PLAINTIFF'S EXHIBIT
DOW-996

DOW CHEMICAL U.S.A.
50983

TEXAS DIVISION
FREEPORT, TEXAS 77541

ENVIRONMENTAL HEALTH REPORT

ASBESTOS SURVEY CELL MANUFACTURING PLANT, RUSSELLVILLE, ARKANSAS

FILE NO. M-213
DATE July 19, 1973
AUTHOR B. S. Horvath
checked by R. T. Silverthorne Jr.
CHECKED R. T. S.
DATE

Summary

Four different operations, involving the mixing of blue asbestos and Derakane and the subsequent grinding of the cured product were surveyed, with atmospheric concentrations found to be below Federal Limits. Time weighted averages were not calculated because work is performed on loose and variable schedule.

ST0683082

Distribution

Gordon Miller- Russellville, Arkansas

[redacted]

PROBLEM

Industrial Hygiene was asked to evaluate the asbestos exposure to Dow personnel by the supervision of the Russellville, Arkansas.

CONCLUSIONS

1. None of the operations and areas surveyed had atmospheric concentrations in excess of the Federal* limit of 5 fibers per cc (fibers greather than 5 microns in length). The operations surveyed are:

   a. Mixing blue asbestos and "Derakane" resin inside of Cel' Finishing Building for cell borders.

   b. Mixing blue asbestos and "Derakane" resin outside of Cell Finishing Building for cell cover patching.

   c. Grinding cell borders

   d. Grinding cell covers

2. The breathing zone concentrations, while not in excess of the Federal limits are sufficiently high to warrant implementations of abatement measures as there is strong evidence that the inhalation of asbestos fibers can be a health hazard at concentrations below the established limits. At present, a safe level of exposure below which adverse effects will not be observed, has not been established.

*As specified in the Occupational Safety and Health Act of 1970.

ST0683083

CONCLUSIONS (continued)

3. Employees were observed using proper respirators the majority of the time, however, there were a few instances where such protective devices were not being used by employees within a few feet of the mixing or grinding operations.

RECOMMENDATIONS

1. An education program* should be given all who are exposed to asbestos in the work atmosphere. Workers should not be allowed to work in areas where there are concentrations of asbestos in the air unless they are properly instructed in the hazards accompanying such work, and the precautions necessary to protect them.

2. Work clothes should be issued to all who either grind on or mix asbestos containing material (borders and cell covers) and should be changed daily.

3. Those who have jobs which require the work clothing mentioned in item 2 should be required to shower daily, with emphasis placed upon washing of the hair.

* Note: It is my understanding that Dr. D. J. Ducommun of Midland Medical Dept. (Bldg. 607) has put together an excellent slide and tape program on the hazards and safe handling of asbestos.

ST0683084

RECOMMENDATIONS (continued)

4. The exposure to those workers who mix asbestos and "Derakane" should be reduced. The following may be utilized to that end:

a. Asbestos and Derakane mixing should be done in one area only. (Presently there are two such areas).

b. The mixing area should be provided with a ventilation and dust collection system.

c. The mix area should be cleaned regularly with a vacuum cleaner to prevent the accumulation of loose asbestos.

5. The exposure to those who grind asbestos containing materials should be reduced. The following may be used to do so:

a. A dust collection system for the portable grinders should be installed.

b. The area should be cleaned regularly with a vacuum cleaner.

DISCUSSION

"African blue" asbestos is received in burlap bags and stored in the Cell Finishing Building. Bags are taken one by one to the mix areas (one inside and one outside of the building) as needed. "Derakane" resin, asbestos fibers mix is made up in five gallon cans. Asbestos is added from time to time by hand until a mix of the correct consistancy is reached. Mixing is done by the use of a power driven hand mixer. Some visable asbestos dust was observed during the mixing operation.

ST0683085

DISCUSSION (continued)

The areas in which the asbestos and resin are mixed were messy at the time of the survey. The people who were observed doing the mixing were wearing a proper dust respirator, however, others were observed in the same area, just a few feet away without a dust respirator.

After the resin asbestos mix has been applied to either the cell or cell cover, and left to set up, the rough spots are then ground off using an air operated hand grinder. The operation is very dusty.

Time weighted average exposures were not calculated for the workers because no real work schedule exists. The amounts of time spent mixing and grinding each day vary greatly. The concentration of asbestos fibers in the air during the time the mixing or grinding tasks were being performed are significant. The numbers obtained are below both the eight hour time weighted average allowable concentration and below the allowable peak concentration. So,we are beneath current federal limits. However, there are many who feel that the published limits are too high for the purpose of preventing asbestos related cancers. The published limits are supposedly based upon the prevention of asbestos disease (also called asbestosis). Therefore, we should aim at reducing the exposure to workers to a level as low as is practical with engineering controls. These controls usually

ST0683086

DISCUSSION (continued)

consists of ventilation - dust collection, segregation, and improved housekeeping. This is in addition to providing personal protective devices such as respirators.

SAMPLE ANALYSIS

Breathing zone samples were collected on a 47 mm diameter (0.8 micron pore size) membrane filter at a rate of about 2 liters per minute, during the period of the task under investigation. Area samples were collected using the same equipment and techniques. The time of sampling was generally 30 minutes or more, when practical.

The fiber classifications and counts were made by Microscopy Group of Central Lab using a phase contrast technique at a 450 magnification.

FEDERAL REGULATIONS (EXPOSURE LIMITS)

Current federal regulations call for a five fiber per cc greater than 5 microns 8 hour time weighted average. Peak exposures are not to exceed 10 fibers per cc at anytime.

A copy of the federal regulations is being included as an appendix.

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ST0683088

SUMMARY OF ALL SAMPLES TAKEN AT THE RUSSELLVILLE CELL MANUFACTURING PLANT

	OPERATION	TIME (MIN.)	CONCENTRATION (f /cc >5μ)
1.	Man mixing asbestos and Derakane inside of building. Area was messy with loose asbestos on floor, but no visable asbestos material in the air (breathing zone sample). Man wore respirator)	4 min.	.471
2.	Same as Sample #1	3 1/2	1.26
3.	Man grinding on chlorine cell border, which contains Derakane - asbestos resin. Majority of grinding was on the non-Derakane-Asbestos section (breathing zone sample). Respirator worn.	18	0.073
4.	Man mixing asbestos with Derakane resin outside of building on west side for patching cell covers. Dust noticeable (breathing zone sample). Respirator worn.	4	3.29
5.	Man grinding on cell covers outside of Cell Finishing Building. (Breathing zone sample). Respirator worn.	5	1.47
6.	Grinding cell covers outside of west side of building (breathing zone sample). Much dust visable. Man wearing respirator.	22	1.38
7.	Man grinding on chlorine cell border. Other man also cutting out drain pipe at same time with abrasive wheel (breathing zone sample). Both men wearing respirators.	23	0.546

404096

SUMMARY OF ALL SAMPLES TAKEN AT THE RUSSELLVILLE CELL MANUFACTURING PLANT

	OPERATION	TIME (MIN.)	CONCENTRATION (f /cc >5μ)
8.	Area sample, 24 ft. south of operation described in sample no. 7.	23	0.266
9.	Man mixing asbestos and Derakane on west side of building 3. Same sample as #4 (breathing zone) using air powered mixer	3	3.35
0.	Area sample while man mixing resin and asbestos in sample #9, 15 ft. west of mixing site.	2	0.230
11.	Area sample of long duration inside of Cell Finishing Building. Periods of grinding and periods of rest were included, but not monitored. Sample may not be representative.	50	1.59
12.	Area sample outside of Cell Finishing Building. No work going on in Cell Cover Area.	46	0.003

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SUMMARY OF BREATHING ZONE SAMPLES WHILE PERFORMING VARIOUS OPERATIONS WHERE ASBESTOS WAS BEING USED.

	OPERATION	CONCENTRATIONS (f/cc 75)
1.	Man mixing asbestos inside of Cell Finishing Building for cell borders. (Breathing zone samples)	.471 1.26
2.	Man mixing asbestos outside of Cell Finishing Building for patching cell covers. (Breathing zone samples)	3.29 3.35
3.	Man grinding on cell borders containing asbestos binder. (Breathing zone samples)	.546 .073
4.	Man grinding on cell covers outside of Cell Finishing Building (Breathing zone sample).	1.38 1.47

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APPENDIX No.1

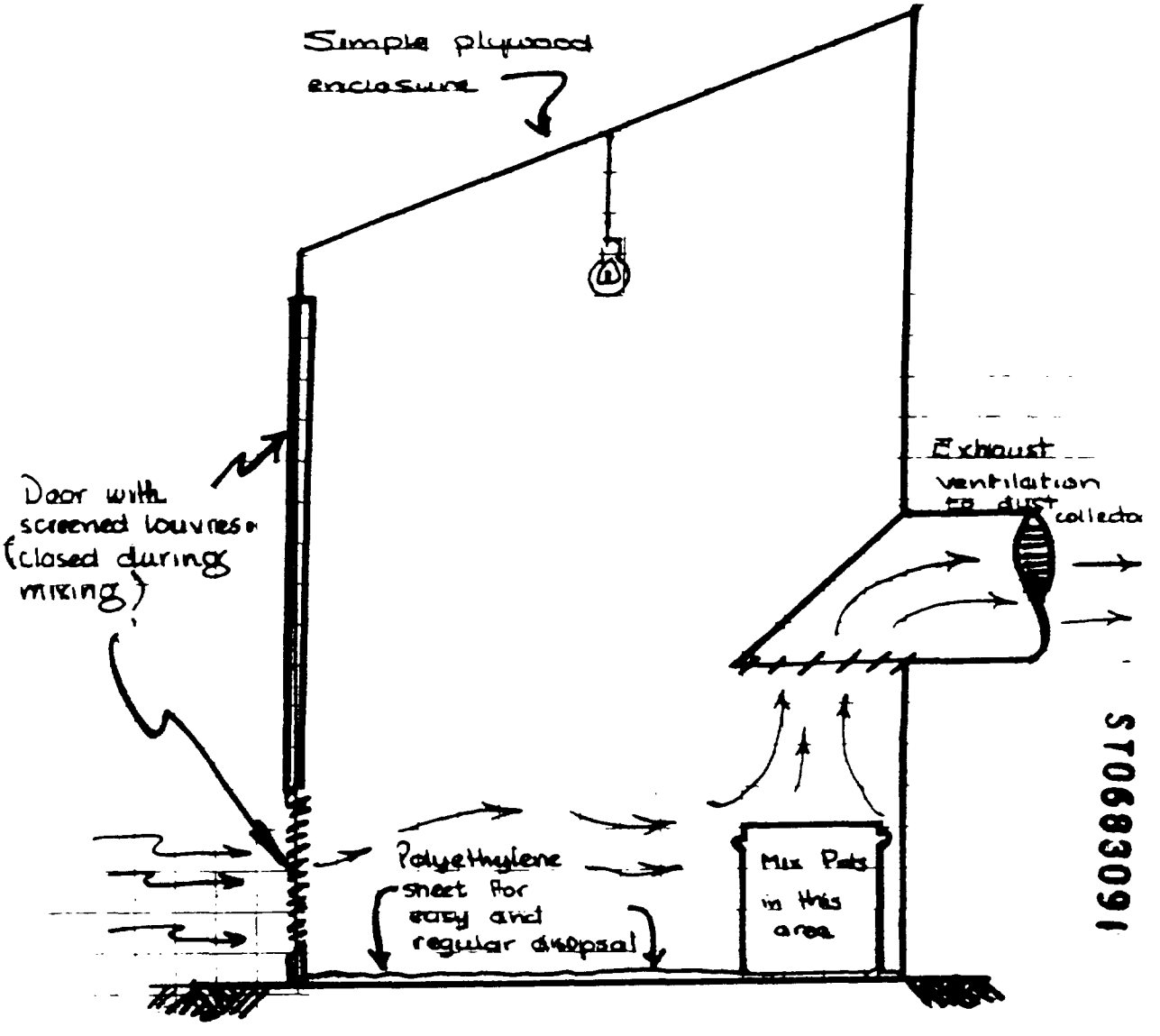
JOB NO. _____ AUTH. NO. _____

CHARGE NO _____ FILE NO. _____

SUBJECT ISOLATED ASBESTOS MIX AREA BY B S Horvath

DATE 7-17-73

SHEET ____ OF ____ CHECKED BY _____



ST0683091

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ST0683092

TABLE G-2

Material	8-hour time weighted average	Acceptable ceiling concentration		
		Concentration	Maximum duration
Benzene (Z37.4-1969)	10 p.p.m	25 p.p.m	50 p.p.m	10 minutes.
Beryllium and beryllium compounds (Z37.29-1970).	2 μg./M³	5 μg./M³	25 μg./M³	30 minutes.
Cadmium fume (Z37.5-1970)	0.1 mg./M³	3 mg./M³		
Cadmium oxide (Z37.5-1970)	0.2 mg./M³	0.6 mg./M³		
Carbon disulfide (Z37.3-1968)	20 p.p.m	30 p.p.m	100 p.p.m	Do.
Carbon tetrachloride (Z37.17-1967)	10 p.p.m	25 p.p.m	200 p.p.m	5 minutes in any 4 hours.
Ethylene dibromide (Z37.31-1970)	20 p.p.m	30 p.p.m	50 p.p.m	5 minutes.
Ethylene dichloride (Z37.21-1969)	50 p.p.m	100 p.p.m	200 p.p.m	5 minutes in any 3 hours.
Formaldehyde (Z37.16-1969)	3 p.p.m	5 p.p.m	10 p.p.m	30 minutes.
Hydrogen fluoride (Z37.28-1969)	do			
Fluorides as dust (Z37.28-1969)	2.5 mg./M³			
Lead and its inorganic compounds (Z37.11-1969).	0.2 mg./M³			
Methyl chloride (Z37.18-1969)	100 p.p.m	200 p.p.m	300 p.p.m	5 minutes in any 3 hours.
Methylene Chloride (Z37.3-1969)	500 p.p.m	1,000 p.p.m	2,000 p.p.m	5 minutes in any 2 hours.
Organo (alkyl) mercury (Z37.30-1969)	0.01 mg./M³	0.04 mg./M³		
Styrene (Z37.15-1969)	100 p.p.m	200 p.p.m	600 p.p.m	5 minutes in any 3 hours.
Trichloroethylene (Z37.19-1967)	do	do	300 p.p.m	5 minutes in any 2 hours.
Tetrachloroethylene (Z37.22-1967)	do	do	do	5 minutes in any 3 hours.
Toluene (Z37.12-1967)	200 p.p.m	300 p.p.m	500 p.p.m	10 minutes.
Hydrogen sulfide (Z37.2-1966)		20 p.p.m	50 p.p.m	10 minutes once only if no other measurable exposure occurs.
Mercury (Z37.8-1971)		1 mg./10M³		
Chromic acid and chromates (Z37.7-1971)		do[3]		

