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CENTRAL RESEARCH AND DEVELOPMENT DEPARTMENT
HASKELL LABORATORY FOR TOXICOLOGY AND INDUSTRIAL MEDICINE

DATE July 13, 1976

TO: C. F. REINHARDT
HASKELL LABORATORY

MEDICAL RESEARCH PROJECT MR- 5135 PART I

TITLE: A STUDY TO MEASURE THE AMOUNT OF ASBESTOS FIBER LIBERATED DURING OPERATING
TIMES OF GAS CHROMATOGRAPHS

Authority is requested to undertake the investigation identified above and
described as follows:

A number of gas chromatographs containing asbestos insulation
materials will be evaluated from the standpoint of determining the
significance of a purported health hazard due to liberation of asbestos
fibers. Air sampling studies will be performed during operation times of
G.C. units. Results of which will be evaluated and, if indicated,
control recommendations provided.

.....
Amount requested 700.00
Previously authorized
Expended to date
Account to be charged 5403

Work to be started In progress
Request for study made by Richard J. Hubiak

.....
If this request meets with your approval, please enter the account to be charged,
have two copies authorized and return them to Haskell Laboratory, Control Section.
The additional copies may be retained for your information and distribution.

Proposed by R.J. Gosen
Industrial Hygienist

Approved by John Z. ...
Manager - Field Services

Authorized B. M. ... 7/14/76
Date

RJG/jch

DUP 0973641

DU 045245



HASKELL LABORATORY

cc: D. H. Payne, Pat. Lab., Chambers Works
G. H. Patterson, Jackson Laboratory
J. R. Martin, Jackson Laboratory
J. F. Neumer, Jackson Laboratory
H. Sherman, Haskell Laboratory
D. J. Sam, CR&D - E-328315
B. C. McKusick/C. F. Reinhardt

July 16, 1976

DR. RICHARD J. HUBIAK
ORGANIC CHEMICALS DEPARTMENT
CHAMBERS WORKS, BLDG. 1094

**A STUDY TO MEASURE THE AMOUNT OF
ASBESTOS FIBER LIBERATED DURING OPERATING TIMES
OF GAS CHROMATOGRAPHS**

(Jackson Labs.-Chambers Works, June 3, 1976)

(Haskell Laboratory Report No. 505-76

MR NO. 5135)

People contacted during study:

Richard Hubiak	- Haskell Laboratory
Mary S. Wolff	- Mt. Sinai School of Medicine
G. H. Patterson	- Jackson Laboratory
J. R. Martin	- Jackson Laboratory
J. F. Neumer	- Jackson Laboratory
George Monterief	- Jackson Laboratory
R. L. Pedrotti	- Jackson Laboratory
Eric Kiass	- Jackson Laboratory
Sal Digiovanni	- Hewlett Packard Company
Edward Marsh	- Hewlett Packard Company
Robert Wynne	- Hewlett Packard Company
Frank Persico	- Perkin Elmer Company
Robert Lay	- Tracor Company (Micro-Tech.)
Gail Hogan	- Johns Manville Company

SUMMARY

The results of the air studies conducted did not show presence of asbestos fibers during operating times of suspect gas chromatographs. However, the possibility still remains that at times when maintenance or repair work is performed on instruments containing asbestos some exposure could occur. Abrasive action to the insulation block such as scraping or brushing could cause airborne generation of fibers. For this reason, it is recommended that all units containing asbestos be adequately sealed. A number of unproven methods which have been used for this purpose are listed in order of preference.

DUP 0973642

DU 045246

INTRODUCTION

In the January 30, 1976 Journal of Science, there appeared a letter from: M. S. Wolff, A. M. Langer and S. B. Shurey entitled "Gas Chromatographs: Health Effects". It was the contention of these writers that occupational exposure to asbestos fibers exists for those working with chromatographs packed with asbestos insulation materials. The impact of this letter was such as to cause considerable consternation and focused attention on all gas chromatographs as a possible health hazard. Since a partial list did exist, of which instruments were suspect, some Du Pont departments undertook control measures by sealing their units in a variety of different ways.

Haskell Laboratory was contacted by Chambers Works for assistance in this matter. It was requested that we research this potential hazard and possibly conduct air-sampling studies to further define the problem. In addition to the air studies, we were to advise on the best methods of sealing units known to contain asbestos.

DISCUSSION

I. Asbestos

A. Physical Properties

It was determined that if asbestos was found it would most probably be composed of amosite fiber. This hypothesis was based on the fact that the Johns Manville Company (Denver, Colorado) was, at the time, the only manufacturer of insulation block for use in chromatographs, being marketed under the tradename - Marinite®. It was reported by a company representative of Johns Manville that we could expect to see either Marinite® 31 (30% amosite) or Marinite® 23 (25% amosite) in the instruments evaluated. He hastened to point out that all new models will be insulated with Marinite® XL, purportedly containing no asbestos; no date for this action was provided.

