



AMERICAN SMELTING AND REFINING COMPANY
Department of Environmental Sciences
Salt Lake City, Utah

Plant: EL PASO

Survey Date: January 16-19, 1974

Field Work: John B. Richardson

Report Date: March 11, 1974

INDUSTRIAL HYGIENE SURVEY REPORT

I. OPERATING CONDITIONS:

Number 2 Blast Furnace was not in operation. Conditions were otherwise normal, including the usual curtailment of the Sinter Plant during the day shift to avoid violations of State SO₂ standards.

II. SAMPLING:

A. A.I.S.I. tape samplers were used in four areas to collect one-hour sequential samples of airborne dust and fume:

- 1) Cadmium Plant - Godfrey roaster
- 2) Cadmium Plant - Storage shed
- 3) Sinter Plant - Fire floor, feeder end
- 4) Blast Furnace - Between No. 1 and No. 2 Blast Furnaces

Samples collected in both the Sinter Plant and the Blast Furnace Department were analyzed for lead only. All Cadmium Plant samples were analyzed for both lead and cadmium by atomic absorption spectrophotometry.

B. Individual dust and fume samples were collected concurrently with Dr. Delmar D. Krehbiel, an Occupational Safety and Health Administration enforcement officer from the Lubbock, Texas district office. M.S.A. personal monitors equipped with Millipore filters were used: plastic casing intact and inlet plug removed.

A respirable dust and fume sample was collected using a M.S.A. personal monitor equipped with a cyclone device and a Millipore filter.

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C. Asbestos samples were taken in the general warehouse, in a small storage shed, in the carpenter shop, and in the Blast Furnace area. A M.S.A. personal monitor and open-face Millipore filters were used.

III. SAMPLING RESULTS:

A. A.I.S.I. Tape Samplers:

Airborne lead and cadmium concentrations are listed as follows:

<u>Department</u>	<u>Location</u>	<u>Anal- ysis</u>	<u>Concentration (mg/m³)</u>			<u>No of Hourly Samples</u>	<u>Figure No.</u>
			<u>Mean</u>	<u>Max.</u>	<u>Min.</u>		
Cadmium	Godfrey Roaster	Cd	0.01	0.04	0.002	23	1
		Pb	0.05	0.15	0.001		2
	Storage Shed	Cd	0.13	0.87	0.004	23	3
		Pb	0.13	0.70	0.004		4
Lead	D & L Fire Floor	Pb	0.43*	1.13	0.07	25	5
	Blast Furnace	Pb	0.14	0.39	0.07	22	6

* Mean value exceeds OSHA 8-hour time-weighted average

OSHA Limits: Pb -- 0.20 mg/m³
 Cd fume -- 0.1 mg/m³
 Cd dust -- 0.2 mg/m³

B. Personal Monitors:

The M.S.A. personal monitor results for dust and fume of lead, cadmium and zinc are tabulated below:

<u>Department</u>	<u>Employee & No.</u>	<u>Job or Operation</u>	<u>Sampling</u>		<u>Anal- ysis</u>	<u>Conc'n. (mg/m³)</u>
			<u>1974 Date</u>	<u>Time (min.)</u>		
Lead-Dross	#60	#5 Kettleman	1/16	325	Pb	0.30 *
Lead-Blast	#168	920 Operator	1/16	327	Pb	0.20
Lead-D & L	#1035	D&L Fireman	1/16	315	Pb	0.47 *
Lead-D & L	#1106	D&L Fireman	1/16	318	Pb	0.45 *

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B. Personal Monitors (Con't.):

Department	Employee & No.	Job or Operation	Sampling		Anal- ysis	Conc'n. (mg/m ³)
			1974 Date	Time (min.)		
Lead-Baghouse	#1092	Baghouse Helper	1/16	310	Pb	0.41 *
Lead-Dross	#2366	Dross Craneman	1/16	281	Pb	0.27 *
Lead-Blast	#20	-----	1/17	265	Pb	1.70 *
Lead-D & L	#1432	Feederman	1/17	265	Pb	0.71 *
Lead-D & L	#1106	D&L Fireman	1/17	266	Pb	0.25 *
Lead-Dross	#2227	Reverb Fceman	1/17	244	Pb	0.48 *
Mill	#2302	Feederman	1/17	254	Pb	0.25 *
Cd Plant	#18	Fireman	1/17	256	Pb	0.28 *
					Cd	0.14 ?
Cd Plant	#82	Craneman	1/17	280	Pb	0.36 *
					Cd	0.26 *
					(Respirable Sample)	Pb 0.09
					(Respirable Sample)	Cd 0.04
					Pb Respirable Fraction =	25%
					Cd Respirable Fraction =	15%
Zinc Kilns	#1218	Loading Surge Bin	1/18	245	Pb	1.42 *
					Zn	6.50 *
Lead-D & L	#2316	Beltman	1/18	168	Pb	3.60 *
Cd\Plant	-----	Fireman	1/18	167	Pb	1.10 *
					Cd	1.42 **

* Exceeds OSHA 8-hour time-weighted average

+ Exceeds OSHA acceptable ceiling concentration for cadmium dust

? May exceed OSHA limit depending upon type of exposure, e.g., dust and/or fume

PRESENT OSHA STANDARDS:

<u>Material</u>	<u>8-hour time-weighted average</u>	<u>Acceptable Ceiling Conc'n. (Not to be exceeded at any time during an 8-hour shift)</u>
Cadmium dust	0.2 mg Cd/m ³	0.6 mg Cd/m ³
Cadmium fume	0.1 mg Cd/m ³	0.3 mg Cd/m ³
Lead dust & fume	0.2 mg Pb/m ³	None
ZnO fume	5.0 mg ZnO/m ³	None

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C. Asbestos sampling:

Asbestos sampling resulted in the following values:

<u>Department</u>	<u>Employee & No.</u>	<u>Job or Operation</u>	<u>Sampling</u>		<u>Conc'n based on sampling time</u> <u>No. fibers >5μ in length/cm³ air</u>	<u>8-hour time weighted conc'n</u>
			<u>1974 Date</u>	<u>Time (min.)</u>		
Warehouse	#5650	Cutting asbestos board	1/18	2	2.3	0.01
	#5650	Cutting asbestos cloth	1/18	2	2.3	0.01
Brickmason Crew	#1522	Mixing Insulag inside shed	1/18	4	4.7	0.04
Carpenter Shop	#5483	Cutting asbestos roll with band saw	1/19	13	22.2 +	0.60
Masonry	#861 441	Caulking Blast Fce.	1/21	102	0.4	0.085
Carpenter Shop	R.Carey	----- Sawing transite	1/23	5	46.3 +	0.48

OSHA 8-hour, time-weighted standard = 5 fibers >5 μ in length/cm³ of air.

