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Preliminary Industrial Hygiene Survey  
at the

PHILIP CAREY MANUFACTURING COMPANY

(December 17, 18, 19, 1962)

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A preliminary industrial hygiene engineering survey was conducted at the Philip Carey Manufacturing Company, Cincinnati, Ohio on December 17, 18, 19, 1962.

Observations were made of the dust-producing operations, namely those involving asbestos and free silica. In addition, various other potentially hazardous environmental conditions were noted.

The purpose of this preliminary evaluation was to establish:

1. a priority schedule - determine which dust producing operations appear to involve the greatest potential hazard. (First efforts would be directed at these operations for proper evaluation and control.)
2. a plan for environmental evaluation - indicate generally where and what types of air samples, ventilation measurements, etc., should be taken to properly define potentially hazardous areas.
3. preliminary time estimates - estimate the approximate time necessary to carry out the steps indicated in (2) above.

Environmental Evaluation -- Priority Schedule

Table I summarizes the areas recommended for environmental evaluation on a priority basis. As indicated, facilities in several of the areas were not observed in operation. Priority ratings for those areas have been based on the types of operations involved, the materials used, the existence or absence of exhaust control and room ventilation, and on the general appearance of the area's dust spillage, rafter dust accumulation, etc.

RECOMMENDED ENVIRONMENTAL MEASUREMENTS  
(OPERATIONS, AREAS OF PRIORITY)

| LOCATION -<br>OPERATION                                    | PRIORITY<br>Ø | ENVIRONMENTAL MEASUREMENTS |                                       |                                                      | COMMENT                                                                                     |
|------------------------------------------------------------|---------------|----------------------------|---------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------------|
|                                                            |               | AIR SAMPLES                | BULK SAMPLE,<br>RAFTER DUST           | VENTILATION<br>MEASUREMENTS                          |                                                                                             |
| <u>BUILDING #28</u>                                        |               |                            |                                       |                                                      |                                                                                             |
| <u>3rd FLOOR</u>                                           |               |                            |                                       |                                                      |                                                                                             |
| • 3-bins receiving Asbestos from scrap grinder in basement | 1             | BZ* dust count (Asbestos)  | Particle size measurement of dust.    | Measure general ventilation. (Roof fan inoperative). |                                                                                             |
| • charging port to 2nd floor beater                        | 1             | GA** dust count            | • median size<br>• standard deviation |                                                      |                                                                                             |
| • storage of Asbestos; handling                            |               |                            |                                       |                                                      |                                                                                             |
| <u>2nd FLOOR</u>                                           |               |                            |                                       |                                                      |                                                                                             |
| • beater - loading operation                               | 2             | BZ dust count              | Particle size measurement.            | Gen. ventilation                                     |                                                                                             |
| • storage of Asbestos; handling                            |               | GA dust count (Asbestos)   |                                       |                                                      |                                                                                             |
| <u>1st FLOOR</u>                                           |               |                            |                                       |                                                      |                                                                                             |
| • rotary cutting operation                                 | 3             | BZ dust count              | Particle size                         | Gen. ventilation                                     |                                                                                             |
| • scrap cutter feed operation                              | 2             | BZ " "                     | " "                                   |                                                      |                                                                                             |
| • emulsion dept., charge ports (3)                         | 3             | BZ " "                     | " "                                   |                                                      | Emulsion - possible air source for:<br>• potassium bichromate<br>• formaldehyde<br>• silica |
| <u>Basement</u>                                            |               |                            |                                       |                                                      |                                                                                             |
| • ream cutter (Seybolt)                                    | 3             | BZ (Asbestos)              | " "                                   | "                                                    |                                                                                             |
| • scrap cutter (fed from 1st floor)                        | 3             | BZ (Asbestos)              | " "                                   |                                                      |                                                                                             |
| • emulsion draw-off, mix                                   | 3             | BZ (Asbestos)              | " "                                   |                                                      |                                                                                             |
| <u>BUILDING #2 - CAREY ROOFING</u>                         |               |                            |                                       |                                                      |                                                                                             |
| <u>TOP FLOOR</u>                                           |               |                            |                                       |                                                      |                                                                                             |
| • addition of Asbestos thru charging ports (ground scrap)  | 1             | BZ Asbestos<br>GA + Silica | Particle size for Silica + Asbestos   | General ventilation measurements                     | Possible exposure to:<br>asphalt fumes                                                      |
| <u>BASEMENT</u>                                            |               |                            |                                       |                                                      |                                                                                             |
| • Roofing machine - sand addition                          | 4             | BZ - Silica                | % free Silica in the dust             | Gen. Vent. Meas.                                     | Not observed in operation                                                                   |
| <u>BLD. #2 ANNEX</u>                                       |               |                            |                                       |                                                      |                                                                                             |
| • Scrap grinder - shingles and asphalt paper               | 3             | BZ Asbestos + Silica       | % free Silica in the dust             |                                                      |                                                                                             |