TABLE G-3—MINERAL DUSTS

Substance	Mppcf[4]	Mg/M³
Silica:		
Crystalline:		
Quartz (respirable)	250[5]	10mg/M³ = %SiO₂+2
Quartz (total dust)	%SiO₂+5	%SiO₂+2 30mg/M³
Cristobalite: Use ½ the value calculated from the count or mass formulae for quartz.		%SiO₂+2
Tridymite: Use ½ the value calculated from the formulae for quartz.		
Amorphous, including natural diatomaceous earth	20	80mg/M³ %SiO₂
Silicates (less than 1% crystalline silica):		
Mica	20	
Soapstone	20	
Talc (non-asbestos-form)	20[6]	
Talc (fibrous). Use asbestos limit		
Tremolite (see talc, fibrous)		
Portland cement	50	
Graphite (natural)	15	
Coal dust (respirable fraction less than 5% SiO_2)		2.4mg/M³ or
For more than 5% SiO_2		10mg/M³ %SiO₂+2
Inert or Nuisance Dust:		
Respirable fraction	15	5mg/M³
Total dust	50	15mg/M³

NOTE: Conversion factors—
mppcf×35.3=million particles per cubic meter
=particles per c.c.

[4] Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.

[5] The percentage of crystalline silica in the formula is the amount determined from air-borne samples, except in those instances in which other methods have been shown to be applicable.

[6] As determined by the membrane filter method at 430× phase contrast magnification.

[7] Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:

Aerodynamic diameter (unit density sphere)	Percent passing selector
2	90
2.5	75
3.5	50
5.0	25
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/M³ in the table for coal dust is 4.5 Mg/M³.

[8] Containing < 1% quartz; if > 1% quartz, use quartz limit.

§ 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, which include, 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 Z9.2–1971, 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

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ST0683093

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 § 1919.6 concerning the availability of ANSI Z88.2-1969 and the maintenance of an historic file in connection herewith. The address of the American National Standards Institute is given in 1910.19(b).

(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 which 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) Laundering: (a) Laundering 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 laundering 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 × (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) Samples 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 [illegible]. The [illegible] shall display the [illegible] in the lower panel with letter sizes and style of a visibility at least equal to that specified in this subdivision.

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Legend	Location
Asbestos	1" Sans Serif, Gothic or [illegible]
[illegible]	[illegible]
Avoid Breathing Dust	¼" Gothic.
Wear Assigned Protective Equipment.	¼" Gothic.
Do Not Remain In Area Unless Your Work Requires It.	¼" Gothic.
Breathing Asbestos Dust May Be Hazardous To Your Health.	14 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 3 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 [illegible] 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 [illegible] upon the request of the 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

404102

DOW CHEMICAL U.S.A.

RUSSELLVILLE CELL MANUFACTURING
May 24, 1973

RECEIVED
1982
O.C.D. MEDICAL BLDG.

L. E. Wretlind

cc: C. J. Barras
O. L. Glaesmann

PERSONNEL EXPOSURE TO TOXIC AND CARCINOGENIC COMPOUNDS AT RUSSELLVILLE CELL MANUFACTURING PLANT.

None of the 14 selected compounds noted as carcinogens by the Occupational Safety and Health Administration, and listed in the May 9 issue of Chemical Week, are used, handled, or contained at this plant.

Two of the compounds listed would be of concern if we handled HCl. The chloromethyl ethers form spontaneously in the atmosphere when formaldehyde and hydrogen chloride mix. Not only is there no HCl here but, since the phenol-formaldehyde impregnator is vented through a flare stack; very little, if any, formaldehyde escapes to the atmosphere.

Other materials not listed to which our personnel may be exposed, and therefore of great concern to us include: Sulfur dioxide, sulfur trioxide, hydrogen sulfide, carbon monoxide, coar tar pitch volatiles, styrene, phenol, asbestos fibers, and dusts. There are also small exposures to Derakane catalyst and epoxy catalyst.

The attached letter by O. L. Glaesmann gives the stack gas analysis for the graphitizers which is the only major source of carbon monoxide, hydrogen sulfide, sulfur dioxide, and sulfur trioxide. As you will note, these materials are well within acceptable levels.

R. G. Melcher's letter of Oct. 16, 1972, shows the styrene levels in Unit 5 are acceptable.

The entire plant was surveyed by R. E. Onan, of the Midland Safety Department, and his report of October 9, 1972, is attached.

At the present time, our three most serious exposure problems and the planned actions are:

1. Coal tar pitch volatiles and dust contain carcinogenic materials. The benzpyrenes in CTP are the same carcinogenic materials found in cigarette smoke. This CTP is transferred in a closed system, and exhaust venting of open conveyers of the green mix is complete. An intensive personnel air sampling is underway. A variety of people will be

cc: CCA 6-5-73

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ST0683095

wearing the continuous gas samplers for the next several months to assure the limit of 0.2 mg/m^3 of benzene solubles is not being exceeded.

2. Asbestos fibers are carcinogenic. Asbestos is being used to make a thixotropic mixture of derakane for sealing cells. A separate, vented room, is being built to contain all mixing equipment. A research program is being carried out by Chlor-Alkali Research to replace asbestos. Personnel air sampling will be conducted to assure the limit of 5 fibers, longer than 5 micrometers, per cubic centimeter of air is not exceeded.

3. Dust is a problem in several parts of the plant. Two large dust collectors have greatly alleviated the problems in the sagger loading and unloading area, and the graphite sawing area. Personnel breathing samples will be taken to define the extent of the problem. Until dust problems are shown to have been eliminated, personnel should continue to wear dust respirators if there is any question on dust levels.

Lee, the testing program effort to cover these three problem areas has been intensified and will be completed within the next three months. Periodic sampling then will be conducted at least every six months.

Gordon R. Miller

lrh

Attachments

ST0683096

OW CHEMICAL U.S.A.

RUSSELLVILLE CELL MANUFACTURING
May 24, 1973

Lee Wretlind

cc: Clarence Barras
Gordon Miller
A. D. Standlee

GRAPHITIZER STACK GAS ANALYSIS - 5-23-73

Furnaces in operation were F302, F304, and F305 producing a total of 3550 pounds of graphite per hour.

The stack was analyzed for carbon monoxide, hydrogen sulfide, sulfur dioxide and sulfur trioxide as sulfuric acid. Carbon monoxide and hydrogen sulfide were determined using Drager Mult-Gas Detectors. The SO_2/SO_3 was determined using a modification of Method 8 (Federal Register 36 24893-24895). The analysis procedure was the same as that used by V. B. Kurfman of Electrochem - Met Lab, Midland Division on July 20, 1972 with one exception. (See remarks.) The sulfur trioxide was calculated as sulfuric acid.

The stack gas velocity was 3700 feet per minute which is equivalant to 26,154 cubic feet per minute. The stack gas temperature was 41.8°C. The indoor temperature was 30.2°C. (West end of graphitizing furnaces)

The results were as follows:

	PPM	lbs/hr
CO	20	2.3
H_2S	20	2.8
SO_2	535	58.7
SO_3/H_2SO_4	46	5.05

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For comparison with the legal allowable concentration, SO_2 and SO_3 data must go through a dispersion equation. The following results were obtained:

	Calculated	Allowable
SO_2	0.07 ppm	0.2 ppm
SO_3/H_2SO_4	16.50 $\mu gm/m^3$	30.0 $\mu gm/m^3$

Remarks:

The procedure used for determining SO_3/H_2SO_4 differed from Kurfman's in the following way. An aliquot from a known volume was evaporated to dryness to remove hydrogen sulfide. The residue was redissolved and titrated. It is believed that hydrogen sulfide was the cause for a poorly defined endpoint as was witnessed also by Kurfman. Kurfman indicated that his result may have been too high for SO_3 due to the endpoint difficulty. The SO_3/H_2SO_4 was found to be about 50 percent as high as in an unevaporated sample.

O. L. Glaesmann

O. L. Glaesmann
Cell Mfg. Plant

sha

ST0683098

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN 48640

July 25, 1972

Clarence Barras
Jack Capps
Russellville Division

cc: Paul Banner, Russellville
Dave Wilson, 628 Bldg.

SO_2/SO_3 IN RUSSELLVILLE GRAPHITIZER STACK

On request from Russellville, a visit was made to the plant to analyze the stack gas for SO_2, SO_3 and/or sulfuric acid mist. The method used was a modification of Method 8 (Federal Register 36 24893-24895 attached). The results measured 7-20-72 were:

SO_2 stack gas analysis = 167 ppm

$SO_3+H_2SO_4$ stack gas analysis = 24.4 ppm calculated as H_2SO_4

stack velocity = 2902 fpm → 20,500 cfm

These results must go through a dispersion equation calculation (Appendix) to give a comparison with legal allowables. The comparison is:

	Calculated	Allowable
SO_2	0.022 ppm	0.2 ppm
SO_3	11.7 μ gm/m³	30.0 μ gm/m³

These results show that the plant with two furnaces operating (one at 964#/hr., the other at 502#/hr.) is within the allowable range, having a safety factor near 10 on SO_2 and near 3 on SO_3.

The safety margin on SO_3 emission may be small at high production rates and this could be improved if catalysis of the conversion can be controlled. The SO_3 level should be checked further to locate where the conversion of S values to SO_3 is occurring, variation in conversion with production activity, and the conditions which catalyze the conversion.

V. B. Kurfman
Electrochem-Met Lab
1703 Building
Phone: (517) 636-2951

ih

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APPENDIX

First reports of SO_3 levels as high as 65 μ gm/m³ (over twice the allowable) raised questions as to possible process variables and as to possible analytical variables, especially conversion of SO_2 to SO_3 after the analytical samples were taken (samples were exposed to uninhibited moisture for some time). Dave Wilson of Midland Division Waste Control was very helpful in discussion of the problem. He also provided a copy of Method 8 and the sampling equipment used. This method absorbs the SO_3 in 80% isopropyl alcohol, which inhibits further transformation of SO_2. The alcohol saturated SO_2 is then absorbed in 3% hydrogen peroxide which converts it to H_2SO_4. The resulting solutions are titrated with $Ba(ClO_4)_2$ solution to a pink Thorin endpoint.

Experimental details - see method 8

2.1.2 omitted heating

2.1.4 omitted filter

2.1.5 used 5 midget impingers

2.1.6 used 2 l/m sampling rate, not isokinetic

4.1.2 10 ml of 80% isopropanol in impingers 1 & 2
10 ml of 3% hydrogen peroxide in impingers 3 & 4
nothing but glass fiber in #5

4.2.1 Wash impingers 1 & 2 into 100 ml graduate and make to 100 ml with 80%. Wash 3 & 4 into 100 ml graduate and make to 100 ml with water.

4.3.1 Pipette 50 ml aliquot of sample from impingers 1 & 2 & titrate. Pipette 10 ml aliquot of sample from impingers 3 & 4 & titrate after adding 40 ml of isopropenol.

ST0683100

THE DOW CHEMICAL COMPANY

October 9, 1972

H. R. Hoyle
Chemical Biology Research
1709 Building

cc: C. J. Barras
J. E. Capps
A. P. Banner
M. Kelyman
B. D. Miles

RUSSELLVILLE CELL MANUFACTURING PLANT-ENVIRONMENTAL CONSIDERATIONS

We are attempting to establish environmental chemical exposure data for the Russellville Cell Manufacturing Plant. Our objectives are to assure that plant personnel are not being exposed to hazardous environments and to provide necessary documentation to comply with the Occupational Safety & Health Act of 1970.

