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DOW-489

THE DOW CHEMICAL [illegible]

REPORT

AUG 31 1951

D.D.I.

INDUSTRIAL HYGIENE SURVEY OF VARIOUS OPERATIONS AT THE CHLORINE CELLS, BLDGS. 261, 196, 137, 295, 236, 270, 303, 207.

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BIOCHEMICAL RESEARCH DEPARTMENT

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I am an author of and have read this report comprising 18 pages with ---- pages of drawings, photographs, graphs, and checked the data herein against the original entries under Biochemical Laboratory File Number T34.21-21-3

Signature E. J. Schneider Date 4-10-51

Signature _____ Date _____

I finished typing this report on 4/6/51 comprising 18 pages and placed therewith ----- pages of drawings, photographs, graphs from an original draft given me by _____ on _____.

I have placed in the plant mail 4 copies of this report for transmittal to

I. F. Harlow, Bldg. 309 (1)
W. R. Perry, Bldg. 261 (1)
Medical Dept. Bldg. 256 (1)
Att: H. H. Gay, M. D.
Safety Department (1)
Att: S. M. MacCutcheon, Bldg. 401

Signature Eunice Chandler Date 4/6/51

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Biochemical Research Department

THE DOW CHEMICAL COMPANY

Sub[redacted] HYGIENE SURVEY [redacted] OPERATIONS AT [redacted] CELLS, BLDGS. [redacted], 196, 137, 295, 236, 27[redacted], 303, 207.

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Work by H. Hoyle
E. J. Schneider

D. Waddams 4-30-51

E. J. Schneider 4/10/51

to:

I. F. Harlow, Bldg. 309 (1)
R. M. Hunter, Bldg. 261 (1)
W. R. Perry, Bldg. 261 (1)
Medical Department (1)
Att: H. H. Gay, M. D., Bldg. 256
Safety Department (1)
Att: S. M. MacCutcheon, Bldg. 401

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SUMMARY AND CONCLUSIONS

1. Significant amounts of chlorine, sufficient to [redacted] inflammation and swelling of the respiratory system from [redacted] periods of exposure, were found in areas where men were working on and among the chlorine cell series.

2. Men working in these areas have been getting by without severe exposure by using respirators, however, it must be kept in mind that excessive amounts of chlorine above the maximum allowable concentration of 1 p.p.m. for an eight-hour exposure do exist among the cell series.

[redacted]sive amounts of chlorine were found in the making [redacted] solution at the cell brine plant, 303 building.

[redacted]ve concentrations of chlorine occurred in the loading of ton cylinders with liquid chlorine when the delivery line became plugged and insufficient time was taken to purge the connecting lines to the cylinder before removing them.

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5. No excessive amounts of chlorine were found during the normal [redacted]ders and no odor of chlorine was noticed durin[redacted]s to purge, test and load tank cars.

[redacted]amounts of chlorine and sulfuric acid were found while dumping the sulfuric acid drying tower to the sewer.

7. No excessive amounts of alkali dust were found among the chlorine cell series.

8. No significant amounts of mercury vapor were found at the discharge of the vacuum pumps for the mercury arc rectifiers.

9. Excessive amounts of pitch dust must be considered to exist, since men who are working at the pitch grinding opera[redacted] do become photo-sensitized and must limit their outdoor acti[redacted]

10. Large amounts of graphite dust were found durin[redacted] loading of plates into the buckets to be impregnated with phenol formaldehyde resin solution. Since the loading operation involves only an hour or so, the exposure to the graphite dust can not be considered excessive.

11. The graphite dust concentrations found in the machine shop were well within the limits for an inert dust.

12. The worker using the band-saw was found to be exposed to more fine dust than workers at the other machines, possibly becaus[redacted]t exhaust ventilation provided.

[redacted]e amounts of formaldehyde or phenol vapors were found during the making of the phenol formaldehyde resin or during the various drumming operations.

14. The millions of particles per cubic foot of air of asbestos was fo[redacted]er than the maximum allowable concentration of 5 for an eigh[redacted]ure for the handling of dry asbestos in covering the cell diaphragms. Since the exposure occurs only eighteen times a day for a short period with a total exposure of less than two hours, the amounts of asbestos found cannot be considered excessive

CHLORINE

I. Significance of Chlorine Exposure

1. For many years a gas concentration of 1 p.p.m. (by volume) has been used as a standard for evaluating workmens' exposures. Recently there has been some expression of opinion that 2 or 3 p.p.m. could be tolerated up to 8 hours daily without adverse effect. Gas concentrations much above 3 p.p.m. unquestionably produce irritation (tissue injury) to the eyes, nose, and throat; concentrations above 10 p.p.m. may cause serious effects on single relatively short exposures. Beginning at about 3 p.p.m. chlorine causes unmistakable pai in the eyes, nose and throat to which very little tolerance develops. This painful action serves as an excellent warning of the presence of harmful concentrations of gas. There appears to be no evidence of chronic effects from repeated exposures at concentrations of less than 2-3 p.p.m. (concentrations having no immediate acute effects). Repeated exposures [redacted].m., however, may maintain an irritation of the eyes [redacted]y passages, produce an erosion of the teeth, and possibly a nonspecific debility.

2. To a large extent the data of Table I, II, III, and IV merely [redacted] expression to what has been apparent by sensory [redacted] and experience, that excessive gas concentrations are encountered rather frequently if not routinely. Considering the nature of the operations and that much chlorine comes from unpreventable or accidental leaks, it may not be practical to reduce these concentrations of chlorine. Accordingly, it is necessary to emphasize the need for proper respiratory protection, the training of workmen, and the provisions for handling leaks. The results emphasize the desirability of medical examinations to assure the workmen are receiving adequate personal protection. If the men show no evidence of injury that is persistent or frequent, then our principal additional recommendation is that every opportunity to lessen chlorine contamination be utilized.

II. Observation and Presentation of Data

1. The odor of chlorine was ever present throughout the cell buildings and from time to time it was noticed that the men were required to use their respirators in order to go about their work.

2. Air samples were collected at several locations and on different days. The results of the air analyses are collected in Table I [redacted] be compared with the accepted maximum allowable [redacted] of 1 p.p.m. for an eight-hour exposure.

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TABLE I

Vapor Concentration of Chlorine Found
Among the Cell Series in Building 137

Location		p.p.m. (by Volume)	
1. Center aisle between series 45 and 46	(10-4-49)	1.44	and cloudy/raining
2. Center aisle between series 41 and 42	(10-4-49)	0.72	" " "
3. Center aisle between series 37 and 38	(10-4-49)	0.31	" " "
4. Center aisle between series 33 and 34	(10-4-49)	0.31	" " "
5. Between series 45 and 47	(10-4-49)	0.31	" " "
6. Between series 41 and 43	(10-4-49)	2.16	" " "
7. On top series 43	(10-5-49)	1.13	cool and clear
8. Between series 46 and 48	(10-5-49)	6.80	" " "
9. Between series 42 and 44	(10-5-49)	4.00	" " "
10. On top series 46	(10-5-49)	3.30	" " "
11. Between series 35 and 37	(10-5-49)	1.44	" " "
12. On top series 35	(10-5-49)	1.44	" " "
13. Between series 31 and 32	(10-5-49)	2.16	" " "
14. Between series 38 and 40	(10-5-49)	1.13	" " "
15. On top series 36	(10-5-49)	1.13	" " "
16. Between series 32 and 34	(10-5-49)	0.31	" " "
17. Near compressors	(10-5-49)	0.31	" " "
18 Center aisle near 13,14,15,16,17,18 series		0.31	" " "
19. On top series 39 repairing leak	(10-6-49)	2.16	and cloudy /raining
20. Near two mechanics repairing compressor	(10-4-49)	4.40	" " "
21. On top series 46 (when back pressure operator added water)	(10-6-49)	7.30	" " "
22. Between series 15 and 17	(10-6-49)	0.72	" " "
23. On top series 15	(10-6-49)	0.31	" " "
24. Between series 16 and 18	(10-6-49)	1.44	" " "
25. On top series 16	(10-6-49)	0.72	" " "
26. On top series 36 repairing leak	(11-18-49)	3.29	cool and clear

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TABLE II

[redacted] Concentration of Chlorine Found among the Chlorine Cell Series in Building 295

	Location		p.p.m. (by Volume)
1.	Between series 93 and 95	(11-18-49)	0.36 clear and coc
2.	Between series 92 and 94	(11-18-49)	0.36 " " "
3.	Between series 93 and 95 and on top	(11-18-49)	0.72 " " "
4.	On top series 103	(11-18-49)	1.53 " " "
5.	On top series 104	(11-30-49)	1.13 " " "
6.	On top series 110	(11-30-49)	0.36 [redacted] "
7.	On top series 109	(11-30-49	4.4 "
8.	On top series 103	(11-30-49)	3.6 "
9.	On top series 101 (men setting it up)	(11-30-49)	14.8, 9.4 "
10.	On top series 99	(11-30-49)	11.5 " " "
11.	On top series 98	(11-30-49)	10.8 " " "
12.	Center aisle near series 92, 93, 94, 95	(11-30-49)	2.56 " " "

3. In the chlorinating of the cell caustic for bleaching solution at the cell brine plant no irritating or excessive amounts of chlorine escaped during the normal operation.

The results of air analyses collected during the preparation of the bleach solution are shown in Table III

TABLE III

[redacted] Concentrations of Chlorine Found in the Making of Bleach Solution, Building # 303

	Location	p.p.m. Chlorine (by Volume)
1.	Platform near tank for making bleach solution. In the fumes at the start of bubbling chlorine through the sodium hydroxide	1.1
2.	In the fumes after one-half hour of bubbling	1.1
3.	In the fumes after one-hour of bubbling and finishing batch up	1.1

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4. The possibility of exposure to chlorine vapors during the loading of tank cars and cylinders was investigated, sensory perception usually being employed as a measure of exposure. If a good vacuum was pulled on the tank car and the connecting lines purged, there was little chance for exposure when removing the valves and testing the car for moisture. With properly repaired valves and tight connections, there was no exposure during loading.

5. In the loading of cylinders, an inside job, there was more chance for exposure to chlorine. During one visit the delivery line for the liquid chlorine became plugged. In removing the connecting lines, insufficient time was allowed for purging and excessive amounts of chlorine were found to exist.

6. During normal operation of the filling of the cylinders no excessive amounts of chlorine were found. The results of air analyses taken during the loading operation of ton cylinders are collected in Table IV.

Table IV

Vapor Concentrations of Chlorine Found During the Filling of Ton Cylinders of Liquid Chlorine, Bldg. 270 (11/15/50)

Location	p.p.m. (by volume)
1. Breathing zone of operator as he disconnected purge lines from empty ton cylinder	3.12
2. Breathing zone of operator as he disconnects lines from full ton cylinder of liquid chlorine (line became plugged and insufficient time was allowed for purging)	8.2

7. In the operation of changing the drying towers in the cell [redacted] enough concentrations of chlorine and sulfuric acid were [redacted] to saturate a respirator.

Table V shows the concentrations of chlorine found during this operation.

SULFURIC ACID (PLUS CHLORINE)

I. Significance of Sulfuric Acid Exposure

1. Sulfuric acid fume or mist has an acute irritating action not too different from that of chlorine. The problem presented by this mixture is practically the same as that presented by chlorine alone. The exposure is short and the concentrations sufficiently low that no great hazard is presented by the operation. It is one that occurs regularly, however, the one can question whether or not it is really necessary.

II. Observation and Presentation of Data

1. The odor of sulfuric acid fumes was masked by the chlorine. Air analyses during the operation showed the presence of considerable acid fumes, however, the exposure was of short duration.

2. The results of the air analyses are collected in Table V and [redacted] with the maximum allowable concentration of 0.25 [redacted] ht-hour exposure.

(Table V - page 9)

Table V

Concentrations of Chlorine and Sulfuric Acid Fumes Found During the Emptying of a Drying Tower to the Sewer, Building 137

Location	p.p.m. Cl_2 (by volume)	p.p.m. H_2SO_4 (by volume)
1. Operators breathing zone as he opens valve to release sulfuric acid from tower to sewer (first series of towers)	3.3 (5 min.)	5.7 (5 min.)
2. Area near sewer after the tower was dumped (first series of towers)	1.3	2.3
3. Operators breathing zone as he opens valve to release sulfuric acid from tower to sewer (second series of towers)	13.8 (5 min.)	3.9 (5 min.)
4. Area near sewer after the tower was dumped (second series of towers)	2.9	2.1

ALKALI DUST (PROBABLY SODIUM CARBONATE)

I. Observations and Presentation of Data

1. No maximum allowable concentration has been established for alkali, however, based on plant experience, no significant amounts of sodium hydroxide were found.

2. The presence of finely dispersed titratable alkali was checked by air analyses among the various cell series and the results are collected in Table VI.

Table VI

Concentration of Sodium Hydroxide Found Among the Chlorine Cells Series in Buildings 137 and 295

Location	Bldg. 137	Mgs./cu.meter as NaOH
1. On top of series 47	(10-6-49)	same as blank
2. Between series 45 and 47	(10-6-49)	"
3. Between series 41 and 43	(10-6-49)	"
4. Between series 50 and 48	(10-6-49)	"
5. Between series 42 and 44	(10-6-49)	"
6. Between series 14 and 16	(11-18-49)	2.44
7. Between series 34 and 36	(11-18-49)	2.44
8. Between series 15 and 17	(11-18-49)	2.18

Table VI (cont'd)
Bldg. 295

9.	Between series 92 and 94	(11-18-49)	1.95
10.	Between series 95 and 97	(11-18-49)	0.66
11.	Between series 109 and 111	(11-18-49)	0.80
12.	Between series 104 and 106	(11-18-49)	1.14

MERCURY

I. Observations and Presentation of Data

1. Air is constantly being evacuated from the mercury arc rectifiers and discharged into the rectifier room. The possibility of some mercury vapor being given off was checked by sampling at the outlets of the vacuum pumps. The results of the air analyses are collected in Table VII and can be compared with the maximum allowable concentration of 0.1 mg./cu. meter. These concentrations of mercury have no significance whatever.

Table VII

Vapor Concentrations of Mercury found in the Rectifier Room, Building 137 (11-13-50)

Location	Conc. Hg. Vapor (by volume)
1. Directly beneath the outlet of the low pressure vacuum pump for G-2 skid of mercury arc rectifiers	<0.006 mgs./cu. meter
2. Directly beneath the outlet of the low pressure vacuum pump for G-1 skid of mercury arc rectifiers	<0.006 mgs./cu. meter
3. Directly beneath the outlet of the low pressure vacuum pump for H-2 skid of mercury arc rectifiers	<0.006 mgs./cu. meter
4. General air taken between skids [redacted] circulating air shut off for winter conditions	<0.006 mgs./ cu. meter

PITCH

I. Significance of Pitch Exposure

1. Coal tar pitch from many different sources has produced a variety of effects in the skin: photosensitivity; acne and other dermatosis; pigmentations and growths, some of which are benign, others malignant. It is said that about half of the cancers attributable to occupational exposures are due to pitch. The heavier fractions and t ars of some petroleums and of shale oil have similar actions. One obtains the impression from published information that the rather heavy exposures among pitch workers cause a high incidence of skin injuries.

2. It is apparent that the men handling pitch in the chlorine cells come in direct contact with the material, resulting in prolonged and repeated contacts upon some portions of the body. The data in Table VIII indicate a moderately dirty atmosphere.