+ Exceeds OSHA ceiling concentration of 10 fibers >5 μ in length/cm³ of air, not to be exceeded at any time during an 8-hour shift.

IV. COMMENTS:

A. Cadmium Plant:

Although tape sampler results show low airborne lead and cadmium levels in this department, personal monitor values indicate otherwise. All three employees sampled showed excessive exposure to lead and cadmium. Although the crane operator's overall lead and cadmium exposure appears less than that of the other two cadmium workers sampled, he may actually experience much higher excursions during the time he loads the hopper.

Personnel in this department appeared to be firmly committed to respirator wearing.

B. Zinc Plant:

The only employee sampled was in the kiln area. Both lead and zinc oxide fume exposures were in excess of the OSHA 8-hour standards.

Respirator-wearing appeared to be generally good.

C. Lead Plant:

With one exception all personal monitor results in this department exceeded the OSHA lead standard. The results of the sampler located in the Sinter Plant confirm this conclusion. The tape sampler located in the Blast Furnace area showed generally low levels of airborne lead, whereas the personal monitor results for the same area indicated that individual exposures are much greater.

Respirator-wearing appeared to be faithfully adhered to in the Lead Plant, except for occasional laxness in the Blast Furnace area.

D. Asbestos Sampling Results:

Of the six samples taken, two were in excess of the OSHA maximum allowable standard (Carpenter Shop). Eight-hour, time-weighted average concentrations for all samples were below the OSHA limit. In the cases of the Insulag mixing and asbestos roll cutting, respirators were worn during sampling.

Based on the OSHA 8-hour standard and the infrequency of the operation, asbestos sheet and cloth cutting in the warehouse constitutes a negligible health hazard. Insulag mixing and Blast Furnace caulking, also intermittent operations, would fall into a low-hazard category. Mixing would become even less of an exposure problem if the task were performed in the open air and not in a small enclosure.

Management has already given verbal assurance that the practice of cutting asbestos rolls with band saws and all similar operations which generate heavy dust concentrations will be promptly discontinued.

Transite sawing, if continued, requires engineering controls, such as local exhaust ventilation and dust collection systems, to attain compliance with the OSHA ceiling concentration standard. Compliance is not achieved by the use of respirators only. A copy of the OSHA asbestos standard is enclosed with this report.

V. RECOMMENDATIONS:

- A. The Lead Department continues to be the principal industrial hygiene problem area at El Paso. Personal monitor results obtained by both OSHA and ASARCO substantiate the findings of past surveys. As recommended in earlier reports, engineering controls should be investigated and applied at the earliest opportunity.
- B. Personal exposures to both lead and zinc oxide fume continue to be high in the zinc kiln area. The reasons for these persistently high levels should be reviewed and remedial actions taken. A materials handling study should be conducted to determine major exposure sources. Following such determinations, engineering controls may be installed or work practices may be altered as needed.
- C. Ways of providing relief for the Cadmium Department crane operator from heavy exposures to lead and cadmium should be investigated. One possibility might be an air line respirator. Another is the installation of a closed-cab air conditioner equipped with high efficiency particulate air (HEPA) filters. Means of reducing the personal exposures of the Cadmium Plant firemen should likewise receive immediate attention.
- D. Where the policy of respirator-wearing has succumbed to isolated cases of indifference, such as in the Blast Furnace area, a program of renewed emphasis should be mounted. The OSHA inspector praised ASARCO's respirator program as well as its almost universal acceptance among the employees. From the point of view of a future OSHA industrial hygiene inspection, one-hundred percent compliance with respirator use would weigh heavily in El Paso's favor. But as a matter of every-day practice, El Paso should continually demonstrate its total commitment to the program.
- E. Employees who routinely use asbestos or asbestos products, such as Insulag and transite, should be apprised of the potential hazard. Wherever practicable, wet handling of asbestos rope, sheets or cloth should be encouraged. Cutting sheets or rolls with high-speed saws should be banned, especially in confined areas, where exposure may recur as traffic stirs up settled fibers. Good housekeeping practices should include prompt clean-up of any asbestos products littering the work area. Vacuuming is the clean-up method of preference.

Copper department masons who use asbestos cloth to form skirts around the converter hoods and the masons who caulk blast furnaces should be encouraged to wear their respirators.

If transite sawing is continued, a properly designed local exhaust ventilation system should be installed in the carpenter shop to control airborne fiber concentrations below OSHA limits during cutting.