I have enclosed a description of the Russellville Cell Manufacturing Process, including information relative to the plant environment and personnel exposure. After reviewing this data, the data submitted in Paul Banner's letter of September 11, 1972, and results from previous environmental work relative to the Cell Manufacturing Plants, please provide the following.

A. TLV (8hrs.) values for the chemicals listed in the process description.

B. Indicate those exposure situations which can be considered safe based on previous analytical work or by virtue of the low apparent exposure level.

C. Indicate those exposure situations where further environmental studies are needed to establish actual exposure levels. Please include recommended sampling procedures.

As you know, Paul Banner has a Dräger instrument and necessary to take dust samples. He has conducted some environmental studies and is anxious to participate in future environmental work.

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We plan to use the enclosed Process Description format to summarize the environmental chemical exposure status of the Cell Manufacturing Plant. Noise Exposure Surveys have been completed in Units III, IV, & V. The results will be summarized in a separate report.

In addition to the specific information requested above, we would appreciate your comments and suggestions.

R. E. Onan
Safety Department
The Dow Chemical Company

jeh

Enclosure

ST0683102

PROCESS DESCRIPTION - [illegible]

UNIT I

ASSIGNMENT	DESCRIPTION	CHEMICAL	TLV	COMMENTS
Unit I Technician	Calcined Petroleum Coke Unloading Received in closed hopper cars. Contents dumped into underground chute from which it is conveyed to storage silo. /Max Exposure = 1 hour/shift/	Calcined Petroleum Coke (negligible exposure)	3.5 mg/m^3	
Unit I Technician	Coal Tar Pitch Loading Received in tank cars at 180°-190°C. Car is hooked up and contents are pumped to a closed tank where pitch is held at 180° - 190°C. /Max Exposure = 30 min/shift/	CT Pitch (negligible exposure		
Unit I Technician	Plant Operation All plant operations are carried out in a building with forced draft from bottom to top. For the most part, material handling systems are closed except where 50 lb. bags of Fe_2O_3 are dumped into a feed hopper. Following describes the anticipated personnel exposure:			
	CP Coke - Should be little free dust in atmosphere under normal operating conditions.	CP Coke	3.5 mg/m^3	
	CT Pitch - Held at 180°-190°C. in closed tank. Most processing operations take place in closed equipment.	CT Pitch		
	Acrid Fumes - There are acrid fumes from the heated coke-pitch mix in localized areas near continuous mixer feeder (CU 105) and at the conveyor after the batch mixer CU 107. Note: Under normal operating conditions exposure to these fumes would not exceed 15 min/shift. Under abnormal conditions	Acrid Fumes		

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SIGNMENT	DESCRIPTION	CHEMICAL	TLV	COMMENTS
	exposure to these fumes may be 7½ hours/ shift. These fumes should be identified so that appropriate precautionary procedures are established.			
nit I echnician	Fe_2O_3 - 50 lb. bags dumped into hopper - There can be noticable dust in the immediate area as the bag is dumped. Operator will dump 8 bags/shift maximum. /Max Exposure = 15 min./shift/	Fe_2O_3 Dust		
	Green Carbon - broken pieces of extruded carbon returned to recycle hopper in wheelbarrow. /Max Exposure = 1 hour/shift/	Green Carbon Dust		
	Extrusion - Mixed batch is extruded into green coke plates at 130°- 160° C. /Max Exposure = 6 hours/shift/	May be some fumes in immediate area of extruder		
	General Atmosphere - LPG fork trucks are operated inside the building in Unit I. Note: Personnel assigned to Unit I will work a full 8 hour shift on the Plant Operation assignment. This may include simultaneous car loading.	CO		

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GNMENT	DESCRIPTION	CHEMICAL	TLV (8hrs.)	COMMENTS
t II hnician	Plate Handling Palletized green carbon plates are taken from the extruder palletizer and moved to the sagger loading area or placed in a temporary storage area. Plates are taken from pallets and placed in a spacer form and suspended in a sagger. (4x4' open top cylindrical steel container) Coke dust generated from handling the plates appears to be negligible. /Max Exposure = 1 hour/shift/	Green Carbon Dust		
	Sagger Filling Saggers are filled with sand from over head hopper to support carbon plates. An exhaust intake is located around and above the top of the sagger to catch dust. However, considerable free sand dust is apparent in the immediate work area. The technician always wears a dust mask (NSA Dust Fol BM 213-97) while working on this job. /Max Exposure = 7 hour/shift/	Sand Dust	0.1/mg/m^3 < 10u	Result from previous analytical work suggests that the level of < 10u dust in the immediate work area may exceed 0.1 mg/m^3
	General Atmosphere LPG fork trucks are operated inside building in Unit II.	CO		
it II chnician	Sagger Unloading Significant amounts of sand dust are apparent in the work area during this operation. The technician always wears a dust mask (same as above) while performing this operation. /Max Exposure - 7 hours/shift/	Sand Dust	0.1 mg/m^3 <10u	

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ICNMENT	DESCRIPTION	CHEMICAL	TLV (8hrs.)	COMMENTS
t chnician	Sagger Handling The saggers are loaded on flat cars, moved to an oven, removed from the oven and unloaded from the flat car. There is no specific chemical exposure involved in these operations other than, perhaps, a low level of carbon dust in the general atmosphere. /Max Exposure = 7 hour/shift/	Essentially None		
	Furnace Operation The saggers are fired in outdoor closed ovens at 850°C. Decomposition products are: Benz-pyrine and related compounds. Complete decomposition of the above chemicals is anticipated in a 950°C. incinerator before discard to atmosphere through 35' high stacks. Operator checks the oven once per hour by ascending to catwalk around top of ovens. /Max Exposure = No direct exp./	Benzpyrene (None Anticipated)		Efficiency of flame incenerator should be checked by sampling stack.

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UNIT III (Graphitizing)

SIGNMENT	DESCRIPTION	CHEMICAL	[illegible]	COMMENTS
	All operations take place in a well ventilated building.			
urnace uilding	Rebuilding Furnaces Lampblack is shoveled from top of furnace. into a portable hopper placed by furnace. When electrodes have been replaced, the hopper is lifted by fork truck and the lampblack is dumped on top of furnace. Considerable lampblack dust is apparent in the immediate work area during these operations. Dust masks (Dust Foe MSA Dust Foe BM 218-97 filter medium) are worn at all times while handling lampblack. Technician assigned to this job will handle lampblack 7 hours per day, about 2½ days out of 5.	Lamp Black Dust	3.5 mg/m^3	
	Fabricating Graphite Heating Elements Saw 2"x10" planks on table saw. (Wears 3M dust mask.) Drills electrode receptacles. Saws out elements with sabre saw. Grinds edges of elements.	Graphite Dust		
Furnace Loading and Unloading	Feeding Baked Carbon Plates to Furnaces and Palletizing Fired Plates as they are Discharged from the Furnaces Hazardous combustion products from plate firing process (SO_2&CO) may be discharged from both ends of furnace. Exhaust system carries away most of these fumes but some escape to the work area.	Coke Dust (Negligible)	3.5 mg/m^3	Exhaust gases were checked by John VanWestenberg on July of 1972. Results: 0.022 PPM SO_2, 11.7 mg/m SO_3 Drazer Tube analysis of atmosphere in work area indicated nil CO & SO
		Graphite Dust	10 mg/m^3	
		SO_2 CO		
	/Max Exposure ~ 7 hours/shift/			

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UNIT III (Continued)

ASSIGNMENT	DESCRIPTION	CHEMICAL	TL	COMMENTS
Plate Grinding	Edges of graphitized plates (before PF resin impregnation) are ground off with hand grinder. Exhaust system is used but it is not very effective. Significant dust in atmosphere of immediate work area. Operator always wears a face shield and dust masks (Dust Foe or double 3M disposable) while performing this operation. /Max Exposure = 5 hour/shift/	Graphite Dust	10 mg/m^3	P.Banner has submitted samples taken in this area to G.H. FLores for analysis. There are no areas in the entire operation having greater dust intensities.
Unloading Carbon Plates and Graphite Plates from Box Cars.	Dust exposure is limited to that which comes from plates while handling.	Carbon Dust (Insignificant) Carbon Dust (Insignificant)		

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ASSIGNMENT	DESCRIPTION	CHEMICAL	TLV	COMMENTS
ad Trim Saw	Graphite plates are automatically fed to end trim saws from pallets and automatically repalletized. The graphite has not been impregnated with PF resin at this point. Exhaust hoods are strategically placed at each saw. /Max Exposure = 7 hrs/shift/	Graphite Dust	(8hrs.) 10mg/m3	
Notch Saw	Essentially same as above	"	"	
PF Impregnation	A. Operates Phenol Formaldehyde Reactors Pumps phenol charge in reactor. " formaldehyde charge in reactor. " 25% Caustic " " " The above operation takes place in a building with one openside and large exhaust fans on roof. All materials are handled in closed systems. However, the reactors are open vented in immediate area. There is odor of phenol and formaldehyde when transferring. Operator wears complete protective clothing (hooded) and face shield during transfer of the above material to reactor and during reaction. /Max Exposure = 4 hours/shift/ B. Operates PT Resin Impregnators Under normal conditions only exposure is to some residual dryed resin in the impregnating chamber after chamber is depressurized and opened. Odor in chamber at completion of cycle is described as musty. /Max Exposure = ½ hour/shift/			

404117

ST0683109

ASSIGNMENT	DESCRIPTION	CHEMICAL	TLV (8hrs.)	COMMENTS
	Note: Occasionally, the impregnation is vented through the wall into the PF Resin Polymerization area, at the end of the impregnating cycle. At this point the PF Resin has been blown back to the storage tank, resin remaining on graphite plates and on interim oven have been baked 14 hours at 120°C. under pressure and much of the pressure has been relieved. The odor of PF Resin is strong in the Polymerization area at time of venting. /Max Exposure = 2-3 min/shift/ C. Unloading Phenol Tank Cars Complete protective suit (air conditioned) is worn during this operation. Transfer system entirely closed. However, storage tank open vented to dike. The odor of phenol is present during the unloading operation. /Max Exposure/TC = 1 hour/shift/ / 1 TC/month/ Unloading Formaldehyde Protective suit is worn and respirator is carried in case of significant fumes encountered. Transfer system is closed. Storage tank open vented to dike. The odor of formaldehyde is present while transferring. /Max Exposure/TT = 15 min / TT/no. infrequent/ Unloading 25% Caustic Soft side goggles are worn. The transfer system is closed. However, the storage tank vents to the dike. /Max Daily Exposure/TT = 15 min /			

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UNIT IV (Continued)

ASSIGNMENT	DESCRIPTION	CHEMICAL	T	COMMENTS
Plate Grinding	Grinds edges of PF impregnated graphite with pedestal grinder fitted with exhaust pick up system. /Max Exposure = 7 hours/shift/	PF Imp. Graphite Dust		
	Same as above except using hand grinder without exhaust pick up system. /Max Exposure = 7 hour/shift/	"		

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UNIT V

ASSIGNMENT	DESCRIPTION	CHEMICAL	TLV (Shrs.)	COMMENTS
Cell Casting (South area)	All operations are carried out in a well ventilated building. Soft side goggles are required at all times in Unit V.			
	A. Prepares molds by removing residual plastic with scraper.			
	B. Inserts graphite plates (electrodes) into forms.	Graphite Dust (Little if any)		
	C. Seals cracks between electrodes using the following mixture which is prepared - 3 gallons at a time in open 5 gallon bucket: Cab-o-Seal or Asbestos Pulp (Scooped) Derakane (Dipped) Cobalt Naphenate Dimethyl Anilene Methyl-Ethyl-Ketone-Peroxide Measured in a graduated cylinder	Cab-o-Seal Asbestos Pulp Derakane Cobalt Naphenate Dimethyl Aniline MEK Peroxide		
	The above mixture is applied by pouring over cracks. Technicians wear Neoprene coated gloves while preparing and handling this material. /Max Exposure = 1 hour/shift/			
	D. Applies Dow Corning Silastic	DC Silastic 732		
	E. Applies mold release agent to forms from bucket using a paint brush and gloves, The release agent is prepared as follows: 25 tubes of DC Silastic 732 injected in 55 gallons of Chlorothene NU-mixed in open drum.	DC Silastic 732 Chlorothene NU		
	F. Prepares molding material as follows: Derakane Sand Fiberglass Remotely added to partially closed mixer. Mixing bowl ≈ 4'x4' cylindrical.	Derakane Sand Dust (much dust released to area for ≈ 1 min.)		