3. The data in Table IX represent counts of small particles, roughly of particle size 0.1 to 5 microns which may be inhaled. This data indicates that relatively small amounts of pitch dust are being inhaled. Since the literature contains no reference to toxic effects attributable to inhalation, we are not greatly concerned about inhalation of pitch dust.

4. Excessive skin contact with pitch dust is to be controlled by arrangement and design of the process to eliminate manual handling and dispersion of dust, by personal protection of workmen, and measures to assure a high degree of personal cleanliness. The clothing and bath requirements on these jobs have been indicated. It is recommended that the men working directly with pitch be given medical examinations at regular intervals.

II. Observations and Presentation of Data

[redacted] exhaust hoods had been installed to control the dust [redacted] grinding pitch. The men working on the pitch grinding equipment, however, through known experiences, are apparently exposed to amounts of pitch sufficient to cause photosensitivity.

2. The results of air analyses taken in the worker's breathing zone and in the work area during various operations encountered in pitch grinding are collected in Table VIII.

Table VIII

Dust Concentrations of Pitch Found During the Grinding and Handling Operations in Preparation of Making Cell Cement - Building 196

Location	Conc. Mgm/cu meter
1. Breathing zone of worker as he opens metal drum of pitch tar and breaks up the contents	65
2. Breathing zone of worker as he shovels broken pieces of pitch into the grinder and dumps buckets of pitch into mills	306
3. Breathing zone of worker as he rakes pulverized pitch from the cyclone and shovels it into the buckets	94
4. Breathing zone of worker as he sweeps area after grinding and filling buckets	453
5. Breathing zone of worker as he operates the cable hoist to dump bucket of pulverized pitch into hopper [redacted] the mixer	209,249

3. The results of dust counts taken in the general area and during the various pitch grinding operations are shown in Table IX.

(Table IX - page 13)

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Table IX

[redacted] Concentrations Found During the Various Pitch [redacted] operations and in the General Area

Location [redacted] zone samples taken [redacted] possible)	m. p. c. f. (average of several counts)
1. Shaking out broken pitch from metal drum	5
2. Breaking up lumps	7
3. Shoveling broken up pitch into grinder	8
4. Dumping buckets of ground pitch to mills	5
5. Sweeping up area where pitch is ground	7
6. Raking out pulverized pitch	5
7. Filling buckets with pulverized pitch	5
8. Sweeping area where buckets are filled	2
9. Dumping bucket to mixer	5
10. Gen. atmosphere near foreman's desk	5
11. Area in front of small mixer while dumping cement to the small mixer with pitch	4
12. Area in front of small mixer while dumping the pitch cement mix	4
13. Area in front of small mixer with men working on poured casting	5
14. Area of building where men are working to prepare the cell forms	5

GRAPHITE DUST

I. Sig[redacted]phite Dust Exposures

[redacted] a few reports of lung injury (pneumoconiosis) among persons working with graphite. Nearly all reports have dealt with natural graphite containing an appreciable amount of other minerals so that it is not definite that graphite dust alone has an adverse effect.

2. It is apparent that considerable amounts of graphite are dispersed in the air, but the counts of particles susceptible to inhalation fall [redacted] any exposures that are questionable. If workmen were regularly and uniformly exposed to counts of more than 50,000,000 particles per cubic foot, correction would be called for.

II. Observations and Presentation of Data

1. A dusty atmosphere was created when a worker used an air hose to remove the loose graphite from the plates before loading. There was still sufficient loose graphite remaining on the plates to make the loading of them very dusty.

2. The results of air analyses made during the loading operations are shown in Table X.

Table X

Dust Concentrations of Graphite Found During the Loading of Plates into the Buckets in Preparation for Pregnating with P.F., Bldg. 261

Location	Dust Conc. Mg./cu. meter
1. Breathing zone of worker blowing loose graphite off a stack of plates with an air hose (room closed up for winter conditions)	2260
2. Breathing zones of two workers as they load a bucket with graphite plates	2870

3. Several dust counts were taken during the plate loading and in the general atmosphere. The results of these counts are shown in Table XI. [redacted] values can be compared with the maximum allowable concentration [redacted] m.c.f. for an inert dust.

[redacted] counts were taken in the machine shop, both during the operation of the machines and in the general atmosphere through the area. The results of these counts are shown in Table XI also.

Table XI

[redacted] Concentrations of Graphite Found [redacted] the Loading of Plates and Various [redacted] in the Machine Shop.

Treating Room

Location (Sample taken in the breathing zone of worker whenever possible)		m.p.c.f. (average of several counts)
1. Blowing the loose graphite off the plates before loading them		50
2. General atmosphere in the room after blowing		35
3. Piling the plates into the buckets		50
4. General atmosphere of the treating room after finishing the loading of the plates	10 min.	20.1
	15 min.	28.3
	20 min.	35.2
	30 min.	30.8
	45 min.	43.0
5. General atmosphere in the treating room in the morning when the plates are unloaded		2.0

Machine Shop

6. General atmosphere in the machine shop early in the morning before work is started	7
7. Cutting corners off of boards at band saw	20
8. Running plates through bevel machine	8
9. Near new machine for grooving boards	10
10. [redacted] for grooving boards	9
11. [redacted] in machines	8
12. [redacted] from machines	9
13. Where operator sits after loading machines	10
14. Blowing small area from machines so board is locked in	11
15. Blowing machine off for cleaning	10
16. Sweeping up area around machines	8

(Table cont'd on page 16)

Table XI -(cont'd)

17.	General atmosphere near foreman's desk	8
18.	General atmosphere near crib	5
19.	General atmosphere other end of shop	5
20.	General atmosphere office area	4
21	Janitor sweeping floor	5

FORMALDEHYDE

I. Significance of Formaldehyde Exposures

1. None of the exposures measured during normal operation were excessive.

II. Observations and Presentation of Data

1. In the making of the phenol formaldehyde resin, the odor of formaldehyde was noticed throughout the room, however, only during the blowing of the mixing tank was there evidence of eye irritation.

2. In all cases where air analyses were made, the concentration of formaldehyde found was below the maximum allowable concentration of 5 p.p.m. The results of air analyses are collected in Table XII.

PHENOL

I. Significance of Phenol Exposures

1. None of the exposures measured during normal operation were excessive.

II. Observations and Presentation of Data

1. A little odor of phenol was noticed during the various operations of making phenol formaldehyde resin. The results of the air analyses can be compared with the concentration of 10 p.p.m. phenol found through past company experience to be an acceptable limit.

2. Table XII also shows the results of air analyses for phenol concentration.

Table XII

[redacted]ntrations of Formaldehyde and Phenol
[redacted]ng Various Operations of the Phenol
[redacted]e Resin Process, Building 236

Location (Winter conditions - doors and windows closed)	p.p.m. Formaldehyde (by volume)	p.p.m. Phenol (by vol
1. General air sample taken in front of reactor and near operator's desk (reactor up to temp.)	1.0	0.40
2. From an elevated platform between the reactor and mixing tank (reactor up to temp.)	1.0	0.87
3. Next to the mixing tank and operator's desk	0.44	
4. Near the mixing tank as phenol was blown in from trailer outside		0.69
5. Near the mixing tank as formaldehyde was pumped in from storage tank	1.27	
6. Near the mixing tank as air was blown to mix contents	2.8, 2.6	1.04
7. Near the mixing tank and operator's desk after blowing had stopped	4.0	
8. Near the vacuum still (operating) in the area where operator spends considerable time making insulating plugs	1.5	1.19
9. Breathing zone of operator filling 100 gal. drum with evaporated P.F. solution	2.9	1.11
10. Breathing zone of operator filling four 50-gal[redacted] utralized and evaporated P.F. [redacted] Texas Division	2.4	0.87
11. Op[redacted]ng zone filling six 50 gal[redacted]maldehyde for interplant use. (work done outside on cold, windy day)	.60	

ASBESTOS

I. Observ[redacted] Presentation of Data

1. [redacted]ing of dry asbestos in making up a slurry of caustic, water and asbestos does offer an exposure to finely divided particles of asbestos.

2. The results of dust counts taken in the breathing zone of a worker as he weighs, dumps, and stirs the asbestos into the slurry are shown in Table XIII. These values can be compared with the maximum allowable concentration of 5 m.p.c.f. for an eight-hour exposure. None of the exposures measured during normal operation were excessive since the duration of exposure is short.

Table XIII

Dust Concentrations Found During the Handling of Dry Asbestos in the Covering of Cell Diaphragms

Location (samples taken in worker'sbreathing zone)	m.p.c.f. (average of several counts)
1. Dumping bag of weighed asbestos (48 lbs.) to slurry tank	8
2. Stirring and mixing the asbestos with water	10
3. Weighing out a bag of asbestos	5

[redacted]

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Summary of Chlorine Concentration Bldg 139

		PPM
1.	Center aisle between series 45+46	1.44
2.	Center aisle between series 41+42	.72
3.	Center aisle between series 37+38	.31
4.	Center aisle between series 33+34	.31
5.	Between series 45+47	.31
6.	Between series 41+43	2.16
7.	On top series 43	1.13
8.	Between series 46+48	6.8
9.	Between series 42+44	4.0
10.	On top series 46	3.3
11.	Between series 35+37	1.44
12.	On top series 35	1.44
13.	Between series 31+32	2.16
14.	Between series 38+40	1.13
15.	On top series 36	1.13
16.	Between series 32+34	.31
17.	Near compressors	.31
18.	Center aisle near 13, 14, 15, 16, 17, 18 series	.31
19.	On top series 39 (repairing leak)	2.16
20.	Near mechanics repairing compressor.	4.4
21.	On top series 46 (under back press open added water)	7.3
22.	Between series 15+17	.72
23.	On top series 15	.31
24.	Between series 16+18	1.44
25.	On top series 16	.72
26.	On top series 36 repairing leak	3.29

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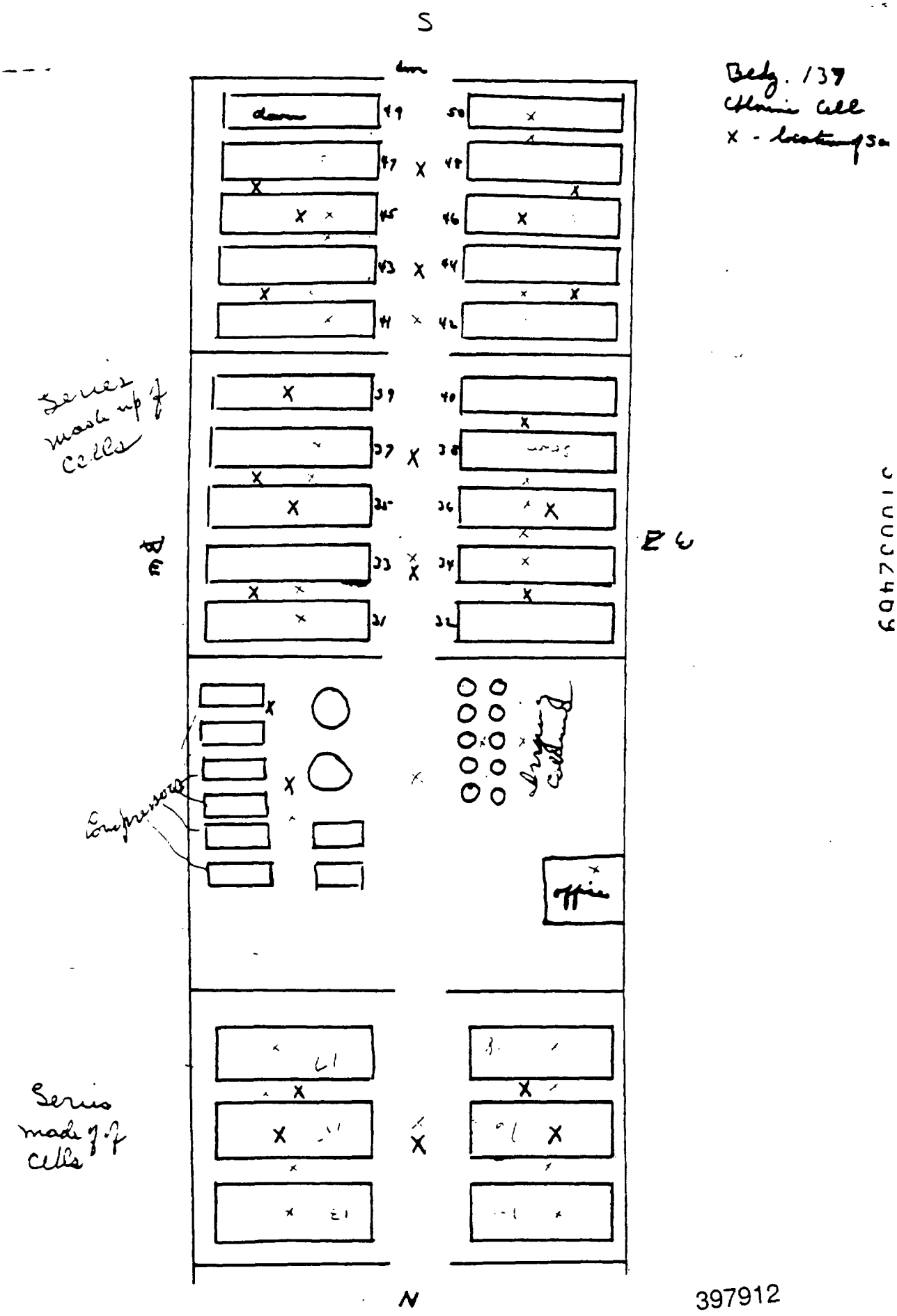
S
Bldg. 137
Chlorine Cell
X - location of Sa
Series made up of cells
Compressors
Irrigation Cell
office
Series made of cells
N

397912

Summary of Chloride Concentrations Dec 29th

		PPM
1.	Between series 93 + 95	.36
2.	Between series 92 + 94	.36
3.	Between series 93 + 95 and on top	.72
4.	On top series 103	1.53
5.	On top series 104	1.13
6.	On top series 110	.36
7.	On top series 109	4.4
8.	On top series 103 (flooded)	3.6
9.	On top series 101 (new working with top)	14.8, 9.4
10.	On top series 99	11.5
11.	On top series 98	10.8
12.	Center aisle new series 92, 93, 94, 95	2.56

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Gnl [illegible] - 236 [illegible]

[illegible] 8.6.6 =

[illegible]

56/54/48/53/62 273

[illegible]7/70/103/68/70 398

67.1

[illegible]

34.1 × 0.404 = 2.8 mpp[illegible]

5.0

ST0032570

Sample 2

[illegible]

Sample 3

[illegible]/141/150/166/166 715

161/159/153/170/101 735

145.0

33.0

112.0 × 0.404 = 9.0

5

398013

Dump & [illegible]	Dump pup	Weighout	Mix of M Cement	Cat [illegible]
[illegible]	34.4	40.8	3.2	1.9
[illegible]	27.1	[illegible]		6.1
[illegible]	27.8	[illegible]		1.2
	29.8	[illegible]		3.1
[illegible]		[illegible]		
13.4		15.1		

ST0032571

Grub rabbits	Area [illegible]	Area near [illegible]	Pist[illegible]
7.7	[illegible]	19.[illegible]	[illegible]
5.6	1.5	[illegible]	[illegible]
5.3	>30		1.2
2.8	>30		[illegible]
2.8			[illegible]
9.0			
5.5			

16.3

7.3

[illegible]
0.1
7.8
>30
>30
[illegible]

all these not >30

2.6 [illegible]

398014

Cell Maintenance

1 hr -	weigh bags	160 min
1-2 hrs -	out of asbestos	60
1 hr -	help on tanks	90
1-1½ hrs -	pins (clamps)	90
1-1½ hrs -	clean up around & stocking	400
5.0 hrs		480

Screen Makers

20
8
160
2
320 min to pull screen

160 min.

mix caustic - 5 min

10 min - to [illegible]

150 min in area [illegible]

total of ~~470 min~~/[illegible]

Cell Maintainance (2) - prep & dissamble old cells

assemble new cells:

(1) put screen into cell

(2) asbestos rope; putty; (rope & cement) (before screen)

(3)

ST0032572

398015

Pull screens (20 - 25 min)

Diaphram Pullers
Cell Maintainance

(1) load rinsed screen into tanks.
2) hook up suction in
3) stall pressure gauge
4) start slurry into vat
5) sink screen with asbestos
(6) pull off, sink again for 1 min
(7) pull off, stick out screen
8) set clamps
9) sink for 1 min
10) screen off [illegible], screen way up
(11) set guide rests; a chain.
(12) remove guides; run screen way up
ASBEST. (13) dump in 1 x 90 lb bag, 1 x 45 lbs bag of asbestos
4.2 (14) start evacuating vat, slurrying asbestos [illegible].
(15) after vat clean, pick up rinsed screen & load into tanks.