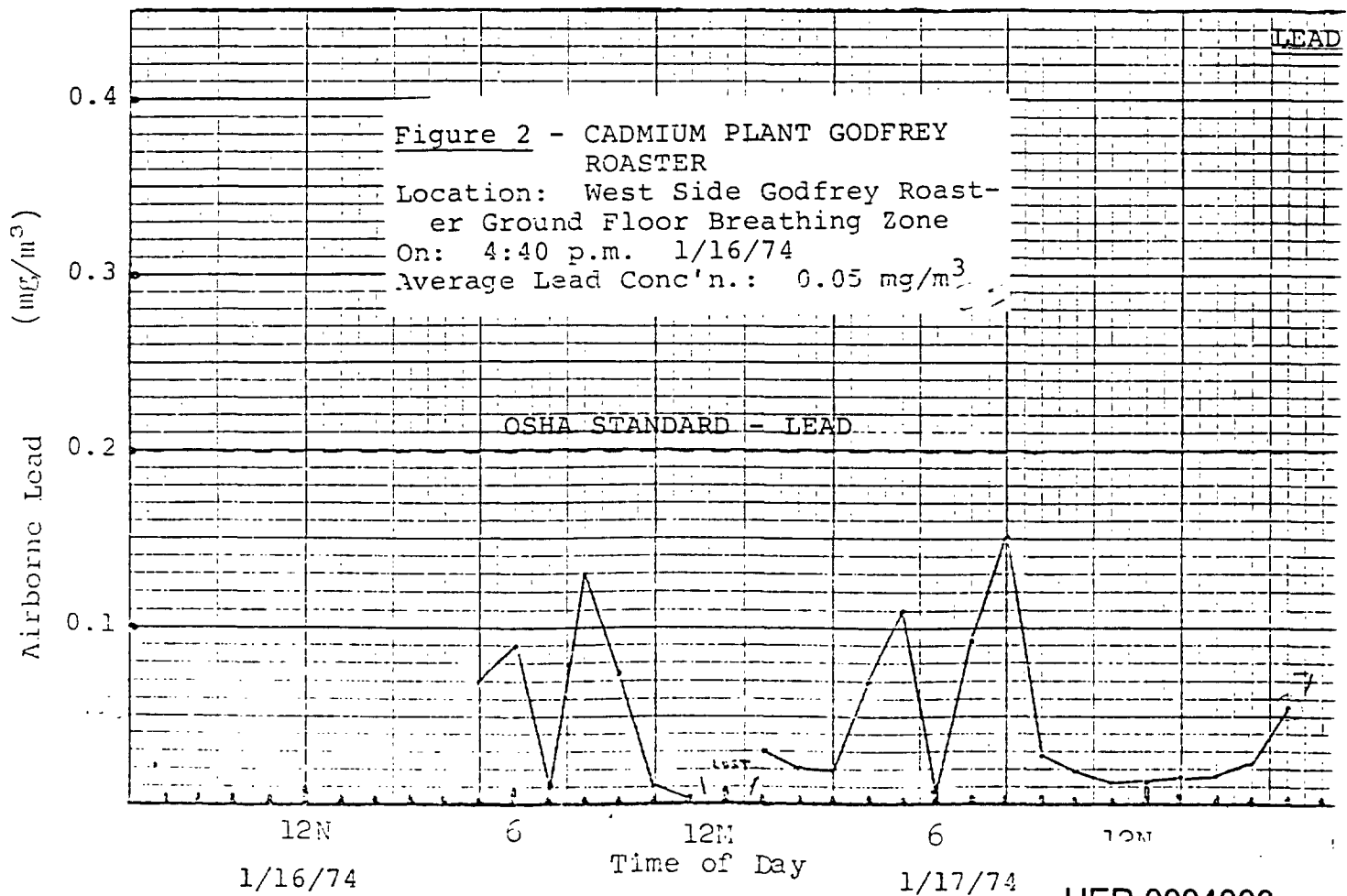
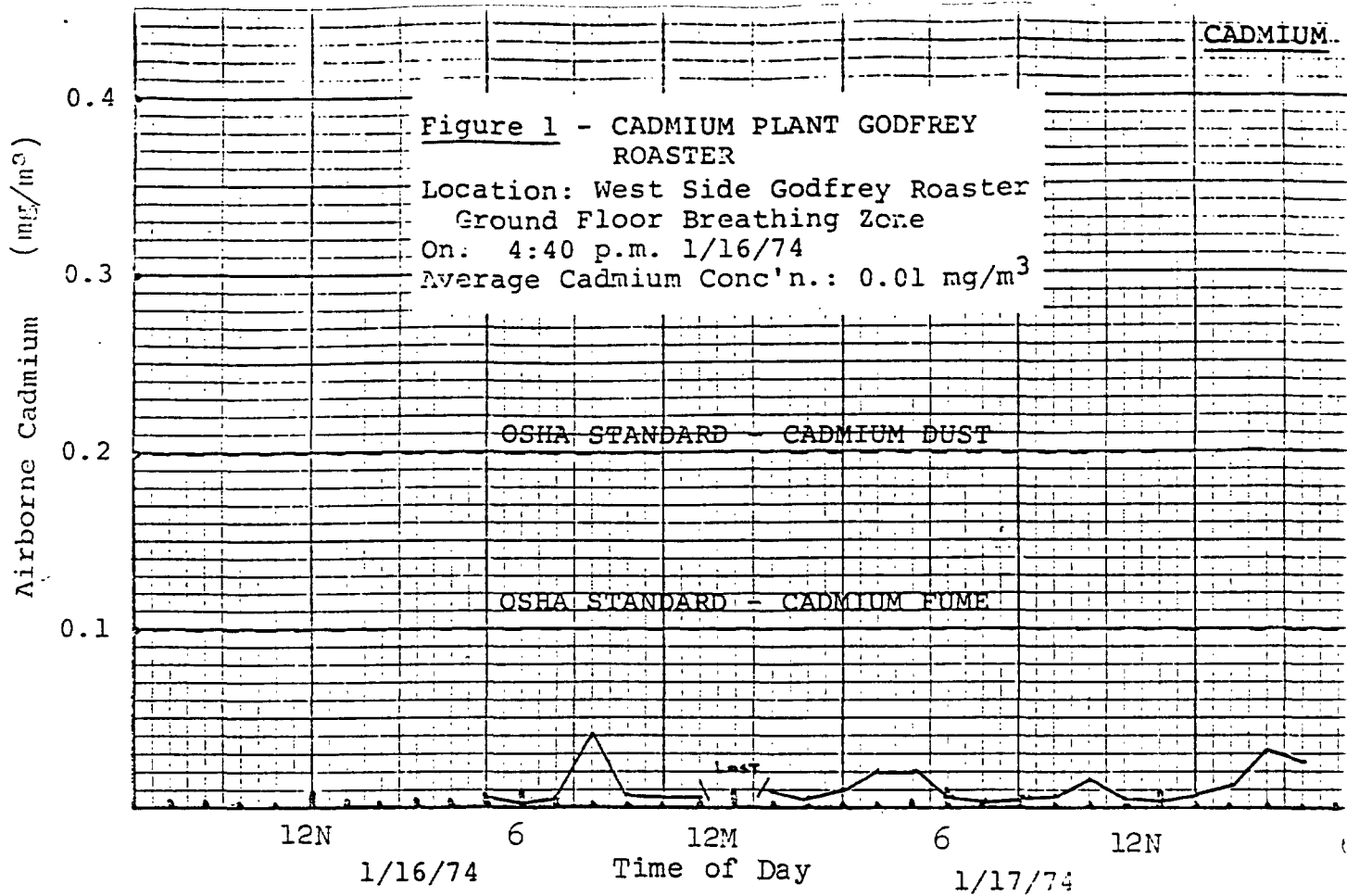
Posting of caution signs is mandatory whenever concentrations of asbestos fibers may exceed either the 8-hour time-weighted average or the ceiling concentration standard. In addition, caution labels should be attached to any asbestos product, waste, scrap or fixture except where asbestos fibers have been modified by a coating, binder or other agent, and the release of asbestos fibers in excess of the exposure limits is not foreseeable during handling or use.