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ASSIGNMENT	DESCRIPTION	CHEMICAL	TLV (8hrs.)	COMMENTS
	F. Continued: Cobalt Naphenate Dimethyl Aniline Methyl-Ethyl-Ketone-Peroxide) Mixer is opened and quantities added from graduated cylinder. Gloves are worn. The above material is occasionally prepared in somewhat smaller quantities in an open mixer.	Fiberglass Cobalt Naphenate Dimethyl Aniline Methyl-Ethyl Ketone-Peroxide		Please refer to work by R.G. Melche Chemical Biology Research. Also, s has been submitted to Flores of chem Biology Research by P. Banner representing maximum exposure under normal operating conditions. Resul has not been formally reported, as yo
	G. Addition to mold The above molding material is transported to the mold in an open container and poured into the mold. Note: Styrene odor in area is strong during Steps F-G. /Max Exposure Steps F-G = 2 hours/shift/			
	H. Clean Equipment Small mixer and transfer container are cleaned by adding = 6 quarts of Chlorothene NU and sloshing then taken outside to dump. /Max Exposure = 15 min./shift/ Derakane added to large semi-closed mixer and allowed to stand between batches.	Chlorothene NU		
Milling (South Mid-section)	Grooves are milled into ends of graphite electrode by using milling machine. Good exhaust system prevents significant milling dust from entering work atmosphere. /Max Exposure = 7 hours/shift/	Graphite Dust (Negligible)		

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UNIT V (continued)

ASSIGNMENT	DESCRIPTION	CHEMICAL	[illegible]	COMMENTS
Cell Assembly	Sand Blasting (North Mid-Section) Inner edges of solidified plastic frames are sand blasted. This is done in an area enclosed by 8' walls. Sand blaster only man allowed in area while sand blasting. He uses sand blaster hood with exterior, filtered air supply. /Max Exposure = 2 hours/shift/	Sand Dust		
	Grinding Operation The plastic edge of solidified plastic molding is ground with hand sander. Operator wears face shield and Dust Foe dust mask. /Max Exposure = 1 hour/day/	Plastic Dust		
	Fabrication (North Section) Polymeric material is poured between electrode molding and frame molding to weld the two together. The polymeric material is prepared in 3 gallon quantities in an open 5 gallon bucket and contains the following: Asbestos Pulp, (Scooped) Derakane, (Dipped) Dimethyl Aniline } small amounts measured MEK Peroxide } with graduated cylinders. /Max Exposure = 2 hour/ shift/	 Asbestos Pulp Derakane Dimethyl Aniline MEK Peroxide		
	LPG Fork trucks are operated in Unit V. The remaining operating in Unit V is mechanical in nature and involves no chemical exposure. Note: Technicians normally remain on one assignment during a shift. Highest exposure to molding material components would occur on Cell Casting assignment. If analytical	CO		

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[illegible] this area is not hazardous it can probably be assumed that there is

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UNIT V (continued)

SIGNMENT	DESCRIPTION	CHEMICAL	TLV	COMMENTS
ll Assembly	Sand Blasting (North Mid-Section) Inner edges of solidified plastic frames are sand blasted. This is done in an area enclosed by 8' walls. Sand blaster only man allowed in area while sand blasting. He uses sand blaster hood with exterior, filtered air supply. /Max Exposure = 2 hours/shift/	Sand Dust		
	Grinding Operation The plastic edge of solidified plastic molding is ground with hand sander. Operator wears face shield and Dust Foe dust mask. /Max Exposure = 1 hour/day/	Plastic Dust		
	Fabrication (North Section) Polymeric material is poured between electrode molding and frame molding to weld the two together. The polymeric material is prepared in 3 gallon quantities in an open 5 gallon bucket and contains the following:			
	Asbestos Pulp, (Scooped)	Asbestos Pulp		
	Derakane, (Dipped)	Derakane		
	Dimethyl Aniline } small amounts measured	Dimethyl Aniline		
	MEK Peroxide } with graduated cylinders.	MEK Peroxide		
	/Max Exposure = 2 hour/ shift/			
	LPG Fork trucks are operated in Unit V.	CO		
	The remaining operating in Unit V is mechanical in nature and involves no chemical exposure.			
	Note: Technicians normally remain on one assignment during a shift. Highest exposure to molding material components would occur on Cell Casting assignment. If analytical			

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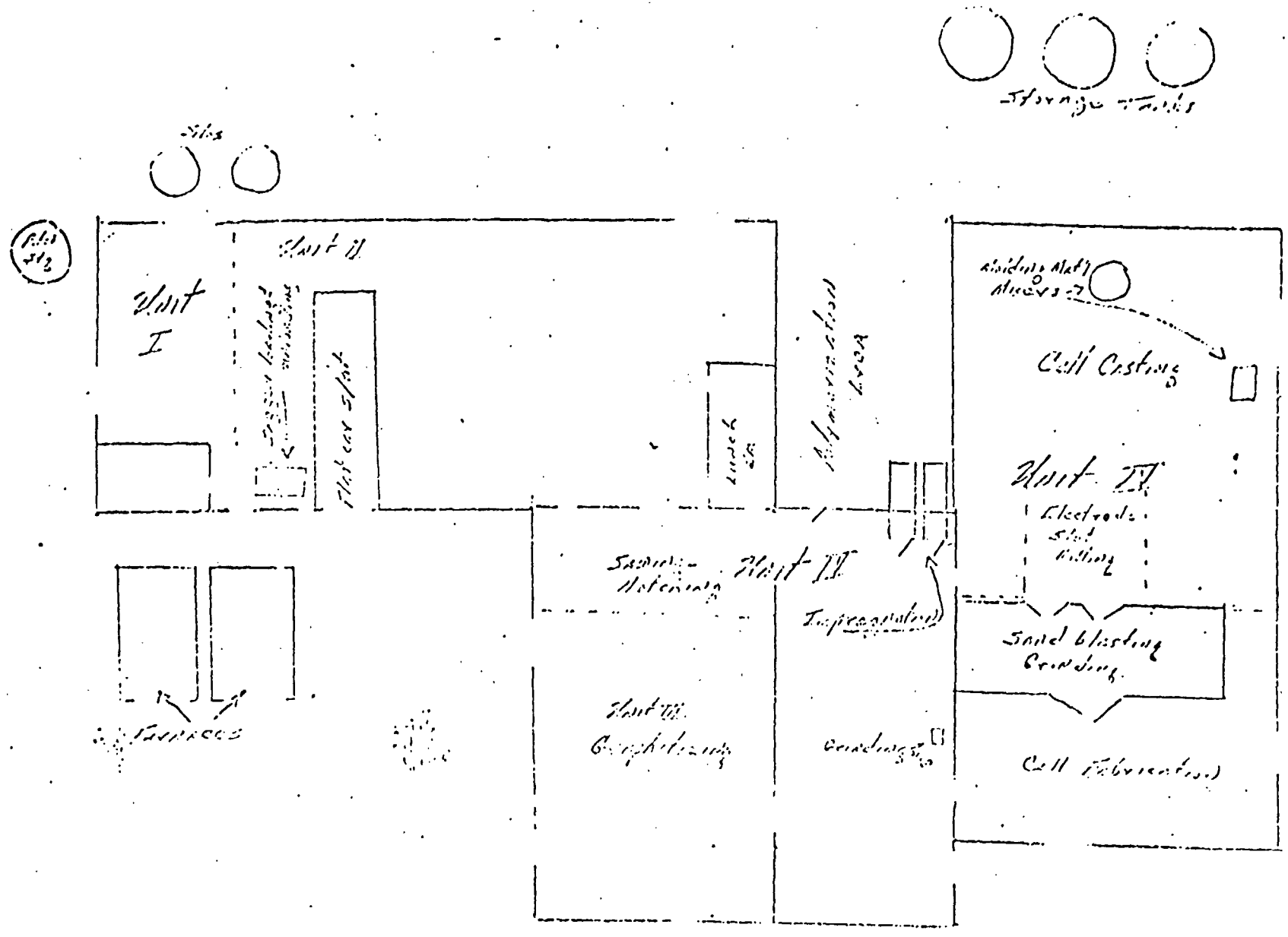
... it can probably be assumed that there is



404124

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DOW CHEMICAL U.S.A.

MIDLAND, MICHIGAN 48640

October 16, 1972

Paul Banner
Cell Mfg. Plant
RUSSELLVILLE

cc: H. R. Hoyle, Chemical Biology Research, 1701 Bldg.
J. Van Westenburg, Electrochem-Metals, 1703 Bldg.

I am reporting the results of your first three samples with this letter. The results of any further samples and a copy of the technical report upon which the results are based will be sent when they are completed.

I am also sending a copy of the OSHA Rules & Regulations. The acceptable exposure limits for styrene monomer are listed on page 15104 and state:

An eight-hour time-weighted average	--	100 ppm
Acceptable ceiling concentration	--	200 ppm
Maximum peak above the acceptable concentration for an eight hour shift	--	600 ppm for five minutes in any three hours

The results for your samples are listed in Table I attached.

R.G. Melcher

R. G. Melcher
Industrial Hygiene Section
Chemical Biology Research
1701 Building
A/C 517 636-3061

sjl/enclosures

ST0683117

Table I

Sample Description/Location	Collection Time & Rate	Styrene Monomer Averaged Conc. (ppm v/v in air)
Tube #1 During casting of two Derakane cells 8/11/72	Total 51 min (high concentration area, 27 min, rate 0.5 l/min)	84
Tube #2 At 5' level adjacent to batch mixer, Unit #5 9/21/72	106 Minutes at 0.5 l/min (pump on only during mixing and dumping)	8.7
Tube #3 Building sample at cell casting station 9/22/72	3 Hours and 30 minutes at 0.5 l/min	3.1

RGMelcher:10/16/72

404126

ST0683118

December 29, 1972

R. R. Langner, Industrial Hygiene Services, 607 Building
G. Johnson, Oyster Creek Division, Freeport, Texas
B. O. Smith, Dowell Division, Houston, Texas
J. H. Van Sandt, Dow Industrial Service, 2020 Building
P. Peacock, Safety & Loss Prevention, Freeport, Texas
J. C. Karl, The Dow Badische Company, Freeport, Texas
G. Van Dusen, Dow Chemical Latin America, Coral Gables
L. Lemaster, Dow Chemical Pacific, Hong Kong
R. G. Vaughn, Louisiana Division, Plaquemine
R. A. DeGesero, Environmental Health, Terneuzen
F. D. Axe, Western Division, Pittsburg, California
N. Murray, Dow Chemical of Canada, Sarnia
W. G. Oppelt, Dow Corning Corporation, Midland
S. M. MacCutcheon, Safety & Loss Prevention, 2030 Building

COAL TAR PITCH VOLATILES

The interpretation of coal tar pitch volatiles has been extended under the OSHA to include the fused polycyclic hydrocarbons which volatilize from the distillation residues of petroleum, wood and other organic materials as well as from coal tar pitch. A NIOSH criteria document is expected soon on coal tar pitch volatiles giving details of requirements for warning signs, environmental monitoring and protective equipment. A recent U. S. Department of Labor policy statement indicates that any violations of the OSHA standard will be considered a serious citation.

Some of the high molecular weight polycyclic hydrocarbons (such as 3,4-benzopyrene, anthracene and phenanthrene) have been shown to be carcinogenic. Since no safe level has been established for these carcinogens, an indirect

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standard has been set to minimize exposure to the fumes and vapors from the hot or burning tars. The Threshold Limit Value of 0.2 mg/m^3 is based on the amount of airborne benzene soluble compounds found in the work areas. Any skin contact with the distillation tars should be avoided since skin absorption can be a significant route of exposure. The water in furnace seals and scrubber systems should be checked since the tar volatiles can easily condense and contaminate the effluent.

Air samples are collected on 0.8 μ pore size filters. The benzene soluble fraction is determined by weighing the filter before and after a benzene flush in a Soxhlet apparatus. Since the method is nonspecific, when taking air samples all potential sources of organic fumes and dusts should be documented. Cellulose acetate and fiber glass filters contain varying amounts of benzene soluble materials, so the use of these filters could distort the analysis. Silver membrane filters have been reported to be the most reliable to minimize this error. Silver membrane filters have been produced by Selas Flotronics, Spring House, Pennsylvania, but there is some question of commercial availability.

The Midland Division Analytical Laboratory has developed both vapor phase and thin layer chromatography methods to identify the components of the benzene soluble fraction. This additional information is useful in evaluating the hazard and determining if the samples have been distorted by some nonpolycyclic materials.

Because of the potential hazard and the extent of coverage under the OSHA, operations which generate organic distillation tars should be surveyed to evaluate the health hazards involved and to assure compliance with OSHA regulations.

G. H. Flores
Industrial Hygiene Section
Chemical Biology Research
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sjl

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Include in

We need to evaluate one man for 5 eight hour shifts and get an average for eight hours. When you are ready get a voluntary from Unit 1.