ST0032573

16 × 3 = 48
16
32 × 3 = 96

50

1 × 2 × 3 × 4 × 5 × 6 × 7 × 8 × 9 × 10 × 11 × 12 × 13 × 14 × 15 × 16

3.3 × 15 = 165 + 33 = 495

16 ⟌ 3.00

25 × 16 = 150 + 25 = 400

16 × 4 = 64 + 336

16 × 21 = 16 + 32 = 336

398016

Foremen - floor work 75%
- Office 15%
- 234 (237) etc. 10%

75% in Floor
20% on Operations
5% out of 295

Spares - (2)/day work in 295; ~~gmb - etc, any job.~~

ST00325574

U Van Summern -261 C 5573

pH control -

mix 1 bag/drum Liquid Chlorine Operator

of this (15-25 % spent in diaphram area).

Sr Cell Shop Mech. - 10 hrs/wk in 295 repair vac pumps, diaphrams pulling equipment, almost all by tasks

Journeyman Cell Shop Mech - 30 hrs/wk in 236 (near floor for Cell Mtnce

---

plasterer (295) works a top series, plasters tops on w/. cement & sand. very little Asbestos Exposure. Clean skids, tear down sacks (out of 295 Cell Mtnce 75% of time), 25% of time in cell maintce. open up, run washer, etc., set diaphrams (3 or 4 days in ½ year)

Series Maintnce. - work on floor at any job. (not once in 3 mos)

398018

ST0032575

SAMPLE RECORD

DOW

ATTENTION:

CPRL REPORT 202360

SEND REPORT TO	DEPARTMENT	BUILDING	DOOR
De Geseró	Biochem Res	1701	
EXTRA COPIES TO			

ACCOUNT NUMBER	LEDGER	ACCOUNT	SUFFIX	PROBLEM INDEX	DEPT.	PROBLEM	DATE SUBMITTED	DATE NEEDED
	8 2 3	0 1 2 1 9	0 2 6				5.15.69	ASAP

SAMPLE DESCRIPTION (identification number; name or structural formula; method of preparation)

TUBES 1, 4, 5

ST00032576

INFORMATION WANTED Identify & Quantify (% total crystalline)
Crystalline Phase

☑ RETURN SAMPLE BLDG. 1701 DOOR

☑ CALL RESULTS PHONE 64759

METHODS PREFERRED (SEE "MODERN METHODS OF RESEARCH AND ANALYSIS"): X-ray DIFF

PRECAUTIONS

☐ VERY TOXIC ☐ EXPLOSIVE ☐ LACRYMATOR ☐ NORMALLY NOT HAZARDOUS ☐ _____

☐ FLAMMABLE ☐ LOW BOILING ☐ SKIN IRRITANT ☐ PROPERTIES UNKNOWN _____

RESULTS

	-1	-4	-5
SERPENTINE	c.c.	c.c.	c.c. Chief constituent
CALCITE	5-15%	5-15%	10-20%
QUARTZ	~5.%	<5.%	5-10%
NaCl	10-15%	5-10%	10-20%
$Mg(OH)_2$	POSSIBLE TRACE IN EACH SAMPLE.		

NOTE: NO VALUE CAN BE DETERMINED AS TO THE AMOUNT OF CRYSTALLINE MATERIAL AND NONCRYSTALLINE MATERIAL PRESENT. THE SAMPLES COULD, HOWEVER, BE AS MUCH AS 50% NONCRYSTALLINE.

ANALYST L. R RUNBERG DATE 5-22-69

FORM C-1570 PRINTED IN U.S.A. R1-68

CHEMICAL PHYSICS RESEARCH LABORATORY BUILDING 1603 DOOR 4
THE DOW CHEMICAL COMPANY - MIDLAND, MICHIGAN 48640

398019

Asbestos in Cl Cells
ESP tubes 5 14.69
Degisero

m^3	ESP#	Tare ~~Gst~~		mg (Δ)g	mg/m³
(22.1)	1	48.1573	48.1814	0.0241	1.1
	2	~~50.0653~~	~~50.0618~~	[illegible]	
	?	~~48.6814~~	~~48.6481~~	[illegible]	
	4	47.2833	47.3050	[illegible]	0.7
	5	48.2047	48.2133	0.0086	0.7
	6	48.3677			

airflow ≈ 6.5 cfm = 184.08 l/min

ST0032577

398020

Use this form for historical data only.

Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34.21-21-3/5608 Date 0869

Building no. 295 Index no. _____

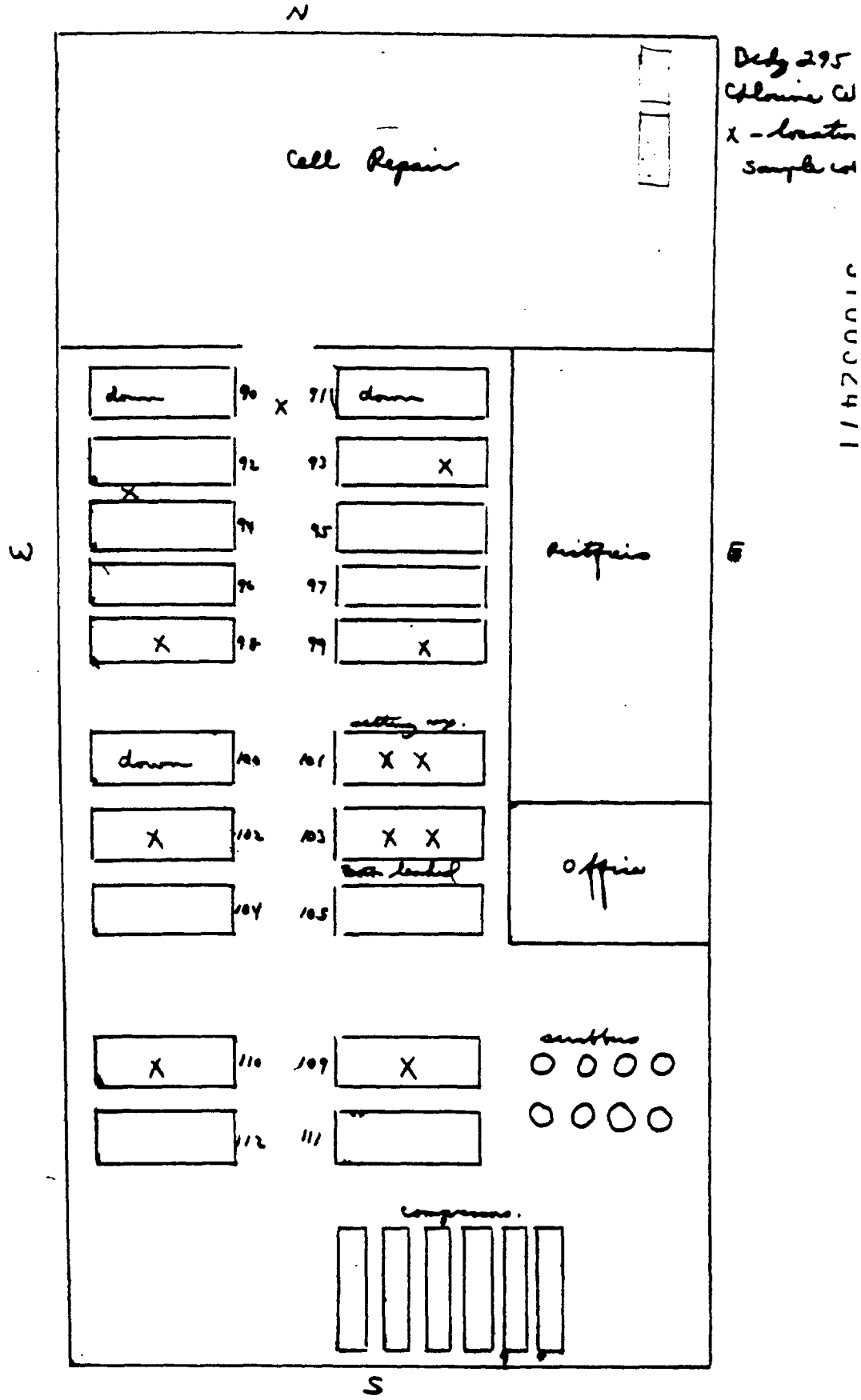
Units of Data X Respirator Worn? _____

Master no. _____

ST0032578

Job Classification	Job No.	Chemical Name: asbestos DR# 270713 TWA/Exc.	Chemical Name: _____ DR# _____ TWA/Exc.
diaphragm puller	775015	9.4/16.3	/
cell maintenance man	758025	6.3/29.8	/
cell maint. man	758025	2.7/5.5	/
cell maint. man	758025	1.7/7.3	/
Spare men	660755	0/5	/
Senior cell shop mechanic	590064	1.1/2.6	/
journeyman Cellshop mechanic	590055	1.1/2.6	/
foreman, crew leader	065755	1.1/1.1	/
plasterers	725755	1.3/14.9	/
		/	/
		/	/
		/	/
		/	/
		/	/
		/	/
		/	/
		/	/
		/	-

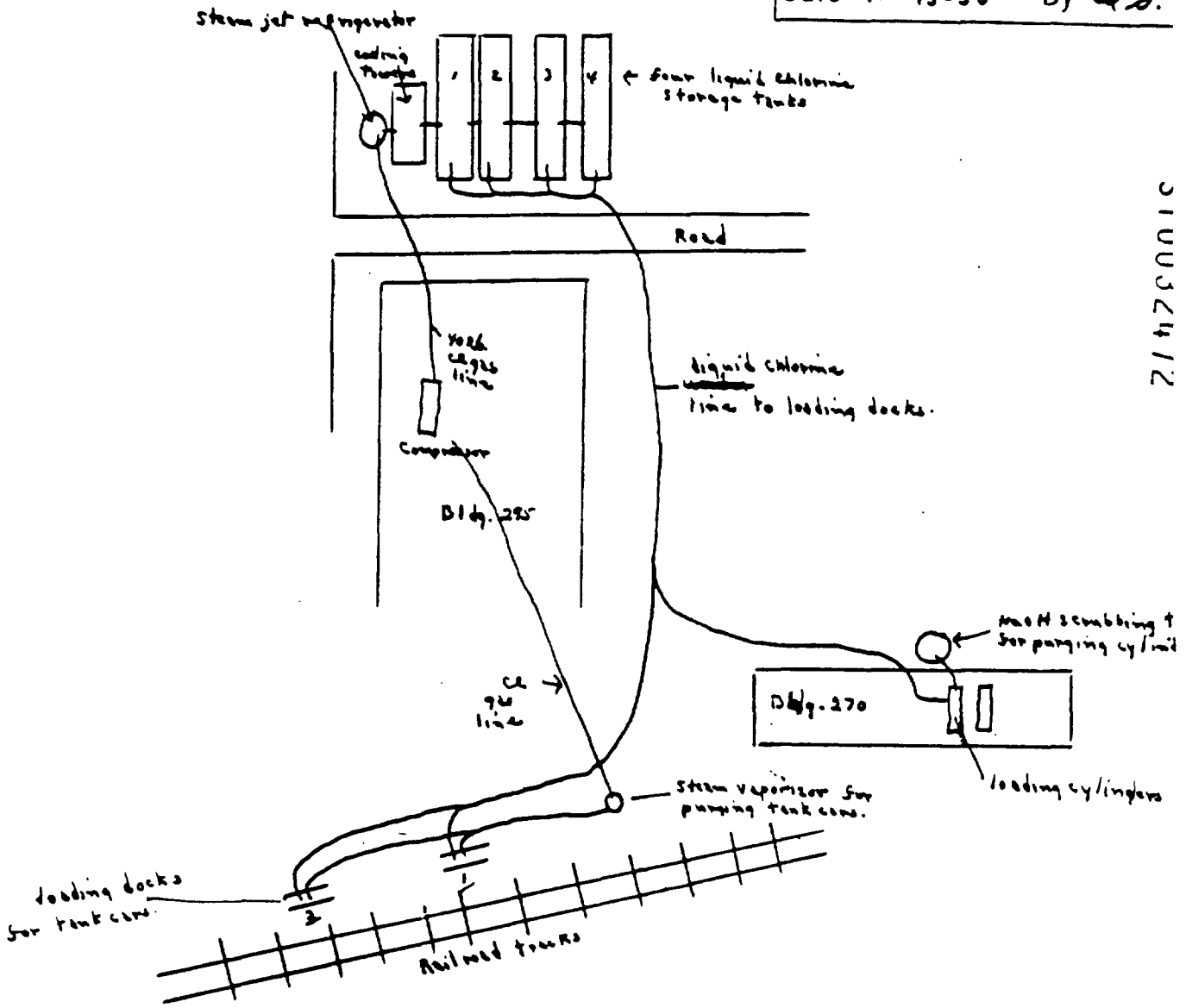
398021


N
Cell Repair
Bldg 295
Chlorine Cel
X - location
Sample col
down
90
X
91
down
92
93
X
94
95
96
97
X
98
99
X
W
E
Ristfiers
setting up.
down
100
101
X X
X
102
103
X X
Office
104
105
X
110
109
X
scrubbers
112
111
compressors.
S

397914

Prob. T3F.21-2/1-3 Bldg 270
Process Chlorine Cells.
Material Liquid Chlorine
Date 11-15-50 By C.L.S.

Chlorine Cells.
Liquid Chlorine



1. Liquid chlorine is made by pressurizing a 40 lb line to 90 lbs and in the summer cooled by steam jet refrigerator. In the winter the temperature of river water is cold enough to liquify the chlorine.
2. The liquid chlorine is stored in 4 tanks and a line is run to Bldg 270 where cylinders can be filled or to two loading docks for tank cars.
3. Cylinders are first purged into a tank of NaOH which is dumped every. all cylinders are washed and dried before refilling.
4. Tank cars are purged through a steam vaporizer which goes back into chlorine gas line.
5. Respiratory equipment is used by the men such as respirator, gloves, goggles

397915

ST0032473

Chlorine Cells
Liquid Chlorine

Prob. T34.21-21-3	Bldg. 27
Process Chlorine Cells	
Material Liquid Chlorine	
Date 11-15-50	By Ed D.

