramic chips. Rubber coating of the screen by using a thermoplastic material should help reduce noise.

.The pug mill machine should have rubber gaskets and mufflers installed on its chop blocks and air releases to reduce noise.

.The salvage machine has been moved outside and is fairly well isolated from the rest of the workers. The operator, however, should wear NIOSH-approved ear protection whenever operating the salvage machine.

.Medical surveillance of workers exposed to asbestos in the past, and to silica now, should continue receiving chest X-rays and pulmonary function testing. If testing is performed at the plant site, make sure the medical contractor is certified and approved through a national association for such on-site testing.

.Until proper ventilation and engineering controls are installed NIOSH-approved respirators and hearing protective devices should be used.

.A proper and sanitary eating facility should be installed at the plant site. It is preferred that the eating area be enclosed, kept free of dusts, kept sanitary, and cleaned once per day. Also, good personal hygiene such as washing hands before eating and before going home should be practiced.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

Evaluation Conducted and Report Prepared by:

James D. McGlothlin, M.S., M.P.H.
Industrial Hygienist
Industrial Hygiene Section
Hazard Evaluations and Technical Assistance Branch

Originating Office:

Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations and Field Studies
Cincinnati, Ohio

Report Typed by:

Jackie Woodruff
Clerk/Typist
Industrial Hygiene Section
Hazard Evaluations and Technical Assistance Branch

X. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this 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 22161.

Copies of this report have been sent to:

1. L.R.I. Industries
2. U.S. Department of Labor, Region V
3. NIOSH, Region V

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

XI. REFERENCES

1. Occupational Disease - A Guide to Their Recognition. W.M. Gafafer, editor, USDHEW, PHS Pub. No. 77-181, 1977, pp. 114-115.

2. Criteria for a Recommended Standard: Occupational Exposure to Crystalline Silica, PHS Pub. No. 75-120.

3. Criteria for a Recommended Standard: Occupational Exposure to Noise. PHS Pub. No. 73-11001.

4. Occupational Safety and Health Standards Subpart J - General Environmental Controls. Code of Federal Regulations, Title 29, Part 1910, Subsection 1910-141, 1971.

5. Documentation of Threshold Limit Values, American Conference of Governmental Industrial Hygienist, 1979, Cincinnati, Ohio, pp. 32-33.

TABLE I
ATMOSPHERIC EXPOSURES TO DUST
CONTAINING FREE SILICA
L.R.I. INDUSTRIES
August 16, 1979

Job	Total Dust (T) or Respirable (R)	Sample Volume (liters)	mg/M3 Sample	Samples % Free Silica	OSHA Calculated Standard mg/M3	Free Silica Calculated Exposure mg/M3
Fork Lift Operator (BZ)	R	846	0.18	<20.0	<0.45	<0.03
Batchware Operator (BZ)	R	842	1.71	9.0	0.91	*0.15
Boxing & Inspection Operator (BZ)	R	830	0.17	<21.0	<0.43	<0.04
Eating Area (Plant 2) (G. A.)	T	820	0.27	<13.6	<1.81	<0.04
Material Handler (BZ)	T	738	0.46	8.8	2.54	0.04
Batchware Area (G. A.) (next to hood)	T	794	0.57	20.0	1.30	0.11
Batchware Area (G. A.) (next to door)	T	788	0.53	21.4	1.23	0.11
Special Refractory (BZ)	R	786	0.39	12.9	0.67	*0.05
Refractory Area (G. A.)	T	780	5.17	12.4	1.95	0.64
Pug Mill (BZ)	R	650	0.38	12.0	0.71	*0.05
Eating Area (Plant 1) (G. A.)	T	754	0.60	22.2	1.19	0.13
Eating Area (Plant 1) (G. A.)	R	748	----	----	N.D.	N.D.

Environmental Criteria: NIOSH Recommended Standard 0.05 for respirable silica 0.05

* = Exceeds the criteria set
BZ = Breathing Zone sample
G.A.= General Area sample
mg/M3=Milligrams of contaminant per cubic meter of air
N.D.= Not Detected