Gordon

OSHA PROGRAM DIRECTIVE 72-21 FOR PROCEDURES TO FOLLOW INSPECTING ESTABLISHMENTS WHERE THERE ARE EXPOSURES TO COAL TAR PITCH VOLATILES

July 5, 1972

OSHA PROGRAM DIRECTIVE No. 72-21

To: Regional Administrators, National Office Directors, Area Office Directors and District Supervisors

Subject: Coal Tar Pitch Volatiles

Attachments:

1. OSHA SIC List
2. Rationale for Coal Tar Pitch Volatiles – Violation Categories
3. OSHA Sampling Data Sheet No. 6

1. *Purpose*

To provide Occupational Safety and Health Administration (OSHA) supervisory staff and field personnel guidelines in planning, scheduling and developing procedures to follow in inspections of establishments where there are apparent exposures to coal tar pitch volatiles.

2. *Documentation Affected*

This directive supplements the Compliance Operations Manual with special emphases on Chapters IV, V, VIII and XIII.

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3. *Action*

a. Compliance Programming.

The Regional Administrator, or his designee, shall identify the workplaces where exposure exists and shall take appropriate action to initiate inspections by Compliance Safety and Health Officers (CSHO's) and Industrial Hygienists. During such compliance inspections, coal tar pitch volatiles will be given the same significance as that assigned to any other occupational health hazard. Industries where coal tar pitch volatiles are prevalent include but are not limited to Steel Making, Aluminum Reduction Operations, Road Construction and Roofing Operations. (See attached SIC List).

b. Inspection Procedures.

(1) Inspection shall be conducted as set forth in Chapter V of the Compliance Operations Manual.

(2) Carbon monoxide exposures shall be measured at all coal tar pitch volatiles locations.

c. Laboratory Services.

(1) The procedure indicated in Chapter XIII of the Compliance Operations Manual shall be adhered to for all analytical services. These services continue to be performed at the Salt Lake City facility. Sampling procedures detailed on the attached data sheets shall be followed.

(2) Issue, calibration and repair of equipment is performed at NIOSH Laboratory of Engineering, U.S. Public Health Services, 1014 Broadway, Cincinnati, Ohio 45202.

d. Violations

Rationale for classifying violations dealing with coal tar pitch volatiles is identified on Attachment No. 2.

e. Abatement.

(1) Instructions for abatement are contained in Chapter X, Section F, of the Compliance Operations Manual. Particular attention should be given to the use of multi-step abatement procedures on page X-9 of the Compliance Operations Manual.

(2) Protection against excessive carbon monoxide and coal tar pitch volatiles can best be obtained by controlling the generation of such contaminants and by controlling the dispersion of such contaminants into the ambient air of the workplace. Engineering controls afford the best protection to employees, and abatement by engineering controls should be required in all instances to the extent that such engineering controls are feasible.

(3) Control of the environment or control and reduction of the opportunity for exposure, rather than protective devices against exposure should be the primary objective in writing citations. Coal tar pitch volatiles may require time for extensive engineering control studies to determine the feasibility of engineering controls and for the implementation of engineering controls, but such engineering controls are the primary objective.

(4) Pending the determination and implementation of feasible engineering controls, or if it is determined that no [illegible] controls, such as rotation of employees should be required. If it is determined that there are no feasible engineering controls that can sufficiently reduce the contamination, abatement requirements should properly include the engineering controls that are feasible, together with feasible administrative controls.

(5) During the time necessary to implement feasible engineering controls and feasible administrative controls, respirator) protective equipment should be utilized as a short-range control in order to provide temporary protection to employees. Respirators may be used as long-range control only when no engineering and administrative controls are feasible.

(6) Employer reporting responsibilities for abatement periods less than 30 days are contained on page X-8 of the Compliance Operations Manual.

(7) When the abatement period exceeds 30 days, copies of the monthly progress reports from the establishment shall be forwarded to the Area Director during the abatement period. (See page X-8 of the Compliance Operations Manual for instructions dealing with abatement periods exceeding 30 days.)

f. Field Reporting Procedures and Forms.

Each OSHA-1 Form shall be marked in red letters at the top of the front page with "Coal Tar-Pitch Volatiles."

g. Sampling Data Sheet.

A sampling data sheet is included as an attachment. This sheet should be read carefully by OSHA personnel before commencing the inspection.

5. *Filing*

This directive is effective immediately and shall be retained until further notice. The information contained in this directive will be incorporated into the next scheduled revision of the Compliance Operations Manual.

Attachment No. 1

LIST OF SIC CODE NUMBERS AND DESCRIPTION OF COAL TAR PITCH VOLATILES EXPOSURES (1957 SIC List)

1621 – Heavy Construction, Except Highway and Street Construction (Pipe line wrapping; general contractors)

1761 – Roofing and Sheet Metal Work

1771 – Concrete Work (Asphalting and Blacktop work)

1799 – Special Trade Contractors, Not Elsewhere Classified (Waterproofing and pipe covering)

2661 – Building Paper and Building Board Mills (Asphalt) (Tar paper)

2815 – Cyclic (Coal Tar) Crudes, and Cyclic Intermediates, Dyes, and Organic Pigments.

2821 – Plastics Materials, Synthetic Resins and Non-vulcanizable Elastomers (Coal tar resins)

2851 – Paints, Varnishes, Lacquers, Enamels, and Allied Products (Coal tar pitch)

2911 – Petroleum Refining (Coke production)

2951 – Paving Mixtures and Blocks (Coal tar paving materials)

[illegible]

3312 – Blast Furnaces (Including Coke Ovens, Steel Works, and Rolling Mills

3321 – Gray Iron Foundries (Coal tar pipe and fittings)

404130

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3334 – Primary Production of Aluminum
3341 – Secondary Smelting and Refining of Nonferrous Metals (Aluminum)
3691 – Storage Batteries (Sealing compounds)
3692 – Primary Batteries, Dry and Wet
3996 – Linoleum, Asphalted-felt-base, and Other Hard Surface Floor Coverings, Not Elsewhere Classified
4925 – Mixed, Manufactured, or Liquefied Petroleum Gas Production and/or Distribution (Coke oven gas, etc.)

Attachment No. 2

RATIONALE FOR COAL TAR PITCH VOLATILES VIOLATION CATEGORIES

Since exposure to coal tar pitch volatiles is not likely to cause immediate death nor immediate disabling injury, there would be no "imminent danger" situation, as defined in the Williams-Steiger Occupational Safety and Health Act of 1970.

Some coal tar pitch volatiles (of the benzene soluble fraction) are recognized as carcinogens (cancer-producing substances) and the consequences of repeated occupational overexposure are of a serious nature. All violations of the 8-hour time-weighted average of 0.2 milligrams per cubic meter of air sampled, at exposed worker's breathing zone, are considered "serious". The terms "de minimis" and "nonserious" do not apply to coal tar pitch volatiles exposures above the 8-hour Threshold Limit Value since no "safe" limit of exposure for all workers can be established for carcinogens.

References:

Documentation for Threshold Limit Values, 1971
American Conference of Governmental Industrial Hygienists

Attachment No. 3

OSHA SAMPLING DATA SHEET NO. 6

Substance:

Coal Tar Pitch Volatiles

Standard:

8-hour time-weighted average: 0.2 mg/M³ (benzene soluble fraction)

Analytical Method:

Weight of benzene soluble fraction of collected material.

Sampling Equipment:

Personal sampling pump plus cassette containing 0.8u pore size silver membrane filter preceded by Gelman glass fiber type-A filter. Pre-weighted and extracted cassette furnished by NIOSH.

Sampling Rate:

2 lpm. (liters per minute)

Sample Size:

Recommended minimum of 1 M³ or an 8-hour sample at 2 lpm.

Minimum Concentration Measured:

0.1 mg/M³.

Blank:

With each batch of samples submit one cassette which is subjected to exactly the same handling as for samples except that no air is drawn through it. Label this as a blank.

Shipping:

Keep samples in the dark and ship as promptly as possible. Stored samples should be kept refrigerated. The cassettes in which the samples are collected should be shipped in a suitable container, designed to prevent damage in transit.

Imminent Danger:

Generally not applicable.

Serious Violation:

Any 8-hour time-weighted average above 0.2 mg/M³ (benzene soluble fraction) for an identified worker not wearing proper respiratory protective equipment is considered a serious violation (serious hazard).

Nonserious Violation:

Does not apply.

De Minimis Violation:

Does not apply.

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Title 29—LABOR

Chapter I—National Labor Relations Board

PART 102—RULES AND REGULATIONS, SERIES 3

Subpart I—Service and Filing of Papers

Proof of Service

Section 102.112 is amended to read as follows:

§ 102.112 Same; by parties; proof of service.

Service of papers by a party on other parties shall be made by registered mail, or by certified mail, or in any manner provided for the service of papers in a civil action by the law of the State in which the hearing is pending. Except for charges, petitions, exceptions, briefs, and other papers for which a time for both filing and response has been otherwise established, service on all parties shall be made in the same manner as that utilized in filing the paper with the Board, or in a more expeditious manner; however, when filing with the Board is accomplished by personal service the other parties shall be promptly notified of such action by telephone, followed by service of a copy by mail or telegraph. When service is made by registered mail, or by certified mail, the return post office receipt shall be proof of service. When service is made in any manner provided by the law of a State, proof of service shall be made in accordance with such law.

This section shall become effective upon date of publication (3–13–71).

OGDEN W. FIELDS,
Executive Secretary.

[FR Doc 71-11710 Filed 8-12-71;8:50 am]

Chapter XVII—Occupational Safety and Health Administration, Department of Labor

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Miscellaneous Amendments

On May 29, 1971, occupational safety and health standards were promulgated (36 F.R. 10466). Subsequent review of the standards, and comments and requests for information from the public have pointed up the need for some clarifications, corrections, and changes in effective dates of standards.

Reconsideration of "additional delay in effective date" provisions in various subparts of 29 CFR Part 1910 has shown that the scope of the provisions is too broad, and includes standards for which no delay is necessary for compliance. The purpose of some of the amendments is to limit the additional delay provisions to the specific standards that need additional time, so that the other standards may become effective sooner. On the other hand, Subpart J of Part 1910 is amended to give for the first time an additional delay to specified provisions.

Section 1910.179(b)(2) has been revised in order to give some time for the modification of existing overhead and gantry cranes, and to reflect accurately the American National Standards Institute (ANSI) standard from which the provision is derived. Similar changes have been made in § 1910.180 (crawler, locomotive, and truck cranes) and in § 1910.181 (derricks), for the same reasons.

Section 1910.217(a)(2) has been revised in order to give 36 months for the modification of presently installed mechanical power presses. The delay is given in the ANSI standard adopted in the section.

Section 1910.93 (air contaminants) has been revised in its entirety, in the interest of greater intelligibility and accuracy.

Several different dates have been changed to August 31, 1971, in order to achieve greater uniformity throughout Part 1910. Other amendments are made to correct mistakes, supply omissions, and to provide greater clarity.

Accordingly, pursuant to authority in section 6(a) and 8(g) of the Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1593, 1600; 29 U.S.C. 655, 657), 29 CFR Part 1910 is hereby amended as set forth below. The provisions of 5 U.S.C. 553 concerning notice of proposed rule making, public participation therein, and delay in effective date are inapplicable by virtue of the exception to 5 U.S.C. Chapter 5 provided in section 6(a) of the Act. In addition, notice and public procedure are unnecessary because of the nature of the amendments, and impracticable, because of the need to give as much advance notice as possible of the changes before August 27, 1971, when many standards in Part 1910 become effective.

Part 1910 is amended as follows:

1. Section 1910.93 of Subpart G is revised to read as follows:

§ 1910.93 Air contaminants.

An employee's exposure to any material listed in table G–1, G–2, or G–3 of this section shall be limited in accordance with the requirements of the following paragraphs of this section.

(a) Table G–1:

(1) *Materials with names preceded by "C"—Ceiling Values.* An employee's exposure to any material in table G–1, the name of which is preceded by a "C" (e.g., C Boron trifluoride), shall at no time exceed the ceiling value given for that material in the table.

(2) *Other materials—8-hour time weighted averages.* An employee's exposure to any material in table G–1, the name of which is not preceded by "C", in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average given for that material in the table.

(b) Table G–2:

(1) *8-hour time weighted averages.* An employee's exposure to any material listed in table G–2, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that material in the table.

(2) *Acceptable ceiling concentrations.* An employee's exposure to a material listed in table G–2 shall not exceed at any time during an 8-hour shift the acceptable ceiling concentration limit given for the material in the table, except for a time period, and up to a concentration not exceeding the maximum duration and concentration allowed in the column under "acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift".

(3) *Example.* During an 8-hour work shift, an employee may be exposed to a concentration of Benzene above 25 p.p.m. (but never above 50 p.p.m.) only for a maximum period of 10 minutes. Such exposure must be compensated by exposures to concentrations less than 10 p.p.m. so that the cumulative exposure for the entire 8-hour work shift does not exceed a weighted average of 10 p.p.m.

(c) Table G–3: An employee's exposure to any material listed in table G–3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that material in the table.

(d) Computation formulae:

(1) (i) The cumulative exposure for an 8-hour work shift shall be computed as follows:

$$E = \frac{C_1T_1 + C_2T_2 + \ldots C_nT_n}{8}$$

where:

E is the equivalent exposure for the working shift.

C is the concentration during any period of time *T* where the concentration remains constant.

T is the duration in hours of the exposure at the concentration *C*.