5. A vacuum is pulled on the tank car before running the valves. The valves are changed and new ones which have been tested for leaks are put on.
6. The car is inspected for moisture inside by dropping a small light to the bottom.
7. The tank car can then be hooked up for loading.
8. If the operator is careful and sure that he is using good tight valves and pulls a vacuum on the tank car before opening it there is little chance for an exposure to chlorine gas.

Filling Cylinders Bldg 270

1. Cylinders are first purged or blown into a tank of NaOH which sets outside the bldg. When caustic is used up the solution is dumped to sewer.
2. The cylinder ne then opened several plugs can be removed and the cylinder inspected. Ton cylinder do not need to be washed if OK but all small cylinders are washed and dried.
3. Clean plugs are put on and the cylinder is filled from the same line used for tank cars. A branch runs into the shed.
4. If operators are careful to have tight connections and purge their lines good there is little chance for exposure.

S# 3421213-90 Bottle 401 11-17-50 8 mins @ 3 liters/min

Sample collected in 25 ml of NaOH diluted to 50 ml using absorber and small pump with rotameter. Sample taken in breathing zone of operator as he disconnected purge line from empty ton cylinder. Odor of Cl_2 noticed but not irritating.

mg Cl/50 .215 24 liters

$\frac{.215}{24}$ = .00896 mg/l × 349 = 3.12 ppm Cl_2

S# 3421213-91 Bottle 210 5 mins

Sample taken in breathing zone of operator as he removes connections from cylinder after filling. Little Cl_2 left in line even though purged. Could taste Cl_2

mg Cl/50 .355

Operator opened outside doors to air out room.
Did not purge line long enough

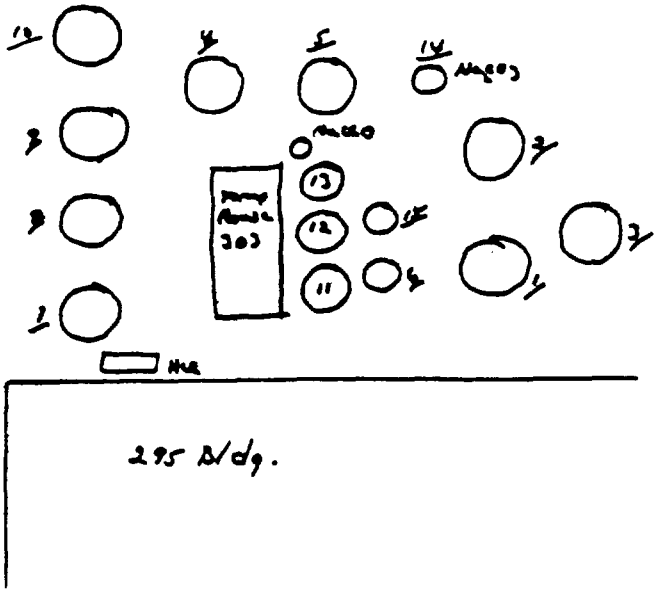
$\frac{.355}{15}$ = .0236 × 348 = 8.2 ppm Cl_2

397916

Prob. T34 21-21-3 Bldg. 30
Process Chlorine Cells.
Material Cell Brine Treating Plant
Date 11-16-50 By [illegible]

Chlorine Cells.

Cell Brine Treating Plant Bldg 303



1. Brine from wells which has been obtained by pumping water down the w[illegible] plus brine from West side evaporators and trench water from the cells all pass through a header over tank #11 which is a saturator. There are three saturators tanks 11, 12, 13 and two are used at a time. These tanks have a heel of salt about 25 ft deep through which the incoming brine passes and becomes saturated.

2. Brine from the wells has a lot of calcium in it also some amm[illegible] The calcium is removed by adding sodium carbonate and the ammonia by adding sodium hypo chloride.

3. The Sodium carbonate liquor is made by mixing cell liquor which is stored in tank 15 containing 10% caustic with trench water from the cells stored in tank #6. These two solutions are mixed so that there is 6% caustic or 60 gm/l which is then pumped to the Ca Mg domain at the lime house where a lime coming from the #10 boiler of the N-T powerhouse bubbles CO_2 through the mixt[illegible] This Na_2CO_3 solution is then pumped back to the brine plant and stored in tank 14 where it is pumped through the header with the saturators.

4. The bleaching liquor is made from passing chlorine gas through the cell liquor in a brick line tank next to the pump house and #13 tan[illegible] The sodium hypo chloride formed is pumped up to the saturators but not through the header.

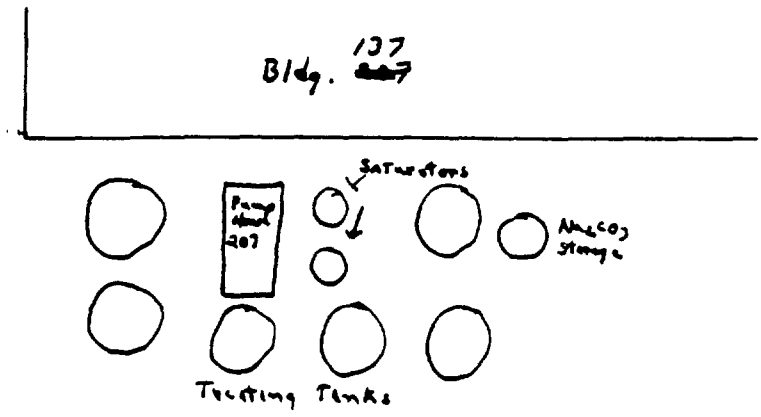
5. When the brine has come through the saturators it is pumped into tanks 1, 2, 3, 4, 5, 9 for settling. This is 100% saturat[illegible]

397917

Chlorine Cells.

Prob. TJY. 21-21-3 Bldg. 303 207
Process Chlorine cells.
Material Cell Brine Plant
Date 11-16-50 By EDS.

6. In these tanks it is adjusted with either more NaOH or $NaCO_3$ as needed have the right density. Some of these liquor is pumped to 207 brine cell plant for acidifying and use at 137 bldg.
7. The rest is pumped to tanks 7, 8, 10 for acidifying with HCl. The desired ph is between 7.8 - 8.2 and the feed brine will now contain approx 26% salt. This feed brine supplies 295 and 236.
8. The HCl is brought mostly from chlor benzol by trailer and stored in tank near tank 7 and pump house.
9. In the pump house there are two pumps for transferring from tanks to tank, two pumps for pumping to 207 bldg and 2 pumps for pumping $NaCO_3$ and cell liquor



1. Brine treated at 207 cell plant comes from G and E Evaporators. G evap brine has caustic in it and E evaporator has calcium in it. There is no well brine started with here.
2. The treating is the same as at the 303 brine plant with the brine first going through the saturators then out to the tanks to be settled and pumped to another tanks for acidifying.
3. As was mentioned, brine before acidify comes from 303 plant since bldg 137 needs more than what can be supplied by E & G evaporators.

Man noticed to have rubber gloves for obtaining samples but did not use eye protection

S1003247 5

397918

Cell Brine Plant

Prob. T34.21-21-3	Bldg. 303
Process Chlorine Cells.	
Material Cell Brine Plant	
Date 12-30-50	By [illegible]

10. The unloading of the HCl trailer to the storage tank is done by blowing. The operator hooks the lines to the trailer then can leave until the trailer has been blown over. Generally he can stand so that the wind carries any fumes away. There are usually 3-4 trailers of acid brought a d to unload.

11. In the making of bleach solution caustic is pumped from the cells 295 to a storage tank inside the pump house from which it is then pumped to the brick lined tank outside. Chlorine is allowed to bubble through the caustic until the desired cone of sodium hypochlorite is made. This generally takes ab an hour.

Again the operator needs only to occasionally watch so that it doesn't cat on fire or the caustic gets used up. One batch is made per shift generally.

S1003247 6

397919

Prob. 17.1-18-13 Bldg. 303
Process Chlorine Cells.
Material Chlorine
Date 12-5-50 By [illegible]

Cell Brine Plant

Preparing Bleach Solution

Samples collected in 25 ml of 4/10 NaOH then diluted to 50 ml. Rate 3 l/min.

S# 1711813-92 Bottle #235 15 mins

Sample collected from the platform near brick line tank finishing the bleach solution. Sample taken during the start of the blowing or bubbling of the Cl_2 through the NaOH solution. Taken in the fumes. no Cl_2 odor.

mg Cl/50 ml. .142

$\frac{.142}{45}$ = .00316 mg/l. x 349 = 1.05 ppm.

S# 1711813-93 Bottle 206 15 mins.

Sample collected same as above 1/2 later. no Cl_2 odor.

mg Cl/50 ml. .142

$\frac{.142}{45}$ = .00316 x 349 = 1.05 ppm.

S# 1711813-94 Bottle 250 15 mins.

Sample same as above about 1/2 later as the bottles were finished up.

mg Cl/50 ml. .142

$\frac{.142}{45}$ = .00316 x 349 = 1.05 ppm.

397920

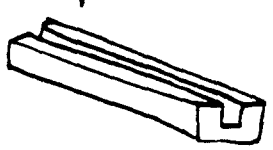
Chlorine Cells.
Making of the Cell.

Prob. T34-21-21-3	Bldg. 241 / 298 / 137 / 196
Process Chlorine Cells.	
Material Making of the cell.	
Date 11-10-50	By EJS

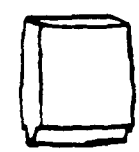
In 196 bldg we have the beginning assembly of the cell. The metal forms are set up and the outer shell is poured with the cement. This cement is a mixture of regular sand gravel water plus the pulverized pitch.

For one side of the cell there is a row of graphite boards set which have been grooved to hold the plates. The graphite plates are then beveled to fit the groove of the board and several plates are then laid.

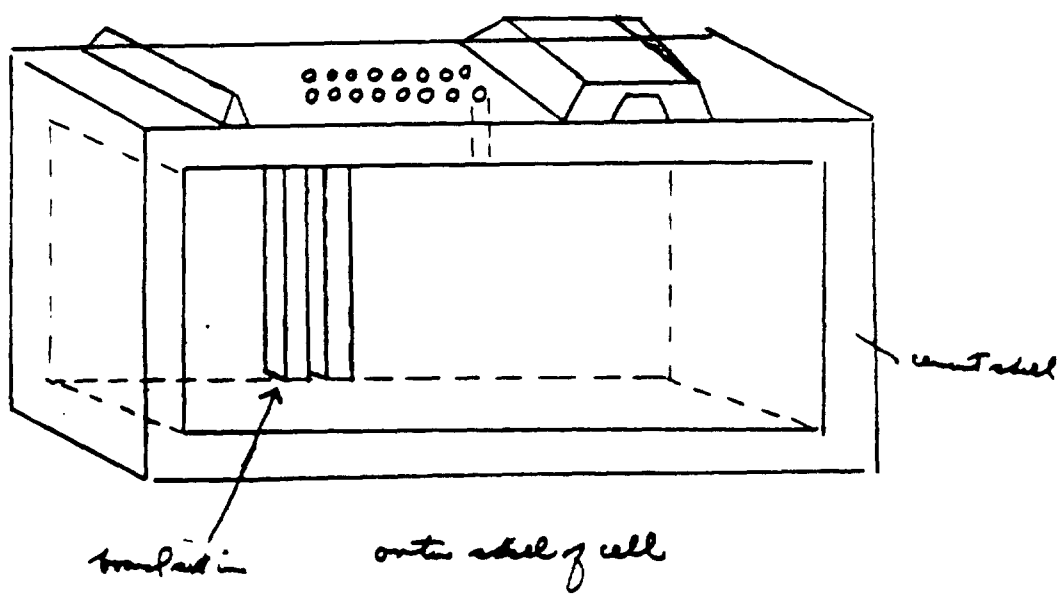
The seating of the plates is in a mixture of graphite and water which is in the form of a paste.



board



plate



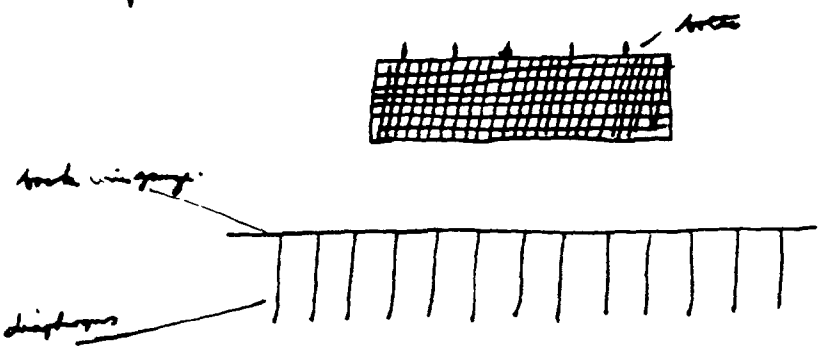
S10032478

397921

Chlorine Cells.
Preparing of the Diaphragm

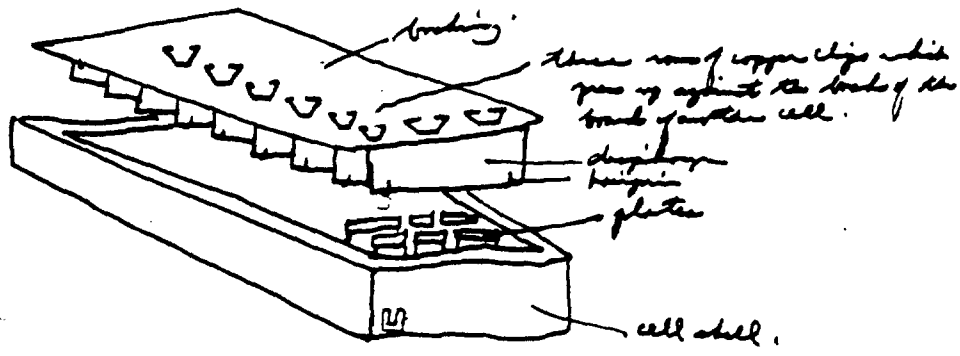
Prob. T34.21-21-3	Bldg.
Process Chlorine Cells.	
Material	
Date 11-10-56	By [illegible]

The cell diaphragm is made up of a series of small diaphragms which fit in among the plates and are fasten to a backing. The diaphragms are made of iron wire gauge or mesh.



An asbestos, coutre and water mixture is sucked on the diaphragms. This is done by dipping the diaphragm into a tank containing the solution into a suction hood fastened on the backing.