John B. Richardson / mh
John B. Richardson
Environmental Specialist

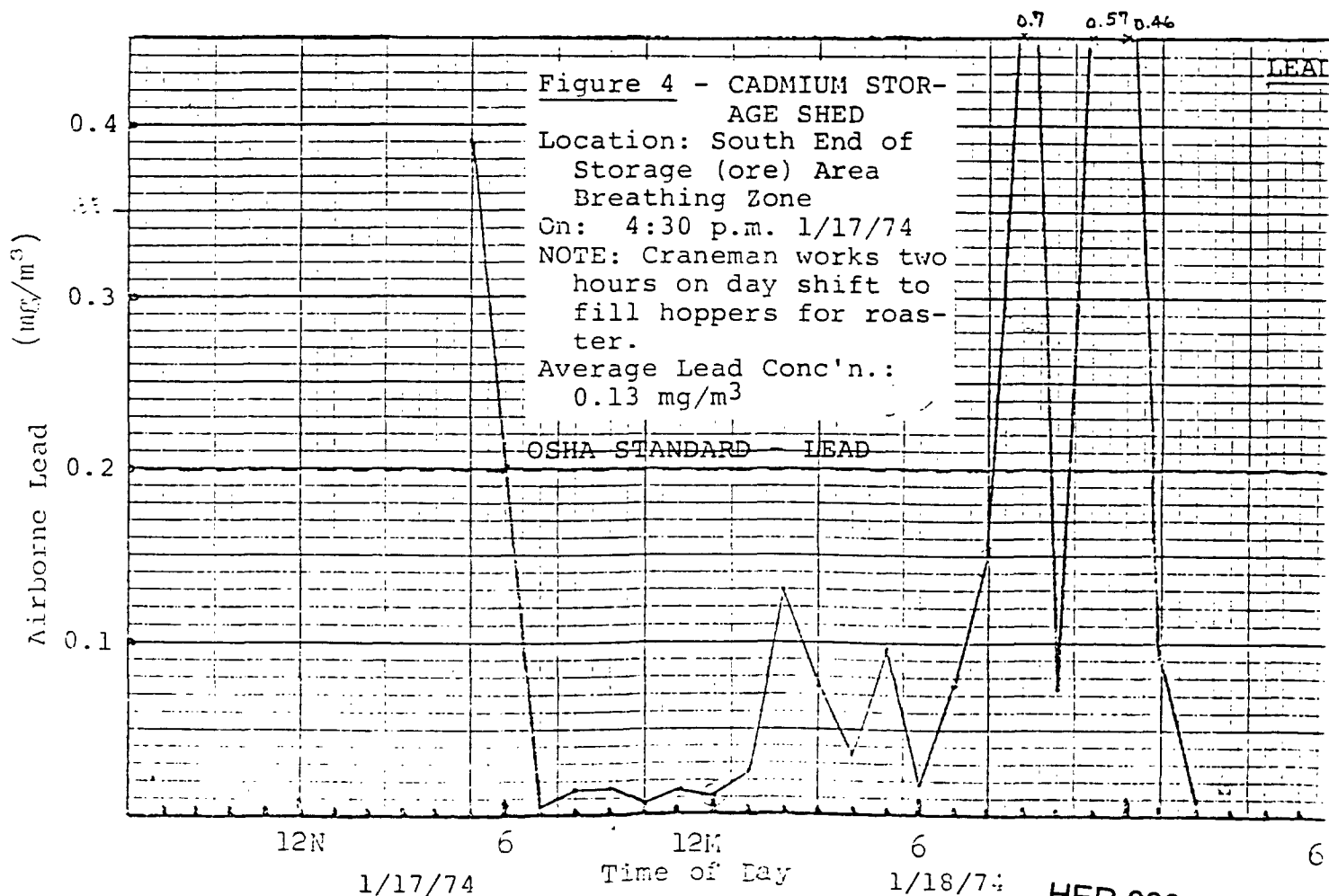