Amosite is an asbestos of the amphibole mineral group characterized by the general chemical formula $(1.5 \text{ MgO}, 5.5 \text{ FeO } 85; \text{O}_2 \text{ H}_2\text{O})$ a hydrated magnesium silicate.

A further more important characterization is its flexibility and high tensile strength (between 175,000 to 500,000 lb/sq. inch) and ability to readily subdivide into fibrils. The mineral, a fibrous form of grunerite, is mined only in South Africa and can be identified by the appearance of long, somewhat harsh fibers with a brownish-yellow to almost white color.

DISCUSSION (CONT'D.)

Amosite, like most other kinds of asbestos, forms inorganic rod-like fibers when crushed or processed. This property results from "a molecular structure in which the units are linked together mostly in one direction and is analogous to the properties associated with a strong two-dimensional structure, familiar in micaceous and slatey minerals that cleave naturally into sheets or plates. This concept is of some importance since it enables one to differentiate between asbestos on the one hand and synthetic inorganic fibers such as glass fiber and mineral woods on the other."

(Ref.: R. Gage, The Physical and Molecular Properties of Asbestos. Annals New York Acad. Sci., 132, p. 31 (1965))

B. Toxicological Considerations

Asbestos, in its several commercial forms, has been shown in very recent time to be associated with the production of a variety of disease entities. These include:

1. Asbestosis: a diffuse, interstitial, nonmalignant, scarring of the lungs;
2. Bronchogenic carcinoma: a malignancy of the interior of the lung;
3. Mesothelioma: a diffuse malignancy of the lining of the chest cavity (pleural mesothelioma), or of the lining of the abdomen (peritoneal mesothelioma); and
4. Cancer of the stomach, colon, and rectum.

Asbestosis may be evident, in its advanced stages by characteristic manifestations on chest X-ray films, by restrictive pulmonary function, or by clinical signs, of finger clubbing or rales (dry, cracking sounds within the lung). Its most important symptom is dyspnea, or undue shortness of breath. The disease is progressive, even in the absence of further exposure, as those inhaled fibers which have been trapped within the lung continue their biological action. In its severe forms, death results from the inability of the body to obtain requisite oxygen or from the heart's failure to pump blood through the scarred lungs.

DISCUSSION (CONT'D.)

Mesotheliomas are diffuse and spread rapidly throughout the cavity of origin. They have yet to be successfully cured by any types of treatment including chemotherapy, radiation, or surgery. Death usually results within a year of diagnosis. In the general population, mesothelioma is so rare that it has yet to be separately coded in the international classification of diseases. It may account for one death in several thousand in the absence of an environmental or occupational asbestos exposure. In some groups of asbestos workers, it may account for one death in ten.

Once established, the other asbestos associated cancers differ little from those occurring in the general population, although there may be variations in the location of the primary site. Appropriate treatment and prognosis follow for the particular tumor. There is very limited long-term survival from lung cancer therapy; and only somewhat better from treated cancer of the colon or rectum.

Asbestosis and asbestos cancer - whether it be lung cancer, pleural mesothelioma, peritoneal mesothelioma, cancer of the stomach, colon, rectum - usually do not become clinically evident until more than 20 years have passed from onset of exposure. This time-frame is now widely recognized. While some such cancers may appear during the second decade following onset of occupational exposure, peak incidence is often not noted until the 30-years-from-onset point, or later. This is true both with regular, long-term asbestos work, and following short-term, brief or intermittent exposures. While variations in the time of occurrence may depend upon intensity and duration of exposure, with heavier exposure often being associated with shorter latency periods, variations among individual cases make it impossible to predict the latency period for the risk of any particular worker.

(Ref.: proposed asbestos standard (OSHA) Federal Register, Vol. 40, p. 47652, October 9, 1975.)

C. Applicable Standards of Exposure

The American Conference of Governmental Industrial Hygienists (ACGIH) in their 1976 TLV listing suggest that five fibers/cc $> 5 \mu$ in length be observed as an average exposure during an eight-hour

DISCUSSION (CONT'D.)

work day (T.W.A.). They also label asbestos as a substance recognized to have carcinogenic or cocarcinogenic potential.

The present OSHA air contaminant limit, as just effective 7-1-76, is 2 fibers/cc > 5 μ in length (T.W.A.) with a maximum peak of 10 fibers/cc. The proposed OSHA asbestos standard would lower the allowable concentration to .5 fibers over eight hours and set a 5 fibers ceiling for a period up to fifteen minutes.