Phenol formaldehyde hairpins made of asbestos rope dipped in the PF solution are placed on the diaphragm to prevent the layer of asbestos from being rubbed off when the diaphragm is lowered into the cells and also keep it off the bottom. Small plugs of asbestos PF + sawdust mixture are also placed in the bottom of the cell to keep the diaphragm up off the bottom

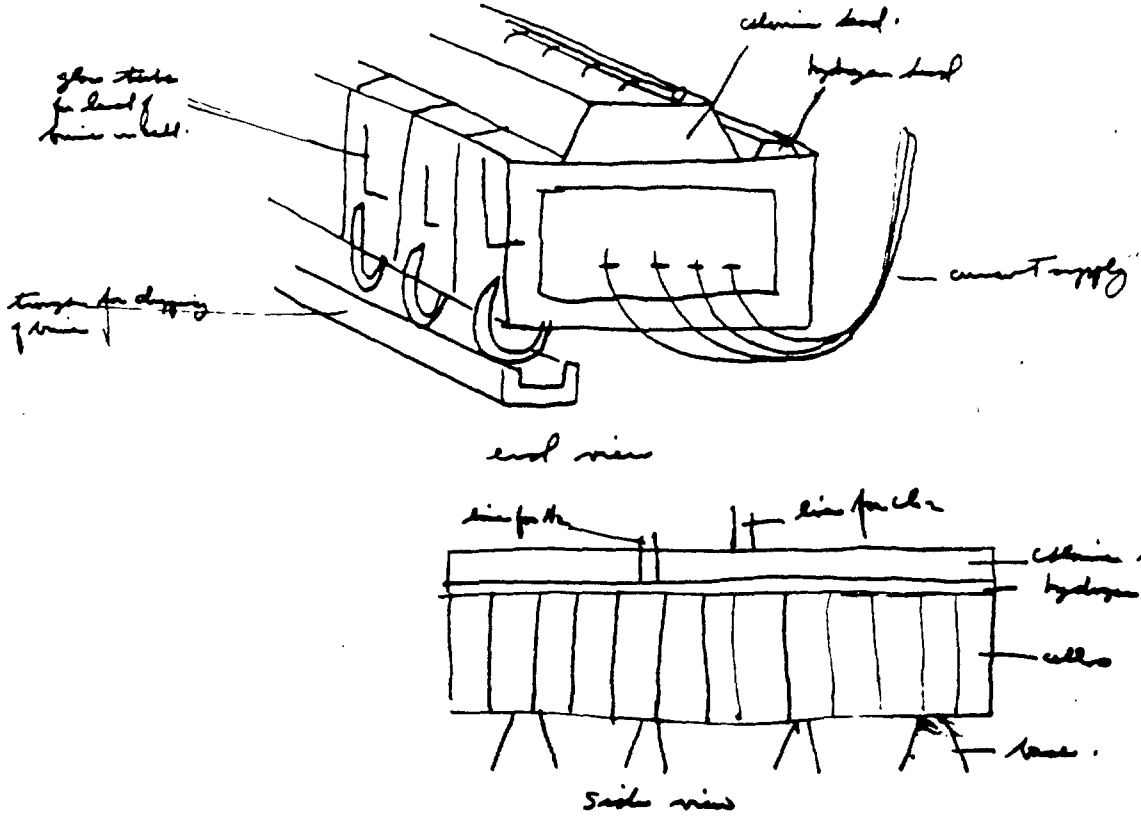


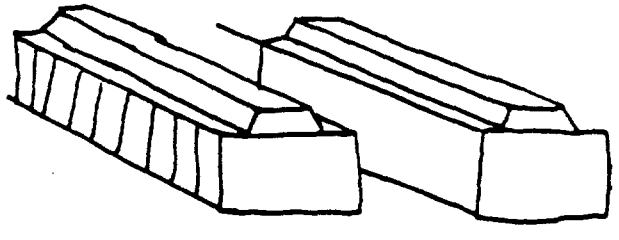
S10032479

397922

Prob. T 34.21-41-3 Bldg.
Process Chlorine Cells.
Material
Date 11-16-48 By CLS.

Chlorine Cells.
Forming of the Cell series.





397923

Prob. 34.21-21-3 Bldg. 295
Process Chlorine Cells.
Material Asbestos
Date 12-11-50 12-15-50 By C.J.S.

Putting Asbestos On the Diaphragms

Samples were collected for asbestos dust in the atmosphere using the Bausch and Lomb dust counter.

Samples collected in Breathing zone of Worker.

	m.p.c.f.
1. Dumping bag of weighed asbestos (48 lbs) to counter tank.	10.3, 2.6, 3.0, 11.9, 3.8,
2. Stirring and mixing the asbestos with water & NaOH	12.9, 7.8, 9.8, 5.5, 5.7, 11.5
3. Weighing out a fresh bag of asbestos.	7.5, 7.4, 3.7, 1.5, 1.7, 2.6, 5.6, 3.1

397924

ST0032482

TABLE 2

INHALATION EXPOSURE SUMMARY

JOB CLASSIFICATION Operators

FILE NO.	BLDG. NO.	PROCESS		
T34.2[illegible]	[redacted]	Chlorine cells		
CHEMICAL ENC[illegible]	[redacted]	Na OH	IND. HYG. STD. —	DATE FROM 10/6/49 TO:
TYPE OF OPERATION [redacted]				

DESCRIPTION OF ACTIVITY	EXPOSURE DURATION	EXPOSURE FREQUENCY	NUMBER OF SAMPLES	MEAN CONCENTRATION mg/m3	CONCENTRATION RANGE mg/m3
1. [illegible] other [illegible] [illegible] among the cells [illegible] 137 [redacted]	8 hrs	daily	11	0.96	<0.01 – 2.44

COMMENTS

ENVIRONMENTAL RESEARCH LABORATORY

BY [illegible] DATE 12/4/58

397925

Samples were taken using the midget impingers containing 10 ml of H_2O and the hand pump @ 11 to 12 in. of H_2O vacuum. Not much odor of Cl_2 noticeable. After 3 hrs have a rough feeling in throat. Rate 2.54 l/min

S# 3421213-27 10 min Tube #18

SSR 150-684

Form 34.21-21-3 Bldg. 137
Process Chlorine Cell 2
Material Na OH
Date 10-6-49 By H. H.

Sample taken on top of #47 series.
S. vol 26.4 l.
mg. na report < 0.006

S# 3421213-28 10 min Tube 8

Between #45 + 47 series
S. vol 26.4 l.
mg. na report < .006

S# 3421213-29 10 min Tube 12

Between #41 + 43 series
S. vol 26.4 l.
mg na report < .006

S# 3421213-30 10 min Tube 2

Between #50 + 48 series
S. vol 26.4 l.
mg na report < .006

S# 3421213-31 10 min Tube 17

Between #42 + 44 series.
S. vol 26.4 l
mg na Report < .006

S# 3421213-32 Tube 3
Blank
mg. na report < 0.006

397926

S. Inman says that when H_2 was wasted into the atmosphere enough caustic was carried with it to cause deposits of caustic dust on beams and the like. He stated that they had no dermatitis at that time as they have had 2 men who have had dermatitis. The one man ~~had~~ cleared up after being away from the job but suffered a recurrence when returned to the job the other man went to another job and cleared up. Inman thinks that caustic is the cause in both cases

Samples using the midget impingers containing 10 cc H_2O Hand pump @ 11 5/12 in. H_2O. Rate 2.64 l/min. all samples taken in the steam from the [illegible] was [illegible] Bldg 137 SSR 151-665

Prod. 34, 21-2-3 Bldg. 137 295
Process Cl₂ Cells
Material NaOH
Date 11-18-49 By H H

S# 3421213-32 no 3 10 min
Between circles 4 & 5
no evidence of NaOH
S. vol 26.4 l → 0.00244 mg/l → 2.44 mg/m³
mg. Na report 0.037 → mg. NaOH 0.0645

S# 3421213-33 no 17 10 min
Between 34 & 36 no evidence of NaOH.
S. vol 26.4 → 0.00244 mg/l → 2.44 mg/m³
mg. Na Report 0.037 → mg. NaOH 0.0640

S# 3421213-34 no 9 10 min 3.4 l/min
Between 15 & 17. nose tickled. E.J.S.
S. vol 34.0 l → 0.00218 mg/l → 2.18 mg/m³
mg. Na report 0.042 → mg. NaOH 0.073

Bldg 295 Rate 2.64 l/min.
S# 3421213-35 no 4 10 min
Between 92 & 94. no effects from NaOH
S. vol 26.4 l → 0.00195 mg/l → 1.95 mg/m³
mg. Na report 0.03 → mg. NaOH 0.052

S# 3421213-36 no 13 10 min
Between 95 & 97. no effects from NaOH
S. vol 26.4 l → 0.00066 mg/l → 0.66 mg/m³
mg. Na report 0.007 → mg. NaOH 0.0174

S# 3421213-37 no 10 10 min
Between 109 & 111. no effects from NaOH
S. vol 26.4 → 0.000795 mg/l → 0.795 mg/m³
mg. Na report 0.012 → mg NaOH 0.021

397927

[illegible]. 34.21-21-3 [illegible]. 295
[illegible] Cl_2 Cells
[illegible] NaOH
[illegible]-18-49 [illegible]

S# 3421213-38 no 12 10 min.
Between 104 + 106. no effect from NaOH
S vol 26.4 l → 0.00114 mg/l ≥ 1.14 mg/m3
mg. Na report 0.030 → mg. NaOH 0.052

S# 3421213-39 no 7

Blank.
mg Na Less than .004

397928

INDUSTRIAL HYGIENE SAMPLE RECORD

SAMPLING METHOD	SAMPLE RATE	PROBLEM	BLDG.	DATE
Sm Impinger	3 l/min	34.21-21-3	137 & 295	8-11-55

TRAPPING MEDIUM	ROTAMETER OR ORIFICE NO.	PROCESS
H_2O		Chlorine cells

ROTOMETER SETTING	OUTSIDE TEMP.	INSIDE TEMP.	MATERIAL
			Na_2CO_3

VENTILATION:

SAMPLE	BOTTLE	DESCRIPTION	TIME START	TIME STOP	CONCENTRATIC
9		137 Bldg 48 to 50 sample between	9:05	9:15	
[illegible] board hole leaking cell liquor					
thru pipe to floor. no skin irritation					
3	295 Bldg	Between 96 & 94	9:55	10:05	
normal operation no skin irritation					
		[signature]			
		8-11-55			

S10032486

1219-100 PRINTED IN U.S.A.

397929

CALCULATIONS RECORD

PROBLEM	RATE	MATERIAL	BUILDING	DATE
34.21-21-3		Na_2CO_3	137 295	8-22-5

MOL. WT.	CONVERSION ~~HAS OTHER~~ TO TOTAL
	1.74 to NaOH 2.3 to Na_2CO_3
ppm/mg/l	PROCESS Chlorine cells

EXPLANATION OF CALCULATIONS:

SAMPLE	TIME	S. VOL.	ANALYSIS	Mg./l.	as Na_2 CONC.
9	10 min	30 l	.0217	.00721	7.2 mg/l
3	10 min	30 l	.0323	.01075	10.75 mg/l
	SSR 216-632				
			H A Hayle		as NaOH
			8-22-55		
3	10	30	.0244	.0081	8.1
9	10	30	.01635	.00545	5.45

ST0032487

1220-100 PRINTED IN U.S.A.

397930

TABLE 3
INHALATION EXPOSURE SUMMARY
JOB CLASSIFICATION PF Resin Operator

FILE NO. 734.21-[redacted]
BLDG. NO. [redacted]
PROCESS Chlorine Cells
CHEMICAL EXCHANGED [redacted]
TYPE OF OPERATION [redacted]
IND. HYG. STD. 5 PPM
DATE FROM 11/7/50 TO:

DESCRIPTION OF ACTIVITY	EXPOSURE DURATION	EXPOSURE FREQUENCY	NUMBER OF SAMPLES	MEAN CONCENTRATION PPM	CONCENTRATION RANGE PPM
1. General atmosphere in the area of the operator's desk [redacted] to him.	4-6 hrs	daily	4	0.8	.44 - 1.0
2. Transferring of [redacted] with air	10-15 min	2-3/day	4	2.6	1.3 - 4.0
3. Loading drums with formaldehyde for plant use. (loaded outside)	10-15 min	occasional	1	0.6	
4. Loading drums with PF resin	30-45 min	daily	2	2.7	2.4 - 2.9

COMMENTS

BY [redacted] DATE 12/4/58

ENVIRONMENTAL RESEARCH LABORATORY

397931

TABLE 4

INHALATION EXPOSURE SUMMARY

JOB CLASSIFICATION PF Resin Operator

FILE NO.	BLDG. NO.	PROCESS
T34,21-2[redacted]		Chlorine Cells

CHEMICAL ENCOMPASSED	ING. HYG. STD.	DATE
[redacted] F.	5 ppM	FROM: 11/4/58 TO:

TYPE OF OPERATION

DESCRIPTION OF ACTIVITY	EXPOSURE DURATION	EXPOSURE FREQUENCY	NUMBER OF SAMPLES	MEAN CONCENTRATION	CONCENTRATION RANGE
				PPM	PPM
1 General atmosphere in the area of the operator's desk and adjacent tanks	4-6 hrs	daily	3	0.82	0.40 - 1.19
2. Sampling of [redacted] air	10-15 mins	2-3/day	2	0.87	0.69 - 1.04
3. Loading drums with PF resin.	30 Mins	daily	2	0.99	0.87 - 1.11

COMMENTS

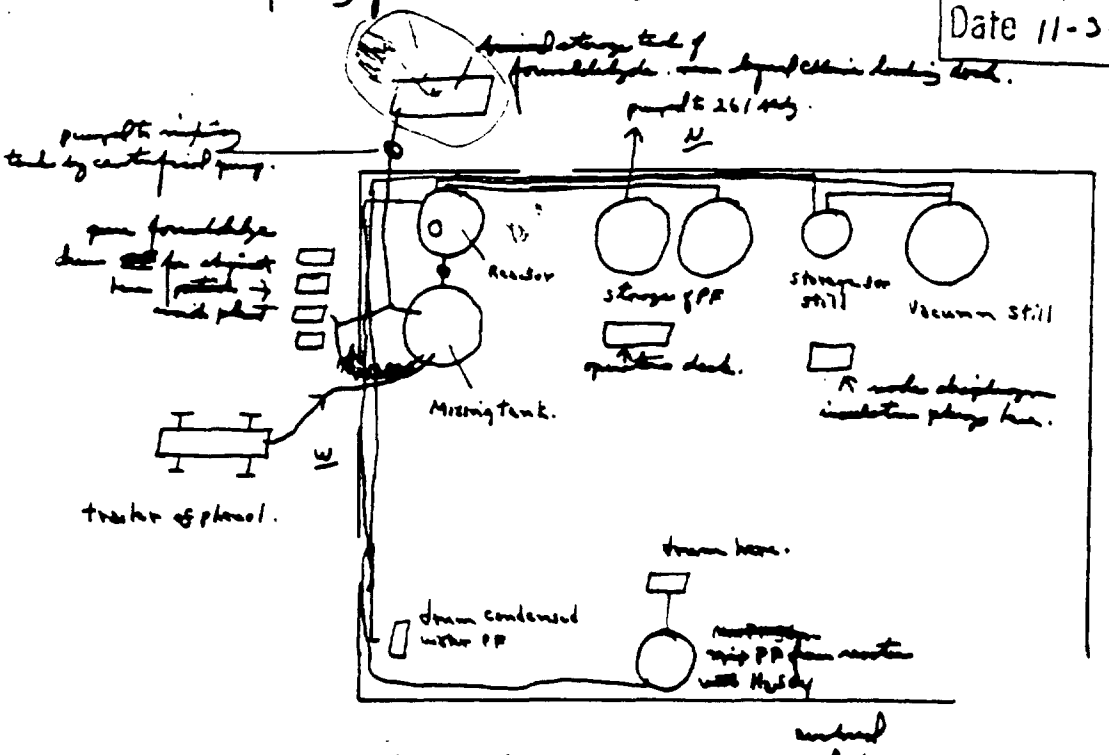
BY [redacted] DATE 12/4/58

ENVIRONMENTAL RESEARCH LABORATORY

397932

Prob 734.21-21-3 Bldg. [illegible]
Process Phenol Formaldehyde Resin
Material Phenol + Formaldehyde
Date 11-3-50 By [illegible]

Chlorine Cells.
Making of Phenol Formaldehyde Resin.