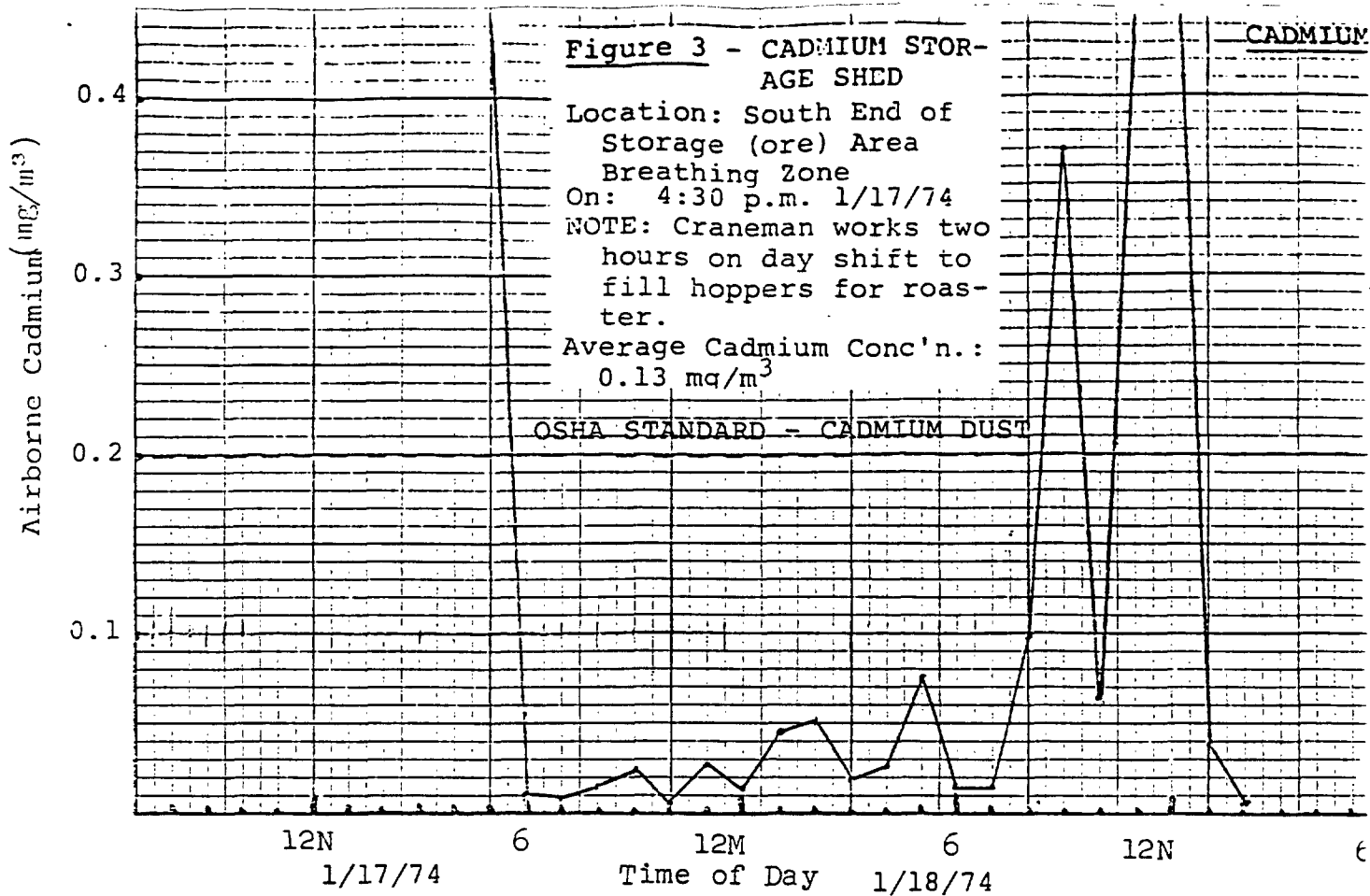
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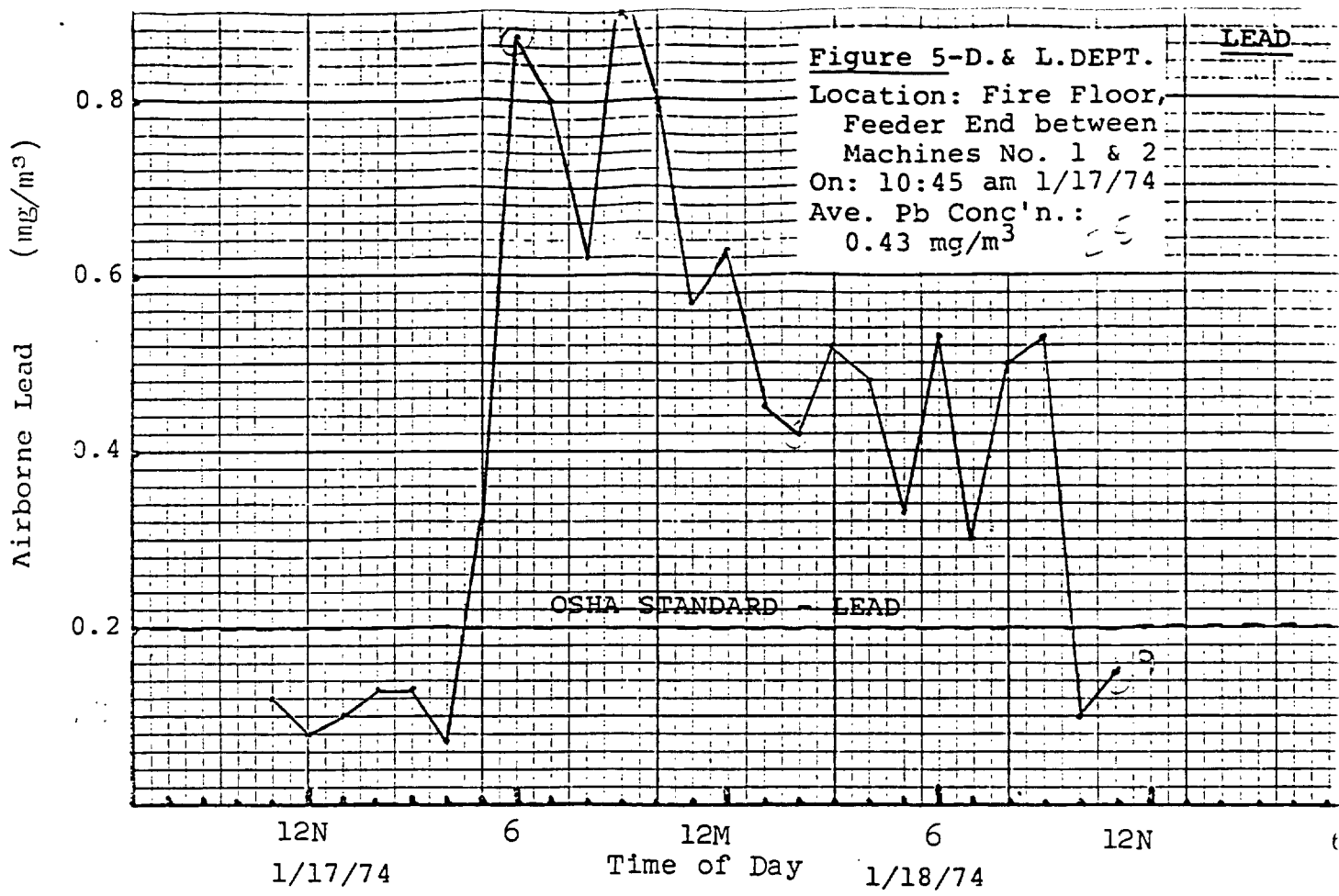