- Ø Recommended priority for study  
\* BZ - Breathing zone of operator  
\*\* GA - General room atmosphere

| LOCATION -<br>OPERATION                                                                                                                                                                                                                              | PRIORITY                 | ENVIRONMENTAL MEASUREMENTS                                                           |                                                                            |                                                                                                                       | COMMENT                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                      |                          | AIR SAMPLES                                                                          | BULK SAMPLE,<br>RAFTER DUST                                                | VENTILATION<br>MEASUREMENTS                                                                                           |                                                                                                                   |
| <u>BUILDING #1 - PAPER MILL</u><br><u>BASEMENT</u><br>• Asbestos addition to beaters<br>• storage area<br>charging to fiberizer<br>charging onto conveyor<br><u>1st FLOOR</u><br>• paper machine<br>machine room dryer (area by 1st<br>four rollers) | 1<br><br>2<br>2<br><br>4 | BZ + GA<br>(Asbestos)<br><br>BZ + GA<br>(Asbestos)<br><br>GA (Asb.)                  | Particle size<br>(Asbestos)<br><br>Particle size<br>meas. (Asb.)<br><br>   | Gen. Vent.<br>Measurements<br><br>Gen. Vent.<br>Measurements<br><br>Gen. Vent.<br>Measurements                        | <br><br><br><br><br>Asphalt fumes                                                                                 |
| <u>BUILDING #3</u><br><u>BASEMENT</u><br>• dry cement mixer operation<br><br>• plastic cement mixing operation<br><u>1st FLOOR</u><br>• sample room; dust due to rotary<br>mixer operation, small carbo saw,<br>and band saw                         | 1<br><br>2<br><br>4      | BZ + GA<br>Asbestos<br>+ Silica<br><br>BZ (Asbestos)<br><br>GA samples<br>(Asbestos) | Part. size for<br>fibers + Silica<br>dust; % free<br>Silica<br>"<br>"<br>" | Meas. all<br>local exhaust<br>systems + gen.<br>ventilation<br>"<br>"<br>Local exhaust<br>on saws; gen.<br>room vent. | Meas. Dow Benax 2A1 (90%<br>disodium 4-dodecylated<br>oxydibenzene sulfonate)<br>"<br>(Not observed in operation) |
| <u>BUILDING #16 - STILL HOUSE</u><br>• Menco platform; #10 mixer and<br>area adjacent<br>• still area                                                                                                                                                | 2<br>-                   | BZ (Silica)<br>GA "                                                                  | % free Silica<br>in dust                                                   | (semi-outdoors)<br>roof only.                                                                                         | Asphalt fumes                                                                                                     |
| <u>BUILDING #39 - EMULSION DEPARTMENT</u><br>• ribbon mixer operation<br>• slurry mixers<br>• asphalt mix                                                                                                                                            | 2                        | BZ (Asbestos)<br>GA (Asbestos)                                                       | Particle size                                                              | Effect of ex-<br>haust on<br>asphalt mix;<br>gen. vent.                                                               | Potential exposures to as<br>Chloroethene vapors, asphal<br>fumes. Not observed in<br>operation.                  |