Formaldehyde and phenol are mixed in a tank with vent to roof in the ratio of 1.4 mole formaldehyde to 1 mole of phenol. This mixture is then pumped to a reactor where a catalyst of flaked caustic is added and the reaction allowed to go 6 hrs @ 60°C. Heat first applied by steam. This reaction makes 60% solids and is transferred to two storage tanks where it is pumped to 261 bldg as needed.

Some of the material from the reactor is loaded into the vacuum stills and 30% of the water is removed. This is then transferred to a storage tank and from this mixture insulation plays one mole for the diaphragm of the chlorine cells. Asbestos & sawdust is mixed with the condensed water PF.

This water mixture is sometimes neutralized with lactic acid and sent to Great Western and Texas for use in chlorine cells.

Some PF mixture is mixed with H_2SO_4 which furthers the reaction. This mixture is then used for patching compound in the cells.

When some organic acid like [illegible] acetyl chloride is added to the H_2SO_4 PF mixture it sets up hard.

Operator had rubber gloves to use when working with the phenol and flaked caustic but did not use eye protection.

The caustic is scoped into a pail and weighed then added to the screw feed.

397933

ST0032490

Prob. T 34.21-21-3	Bldg. 23[illegible]
Process Phenol Formaldehyde [illegible]	
Material Formaldehyde	
Date 11-7-50	By Ed [illegible]

Chlorine Cells

Samples were taken in 25 ml of 1/2% $NaHSO_3$ solution then diluted to 50 ml.
Used white pump with rotameter set 13.4 giving 3 l/min.

S# 3421213-60 10:20 am Bottle #139 15 mins.
Body entirely closed up with windows in for winter and the doors closed. Reactor had been running 3 hrs and up to temperature. Slight odor noticed. Sample collected in front of the mixing tank.
~~mg HCHO/50 ml .07~~
new method mg HCHO/50 .024 ~~[illegible] 1 ppm~~
$\frac{.024}{45}$ = .00053 × 815 = .44 ppm HCHO

S# 3421213-61 10:40 am Bottle 410 15 mins
Sample collected from an elevated platform between the reactor and the mixing tank. Slight odor noticed.
~~mg HCHO/50 ml < .05~~
new method mg HCHO/50 .055 ~~[illegible] 1 ppm~~
$\frac{.055}{45}$ = .00123 × 815 = 1.0 ppm HCHO

S# 3421213-62 Bottle 424 15 mins.
Sample collected in front of the PF storage tanks beside operators desk no odor.
~~mg HCHO/50 ml < .05~~
mg HCHO/50 .055 ~~[illegible] 1 ppm~~
$\frac{.055}{45}$ = .00123 × 815 = 1.0 ppm HCHO

S# 3421213-63 Bottle 423 15 mins.
Sample collected near the vacuum still (not operating) where operator sits and presses out plugs made from water condensed PF asbestos & sawdust
~~mg HCHO/50 ml < .05~~
new method mg HCHO .047 ~~[illegible] 1 ppm~~
$\frac{.047}{45}$ = .00104 × 815 = 0.85 ppm HCHO

S# 3421213-64 Bottle 406 1:45 pm 10 mins.
Sample collected near mixing tank as formaldehyde was pumped in slight odor at times.
~~mg HCHO/50 < .05~~
mg HCHO .047 ~~[illegible] 1 ppm~~
$\frac{.047}{30}$ = .00156 × 815 = 1.27 ppm HCHO

397934

Prob. T34.21-21-3 Bldg. 236
Process Phenol Formaldehyde Resin
Material Formaldehyde
Date 11-7-50 By CDS.

Chlorine Cells.

Samples collected in 25 ml of 1/2% $NaHCO_3$ solution then diluted to 50 ml.
Used white pump with rotameter set 13.4 giving 3 l/min.

S# 3421213-65 Bottle 403 2:00 pm 10 mins
Sample collected near mixing tank as air was applied to the mixture of phenol and formaldehyde. Eye irritation came in squirts. Room closed up and tank in sealed with rent to roof. 3 x 10 = 30 liters
~~mg HCHO/50 ml .07~~
new method mg HCHO/50 .1.02 ~~[illegible] 1 ppm~~
$\frac{.1.02}{30}$ = .0034 mg/l. x 815 = 2.8 ~~[illegible]~~ ppm.

S# 3421213-66 Bottle 405 2:30 10 mins.
Sample collected near mixing tank and operators desk after blowing was stopped. No odor or eye irritation noticed.
~~mg HCHO/50 ml < .05~~
new method mg HCHO/50 .15 ~~[illegible] 1 ppm~~
$\frac{.15}{30}$ = .005 x 815 = 4.0 ppm HCHO

S# 3421213-67 Bottle 252 11-8-50 11 mins.
Sample collected outside in box of operator as he filled 6 drums 50 gm with formaldehyde for plant use. Cool day with breeze. No eye irritation and very little odor noticed. (Has been rouge at times)
~~mg HCHO/50 ml < .05~~
new method mg HCHO/50 .024 ~~[illegible] 1 ppm~~
$\frac{.024}{33}$ = .00073 x 815 = .60 ppm HCHO

S# 3421213-68 Bottle 421 11-9-50 30 mins.
In front of vacuum still when operator sits making plugs. Still operating
~~mg HCHO/50 < .05~~
new method mg HCHO/50 .165 ~~[illegible] 1 ppm~~
$\frac{.165}{30}$ = .00183 x 815 = 1.5 ppm HCHO

S# 3421213-69 Bottle 419 11-10-50 10 mins
Sample collected in front of mixing tank as another batch or mixture was blown irritating to nose & eyes. 3 x 10 = 30 liters
~~mg HCHO/50 ml < .05~~
new method .095 mg HCHO/50 ml ~~[illegible] 1 ppm~~
$\frac{.095}{30}$ = .00316 mg/l x 815 = 2.6 ppm

397935

S1003249Z

Prob. T34.21-4-3 Bldg. 23(
Process Phenol Formaldehyde Re
Material Formaldehyde
Date 11-10-50 By CDS.

Chlorine Cells.

Samples were taken in 25 ml of 1/2% NaHSO3 then diluted to 50 ml.
Used white pump with rotameter set 13.4 giving 3 l/min.

5# 3421213 - 80 Bottle 123 6 mins

By of operator as he filled a 100 gal drum with evaporated PF. Operator does not stand over the drum all the time.

~~mg HCHO < .05~~

new method .065 mg HCHO ~~less than 1 ppm~~

$\frac{.065}{18}$ = .0036 x 815 = 2.9 ppm HCHO

5# 3421213 - 81 Bottle 404 18 mins.

By of operator as he filled 4 drums with evaporated and neutralized (with lactic acid) PF for Great Western and Texas Divisions. Temp of mixture 14°C.

~~mg HCHO < .05~~ ~~less than 1 ppm~~

new method mg HCHO .16

$\frac{.16}{54}$ = .00296 x 815 = 2.4 ppm HCHO

5# 3421213 - 82 Bottle
Blank.

~~mg HCHO .07~~

new method Nil

397936

Prob. T34.21-21-3 Bldg. 236
Process Phenol Formaldehyde Resin
Material Phenol
Date 11-7-50 By [illegible]

Chlorine Cells.

Samples collected in 1/10 NaOH 25 ml then diluted to 50 ml.
Used white pump with rotameter set 13.4 giving 3 l/min.

S# 3421213-70 Bottle 422 1:30 pm 10 mins
Sample collected near mixing tank as phenol from trailer outside was blown into the tank. slight odor.
mg phenol/50 .16 - .08 = .08 10 x 30 30 liters
$\frac{.08}{30}$ = .00267 mg/l. 0.69
.00267 x 260 = ~~[illegible]~~ ppm phenol

S# 3421213-71 Bottle 128 2:15 pm 10 mins.
Sample collected near mixing tank as air was blown into the mix of phenol and formaldehyde. Formaldehyde masks odor of phenol.
mg phenol/50 .20 - .08 = .12 3x10 = 30 liters
$\frac{.12}{30}$ = .004 mg/l. 1.04
.004 x 260 = ~~[illegible]~~ ppm phenol.

S# 3421213-72 Bottle 418 2:45 ppm 15 mins
Sample collected from platform between mixing tank and reactor. Material in both. 3x15 = 45 liters
mg phenol/50 .23 - .08 = .15
$\frac{.15}{45}$ = .00333 mg/l. 0.87
.00333 x 260 = ~~[illegible]~~ ppm phenol.

S# 3421213-73 Bottle 250 3:05 pm 15 mins.
Sample collected near the operators desk and PF storage tank
mg phenol/50 .15 - .08 = .07 3x15 = 45 liters
$\frac{.07}{45}$ = .00156 mg/l. 0.4
.00156 x 260 = ~~[illegible]~~ ppm phenol.

S# 3421213-74 Bottle 149 30 mins.
In front of the vacuum stall where operators into making plugs.
mg phenol/50 .49 - .08 = .41 3x30 = 90 liters
$\frac{.41}{90}$ = .00456 mg/l. 1.19
.00456 x 260 = ~~[illegible]~~ ppm phenol.

397937

Prob. T 34.21-21-3	Bldg. 236
Process Phenol Formaldehyde Resin	
Material Phenol	
Date 11-10-50	By [illegible]

Colonia Cells.

Samples were taken in 25 ml of N/10 NaOH then diluted to 50 ml.
Used white pump with rotameter set 13.4 giving 3 l/min.

5# 3421213-75 Bottle 235 7 mins

By of operator as he fills 100 gal drum of evaporated P.F. no odor noticed. Operator does not stand over drum all the time.

mg phenol/50 .17 - .08 = .09 3x7 = 21 liter

$\frac{.09}{21}$ = .00428 mg/l.

.00428 x 260 = 1.11 ppm phenol

5# 3421213-83 Bottle 412 15 mins

By of operator filling 4 drums of (50 gal) with evaporated and neutralized (with lactic acid) P.F. for Great Western & Texas Dionine

mg phenol/50 .23 - .08 = .15

$\frac{.15}{45}$ = .00334 mg/l 3x15 = 45 liter

.00334 x 260 = 0.87 ppm phenol

5# 3421213-84 Bottle
Blank.
mg phenol/50 .08

397938

TABLE 8

INHALATION EXPOSURE SUMMARY

JOB CLASSIFICATION Operators

FILE NO.	BLDG. NO.	PROCESS	
T34.21-2[illegible]	637	Chlorine Cell	
CHEMICAL ENCOUNTERED	Mercury	IND. HYG. STD. 0.1 mg/m³	DATE FROM: 11/13/50 TO:
TYPE OF OPERATION			

DESCRIPTION OF ACTIVITY	EXPOSURE DURATION	EXPOSURE FREQUENCY	NUMBER OF SAMPLES	MEAN CONCENTRATION mg/m³	CONCENTRATION RANGE mg/m³
1. The analyses made for evidence of mercury vapor at the outlet of vacuum pump [illegible] per min (not breathing [illegible])	—	—	4	<0.0063	<0.0063

COMMENTS

ENVIRONMENTAL RESEARCH LABORATORY

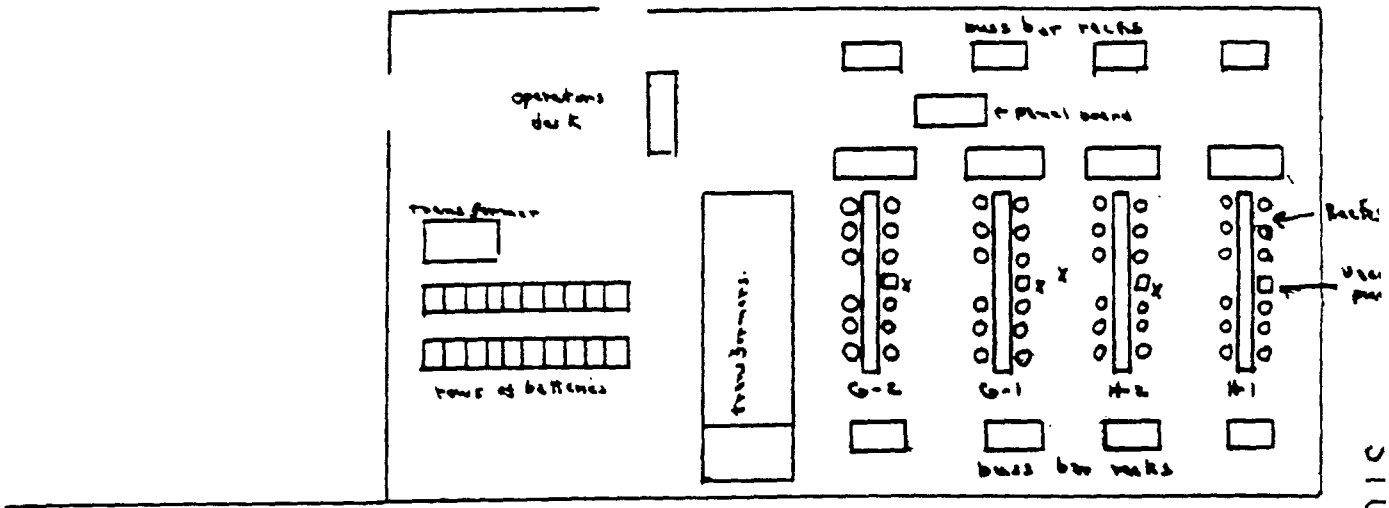
DATE 12/9/58

BY [illegible]

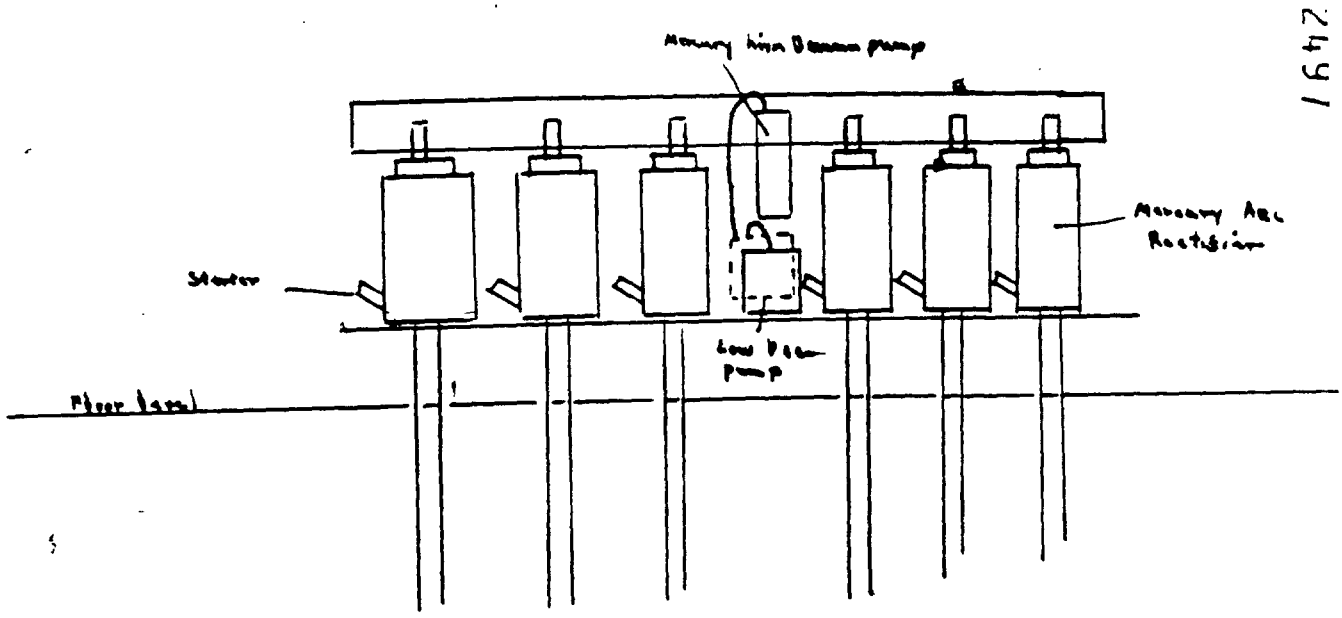
397939

Chlorine Cells.
Section of a Rectifier Room Bldg 137.