TABLE II

NOISE LEVEL READINGS IN WORKERS' HEARING ZONE

L.R.I. INDUSTRIES

JULY 10, 1979 and AUGUST 16, 1979

Date	Location/Job	Noise Level Range dBA Slow Response Scale Ear Level	Abrasive Chip Size
July 10, 1979	Abrasive Chip Boxing Area Machine #1	100 - 108	7/8" x 1/4"
July 10, 1979	Machine #2	91 - 98	5/8" x 3/16"
Aug. 16, 1979	Machine #2	97 - 100	1/4" x 1/4"
Aug. 16, 1979	Salvage Machine (outside shop)	100 - 110	Various Sizes
Aug. 16, 1979	Pug Mill Machine #5 Mill	97 - 99	1/4" x 1/4"
Aug. 16, 1979	Abrasive Chip Boxing Area Machine #2 Noise Dosimeter Reading	*108%	5/8" x 3/16"

Environmental Criteria: NIOSH Recommended Standard - 85 dBA 8-hour time-weighted average 115 dBA ceiling
ACGIH TLV - 85 dBA 8-hour time-weighted average 115 dBA ceiling
OSHA Standard - 90 dBA 8-hour workday 115 dBA for 15 minutes or less

* Readings above 100% indicate overexposure to noise on a 90 dBA 8-hour workday OSHA standard.