| LOCATION - OPERATION                                      | PRIORITY | ENVIRONMENTAL MEASUREMENTS    |                                          |                                                         | COMMENT                                                                                                                                                                  |
|-----------------------------------------------------------|----------|-------------------------------|------------------------------------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                           |          | AIR SAMPLES                   | BULK SAMPLE, RAFTER DUST                 | VENTILATION MEASUREMENTS                                |                                                                                                                                                                          |
| <u>LDING #24 - ASBESTOS-CEMENT</u><br>1st FLOOR SOUTH END |          |                               |                                          |                                                         |                                                                                                                                                                          |
| storage area, handling                                    | 4        | GA (Asbestos)                 | Particle size for Asbestos               | Gen. Vent.                                              | Not operating during inspection. Priority based on type of operation, general appearance, exhaust control, number of persons involved, spillage, dust accumulation, etc. |
| asbestos fiberizer operation                              | 1        | BZ + GA Asb.                  | "                                        | Check local exhaust                                     |                                                                                                                                                                          |
| Canadian Asbestos "Fluffer"                               | 1        | "                             | "                                        | "                                                       |                                                                                                                                                                          |
| sand unloading operation                                  | 2        | BZ+GA Silica                  | Particle size for Silica                 | "                                                       |                                                                                                                                                                          |
|                                                           |          |                               | % free Silica                            | "                                                       |                                                                                                                                                                          |
| Silica grinder (ball mill)                                | 1        | BZ+GA Silica                  | "                                        | "                                                       |                                                                                                                                                                          |
| Silica flour draw off (for Manco platform use)            | 1        | GA Silica                     | "                                        | "                                                       |                                                                                                                                                                          |
| <u>MEZZANINE</u>                                          |          |                               |                                          |                                                         |                                                                                                                                                                          |
| charging weigh cars                                       | 1        | BZ + GA for Asbestos + Silica | Particle size of Asb. and of Silica; + % | Check all local exhaust systems and general ventilation |                                                                                                                                                                          |
| charging stock mixers                                     | 1        |                               |                                          |                                                         |                                                                                                                                                                          |
| hand charge mixer                                         | 1        |                               |                                          |                                                         |                                                                                                                                                                          |
| hopper, elevator, collector area                          | 2        | GA (Asbestos + Silica)        | free Silica in rafter dust               |                                                         | Check paint spray area (apparent good control).                                                                                                                          |
| <u>MAIN FLOOR AREA</u>                                    |          |                               |                                          |                                                         |                                                                                                                                                                          |
| board cutting and trimming                                | 3        | BZ + GA for Asbestos          | Particle size of Asbestos                | "                                                       |                                                                                                                                                                          |
| scrap cutting for trimmer                                 | 3        | "                             | "                                        | "                                                       |                                                                                                                                                                          |
| edge trimming                                             | 3        | "                             | "                                        | "                                                       |                                                                                                                                                                          |
| scrap grinding room                                       | 1        | "                             | "                                        | "                                                       | Not observed in operation.                                                                                                                                               |
| <u>LDING #27 - CAREY-TEMP.</u>                            |          |                               |                                          |                                                         |                                                                                                                                                                          |
| <u>4th FLOOR</u>                                          |          |                               |                                          |                                                         |                                                                                                                                                                          |
| Asbestos fiberizer                                        | 3        | BZ + GA for Asbestos          | Particle size of Asbestos                | Gen vent. and all local exhaust systems                 |                                                                                                                                                                          |
| Asbestos weighing, charging                               | 3        |                               |                                          |                                                         |                                                                                                                                                                          |
| <u>3rd FLOOR</u>                                          |          |                               |                                          |                                                         |                                                                                                                                                                          |
| band saw operation                                        | 2        | "                             | "                                        |                                                         |                                                                                                                                                                          |
| <u>2nd FLOOR</u>                                          |          |                               |                                          |                                                         |                                                                                                                                                                          |
| hand stripping operation                                  | 2        | "                             | "                                        | "                                                       |                                                                                                                                                                          |