Prob. T3X.2[illegible]-3	Bldg. 137
Process Chlorine Cells.	
Material Mercury	
Date 11-13-50	By CDS.



X - sample points.



Side View of Mercury Arc Rectifier Skid

397940

Prob. T 3421-21-3 Bldg. 137
Process Chlorine Cells.
Material Mercury
Date 11-13-50 By [illegible]

Chlorine Cells.

Using the large impinger with 75 ml of 3% H_2 .25% KI solution samples were collected in the Rectifier Room for mercury vapor. Rate for sampling 1.5 cu ft/min

S# 3421213-85 Bottle 241 Imp #13 30 mins

Sample collected about 3-4 inches from the outlet of the low vacuum pump for G-2 Shield of mercury arc rectifiers.

The circulating air for the room was shut off since the weather out was cold enough to handle the heat of the rectifier.

mg Hg/75 ml <.008 Sample Vol. 45 cu ft. → 1.27

$\frac{.008}{45}$ = <.000178 mg/cu ft. $\frac{.008}{1.27}$ = <.0063 mg/cu meter

S# 3421213-86 Bottle 130 Imp #1 30 mins

Sample same as above under the outlet of vacuum pump for G-1

Sample Vol. 45 cu ft.

mg Hg/75 ml <.008

<.0063 mg/cu meter

S# 3421213-87 Bottle 147 Imp 12 30 mins

Sample as gen. air sample between shields G-1 + H-2.

Sample Vol. 45 cu ft.

mg Hg/75 ml <.008 <.0063 mg/cu meter

S# 3421213-88 Bottle 209 Imp #17 30 mins

Sample under the outlet of vacuum pump for H-2.

Sample Vol. 45 cu ft.

mg Hg/75 ml <.008 <.0063 mg/cu meter

S# 3421213-89 Bottle 169

Blank.

mg Hg/75 ml <.008 <.0063 mg/cu meter.

397941

TABLE 9

INHALATION EXPOSURE SUMMARY

JOB CLASSIFICATION Graph to Plate Impregnating Operators

FILE NO.	BLDG. NO.	PROCESS	IND. HYG. STD.	DATE
T34.21-26		Ch[illegible] Cells	15 mgs/m³	FROM: 11/6/[illegible] TO:

CHEMICAL ENGINEER [illegible]

TYPE OF OPERATION [illegible]

DESCRIPTION OF ACTIVITY	EXPOSURE DURATION	EXPOSURE FREQUENCY	NUMBER OF SAMPLES	MEAN CONCENTRATION	CONCENTRATION RANGE
				mgs/m³	mgs/m³
1. Breathing zone of operator blowing loose graphite from stack of graphite plates	3 min	several times/shift	1	2260	2260
2. Breathing zone of [illegible] loading plates into a camera.	10-15 min	several times/shift	1	2870	2870

COMMENTS

BY [illegible] DATE 12/9/58

ENVIRONMENTAL RESEARCH LABORATORY

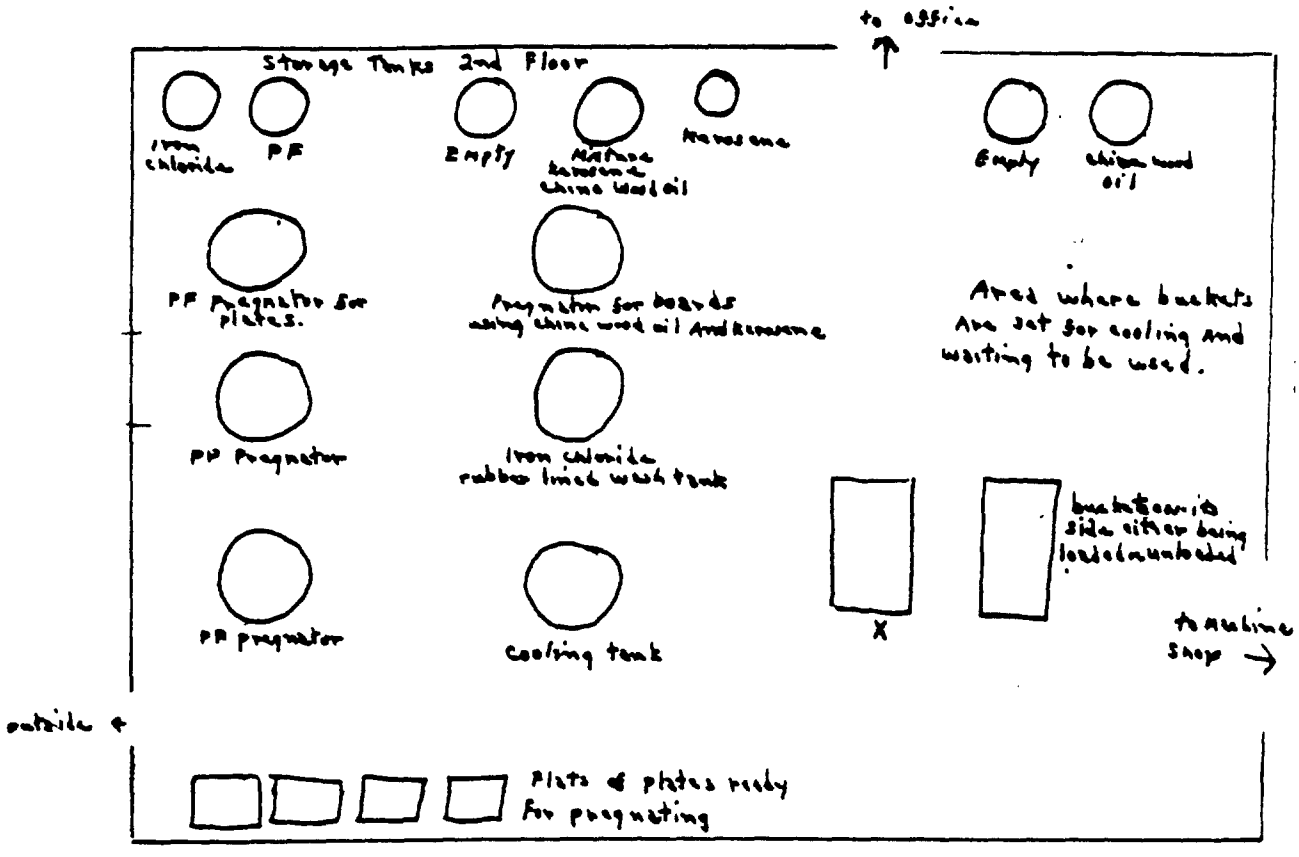
FORM C-3070 PRINTED IN U.S.A. 10-56

397942

ST0032500

Prob. T34 21-21-3	Bldg. 261
Process Chlorine Cells.	
Material Pregnating plates & Boards	
Date 11-6-50	By CJS.

Chlorine Cells.
Pregnating Room
Phenol formaldehyde Resin and
China wood oil (tung oil) and kerosene.



X - dust sample collected in breathing zone of 2 workers loading bucket with Graphite plates.

1. There is no significant exposure to phenol or formaldehyde in the pregnating of graphite plates with a phenol formaldehyde resin. When the hot bucket of plates is lifted out of the pregnator very little odor and no eye irritation was noticed.
2. In the pregnating of boards with chinese wood oil (tung oil) and kerosene the exposure to the hot fumes mixed in steam when the bucket was lifted from the pregnator was irritating to the eyes but little odor.

Since the exposure was of short duration (5 mins) and extensive analytical work would be necessary to obtain satisfactory chemical analysis of the exposure no attempts were made to determine it.

Men had rubber gloves but no eye irritation for protection

397943

Prob. 734.21-21-3	Bldg. 261
Process Pregnating Graphite Plate	
Material Graphite	
Date 11-6-50	By [illegible]

Chlorine Cells.

Loading of carriers with graphite plates for ~~[illegible]~~ inserting into a pressure vessel for pregnating with PF.

Samples collected with the electrostatic precipitator in the breathing zone of two workers as they blew loose graphite off of plates and loaded them.

S# 342/2/3 - 58 3 mins. = 9 liters

Breathing zone of worker as he blew the loose graphite from ~~off of~~ a stack of plates before loading them. Room filled with dust.

57.1005
57.0802
.0203 grs.

$\frac{20.3}{9}$ = 2.26 mgs / liter = 2260 mgs/cu m

~~$\frac{2.26}{28.3}$ = .798 mgs/cu ft~~

2.26 × 28.3 = 64.3 mgs/cu ft

S# 342/2/3 - 59 13 mins = 39 liters

Breathing zone of two worker's loading plates with the carrier. Dusty j

50.9796
56.8678
.1118 grs.

$\frac{111.8}{39}$ = 2.87 mgs / liter = 2870 mgs/cu m

~~$\frac{2.87}{28.3}$ = 1.012 mgs/cu ft.~~

2.87 × 28.3 = 81.3 mgs/cu ft.

ST0032501

397944

Prob. T34.21-21-3	Bldg. 26
Process Chlorine Cells	
Material Graphite	
Date 12-11-50 12-15-50	By Ed S.

Graphite Dust In The Preparating Room and Machine Shop.

Samples were collected for ~~[illegible]~~ graphite dust in the atmosphere using the Bausch and Lomb. Dust Counter.

Treating Room

1. Blowing the loose graphite off the plates on the slide before loading them to the buckets. 18.1, 27.2, 39.9, 69.5, 58.8, 69.4, 47.3,
2. General atmosphere in the room after blowing. 30.1, 31.4, 42.9,
3. BZ of two men piling the plates into the buckets. 25.8, 40.1, 84.6, 56.7, 37.4, 25.0, 69.1, 48.8, 54.4,
4. General atmosphere of room after finishing the loading of the plates.
   - 10 min after 26.1
   - 15 min after 28.3
   - 20 min after 35.2
   - 30 min after 30.8
   - 45 min after 41.0
5. General atmosphere in the room in the morning when the plates are unloaded. 2.8, 2.4, 1.9, 1.7

Machine Shop.

1. General atmosphere in the machine shop early in morning before work is started 8.1, 5.9, 6.0
2. B.Z. of worker cutting corners off boards at band saw. 20.1, 35.8, 7.2, 6.8, 27.2
3. B.Z. of worker working at the machine to ~~[illegible]~~ bevel the plates 6.6, 6.4, 10.3, 7.1 feed them in one end and stack them at the other
4. Near new machine for grooving boards. 10.0, 12.3, 11.7, 10.5,
5. Near old machine for grooving boards. 12.3, 13.1, 8.7, 4.2
6. Placing board in new machine 8.9
7. Placing board in old machine 7.2
8. Removing board in new machine 8.5,
9. Removing board in old machine 9.4
10. O.BZ sitting near machines after boards are loaded to machine 14.3, 10.6, 7.3,
11. Blowing small area from machines so board is locked in. 13.0, 9.5,
12. Blowing machine off for cleaning 5.7, 13.6, 12.0, 10.8, 11.1, 9.5
13. Sweeping up area around machines 6.5, 8.8, 7.0, 7.6, 8.3
14. General atmosphere near foreman desk. 8.0, 6.6,
15. General atmosphere near crib 5.1, 5.6,
16. General atmosphere other end of shop. 5.4, 6.7, 3.5,
17. General atmosphere office area 4.0, 3.1,
18. BZ Janitor sweeping floor. 4.2, 4.3, 5.2

397945

TABLE 11
INHALATION EXPOSURE SUMMARY
JOB CLASSIFICATION Cell Manufacture

FILE NO. T34.21-[illegible] | BLDG. NO. | PROCESS Chlorine Cells

CHEMICAL EN[illegible] | IND. HYG. STD. — | DATE

TYPE OF OPERATION [illegible] | FROM 11/3/[illegible] | TO

DESCRIPTION OF ACTIVITY	EXPOSURE DURATION	EXPOSURE FREQUENCY	NUMBER OF SAMPLES	MEAN CONCENTRATION mgs/m³	CONCENTRATION RANGE mgs/m³
1. Breathing zone of weiher breaking up chunks of pitch and [illegible] grind. Also includes cleaning up [illegible]	1-1½ hrs	daily	3	277	63-453
2. Breathing zone of [illegible] buckets with pitch, and then [illegible] contents into a mixer.	4 hrs.	daily	3	184	94-249

COMMENTS

BY [illegible] | DATE 12/7/58

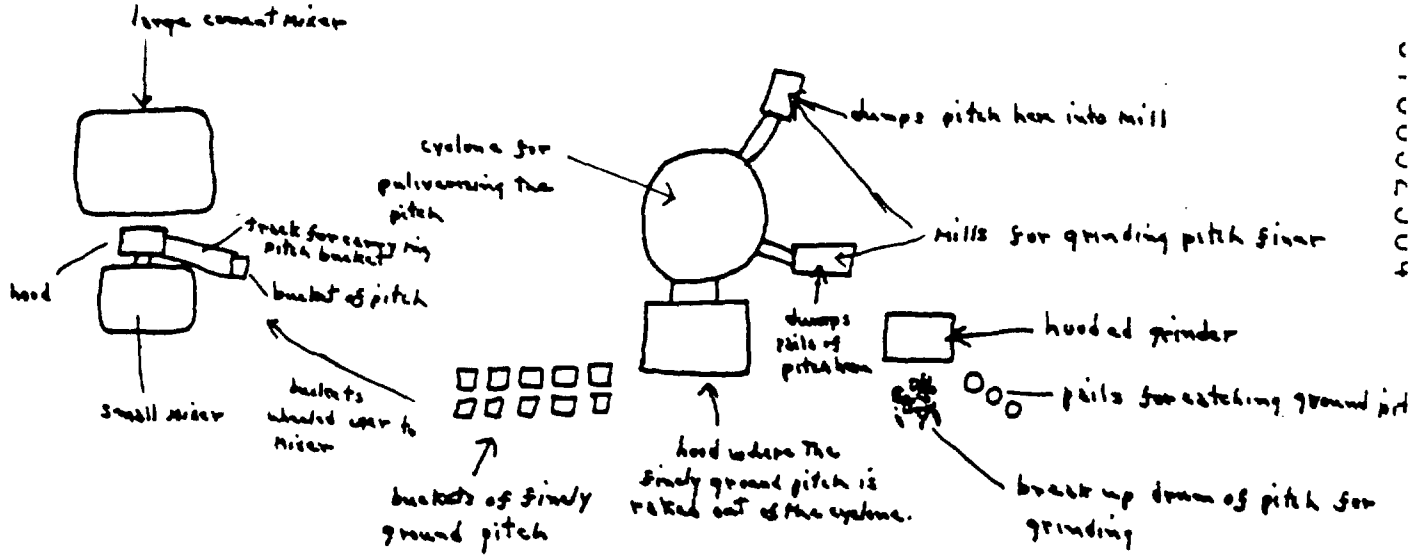
ENVIRONMENTAL RESEARCH LABORATORY

397946

51003250 3

Chlorine Cells.
Pitch Grinding

Prob. 34.21-21-3	Bldg. 191
Process Cell manufacture	
Material Pitch	
Date 11-3-50	By EJS.