The value of *E* shall not exceed the 8-hour time weighted average limit in table G–1, G–2, or G–3 for the material involved.

(ii) To illustrate the formula prescribed in subdivision (i) of this subparagraph, note that Lotsy) acetate has an 8-hour time weighted average limit of 100 p.p.m. (table G–1). Assume that an

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404132

employee is subject to the follo exposure:

Two hours exposure at 150 p p m
Two hours exposure at 75 p p m
Four hours exposure at 50 p p m

Substituting this information in the formula, we have

$$\frac{2\times150+2\times75+4\times50}{8}=81 \text{ p p m.}$$

Since 81 p p m is less than eight, the 8-hour time weighted average limit, the exposure is acceptable.

(2) (i) In case of a mixture of air contaminants an employer shall compute the equivalent exposure as follows:

$$E_m=\frac{C_1}{L_1}+\frac{C_2}{L_2}+\ldots\frac{C_n}{L_n}$$

Where:

E_m is the equivalent exposure for the mixture

C is the concentration of a particular contaminant.

L is the exposure limit for that contaminant, from table G-1, G-2, or G-3.

The value of E_m shall not exceed unity (1).

(ii) To illustrate the formula prescribed in subdivision (i) of this subparagraph, consider the following exposures:

Material	Actual concentration of 8-hour exposure	8-hour time weighted average exposure limit
Acetone (Table G-1)	500 p p m	1,000 p p m.
2-Butanone (Table G-1)	45 p p m	200 p p m.
Toluene (Table G-2)	40 p p m	200 p p m.

Substituting in the formula, we have:

$$E_m=\frac{500}{1,000}+\frac{45}{200}+\frac{40}{200}$$

$$E_m=.0500+.0225+.0200$$

$$E_m=.0925$$

Since E_m is less than unity (1), the exposure combination is within acceptable limits.

(e) To achieve compliance with paragraph (a) through (d) of this section, administrative or engineering controls must first be determined and implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section. Any equipment and technical measure use for this purpose must be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with § 1910.134 of this chapter.

TABLE G-1

Substance	p p m *	mg/M³ *
Acetaldehyde	200	360
Acetic acid	10	25
Acetic anhydride	5	20
Acetone	1,000	2,400
Acetonitrile	40	70
Acetylene dichloride, see 1,2-Dichloroethylene		
Acetylene tetrachloride	1	14
Acrolein	0.1	0.25
Acrylonitrile - Skin		0.2
Aerochlorohydrin - Skin	20	45
Allyl alcohol - Skin		0.25
Allyl chloride	2	5
Allyl glycidyl ether (AGE)	1	5
Allyl propyl disulfide	10	45
2-Aminoethanol, see Ethanolamine	2	12
2-Aminopyridine	0.5	2
Ammonia	50	35
Ammonium sulfamate (Ammate)		15
n-Amyl acetate	100	525
sec-Amyl acetate	125	650
Aniline - Skin	5	19
Anisidine (o, p-isomers) - Skin		0.5
Antimony and compounds (as Sb)		0.5
ANTU (alpha naphthyl thiourea)		0.3
Arsenic and compounds (as As)		0.5
Arsine	0.05	0.2
Azinphos-methyl - Skin		0.2
Barium (soluble compounds)		0.5
p-Benzoquinone, see Quinone		
Benzidine - Skin		5
Benzyl chloride	1	5
Biphenyl, see Diphenyl		
Bis(chloromethyl) ether		
Borates, tetra, sodium salts		1
Boron oxide		15
Boron trifluoride	1	3
Bromine	0.1	0.7
Bromoform - Skin	0.5	5
Butadiene (1,3-Butylene)	1,000	2,200
Butanethiol, see Butyl mercaptan		
2-Butanone	200	590
2-Butoxy ethanol (Butyl Cellosolve) - Skin	50	240
Butyl acetate (n-butyl acetate)	150	710
sec-Butyl acetate	200	950
tert-Butyl acetate	200	950
Butyl alcohol	100	300
sec-Butyl alcohol	150	450
tert-Butyl alcohol	100	300
C Butylamine - Skin	5	15
C tert-Butyl chromate (as CrO_3) - Skin		0.1
n-Butyl glycidyl ether (BGE)	50	270
*Butyl mercaptan	10	35
p-tert-Butyltoluene	10	60
Calcium arsenate		1
Calcium oxide		5
**Camphor	2	
Carbaryl (Sevin®)		5
Carbon black		3.5
Carbon dioxide	5,000	9,000
Carbon monoxide	50	55
Cellulose - Skin		0.5
Chlorinated camphene - Skin		0.5
Chlorinated diphenyl oxide		0.5
*Chlorine	1	3
Chlorine dioxide	0.1	0.3
C Chloroacetaldehyde	0.1	0.4
C Chloroacetic acid - Skin	1	3
α-Chloroacetophenone (phenacyl chloride)	0.05	0.3
Chlorobenzene (monochlorobenzene)	75	350
o-Chlorobenzylidene malononitrile (OCBM)	0.05	0.4
Chlorobromomethane	200	1,050
2-Chloro-1,3-butadiene, see Chloroprene		
Chlorodiphenyl (42 percent Chlorine) - Skin		1
Chlorodiphenyl (54 percent Chlorine) - Skin		0.5
1-Chloro-2,3-epoxypropane, see Epichlorohydrin		
2-Chloroethanol, see Ethylene chlorohydrin		
Chloroethylene, see Vinyl chloride		
C Chloroform (trichloromethane)	50	240
1-Chloro-1-nitropropane	20	100
Chloroprene	0.1	0.7
Chloroprene (2-chloro-1,3-butadiene) - Skin	25	90

TABLE G-1—Continued

Substance	p p m *	mg/M³ *
Chromium, sol. chromic, chromous salts as Cr		0.5
Metal and insol. salts		1
Coal tar pitch volatiles (benzene soluble fraction) anthracene, BaP, phenanthrene, acridine, chrysene, pyrene		0.2
Cobalt, metal fume and dust		0.1
Copper fume		0.1
Dusts and Mists		1
Cotton dust (raw)		1
Crag® herbicide		15
Cresol (all isomers) - Skin	5	22
Crotonaldehyde	2	6
Cumene - Skin	50	245
Cyanide (as CN) - Skin		5
Cyclohexane	300	1,050
Cyclohexanol	50	200
Cyclohexanone	50	200
Cyclonite	300	1,010
Cyclopentadiene	75	200
2,4-D		10
DDT - Skin		1
DDVP, see Dichlorvos		
Diacetone alcohol - Skin	50	240
Diazomethane	0.2	0.4
Diborane	0.1	0.1
Dibutyl phthalate		5
C o Dichlorobenzene	50	300
p-Dichlorobenzene	75	450
Dichlorodifluoromethane	1,000	4,950
1,3-Dichloro-5,5-dimethyl hydantoin		0.2
1,1-Dichloroethane	100	400
1,2-Dichloroethylene	200	790
C Dichloroethyl ether - Skin	15	90
Dichloromethane, see Methylene chloride		
Dichloromonofluoromethane	1,000	4,050
C 1,1-Dichloro-1-nitroethane	10	60
1,2-Dichloropropane, see Propylene dichloride		
Dichlorotetrafluoroethane	1,000	7,000
Dichlorvos (DDVP) - Skin		1
Dieldrin - Skin		0.25
Diethylamine	25	75
Diethylamino ethanol - Skin	10	50
Diethyl ether, see Ethyl ether		
Difluorodibromomethane	100	860
C Diglycidyl ether (DGE)	0.5	2.8
Dihydroxybenzene, see Hydroquinone		
Diisobutyl ketone	50	290
Diisopropylamine - Skin	5	20
Dimethoxymethane, see Methylal		
Dimethyl acetamide - Skin	10	35
Dimethylamine	10	18
Dimethylaminobenzene, see Xylidine		
Dimethylaniline (N-dimethyl aniline) - Skin	5	25
Dimethylbenzene, see Xylene		
Dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate, (Dibrom)		3
Dimethyl formamide - Skin	10	30
2,6-Dimethyl heptanone, see Diisobutyl ketone		
1,1-Dimethylhydrazine - Skin	0.5	1
Dimethyl phthalate		5
Dimethylsulfate - Skin	1	5
Dinitrobenzene (all isomers) - Skin		1
Dinitro-o-cresol - Skin		0.2
Dinitrotoluene - Skin		1.5
Dioxane (Diethylene dioxide) - Skin	100	350
Diphenyl	0.2	1
Diphenylmethane diisocyanate (see Methylene bisphenyl isocyanate (MDI))		
Dipropylene glycol methyl ether - Skin	100	600
Di sec. octyl phthalate (Di-2-ethylhexyl phthalate)		5
Emery - Skin		0.5
Epichlorohydrin - Skin	5	19
EPN - Skin		0.5
1,2-Epoxypropane, see Propylene oxide		
2,3-Epoxy-1-propanol, see Glycidol		
Ethanethiol, see Ethyl mercaptan		

See footnotes at end of table.

404133

ST0683125

TABLE G-1—Continued

Substance	p.p.m.*	mg/M³*
2-Chloroallene	1	4
2-Chloroethanol—Skin	250	740
2-Ethoxyethanol—Skin		
2-Ethoxyethyl acetate (cellosolve acetate)—Skin	100	540
Ethyl acetate	400	1,400
Ethyl acrylate—Skin	25	100
Ethyl alcohol (ethanol)	1,000	1,900
Ethylamine	10	18
Ethyl sec-amyl ketone (5-methyl-3-heptanone)	25	130
Ethyl benzene	100	435
Ethyl bromide	200	890
Ethyl butyl ketone (3-heptanone)	50	230
Ethyl chloride	1,000	2,600
Ethyl ether	400	1,200
Ethyl formate	100	300
C Ethyl mercaptan	10	25
Ethyl silicate	100	850
Ethylene chlorohydrin—Skin	5	16
Ethylenediamine	10	25
Ethylene dibromide, see 1,2-Dibromoethane		
Ethylene dichloride, see 1,2-Dichloroethane		
C Ethylene glycol dinitrate and/or Nitroglycerin—Skin	▲0.2	1
Ethylene glycol dimethyl ether acetate, see Methyl cellosolve acetate		
Ethylene imine—Skin	0.5	1
Ethylene oxide	50	90
Ethylidine chloride, see 1,1-Dichloroethane		
N-Ethylmorpholine—Skin	20	94
Ferbam		15
Ferrovanadium dust		1
Fluorides (as F)		2.5
Fluorine	0.1	0.2
fluorotrichloromethane	1,000	5,600
Formic acid	5	9
Furfural—Skin	5	20
Furfuryl alcohol	50	200
Glycidol (2,3-Epoxy-1-propanol)	50	150
Glycol monomethyl ether, see 2-Ethoxyethanol		
Guthion, see Azinphosmethyl		
Hafnium		0.5
Heptachlor—Skin		0.5
Heptane (n-heptane)	500	2,000
Hexachloroethane—Skin	1	10
Hexachloronaphthalene—Skin		0.2
Hexane (n-hexane)	500	1,800
2-Hexanone	100	410
Hexone (Methyl isobutyl ketone)	100	410
sec-Hexyl acetate	50	300
Hydrazine—Skin	1	1.3
Hydrogen bromide	3	10
C Hydrogen chloride	5	7
Hydrogen cyanide—Skin	10	11
Hydrogen peroxide (90%)	1	1.4
Hydrogen selenide	0.05	0.2
Hydroquinone		2
C Iodine	0.1	1
Iron oxide fume		10
Isoamyl acetate	150	525
Isoamyl alcohol	100	360
Isobutyl acetate	150	700
Isobutyl alcohol	100	300
Isophorone	25	140
Isopropyl acetate	250	950
Isopropyl alcohol	400	980
Isopropylamine	5	12
Isopropylether	500	2,100
Isopropyl glycidyl ether (IGE)	50	240
Kelene	0.5	0.9
Lead arsenate		0.15
Lindane—Skin		0.5
Lithium hydride		0.025
L.P.G. (liquified petroleum gas)	1,000	1,800
Magnesium oxide fume		15
Malathion—Skin		15
Maleic anhydride	0.25	1
C Manganese		5
Methyl acetate	25	100
Methanethiol, see Methyl mercaptan		
Methoxychlor		15
2-Methoxyethanol, see Methyl cellosolve		
Methyl acetate	200	610
Methyl acetylene (propyne)	1,000	1,650
Methyl acetylene-propadiene mixture (MAPP)	1,000	1,800
Methyl acrylate—Skin	10	35
Methylal (dimethoxymethane)	1,000	3,100
Methyl alcohol (methanol)	200	260
Methylamine	10	12
Methyl amyl alcohol, see Methyl isobutyl carbinol		