| LOCATION -<br>OPERATION                                          | PRIORITY | ENVIRONMENTAL MEASUREMENTS   |                                 |                                                                         | COMMENT                                                                          |
|------------------------------------------------------------------|----------|------------------------------|---------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------|
|                                                                  |          | AIR SAMPLES                  | BULK SAMPLE,<br>RAFTER DUST     | VENTILATION<br>MEASUREMENTS                                             |                                                                                  |
| <u>BUILDING #30</u>                                              |          |                              |                                 |                                                                         |                                                                                  |
| • Carbo-saw operation                                            | 2        | BZ (Asbestos)                |                                 | Check local                                                             |                                                                                  |
| • Tysamen saw                                                    | 3        | BZ "                         |                                 | exhaust on                                                              |                                                                                  |
| • Kinetic saws (2)                                               | 2        | BZ "                         |                                 | all units                                                               |                                                                                  |
| • Field saw                                                      | 3        | BZ "                         |                                 |                                                                         |                                                                                  |
| • DeWalt saw                                                     | 3        | EZ "                         | Particle size                   |                                                                         |                                                                                  |
| • Small carbo saws (outside)                                     | 3        | BZ "                         | of Asbestos                     |                                                                         |                                                                                  |
| • New saw                                                        | 2        | BZ "                         |                                 |                                                                         |                                                                                  |
| • Crating operation                                              | 4        | BZ "                         |                                 |                                                                         |                                                                                  |
| • Shear cutters                                                  | 3        | BZ "                         |                                 |                                                                         |                                                                                  |
| • General shop area                                              | 3        | GA "                         |                                 |                                                                         |                                                                                  |
| • Laminator mixing platform                                      | 3        | GA "                         |                                 |                                                                         | BZ sample; measure Dowicid<br>(sodium pentachlorophenolate<br>check caustic use. |
| <u>BUILDING #9 - SHINGLE MILL</u>                                |          |                              |                                 |                                                                         |                                                                                  |
| <u>1st FLOOR</u>                                                 |          |                              |                                 |                                                                         |                                                                                  |
| • Asbestos unloading hopper                                      | 2        | BZ (Asbestos)                | Particle size;                  |                                                                         |                                                                                  |
| • sand and mica addition to reverse<br>side of shingle           | 4        | GA (Silica)                  | % free Silica                   |                                                                         | Asphalt fumes                                                                    |
| <u>2nd FLOOR</u>                                                 |          |                              |                                 |                                                                         |                                                                                  |
| • mixers, weigh scale for 'c dust<br>belt conveyors for granules | 2        | GA (Silica)<br>GA (Asbestos) | Particle size;<br>% free Silica | Check enclo-<br>sures, local<br>exhaust<br>systems; gen.<br>ventilation |                                                                                  |
| <u>3rd FLOOR</u>                                                 |          |                              |                                 |                                                                         |                                                                                  |
| • 'c dust vibratory separator                                    | 1        | BZ (Asbestos)                | Particle size                   | "                                                                       | Not observed in operation.                                                       |
| • slate dust store and delivery                                  | 1        | GA Asbestos +                | % free Silica                   |                                                                         |                                                                                  |
| granule bins                                                     | 2        | Silica                       |                                 |                                                                         |                                                                                  |