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LEAD

Figure 5-D. & L. DEPT.

Location: Fire Floor,
Feeder End between
Machines No. 1 & 2
On: 10:45 am 1/17/74
Ave. Pb Conc'n.:
0.43 mg/m³



LEAD

Figure 6 - BLAST FURNACE

Location: Located between No. 1
and No. 2 Blast Furnaces
On: 11:18 a.m. 1/18/74
Average Lead Con'n.: 0.14 mg/m³

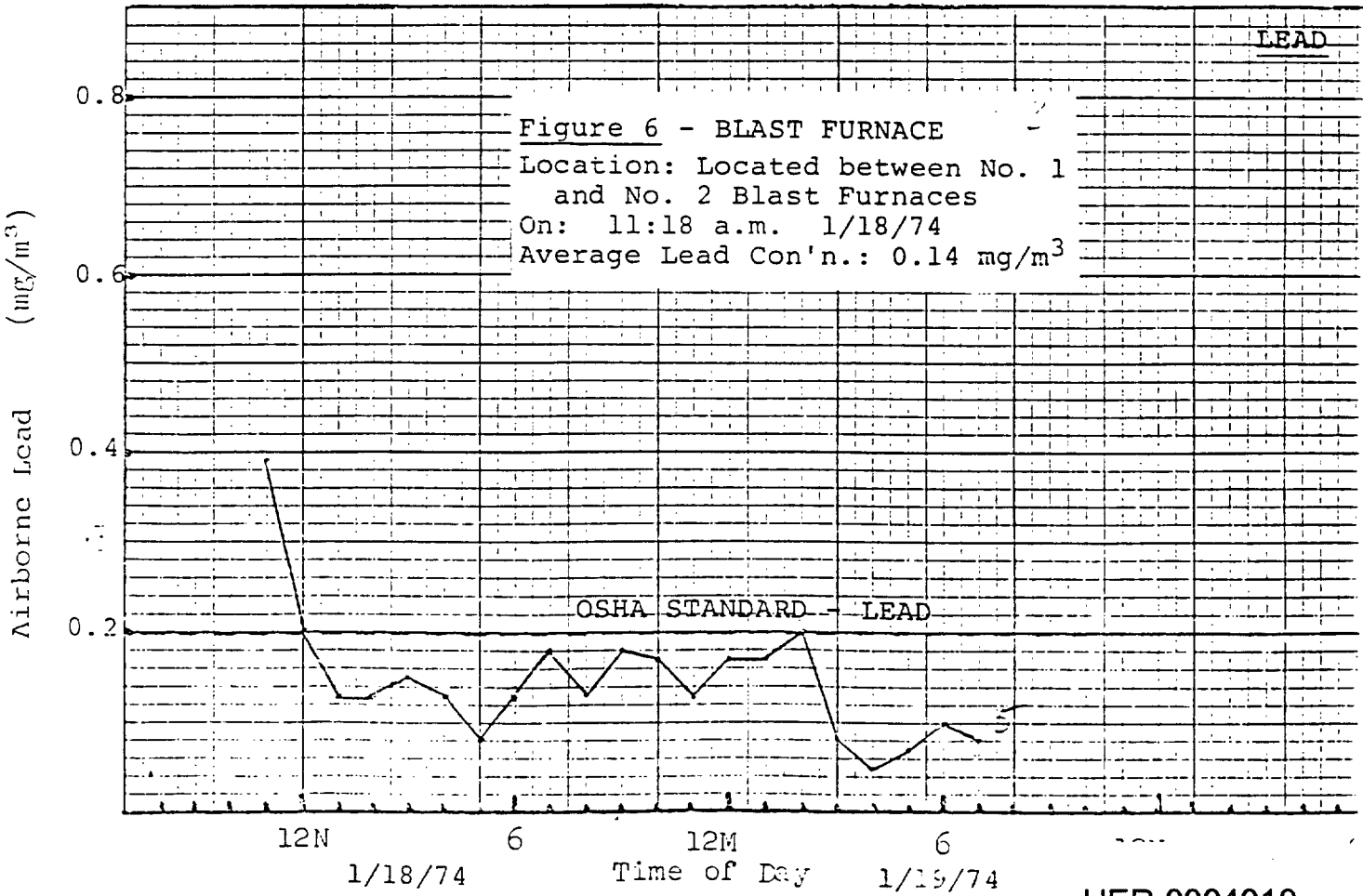


TABLE G-3

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift.	
			Concentration	Maximum duration
Benzene (Z37.1-1959)	10 p.p.m.	25 p.p.m.	50 p.p.m.	10 minutes
Beryllium and beryllium compounds (Z37.2-1970)	2 $\mu\text{g}/\text{M}^3$	6 $\mu\text{g}/\text{M}^3$	25 $\mu\text{g}/\text{M}^3$	30 minutes
Cadmium fume (Z37.5-1970)	0.1 mg./M ³	3 mg./M ³		
Cadmium dust (Z37.5-1970)	0.2 mg./M ³	0.6 mg./M ³		
Carbon disulfide (Z37.3-1955)	20 p.p.m.	30 p.p.m.	100 p.p.m.	Do.
Carbon tetrachloride (Z37.17-1957)	10 p.p.m.	25 p.p.m.	200 p.p.m.	5 minutes in any 4 hours
Dibenzene dichloride (Z37.31-1970)	20 p.p.m.	30 p.p.m.	60 p.p.m.	8 minutes
Dibenzene dichloride (Z37.31-1959)	30 p.p.m.	100 p.p.m.	200 p.p.m.	8 minutes in any 3 hours
Formaldehyde (Z37.14-1957)	3 p.p.m.	8 p.p.m.	10 p.p.m.	30 minutes
Hydrogen fluoride (Z37.25-1959)	do	do		
Hydrofluoric acid (Z37.25-1959)	2.5 mg./M ³			
Lead and its inorganic compounds (Z37.11-1959)	0.2 mg./M ³			
Methyl chloride (Z37.13-1959)	100 p.p.m.	200 p.p.m.	300 p.p.m.	5 minutes in any 3 hours
Methylene Chloride (Z37.3-1959)	500 p.p.m.	1,000 p.p.m.	2,000 p.p.m.	5 minutes in any 2 hours
Organic alkyl mercury (Z37.30-1959)	0.01 mg./M ³	0.04 mg./M ³		
Styrene (Z37.15-1959)	100 p.p.m.	200 p.p.m.	600 p.p.m.	5 minutes in any 3 hours
Trichloroethylene (Z37.19-1957)	do	do	300 p.p.m.	5 minutes in any 2 hours
Tetrachloroethylene (Z37.22-1957)	do	do	do	8 minutes in any 3 hours
Toluene (Z37.12-1957)	200 p.p.m.	300 p.p.m.	500 p.p.m.	10 minutes
Hydrogen sulfide (Z37.2-1955)		20 p.p.m.	60 p.p.m.	10 minutes once only if no other measurable exposure occurs
Mercury (Z37.3-1971)		1 mg./10M ³		
Chromic acid and chromates (Z37.7-1971)		do		

TABLE C-3-MINERAL DUSTS

Substance.....	Mppel •	mg/M ³
Silica:		
Crystalline:		
Quartz (respirable).....	250'	10mg/M ³ =
	%SiO ₂ +6	%SiO ₂ +2
Quartz (total dust).....		3mg/M ³
		%SiO ₂ +2
Amorphous: Use 1/6 the value calculated from the count or mass formulae for quartz.		
Tridymite: Use 1/6 the value calculated from the formulae for quartz.		
Amorphous, including natural carbonaceous earth.....	20	50mg/M ³
		%SiO ₂
Silicates less than 1% crystalline:		
Zeolite.....	20	
Pyrophyllite.....	20	
Lawsonite (staple-form).....	20 ³	
Talc (fibrous, Use asbestos formula).....		
Talc (non-fibrous) (see talc, fibrous).....		
Pyrophyllite.....	50	
Greenalite.....	15	
Calc. dust, respirable fraction less than 5% SiO ₂		2.4mg/M ³
		or
For more than 5% SiO ₂		10mg/M ³
		%SiO ₂ +2
Isotop. Nat. Fine Dust:		
Respirable fraction.....	15	5mg/M ³
Total dust.....	50	15mg/M ³

NOTE: Count-ratio factors—
 1. 100000 = 1000 particles per cubic meter
 2. 1000000 = 10000 particles per c.c.
 3. 10000000 = 100000 particles per cubic foot of air, based on
 10000000 particles counted by light-beam technique.
 4. The factor of 1000000 of crystalline silica in the formula
 is the amount determined from air-borne samples, ex-
 cept where indicated in which other methods have been
 applied to the sample.
 5. The amount of dust by the membrane filter method at
 10000000 is not indicated.
 6. The amount of free and percent quartz for the appli-
 cation of the formula to be determined from the fraction
 of quartz in the dust with the following characteristics:
 1. Crystalline < 10 quartz; > 10 quartz, less quartz
 dust.