TABLE G-1—Continued

Substance	p.p.m.*	mg/M³*
Methyl n-amyl ketone (2-Heptanone)	100	465
C Methyl bromide—Skin	20	80
Methyl butyl ketone, see 2-Hexanone		
Methyl cellosolve—Skin	25	80
Methyl cellosolve acetate—Skin	25	120
Methyl chloride	300	1,000
Methylcyclohexane	500	2,000
o-Methylcyclohexanone—Skin	100	460
Methyl ethyl ketone (MEK), see 2-Butanone		
Methyl formate	100	250
Methyl iodide—Skin	5	24
Methyl isobutyl carbinol—Skin	25	100
Methyl isobutyl ketone, see Hexone		
Methyl isocyanate—Skin	0.02	0.05
C Methyl mercaptan	10	20
Methyl methacrylate	100	410
Methyl propyl ketone, see 2-Pentanone		
C α-Methylstyrene	100	480
C Methylene bisphenyl isocyanate (MDI)	0.02	0.2
Molybdenum		
Soluble compounds		5
Insoluble compounds		15
Monomethyl aniline—Skin	2	9
C Monomethyl hydrazine—Skin	0.2	0.35
Morpholine—Skin	20	70
Naphtha (coal tar)	100	400
Naphthalene	10	50
Nickel carbonyl	0.001	0.007
Nickel, metal and soluble compounds, as Ni		1
Nicotine—Skin		0.5
Nitric acid	2	5
Nitric oxide	25	30
p-Nitroaniline—Skin	1	6
Nitrobenzene—Skin	1	5
p-Nitrochlorobenzene—Skin		1
Nitroethane	100	310
Nitrogen dioxide	5	9
Nitrogen trifluoride	10	29
Nitroglycerin—Skin	0.2	2
Nitromethane	100	250
1-Nitropropane	25	90
2-Nitropropane	25	90
Nitrotoluene—Skin	5	30
Nitrotrichloromethane, see Chloropicrin		
Octachloronaphthalene—Skin		0.1
*Octane	500	2,350
*Oil mist, mineral		*5
Osmium tetroxide		0.002
Oxalic acid		1
Oxygen difluoride	0.05	0.1
Ozone	0.1	0.2
Paraquat—Skin		0.5
Petroleum distillates (naphtha)	500	2,000
Propane	1,000	1,800
Silver, metal and soluble compounds		0.01
Sodium fluoroacetate (1080)—Skin		0.05
Sodium hydroxide		2
Stibine	0.1	0.5
*Stoddard solvent	500	2,950
Styrene		0.15
Sulfur dioxide	5	13
Sulfur hexafluoride	1,000	6,000
Sulfuric acid		1
Sulfur monochloride	1	6
Sulfur pentafluoride	0.025	0.25
Sulfuryl fluoride	5	20
Systox, see Demeton(s)		
2,4,5-T		10
Talc (dust		2
TEDP—Skin		0.2
Tellurium		0.1
Tellurium hexafluoride	0.02	0.2
TEPP—Skin		0.05
C Terphenyls	1	9
1,1,1,2-Tetrachloro-2,2-difluoroethane	500	4,170
1,1,2,2-Tetrachloro-1,2-difluoroethane	500	4,170
1,1,2,2-Tetrachloroethane—Skin	5	35
Tetrachloroethylene, see Perchloroethylene		
Tetrachloromethane, see Carbon tetrachloride		
Tetrachloronaphthalene—Skin		2
Tetraethyl lead (as Pb)—Skin		0.075
Tetrahydrofuran	200	590
Tetramethyl lead (as Pb)—Skin		0.075
Tetramethyl succinonitrile—Skin	0.5	3
Tetranitromethane	1	8

TABLE G-1—Continued

Substance	p.p.m.*	mg/M³*
Tetryl (2,4,6-Trinitrophenylmethylnitramine)—Skin		1.5
Thallium (soluble compounds)—Skin as Tl		0.1
Thiram		5
Tin (inorganic compounds, except oxides)		2
Tin (organic compounds)		0.1
C Toluene-2,4-diisocyanate	0.02	0.14
o-Toluidine—Skin	5	22
Toxaphene, see Chlorinated camphene		
Tributyl phosphate		5
1,1,1-Trichloroethane, see Methyl chloroform		
1,1,2-Trichloroethane—Skin	10	45
Parathion—Skin		0.1
Pentaborane	0.005	0.01
Pentachloronaphthalene—Skin		0.5
Pentachlorophenol—Skin		0.5
*Pentane	1,000	2,950
2-Pentanone	200	700
Perchloromethyl mercaptan	0.1	0.8
Perchloryl fluoride	3	13
Phenol—Skin	5	19
p-Phenylene diamine—Skin		0.1
Phenyl ether (vapor)	1	7
Phenyl ether-biphenyl mixture (vapor)	1	7
Phenylethylene, see Styrene		
Phenyl glycidyl ether (PGE)	10	60
Phenylhydrazine—Skin	5	22
Phosdrin (Mevinphos®)—Skin		0.1
Phosgene (carbonyl chloride)	0.1	0.4
Phosphine	0.3	0.4
Phosphoric acid		1
Phosphorus (yellow)		0.1
Phosphorus pentachloride		1
Phosphorus pentasulfide		1
Phosphorus trichloride	0.5	3
Phthalic anhydride	2	12
Picric acid—Skin		0.1
Pival (2-Pivalyl-1,3-indandione)		0.1
Platinum (Soluble Salts) as Pt		0.002
Propargyl alcohol—Skin	1	2
n-Propyl acetate	200	840
Propyl alcohol	200	500
n-Propyl nitrate	25	110
Propylene dichloride	75	350
Propylene imine—Skin	2	5
Propylene oxide	100	240
Propyne, see Methylacetylene		
Pyrethrum		5
Pyridine	5	15
Quinone	0.1	0.4
RDX—Skin		1.5
Rhodium, Metal fume and dusts, as Rh		0.1
Soluble salts		0.001
Ronnel		15
Rotenone (commercial)		5
Selenium compounds (as Se)		0.2
Selenium hexafluoride	0.05	0.4
Titanium dioxide		15
Trichloromethane, see Chloroform		
Trichloronaphthalene—Skin		5
1,2,3-Trichloropropane	50	300
1,1,2-Trichloro-1,2,2-trifluoroethane	1,000	7,600
Triethylamine	25	100
Trifluoromonobromomethane	1,000	6,100
2,4,6-Trinitrophenol, see Picric acid		
2,4,6-Trinitrophenylmethylnitramine, see Tetryl		
Trinitrotoluene—Skin		1.5
Triorthocresyl phosphate		0.1
Triphenyl phosphate		3
Turpentine	100	800
Uranium (soluble compounds)		0.05
Uranium (insoluble compounds)		0.25
C Vanadium		
V(O)dust		0.5
V(O)fume		0.1
Vinyl benzene, see Styrene		
**C Vinyl chloride	500	1,300
Vinylcyanide, see Acrylonitrile		
Vinyl toluene	100	480
Warfarin		0.1
Xylene (xylol)	100	435
Xylidine—Skin	5	25
Yttrium		1
Zinc chloride fume		1
Zinc oxide fume		5
Zirconium compounds (as Zr)		5

See footnotes at end of table

404134

[illegible] Addition.

[illegible] Parts of vapor or gas per million parts of contaminated air by volume at 25° C and 760 mm. Hg. pressure.

[illegible] Approximate milligrams of particulate matter per cubic meter of air.

[illegible] Use footnote "c" is used to avoid confusion with ceiling value limitations.)

[illegible] An atmospheric concentration of not more than 0.02 p.p.m., or personal protection may be necessary to avoid headache.

[illegible] As sampled by method that does not collect vapor.

[illegible] For control of cancer-suspect skin-absorbed exposure, biological monitoring essential for personnel control.

TABLE G-2

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 (Z37.4-1970)	10 p.p.m.	25 p.p.m.	50 p.p.m.	10 minutes
Beryllium and beryllium compounds (Z37.29-1970)	2 μg/M³	5 μg/M³	25 μg/M³	30 minutes
Cadmium fume (Z37.5-1970)	0.1 mg/M³	3 mg/M³		
Cadmium dust (Z37.5-1970)	0.2 mg/M³	0.6 mg/M³		
Carbon disulfide (Z37.3-1968)	20 p.p.m.	30 p.p.m.	100 p.p.m.	Do
Carbon tetrachloride (Z37.17-1967)	10 p.p.m.	25 p.p.m.	200 p.p.m.	5 minutes in any 4 hours
Ethylene dibromide (Z37.31-1970)	20 p.p.m.	30 p.p.m.	50 p.p.m.	5 minutes.
Ethylene dichloride (Z37.21-1969)	50 p.p.m.	100 p.p.m.	200 p.p.m.	5 minutes in any 3 hours
Formaldehyde (Z37.16-1969)	3 p.p.m.	5 p.p.m.	10 p.p.m.	30 minutes
Hydrogen fluoride (Z37.28-1969)	do	do	do	
Fluoride as dust (Z37.28-1969)	2.5 mg/M³	do	do	
Lead and its inorganic compounds (Z37.11-1970)	0.2 mg/M³	do	do	
Methyl chloride (Z37.18-1969)	100 p.p.m.	200 p.p.m.	300 p.p.m.	5 minutes in any 3 hours.
Methylene Chloride (Z37.3-1968)	500 p.p.m.	1,000 p.p.m.	2,000 p.p.m.	5 minutes in any 2 hours
Organo (alkyl) mercury (Z37.30-1969)	0.01 mg/M³	0.04 mg/M³		
Styrene (Z37.15-1969)	100 p.p.m.	200 p.p.m.	600 p.p.m.	5 minutes in any 3 hours.
Trichloroethylene (Z37.19-1967)	do	do	300 p.p.m.	5 minutes in any 2 hours
Tetrachloroethylene (Z37.22-1967)	do	do	do	5 minutes in any 3 hours
Toluene (Z37.12-1967)	200 p.p.m.	300 p.p.m.	500 p.p.m.	10 minutes.
Hydrogen sulfide (Z37.2-1966)	20 p.p.m.	30 p.p.m.	50 p.p.m.	10 minutes once only if no other measurable exposure occurs.
Mercury (Z37.8-1971)		1 mg/10M³		
Chromic acid and chromates (Z37.7-1971)		do		

TABLE G-3—MINERAL DUSTS

Substance	Mppcf	Mg/M³
Silica:		
Crystalline:		
Quartz (respirable)	250	10mg/M³ ÷ (%SiO₂+2)
Quartz (total dust)		30mg/M³ ÷ (%SiO₂+2)
Cristobalite: Use ½ the value calculated from the count or mass formulae for quartz		
Tridymite: Use ½ the value calculated from the formulae for quartz		
Amorphous, including natural diatomaceous earth	20	80mg/M³ ÷ %SiO₂
Tremolite	5	20mg/M³ ÷ %SiO₂
Silicates (less than 1% crystalline silica)		
Asbestos—(5 fibers per milliliter greater than 5 microns in length + or-	2	
Mica	20	
Soapstone	20	
Talc	20	
Portland cement	50	
Graphite (natural)	15	
Coal dust (respirable fraction less than 5% SiO₂)		2.4mg/M³ or
For more than 5% SiO₂		10mg/M³ ÷ (%SiO₂+2)
Inert or Nuisance Dust:		
Respirable fraction	15	5mg/M³
Total dust	30	15mg/M³

NOTE: Conversion factors:
mppcf × 35.3 = million particles per cubic meter
= particles per c.c.

[illegible] Millions of particles per cubic foot of air, based on impinger samples counted by light field techniques.

[illegible] The percentage of crystalline silica in the formula is the amount determined from air-borne samples, except in those instances in which other methods have been shown to be applicable.

[illegible] As determined by the membrane filter method at 430 X phase-contrast magnification.

[illegible] Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size selector with the following characteristics:

Aerodynamic diameter (unit density sphere)	Percent passing selector
2	90
2.5	75
3.5	50
5.0	25
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/M³ in the table for coal dust is 4.5 Mg/M³.

2. Section 1910.98 of Subpart G is revised to read as follows:

§ 1910.98 Effective dates.

(a) The provisions of this Subpart G shall become effective on August 27, 1971, except as provided in the remaining paragraphs of this section.

(b) The following provisions shall become effective on February 15, 1972:

§ 1910.94 (a)(2)(iii), (a)(3), (a)(4), (b), (c)(2), (c)(3), (c)(4), (c)(5), (c)(6)(i), (c)(6)(ii), (d)(1)(ii), (d)(3), (d)(6), (d)(5), and (d)(7).

(c) Notwithstanding anything in paragraph (a), (b), or (d) of this section, any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation.

(d) Notwithstanding anything in paragraph (a) of this section, if any standard in 41 CFR Part 50-204, other than a national consensus standard incorporated by reference in § 50-204.2(a)(1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this Subpart G which is derived from 41 CFR Part 50-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

3. Section 1910.114 of Subpart H is revised to read as follows:

§ 1910.111 Effective dates.

(a) The provisions of this Subpart H shall become effective on August 27, 1971, except as provided in the remaining paragraphs of this section.