| LOCATION -<br>OPERATION                                          | PRIORITY | ENVIRONMENTAL MEASUREMENTS                                                        |                                    |                                                              | COMMENT                                                                                                                                 |
|------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------|------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
|                                                                  |          | AIR SAMPLES                                                                       | BULK SAMPLE,<br>RAFTER DUST        | VENTILATION<br>MEASUREMENTS                                  |                                                                                                                                         |
| <u>BUILDING #14 - PAINT HOUSE</u>                                |          |                                                                                   |                                    |                                                              |                                                                                                                                         |
| <u>TOP FLOOR</u><br>• two charging ports for mixers on 2nd floor | 3        | BZ + GA for Asbestos + % free Silica                                              | Particle size of Asbestos          | Gen. ventilation                                             |                                                                                                                                         |
| <u>2nd FLOOR</u><br>• mixers; charging ports                     | 1        | BZ + GA for Asbestos + Silica                                                     | Particle size of Asbestos + Silica | Check local (slot) exhaust on charging set-up for #9 mixer   | Measure chlorinated hydrocarbon concentration in air (breath zones.)                                                                    |
| • charge area for #9 mixer on 1st floor                          | 1        |                                                                                   |                                    |                                                              |                                                                                                                                         |
| <u>1st FLOOR</u><br>• #9 mixer; surrounding area                 | 2        |                                                                                   |                                    | Check local exhaust on draw off; check entire exhaust system | Asphalt fumes, chlorinated hydrocarbons, mineral spin dust from floors above                                                            |
| • general area - other mixers and draw off points                | 2        |                                                                                   |                                    |                                                              |                                                                                                                                         |
| <u>BUILDING #16 - ROCK WOOL</u>                                  |          |                                                                                   |                                    |                                                              |                                                                                                                                         |
| • cupola areas                                                   |          | Carbon monoxide, sulfur dioxide, lead fumes various binders (list to be obtained) |                                    | Gen. bldg. ventilation                                       | This building only considered briefly in this preliminary survey (directed mainly at the Asbestos and Silica problems). Needs attention |
| • wool chamber - wool lines                                      |          |                                                                                   |                                    | Local exhaust systems, inlet and outlet ends wool chamber    |                                                                                                                                         |

Representative Air Samples

The exact number and location of breathing zone and general room air samples has not been specified for each operation. This can only be determined when detailed area evaluations are undertaken. At that time the measurements necessary to accurately describe each area will be determined by such factors as:

1. the quantities and types of materials used
2. how the materials are handled; variations in process
3. whether the operation is continuous or intermittent
4. how many persons are involved; their locations
5. whether personnel are exposed to dust from several different operations
6. changes in room air flow patterns; seasonal variations, etc.
7. effect of local exhaust systems

The problem of obtaining representative samples is a complicated one. The time required to obtain dust samples usually is of the order of minutes or hours; while a period of some months up to many years is generally required for the development of diseases from dusts. These diseases result from the integrated effect of dust breathed over a long period. On the other hand, a single in-plant dust determination represents only the amount of dust in the atmosphere at a definite time and place. It cannot give an indication of the average exposure of a man over a period of years -- particularly if he has not worked continuously at the one job.

Thus a proper measure of dust exposures requires a picture of the variations in dustiness -- the dust floods -- as well as a measure of the average concentration. The locations of the sampling points, the volume of sample to be collected, and

the frequency of sampling must therefore be chosen carefully through a detailed study of the particular operation. Generally every effort is made to evaluate a dusty area with as few samples as possible -- dust counts and particle size measurements are tedious and time consuming operations.

The casual observer might well ask why any air samples or atmospheric measurements are necessary -- some of the plant areas are quite obviously very dusty. However, it is only by actual atmospheric dust measurements that the quantity of respirable contamination can be established. Beyond this, of course, is the major objective of sampling which is to identify the principal sources of dust in order to apply appropriate control measures. Follow-up atmospheric samples then can indicate the effectiveness of such control measures.

#### Time Estimate -- Engineering Evaluation

Table II contains time estimates (in man-days) to conduct in-plant and laboratory measurements, to interpret and compute the results, and to formulate recommendations. These estimates are the best approximations which can be given at this time. (The actual time will depend largely upon the number of samples necessary, which in turn will vary from operation to operation as explained in the previous section, page 7.)