Aerodynamic diameter (unit: density sphere)	Percent passing selector
2	99
2.5	73
3.5	50
5.0	22
10	0

The measurements under this note refer to the use of an AEC instrument. If the respirable fraction of coal dust is determined with a MRE the figure corresponding to that of 2.4 Mg/M^3 in the table for coal dust is 4.5 Mg/M^3 .

§ 1910.93a Asbestos.

(a) *Definitions.* For the purpose of this section, (1) "Asbestos" includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

(2) "Asbestos fibers" means asbestos fibers longer than 5 micrometers.

(b) *Permissible exposure to airborne concentrations of asbestos fibers*—(1) *Standard effective July 7, 1972.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(2) *Standard effective July 1, 1976.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(3) *Ceiling concentration.* No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(c) *Methods of compliance*—(1) *Engineering methods.* (i) *Engineering controls.* Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust collection, shall be used to meet the exposure limits prescribed in paragraph (b) of this section.

(ii) **Local exhaust ventilation.** (a) Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2-1971, which is incorporated by reference herein.

(b) See § 1910.6 concerning the availability of ANSI Z92-1971, and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(iii) *Particular tools.* All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems in accordance with subdivision (II) of this subparagraph.

(2) *Work practices*—(i) *Wet methods*. Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits prescribed in paragraph (b) of this section, unless the usefulness of the product would be diminished thereby.

(ii) *Particular products and operations.* No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne asbestos fibers in excess of the limits prescribed in paragraph (b) of this section.

(iii) *Spraying, demolition, or removal.* Employees engaged in the spraying of asbestos, the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment in accordance with paragraph (d) (2) (iii) of this section and with special clothing in accordance with paragraph (d) (3) of this section.

(d) *Personal protective equipment*—
(1) Compliance with the exposure limits prescribed by paragraph (b) of this section may not be achieved by the use of respirators or shift rotation of employees, except:

(i) During the time period necessary to install the engineering controls and to institute the work practices required by paragraph (c) of this section:

(ii) In work situations in which the methods prescribed in paragraph (c) of

this section are either technically not feasible or feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by paragraph (b) of this section; or

(iii) In emergencies.

(iv) Where both respirators and personnel rotation are allowed by subdivisions (i), (ii), or (iii) of this subparagraph, and both are practicable, personnel rotation shall be preferred and used.

(2) Where a respirator is permitted by subparagraph (1) of this paragraph, it shall be selected from among those approved by the Bureau of Mines, Department of the Interior, or the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, under the provisions of 30 CFR Part 11 (37 F.R. 6244, Mar. 25, 1972), and shall be used in accordance with subdivisions (i), (ii), (iii), and (iv) of this subparagraph.

(i) *Air purifying respirators.* A reusable or single use air purifying respirator, or a respirator described in subdivision (ii) or (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

(ii) *Powered air purifying respirators.* A full facepiece powered air purifying respirator, or a powered air purifying respirator, or a respirator described in subdivision (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average concentrations of asbestos fibers are reasonably expected to exceed 10 times, but not 100 times, those limits.

(iii) *Type "C" supplied-air respirators, continuous flow or pressure-demand class.* A type "C" continuous flow or pressure-demand, supplied-air respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed 100 times those limits.

(iv) *Establishment of a respirator program.* (a) The employer shall establish a respirator program in accordance with the requirements of the American National Standards Practices for Respiratory Protection, ANSI Z88.2-1969, which is incorporated by reference herein.

b. See § 1910.6 concerning the availability of ANSI Z88.2-1969 and the maintenance of an historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.103.

(c) No employee shall be assigned to tasks requiring the use of respirators if,

based upon his most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay he had just prior to such transfer, if such a different position is available.

(3) *Special clothing:* The employer shall provide, and require the use of, special clothing, such as coveralls or similar whole body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos fibers, which exceed the ceiling level prescribed in paragraph (b) of this section.

(4) *Change rooms:* (i) At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, the employer shall provide change rooms for employees working regularly at the place.

(ii) *Clothes lockers:* The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

(iii) *Laundrying:* (a) Laundrying of asbestos contaminated clothing shall be done so as to prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(b) Any employer who gives asbestos-contaminated clothing to another person for laundrying shall inform such person of the requirement in (a) of this subdivision to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(c) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (g) of this section.

(e) *Method of measurement.* All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400-450 X (magnification) (4 millimeter objective) with phase contrast illumination.

(f) *Monitoring—(1) Initial determinations.* Within 6 months of the publication of this section, every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits prescribed in paragraph (b) of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program in accordance with paragraph (c) of this section.

(2) *Personal monitoring—(i) Sam-* ples shall be collected from within the

breathing zone of the employees, on membrane filters of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) *Sampling frequency and patterns.* After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section.

(3) *Environmental monitoring—(i)* samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees. Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) *Sampling frequency and patterns.* After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph (b) of this section.

(4) *Employee observation of monitoring.* Affected employees, or their representatives, shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

(g) *Caution signs and labels.* (1) *Caution signs.* (i) *Posting.* Caution signs shall be provided and displayed at each location where airborne concentrations of asbestos fibers may be in excess of the exposure limits prescribed in paragraph (b) of this section. Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

(ii) *Sign specifications.* The warning signs required by subdivision (i) of this subparagraph shall conform to the requirements of 20" x 14" vertical format signs specified in § 1910.145(d)(4), and to this subdivision. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

HER 0004012

Legend	Notation
Asbestos-----	1" Sans Serif, Gothic or Block.
Dust Hazard-----	¾" Sans Serif, Gothic or Block.
1 Breathing Dust----	¾" Gothic.
Wear Assigned Protective Equipment.	¾" Gothic.
Do Not Remain In Area Unless Your Work Requires It.	¾" Gothic.
Breathing Asbestos Dust May Be Hazardous To Your Health.	1½ point Gothic.

Spacing between lines shall be at least equal to the height of the upper of any two lines.

(2) **Caution labels**—(i) **Labeling.** Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section will be released.

(ii) **Label specifications.** The caution labels required by subdivision (i) of this subparagraph shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

Contains Asbestos Fibers

Avoid Creating Dust

Breathing Asbestos Dust May Cause Serious Bodily Harm

(h) **Housekeeping**—(1) **Cleaning.** All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers if, with their dispersion, there would be an excessive concentration.

(2) **Waste disposal.** Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

(i) **Recordkeeping**—(1) **Exposure records.** Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 2 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health, and to authorized representatives of either:

(2) **Employee access.** Every employee and former employee shall have reasonable access to any record required to be maintained by subparagraph (1) of this

paragraph, which indicates the employee's own exposure to asbestos fibers.