(b) The following provisions shall become effective on February 15, 1972:

§ 1910.101(b).
§ 1910.102.
§ 1910.103 (a)(2), (b)(1)(i), (b)(1)(iii), (b)(2)(ii), and (b)(3).
§ 1910.105.
§ 1910.106 (b)(1), (b)(2), (b)(3), and (b)(4).
§ 1910.109 (b)(5), (c)(1), (c)(2), (c)(3), (c)(4), (c)(5), (c)(d), (d)(2), (d)(3)(ii), (d)(4)(i)(3), (d)(4)(iii), (d)(4)(iv), (d)(5)(v), (d)(5)(vi)(a), (e)(3)(iii), (e)(3)(v), (e)(4), (e)(7), (f)(2)(iii), (f)(3)(i), (f)(4)(iii), (f)(4)(iv), (f)(4)(viii), (f)(5), (g), (h), and (i).
§ 1910.107 (b)(1), (b)(2), (b)(3), (b)(4), (b)(5)(i), (b)(5)(iii), (b)(5)(iv), (b)(6), (b)(7), (b)(8), (b)(10), (c)(1), (e)(4), (e)(6), (e)(10), (e)(7), (d), (e)(7), (e)(8), (f)(1), (f)(3), (h), (i), (j), (l)(2), (l)(4), (l)(5), (l)(6), (l)(7), and (m)(1).
§ 1910.108 (b), (c), (e)(1), (g)(2), (g)(3), (g)(4), and (g)(5).
§ 1910.108 (g)(6) and (h).
§ 1910.110
§ 1910.111.

(c) Notwithstanding anything in paragraph (a), (b), or (d) of this section, any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation.

(d) Notwithstanding anything in paragraph (a), or (b) of this section, if any standard in 41 CFR Part 50-204, other than a national consensus standard incorporated by reference in § 50-204.2(a)(1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established

ST0683127

404135

federal standard in this Subpart H which is derived from 41 CFR Part 50-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

4. Section 1910.138 of Subpart I is revised to read as follows:

§ 1910.138 Effective dates.

(a) The provisions of this Subpart I shall become effective on August 27, 1971, except that:

(1) Any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation; and

(2) If any standard in 41 CFR Part 50-204, other than a national consensus standard incorporated by reference in § 50-204.2(a)(1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this Subpart I which is derived from 41 CFR Part 50-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

5. In § 1910.141 of Subpart J, paragraph (c)(2) (iv) and (v) are revised, and a new paragraph (i) is added at the end of the section, to read as follows:

§ 1910.141 Sanitation.

• • • • •

(c) *Toilet facilities.* • • •

(2) *Construction of toilet rooms.* • • •

(iv) In all toilet rooms installed on or after August 31, 1971, the floors and side walls, to a height of at least 6 inches, including the angle formed by the floor and side walls, shall be of watertight construction.

(v) The floors, walls, ceilings, partitions, and doors of all toilet rooms shall be of a finish that can be easily cleaned. Installations made on or after August 31, 1971, cove bases shall be provided to facilitate cleaning.

• • • • •

(i) *Scope.* This section applies to all permanent places of employment except where domestic, mining, or agricultural work only is performed. Measures for the control of toxic materials are considered to be outside the scope of this section.

6. In § 1910.142 of Subpart J, paragraph (d)(7) is revised to read as follows:

§ 1910.142 Temporary labor camps.

• • • • •

(d) *Toilet facilities.* • • •

(7) Every water closet installed on or after August 31, 1971, shall be located in a toilet room.

• • • • •

7. In § 1910.145 of Subpart J, paragraphs (a)(2) and (f)(10) are revised to read as follows:

910.145 *Specifications for accident prevention signs and tags.*

(a) *Scope.* • • •

(2) All new signs and replacements of old signs on or after August 31, 1971, shall be in accordance with these specifications.

• • • • •

(f) *Sign design and colors.* • • •

(10) *Slow-moving vehicle emblem.* This emblem (see fig. J-7) consists of a fluorescent yellow-orange triangle with a dark red reflective border. The yellow-orange fluorescent triangle is a highly visible color for daylight exposure. The reflective border defines the shape of the fluorescent color in daylight and creates a hollow red triangle in the path of motor vehicle headlights at night. The emblem is intended as a unique identification for, and it shall be used only on, vehicles which by design move slowly (25 m.p.h. or less) on the public roads. The emblem is not a clearance marker for wide machinery nor is it intended to replace required lighting or marking of slow-moving vehicles. Neither the color film pattern and its dimensions nor the backing shall be altered to permit use of advertising or other markings. The material, location, mounting, etc., of the emblem shall be in accordance with the American Society of Agricultural Engineers Emblem for Identifying Slow-Moving Vehicles, ASAE R276, 1967, or ASAE S276.2 (ANSI B114.1-1971).

• • • • •

8. Section 1910.147 of Subpart J is revised to read as follows:

§ 1910.147 Sources of standards.

The standards in this Subpart J are derived from the following sources:

Sec.	Source
1910.141	ANSI Z4.1-1968, Minimum Requirements for Sanitation in Places of Employment.
1910.142	ANSI Z4.4-1968, Minimum Requirements for Sanitation in Temporary Labor Camps.
1910.143	ANSI Z4.3-1970, Minimum requirements for Nonwater Carriage Disposal Systems.
1910.144	ANSI Z53.1-1967, Safety Color Code for Marking Physical Hazards.
1910.145 (a)-(e) ...	ANSI Z35.1-1968, Specifications for Accident Prevention Signs, and ANSI B114.1-1971, Slow-Moving Vehicle Identification Emblem.
1910.145(f) ...	ANSI Z35.2-1968, Specifications for Accident Prevention Tags

9. Section 1910.148 of Subpart J is revised to read as follows:

§ 1910.148 Standards organizations.

Standard and specifications of the following organizations have been referenced in this Subpart J:

American National Standards Institute, 1430 Broadway, New York, NY 10018

National Association of Plumbing and Mechanical Officials, 5272 Alhambra Avenue, Los Angeles, CA 90032

American Society of Agricultural Engineers, 2950 Niles Road, Post Office Box 229, St. Joseph, MI 49085

10. Subpart J is amended by adding at the end thereof a new § 1910.149 to read as follows:

§ 1910.149 Effective dates.

(a) The provisions of this Subpart J shall become effective on August 27, 1971, except as provided in the remaining paragraphs of this section.

(b) The following provisions shall become effective on February 15, 1972:

§ 1910.142 (b)(3), (b)(5), (b)(7), (d)(6), (f), (g), (i)(1), and (i)(2).

(c) Notwithstanding anything in paragraph (a), (b), or (d) of this section, any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation.

(d) Notwithstanding anything in paragraph (a) of this section, if any standard in 41 CFR Part 50-204, other than a national consensus standard incorporated by reference in 50-204.2(a)(1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this Subpart J which is derived from 41 CFR Part 50-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

11. Section 1910.165 of Subpart L is revised to read as follows:

§ 1910.165 Effective dates.

(a) The provisions of this Subpart L shall become effective on August 27, 1971, except as provided in the remaining paragraphs of this section.

(b) The following provisions shall become effective on February 15, 1972:

§ 1910.157(c).
§ 1910.158 (b) and (c).
§ 1910.159 (a), (b), and (c).
§ 1910.160(a).
§ 1910.161(a).

(c) Notwithstanding anything in paragraph (a), (b), or (d) of this section, any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation.

(d) Notwithstanding anything in paragraph (a) of this section, if any standard in 41 CFR Part 50-204, other than a national consensus standard incorporated by reference in § 50-204.2(a)(1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National

ST0683128

404136

Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this Subpart L which is derived from 41 CFR Part 50-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

12. In § 1910.179 of Subpart N, paragraph (b)(2) is revised to read as follows:

§ 1910.179 Overhead and gantry cranes.

• • • • •

(b) *General requirements.* • • •

(2) *New and existing equipment.* All new overhead and gantry cranes constructed and installed on or after August 31, 1971, shall meet the design specifications of the American National Standard Safety Code for Overhead and Gantry Cranes, ANSI B30.2.0-1967 Overhead and gantry cranes constructed before August 31, 1971, should be modified to conform to these design specifications by February 15, 1972, unless it can be shown that the crane cannot feasibly or economically be altered and that the crane substantially complies with the requirements of this section.

• • • • •

13. In § 1910.180 of Subpart N, paragraph (b)(2) is revised to read as follows:

§ 1910.180 Crawler, locomotive, and truck cranes.

• • • • •

(b) *General requirements.* • • •

(2) *New and existing equipment.* All new crawler, locomotive, and truck cranes constructed and utilized on or after August 31, 1971, shall meet the design specifications of the American National Standard Safety Code for Crawler, Locomotive, and Truck Cranes, ANSI B30.5-1968. Crawler, locomotive, and truck cranes constructed prior to August 31, 1971, should be modified to conform to those design specifications by February 15, 1972, unless it can be shown that the crane cannot feasibly or economically be altered and that the crane substantially complies with the requirements of this section.

• • • • •

14. In § 1910.181 of Subpart N, paragraph (b)(2) is revised to read as follows:

§ 1910.181 Derricks.

• • • • •

(b) *General requirements.* • • •

(2) *New and existing equipment.* All new derricks constructed and installed on or after August 31, 1971, shall meet the design specifications of the American National Standard Safety Code for Derricks, ANSI B30.6-1969 Derricks constructed prior to August 31, 1971, should be modified to conform to those design specifications by February 15, 1972, unless it can be shown that the derrick cannot feasibly or economically be altered and that the derrick substantially complies with the requirements of this section.

• • • • •

15. Section 1910.182 of Subpart N is revised to read as follows:

§ 1910.182 Effective dates.

(a) The provisions of this Subpart N shall become effective on August 27, 1971, except as provided in the remaining paragraphs of this section.

(b) The following provisions shall become effective on February 15, 1972.

§ 1910.177 (d) and (f).
§ 1910.178 (c) and (e).
§ 1910.179 (b)(6), (c), (d), (e), (f), (g), and (h).
§ 1910.180(c).

(c) Notwithstanding anything in paragraph (a), (b), or (d) of this section, any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation.

(d) Notwithstanding anything in paragraph (a) of this section, if any standard in 41 CFR Part 50-204, other than a national consensus standard incorporated by reference in § 50-204.2(a)(1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal Standard in this Subpart N which is derived from 41 CFR Part 50-204 shall also become effective and shall be applicable to such employment and place of employment, on the same date.

16. In § 1910.211 of Subpart O, paragraph (d)(45) is revised to read as follows:

§ 1910.211 *Definitions.*

• • • • •

(d) • • •

(45) "Point of operation" means the area of the press where material is actually positioned and work is being performed during any process such as shearing, punching, forming, or assembling.

• • • • •

17. In § 1910.217 of Subpart O, paragraphs (a)(2) and (b)(7) (v) and (vi) are revised to read as follows:

§ 1910.217 *Mechanical power presses.*

(a) *General requirements.* • • •

(2) *Former installations.* All mechanical power presses installed prior to August 31, 1971, shall be brought into conformity with the requirements of this section not later than August 31, 1974.

• • • • •

(b) *Mechanical power press guarding and construction, general.* • • •

(7) *Machines using part revolution clutches.* • • •

(v) Two-hand controls for single stroke shall conform to the following requirements:

(a) Each hand control shall be protected against unintended operation and arranged by its location, construction, and/or separation so that the concurrent use of both hands is required to trip the press.

(b) The control system shall be designed to permit no adjustment which will require concurrent pressure from both hands during the die closing portion of the stroke.

(c) The control system shall incorporate an antirepeat feature.

(d) The control systems shall be designed to require release of all operators' hand controls before an interrupted stroke can be resumed. This requirement pertains only to those single-stroke, two-hand controls manufactured and installed on or after August 31, 1971.

(vi) [Revoked]

• • • • •

18. Section 1910.220 of Subpart O is revised to read as follows:

§ 1910.220 *Effective dates.*

(a) The provisions of this Subpart O shall become effective on August 27, 1971, except as provided in the remaining paragraphs of this section.

(b) The following provisions shall become effective on February 15, 1972.

§ 1910.212(a).
§ 1910.213 (a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k), (l), (m), (n), (o), (p), (q), and (r).
§ 1910.214 (a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k), (l), (m), (n), (o), (p), (q), (r), (s), (t), (u), and (v).
§ 1910.215 (a) and (b).
§ 1910.216 (a), (b), (c), and (f).
§ 1910.217 (a), (b), (c), and (d).
§ 1910.218 (a), (b), (d), (e), (g), and (j).
§ 1910.219 (b), (c), (d), (e), (f), (g), (h) (i), and (k).

(c) Notwithstanding anything in paragraph (a), (b), or (d) of this section, any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation.

(d) Notwithstanding anything in paragraph (a) or (b) of this section, if any standard in 41 CFR Part 50-204 other than a national consensus standard incorporated by reference in § 50-204.2(a)(1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this Subpart O which is derived from 41 CFR Part 50-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

§ 1910.242 [Amended]

19. Paragraph (c) of § 1910.242 of Subpart P is revoked.

20. Section 1910.215 of Subpart P is revised to read as follows:

§ 1910.215 *Effective dates.*

(a) The provisions of this Subpart P shall become effective on August 27, 1971, except as provided in the remaining paragraphs of this section.

(b) The following provisions shall become effective on February 15, 1972.

ST8683/29

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