TABLE II  
TIME ESTIMATES -- ENGINEERING SURVEY

#1 PRIORITY  
 (14 Areas)

Time to Complete  
 (in man-days)

In-Plant Measurements

- . air samples (estimate between 25 and 45 samples)
- . bulk samples (est. between 10 and 15 samples)
- . ventilation; local exhaust, general air movement
- . occupational analysis

14

Laboratory Measurements

- . dust counts (estimate between 25 and 45)
- . particle size measurements (est. between 12 and 18)
- . chemical analyses (est. between 5 and 8)

16

Interpretation

- . computations, data analysis
- . conclusions, recommendations, report

10

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Total 40

#2 PRIORITY  
 (19 Areas)

In-Plant Measurements

- . air samples (estimate between 26 and 48 samples)
- . bulk samples (est. between 12 and 17 samples)
- . ventilation measurements; local exhaust, general air
- . occupational analysis

15

Laboratory Measurements

- . dust counts (estimate between 26 and 45 counts)
- . particle size measurements (est. between 10 and 20)
- . chemical analyses (est. between 5 and 8)

16

Interpretation

- . computations, data analysis
- . conclusions, recommendations, report

10

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Total 41

TABLE II (cont'd)

#3 PRIORITY  
(15 Areas)Time to Complete  
(in man-days)In-Plant Measurements

- air samples (estimate between 22 and 40 samples)
- bulk samples (est. between 5 and 8 samples)
- ventilation measurements; all areas
- occupational analysis

12

Laboratory Measurements

- dust counts (estimate between 22 and 40 counts)
- particle size measurements (est. between 6 and 10)
- chemical analyses (est. between 2 and 4)

13

Interpretation

- computations, data analysis
- conclusions, recommendations, report

8

Total 33

#4 PRIORITY  
(6 Areas)In-Plant Measurements

- air samples (estimate between 10 and 18)
- bulk samples (est. between 4 and 8)
- ventilation measurements
- occupational analysis

7

Laboratory Measurements

- dust counts (est. between 10 and 18)
- particle size measurements (est. between 4 and 8)
- chemical analyses (est. between 2 and 4)

7

Interpretation

- computations, data analysis
- conclusions, recommendations, report

5

Total 19

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THRESHOLD LIMIT VALUES

In any dusty environment there is the question of "how much" dust is safe. To help answer this question, Threshold Limit Values for various toxic materials have been established by the American Conference of Governmental Industrial Hygienists. These values of allowable air concentrations represent conditions under which most workers may be repeatedly exposed, day after day, without adverse effects. They are guides for the control of health hazards -- not fine lines between safe and dangerous concentrations.

The limits are based on the best available information from industrial experience, from experimental studies, and, when possible, from a combination of the two. They are subject to modification as more complete data become available. In the case of dusts containing at least 45% free silica, 5 million particles of dust per cubic foot of air (mppcf) has been established as the Threshold Limit Value. For dusty atmospheres containing asbestos, the level similarly has been set at 5 mppcf.

However, because of the fibrous nature of asbestos, the threshold limit cannot be considered to be as firmly established as are limits for some of the other dusts. Techniques used for evaluating most other dusts\* (considered as spherical particles) may not be entirely valid for asbestos. The etiology of asbestosis still is under study and research efforts are vitally concerned with the effect of the length and diameter of the fibers in producing lung damage.

\* Based on the standard procedure for sampling and counting dusts adopted by the Fifth Annual Meeting of ACGIH (1942).

One large manufacturer of products using asbestos evaluates air samples taken in the plant for both dust and fibers. The respirable dust consists of the more or less spherical particles 10 microns\* and less in diameter, while the fiber is considered to be those elongated particles greater than 10 microns in length.

A threshold limit of 5 million particles per cubic foot of air (mppcf) is applied for the dust and 1 mppcf is applied to the fiber. (The 1 mppcf fiber threshold limit is based on experimental work conducted at the Saranac Laboratories, Saranac, New York and reported in "Experimental Studies of Asbestosis".) These guide lines are said to have worked out well based on this particular industry's clinical experience.

\* 1 micron is approximately  $\frac{1}{25,000}$  of an inch.