(3) **Employee notification.** Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph (b) of this section shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.

(j) **Medical examinations**—(1) **General.** The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

(2) **Preplacement.** The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_{1.0}).

(3) **Annual examinations.** On or before January 31, 1973, and at least annually thereafter, every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged in occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_{1.0}).

(4) **Termination of employment.** The employer shall provide, or make available, within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_{1.0}).

(5) **Recent examinations.** No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

(6) **Medical records**—(i) **Maintenance.** Employers of employees examined pursuant to this paragraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

(ii) **Access.** The contents of the records of the medical examinations required by this paragraph shall be made available, for inspection and copying,

to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of NIOSH, to authorized physicians and medical consultants of either of them, and, upon the request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.

§ 1910.94 Ventilation.

(a) **Abrasive blasting**—(1) **Definitions applicable to this paragraph**—(i) **Abrasive.** A solid substance used in an abrasive blasting operation.

(ii) **Abrasive-blasting respirator.** A continuous flow air-line respirator constructed so that it will cover the wearer's head, neck, and shoulders to protect him from rebounding abrasive.

(iii) **Blast cleaning barrel.** A complete enclosure which rotates on an axis, or which has an internal moving tread to tumble the parts, in order to expose various surfaces of the parts to the action of an automatic blast spray.

(iv) **Blast cleaning room.** A complete enclosure in which blasting operations are performed and where the operator works inside of the room to operate the blasting nozzle and direct the flow of the abrasive material.

(v) **Blasting cabinet.** An enclosure where the operator stands outside and operates the blasting nozzle through an opening or openings in the enclosure.

(vi) **Clean air.** Air of such purity that it will not cause harm or discomfort to an individual if it is inhaled for extended periods of time.

(vii) **Dust collector.** A device or combination of devices for separating dust from the air handled by an exhaust ventilation system.

(viii) **Exhaust ventilation system.** A system for removing contaminated air from a space, comprising two or more of the following elements: (a) enclosure or hood, (b) duct work, (c) dust collecting equipment, (d) exhauster, and (e) discharge stack.

(ix) **Particulate-filter respirator.** An air purifying respirator, commonly referred to as a dust or a fume respirator, which removes most of the dust or fume from the air passing through the device.

(x) **Respirable dust.** Airborne dust in sizes capable of passing through the upper respiratory system to reach the lower lung passages.

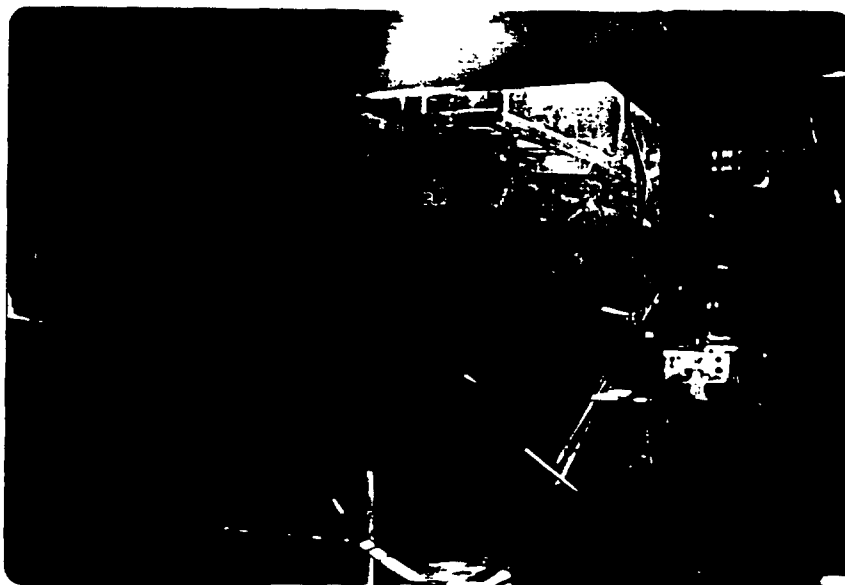
(xi) **Rotary blast cleaning table.** An enclosure where the pieces to be cleaned are positioned on a rotating table and are passed automatically through a series of blast sprays.

(xii) **Abrasive blasting.** The forcible application of an abrasive to a surface by pneumatic pressure, hydraulic pressure, or centrifugal force.

(2) **Dust hazards from abrasive blasting.** (i) **Abrasives** and the surface coatings on the materials blasted are shattered and pulverized during blasting

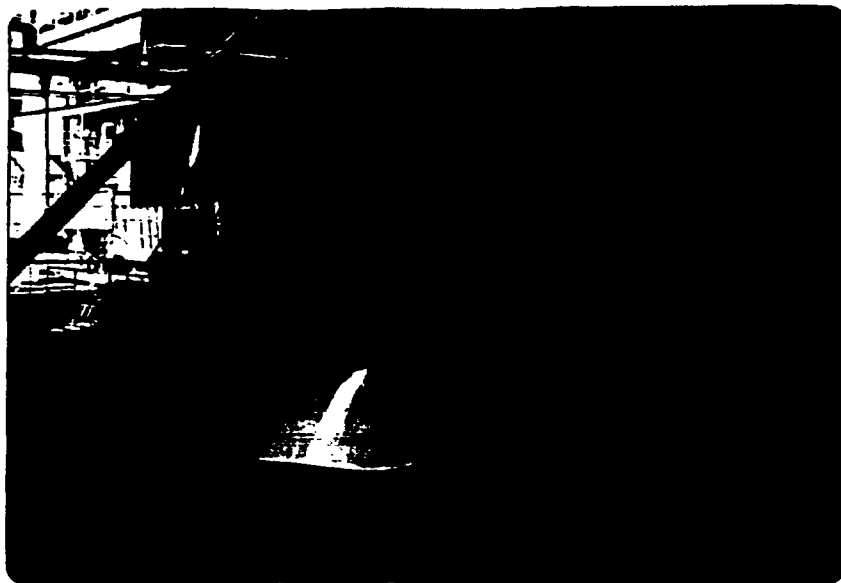


A.I.S.I. Tape sampler monitoring airborne
lead near Blast Furnace No. 1.



Fugitive emissions in the
area of Blast Furnace No.1.

HER 0004014



Uncontrolled emissions from slag tapping
the zinc fuming furnace (picture reversed)



Opening plugged tuyeres on
Blast Furnace No. 1.

HER 0004015



Hooding for No. 3 Blast Furnace (foreground)
controls metal fumes from slag and lead kettle.



Movable hood controls fumes during
matte tapping from copper reverb.