Pitch grinding is done the first thing in the morning with either two large drums of pitch broken up + ground or three small ones. It takes approximately 1 to 1½ hrs including cleaning up the area of the grinding.

In the afternoon when the cells are ready to be poured the buckets of pitch filled from the previous day are wheeled to the mixers and hauled up a track to be dumped in the mixers. Generally seven runs are made then there is time to fill the empty buckets for the next day and a run of 3-7 more buckets is made and these are then filled for the next day.

Samples were collected in the breathing zone of the worker using the electrostatic precipitator.

5# 3421213-53 10 mins @ 3l/min = 30 liters

Sample collected in 4 of worker as he shoveled broken pieces of pitch into grinder then dumped pail of ground pitch into the mills.

56.8836
56.8744
.0092 gm.

$\frac{9.2 \text{ mgs}}{30}$ = .306 mgs/liter = 306 mgs/liter
.306 x 28.3 = 8.66 mgs/cu ft
~~.306 / 28.3 = 0.108 mgs/cu ft.~~

397947

S# 3421213 - 54 5 mins = 15 liters

B.Y. of worker is he cleaned up around by sweeping the floor.

57.0267
57.0199
.0068 gms

$\frac{6.8}{15}$ = .453 mg/l. = 453 mg/cu meter

~~.453 / 28.3 = .0161 mg/cu ft.~~

.453 x 28.3 = 12.8 mg/cu ft

S# 3421213 - 55 15 mins = 45 liters

B.Y. of worker standing beside mixer where he operates the cable to carry up the bucket to the mixer. Dumping buckets of pitch. Three batches were made during the sample time with three buckets dumped

57.0956
57.0862
.0094 gms.

$\frac{9.4}{45}$ .209 mg/l. = 209 mg/cu meter

~~.209 / 28.3 = .0074 mg/cu ft.~~

.209 x 28.3 = 5.9 mg/cu ft

S# 3421213 - 56 20 mins = 60 liters

B.Y. of worker filling buckets and pulling pitch out of the cyclone

56.8768
56.8712
.0056 gms.

$\frac{5.6}{60}$ = .0935 mg/l. = 93.5 mg/cu

~~.0935 / 28.3 = .0033 mg/cu ft.~~

.0935 x 28.3 = 2.64 mg/cu ft

S# 3421213 - 57 28 mins = 84 liters 11/6/50

B.Y. of worker as he broke up a large drum of pitch and ground it up

56.8776
56.8723
.0053 gms.

$\frac{5.3}{84}$ = .063 mg/l. = 63 mg/cu meter

~~.063 / 28.3 = .00187 mg/cu ft.~~

.063 x 28.3 = 1.78 mg/cu ft

S# 3421213 - 57 37 mins = 111 liters

B.Y. of worker as he dumped buckets of pitch into mixer. Same as sample #55. Five buckets were dumped. Possibility of sand + cement in sample.

57.0412
57.0147
026.5

$\frac{26.5}{111}$ = .249 mg/l. = 249 mg/cu meter

~~.249 / 28.3 = .088 mg/cu ft.~~

.249 x [illegible] = 7.05 mg/cu ft.

397948

Prob. 3K21-21-3	Bldg. 196
Process Chlorine Cells.	
Material Pitch	
Date 12-5-50 12-11-50	By [illegible]

Pitch Grinding

Samples were collected for pitch dust in the atmosphere using the Bausch and Lomb dust counter

mm p.c.f.

1. Breaking up lumps 4.6, 8.5, 7.3,
2. Shoveling broken up pitch into grinder 11.3, 6.4, 6.6, 9.1
3. Dumping bucket of ground pitch to mills 5.4, 4.2, 5.5, 3.9, 5.1, 8.6, 5.7,
4. Shoking out broken up pitch from metal drum 4.9,
5. Sweeping area where pitch is ground. 10.4, 11.1, 4.0, 8.4, 3.9 (gen air)
6. Raking out pulverized pitch 3.9, 3.5, 6.5, 4.
7. Filling buckets with pulverized pitch 3.1, 4.4, 5.2, 3.8, 4.7, 6.7 (gen air)
8. Sweeping area where buckets are filled with pulverized pitch 2.2, 2.0, 1.7
9. Dumping bucket to mixer 6.6, 5.2, 2.8, 4.9, 5.6
10. Area near foreman's desk. 5.6, 2.9, 6.2, 6.0, 5.4
11. Area in front of mixer while dumping cement to small mixer 4.3, 5.1, 2.1, 3.6,
12. Area in front of small mixer while dumping mixed pitch + cement to loading bucket. 4.3, 4.3, 3.9, 2.0
13. Area in front of small mixer with man working on poured casting. 6.7, 6.9, 2.7, 2.1,
14. Area of bldg where men are working to prepare forms for pouring. 10.7, 1.2, 3.6, 4.7, 3.4

397949

Use this form for field work only.

Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34.21-21-3/5601 Date 1250

Building no. 137 Index no. _____

Units of Data P Respirator Worn? _____

Master no. _____

Job Classification	Job No.	Chemical Name: Chlorine DR# 67834 TWA/Exc.	Chemical Name: Sulfuric acid DR# 93583 TWA/Exc.
operator	336755	0 / 7.3	/
op.	336755	0 / 13.8	0 / 5.7
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		/	/
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		/	/
		/	/
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397950

Use this form for historical data only.

Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34.21-21-3/5601 Date 1250

Building no. 295 Index no. _____

Units of Data P Respirator Worn? _____

Master no. _____

Job Classification	Job No.	Chemical Name: chlorine DR# 67834 TWA/Exc.	DR# TWA/Exc.
op.	336755	0/14.8	/
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		/	/
		/	/
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Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34.21-21-3/5601 Date 1250

Building no. 303 Index no. _____

Units of Data P Respirator Worn? _____

Master no. _____

Job Classification	Job No.	Chemical Name: Chlorine DR# 67834 TWA/Exc.	Chemical Name: _____ DR# _____ TWA/Exc.
Op.	336755	0/1.1	/
		/	/
		/	/
		/	/
		/	/
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Use this form for historical data only.

Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34.21-21-3/5601 Date 1250

Building no. 270 Index no. _____

Units of Data P Respirator Worn? _____

Master no. _____

Job Classification	Job No.	Chemical Name: Chlorine DR# 67834 TWA/Exc.	DR# _____ TWA/Exc.
OP.	336255	0/8.2	/
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		/	/
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Use this form for historical data only.

Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34.21-21-3/5601 Date 1250

Building no. 137 Index no. _____

Units of Data M Respirator Worn? _____

Master no. _____

Job Classification	Job No.	Chemical Name: Sodium hydroxide DR# 7994 TWA/Exc.	Chemical Name: mercury DR# 995631 TWA/Exc.
op.	336755	0/2.44	0/<0.006

397954

Use this form for historical data only.

Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34.21-21-3/5601 Date 1250

Building no. 295 Index no. _____

Units of Data M Respirator Worn? _____

Master no. _____

Chemical Name: Sodium hydroxide

Job Classification	Job No.	DR# 79914 TWA/Exc.	DR# _____ TWA/Exc.
op	336755	0 / 2.44	/
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		/	/
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Use this form for historical data only.

Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34.21-21-3 /5601 Date 1250

Building no. 196 Index no. _____

Units of Data M Respirator Worn? _____

Master no. _____

Job Classification	Job No.	Chemical Name: total Pitch dust DR# A000-0003 TWA/Exc.	Chemical Name: _____ DR# _____ TWA/Exc.
0	0	0/453	1

Use this form for historical data only.

Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34-21-21-3/5601 Date 1250

Building no. 261 Index no. _____

Units of Data M Respirator Worn? _____

Master no. _____

		Chemical Name	
		graphite	
Job Classification	Job No.	DR# 10100066	DR#
		TWA/Exc.	TWA/Exc.
0	0	012870	1

397957

se this form for historical data only.

Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34-21-21-3/5601 Date 1250

Building no. 236 Index no. _____

Units of Data P Respirator Worn? _____

Master no. _____

		Chemical Name	
		formaldehyde	phenol
Job Classification	Job No.	DR# 24204	DR# 1115419
		TWA/Exc.	TWA/Exc.
OP.	336755	0/4	0/1.19

se this form for historical data only.

Industrial Hygiene Chemical Exposure Data Entry Log
Field Survey TWA Exposure And Excursion Exposure Data

Report no. 34.21-21-3/5601 Date 1250

Building no. 0 Index no. _____

Units of Data X Respirator Worn? _____

Master no. _____

Job Classification	Job No.	Chemical Name: asbestos DR# 270713 TWA/Exc.	DR# _____ TWA/Exc.
0	0	0/10	/
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		/	/
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Biochemical Research Laboratory

The Dow Chemical Company

EXPOSURES TO ASBESTOS DUST ENCOUNTERED IN THE CHLORINE CELLS MAINTENANCE AREA, 295, 236, 137 AND 261 BUILDINGS

File: T34.21-21-3(K)
Date: 9/9/69
By: R. A. DeGesero

ST0032517

Signed Roy A. DeGesero Date September 9, 1969

Checked H Stoyle Date 9-9-69

PROBLEM

Supervision requested that the Environmental Research Laboratory survey and evaluate exposures to asbestos encountered by personnel during several operations in the Chlorine Cells area, 295, 236, 137 and 261 Buildings.

CONCLUSIONS

1. The present TLV (Threshold Limit Value) for asbestos exposure is 5 mppcf (million particles per cubic foot). By 1971, barring information to the contrary, the TLV will be lowered to 2 mppcf. The proposed TLV should be observed.

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2. The northern end of 295 Building (cell repair and screen making) is an area of potential asbestos exposure. The southern end of 236 Building (chipping and cell repair area) is an area of potential asbestos exposure. Other buildings reviewed in the Chlorine Cell Complex (261, 137) lack significant potential for asbestos exposure.

ST0032518

3. In 295 Building, personnel in the job classifications Cell Maintenance Man and Diaphragm Puller receive time-weighted exposures to asbestos in excess of the present and proposed TLV's for asbestos (5 mppcf and 2 mppcf, respectively). The time-weighted exposures for these job classifications are

Diaphragm Puller	--	9.4 mppcf
Cell Maintenance "weigher"	--	6.3 mppcf
Cell Maintenance "set-up men"	--	2.7 mppcf

These exposures are unacceptable and must either be reduced to within the proposed health standard of 2 mppcf by lowering concentrations of asbestos-containing dust in air, or approved respirators must be worn.

4. "Spares" in 295 Building are receiving time-weighted exposures of 1.7-9.4 mppcf, depending on whom they substitute for. The yearly average time-weighted exposure is 5.0 mppcf, assuming "Spares"

ST0032519

substitute equally for the Diaphragm Pullers, Set-Up Men, Repair Men and Weighers in the course of a year's work. This exposure is unacceptable and must either be reduced to within the proposed health standard of 2 mppcf by lowering concentrations of asbestos-containing dust in the air, or approved dust respirators must be worn.

5. Personnel in 295 Building who are receiving time-weighted exposures within the proposed TLV of 2 mppcf include:

Senior Cell Shop Mechanic	--	1.1 mppcf
Journeyman Cell Mechanic	--	1.1 mppcf
Foreman, Crew Leader	--	1.1 mppcf
Cell Maintenance "repair men"	--	1.7 mppcf
Plasterer	--	1.3 mppcf

No health hazard is anticipated at these time-weighted levels of exposure to asbestos.

6. The Liquid Chlorine Operator, Assistant Operator and Hydrogen Operator in 295 Building can receive exposure to asbestos during a daily mixing operation. Based on concentrations found to be typical of mixing operations, no hazard to health from asbestos exposure is anticipated in light of the brief exposure time (at most 20 minutes per day).

ST0032520

7. The following job classifications in 236 and 137 Buildings were examined for potential asbestos exposure: Plant Mechanic (295, 137 Buildings), Electrode Maker (261 Building), Resin Protector Fabricator (236 Building), Cell Welder (236 Building), Special Welder (236 Building) and Electrician (295, 137 Buildings). Asbestos exposures encountered by personnel in these classifications are small, and asbestos is not used in their work areas to any great extent. No hazard to health from asbestos exposure is anticipated for personnel in these job classifications.

RECOMMENDATIONS

1. Personnel in the Chlorine Cells area who are currently receiving time-weighted exposures to asbestos-containing dust in excess of 2.0 mppcf should be required to use approved respiratory protection until other means of lowering exposures can be found (e.g., ventilation improvement, changing work procedures, etc.), or some material can be substituted for asbestos which does not present the pulmonary hazards of asbestos.

ST0032521

2. Bags and drums of asbestos should not be allowed to release asbestos fibers to the room air. If possible, asbestos should be weighed out and handled within a suitable exhaust hood. Bags and drums should be kept sealed and covered when not in use.

3. Supervision should request asbestos manufacturers use packages which do not allow leakage of asbestos. The burlap bags allow visible amounts of asbestos to escape from the bag when bags are jarred or placed near open doors, etc.

4. The practice of sitting on bags of asbestos in 295 Building should be discouraged. Fibers of asbestos were seen to leak out of the burlap bags when men sat on the bags.

5. Good housekeeping is essential in safe handling of asbestos fibers. Spills should be cleaned up at once. Vacuum cleaning is preferred to sweeping with a broom. Supervision should determine whether an industrial vacuum cleaner is feasible in 295 Building or insist that prior to broom sweeping the spills be thoroughly wetted with water to minimize dustiness.

ST0032522

6. All personnel who have occasion to use asbestos should be informed of the hazards of the material and learn correct procedures for handling asbestos fibers so as to prevent high dust levels. An educational effort concerning use of approved* respiratory protection should be undertaken or continued, especially in areas of major exposures.

7. Any upgrading in ventilation, procedures, or handling of materials should be evaluated by the Environmental Research Laboratory to ascertain the effectiveness of such changes in terms of lowering exposures to asbestos dust.

PRESENTATION OF DATA

A total of 36 breathing zone impinger samples and 3 electrostatic precipitator samples were collected in 295 Building on May 13, May 14, May 15, and May 27, 1969. Three breathing zone impinger samples were collected in 236 Building on August 4, 1969. The enclosed Floor Plan shows sampling points in 295 Building.

*U.S. Bureau of Mines approved respiratory protection available at the Safety Department, 400 Building, include the "Dustfoe" 66 and Suregard R2090 cartridge respirators which remove the respirable range of dust. Respirators must be properly fitted.

ORIG DATA T34.21-21-3

Chlorine Cells Asbestos Survey - 5-18-71

fibers > 5μ Staff 8-10-71

SAMPLE	PARTICLES PER 0.692 mm² FILTER AREA >5μ	TOTAL PARTICLES PER FILTER >5μ	AIR VOL SAMPLED ml	PARTICLES PER ml
1	21	42,091	40,000	1.05
2	0	0	128,000	0
3	3	6013	40,000	0.15
4	0	0	120,000	0
5	5	10,022	40,000	0.25
6	1	2004	120,000	0.02
7	44	88,191	40,000	2.20
8	8	16,035	120,000	0.13
9	28	56,121	40,000	1.40
10	5	10,022	120,000	0.08
11	0	0	BLANK	—
12	5	10,022	120,000	0.08
13	22	44095	300,000	0.15
14	0	0	BLANK	—
15	0	0	BLANK	—

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