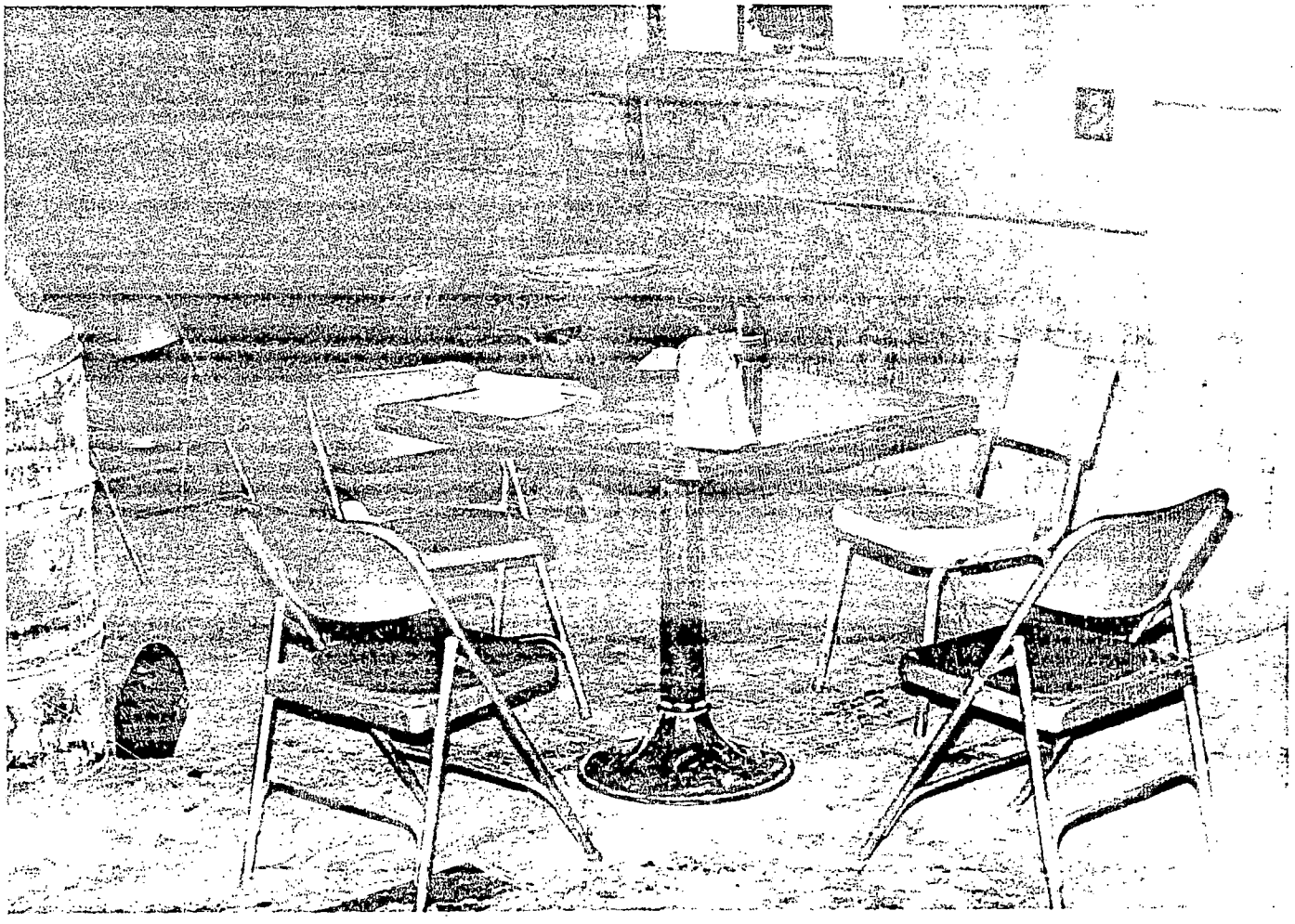

Figure 1

Eating Facilities Plant 1

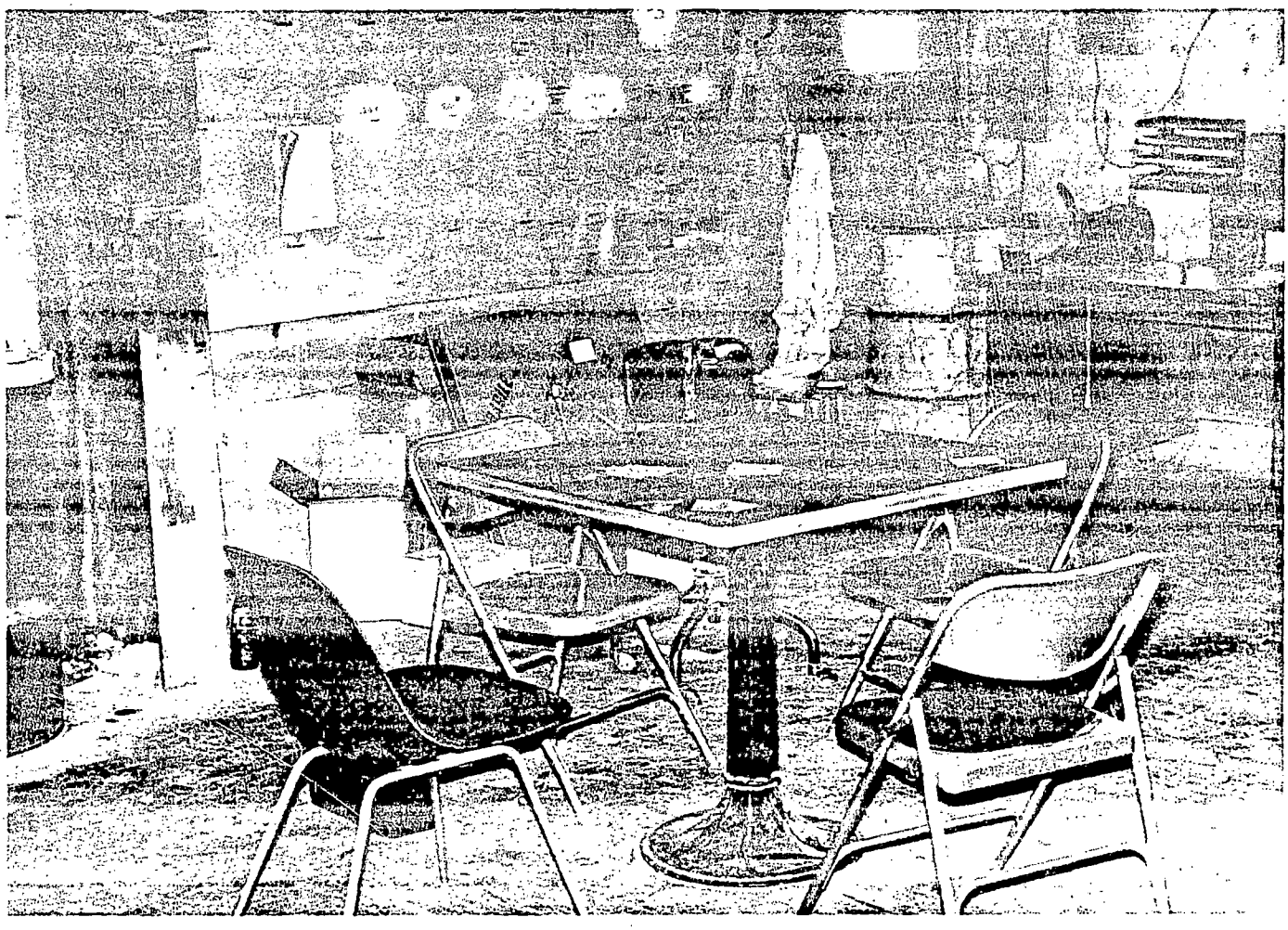

Figure 2

Eating Facilities Plant 2