The impact of both the present and proposed OSHA asbestos standard is great if there exists a need, by reason of employee exposure, to comply with the specification language of the standard. If, for example, asbestos fibers were to be found in the areas monitored, this would automatically trigger the immediate need to:

1. Conduct initial environmental monitoring.
2. Conduct personnel monitoring.
3. Implement medical monitoring including the required physical exams.
4. Advise employees of asbestos exposure and educate them as to the hazards of same.
5. Implement record keeping procedures.

If fiber concentrations exceeded limits, in addition to the above, an employer would be further required to:

6. Develop a written compliance program.
7. Implement engineering controls and work practice procedures.
8. Implement respiratory protective program.
- and
9. Comply with posting and labelling requirements.

It goes without saying that the need to comply with the specifics of this standard would indeed be burdensome. A more popular alternative would be to prevent release of fiber thereby eliminating exposure and the need to observe the detailed requirements of the OSHA asbestos standard.

DISCUSSION (CONT'D.)

II. Results of Air Tests Conducted

On June 3, 1976 area samples for determination of airborne asbestos fiber concentration were collected in Rooms 1101, 1106, 2109 and 2110 of Jackson Laboratory of the Chambers Works. A sampling train consisting of a portable low volume (0-2.5 liter) pump, tubing, and a sampling head (cassette) containing a Millipore® AA filter (37 mm, 0.8 micron pore size) was used. All samples were collected at worker breathing-zone level.

Samples were analyzed (sized and counted) for asbestos fiber content by phase contrast microscopy at 450 x magnification.

A. Sampling Location(s) within Room(s)

- Sample 1 - Room 2110 - directly over an operating Perkin Elmer 900 G.C. Oven door opened and closed repeatedly, two other operating G.C. instruments were present.
- Sample 2 - Room 2110 - taken of an operating F30 Perkin Elmer approximately ten feet from the first sample. Both samples in Room 2110 were collected simultaneously.
- Sample 3 - Room 2109 - the sampling train was placed next to a Guild column conditioner (L14536). Four other G.C. instruments present in the room were in operation during the sampling run.
- Sample 4 - Room 1101 - taken directly next to an operating Perkin Elmer 990 G.C.
- Sample 5 - Room 1106 - taken directly next to a Perkin Elmer 990 G.C. The oven door opened and closed twelve times during the sample run.

B. Results

<u>Location</u>	<u>Sample No.</u>	<u>Flow Rate Liters/Min.</u>	<u>Sampling Time Length (Min.)</u>	<u>Asbestos Fibers Found</u>	<u>Concentration Determined</u>
2110	1	1.2	57	0	--
2110	2	1.1	49.4	0	--
2109	3	1.68	49.1	0	--
1101	4	1.5	54.5	0	--
1106	5	1.2	50.1	0	--

DISCUSSION (CONT'D.)

III. Gas Chromatographs (Containing Asbestos)

A partial list is presented here of those gas chromatographs which by company admission contain asbestos as insulation.

<u>Manufacturer</u>	<u>Model Numbers</u>
Perkin Elmer	800, 900, 990, 3920
Hewlett Packard	402, 609, 720
Tracor (Micro Tech)	220

This is by no means an exhaustive list. Some models may have asbestos present by reason of tape used for insulation purposes. Hewlett Packard contends that none of their models manufactured after 1972 have contained asbestos. Perkin Elmer stated that new models (later 1976) will be asbestos free.

IV. Methods of Control

There have been a number of methods suggested by those contacted for sealing the insulation materials thereby preventing the possibility of exposure. These will be listed here in order of author preference:

1. To coat the insulation block with porcelain cement - Mount Sinai has done this - a vendor of porcelain cements in the Pennsylvania area is Saureisen Cements Company, Pittsburgh, Pennsylvania 15238.
2. To coat with polyamic acid preferably with a dye additive to identify treated areas (recommendation of Jackson Laboratory personnel).
3. To coat with sodium silicate (water glass) - recommendation of Johns Manville.
4. To cover exposed areas with heat stable paint or laquer (recommendation of Perkin Elmer).
5. To line exposed areas with stainless steel as was done in one G.C. at Jackson Laboratory. (The expense, time and effort needed may rule out this method.)

CONCLUSIONS AND RECOMMENDATIONS

The results of this study indicate that under normal operations the likelihood of finding asbestos fiber present near operating gas chromatographs containing asbestos as insulation material is low. However, the possibility remains that during certain preventive maintenance and repair activities release and generation of airborne concentrations of asbestos fibers can occur. Therefore, it is recommended that all gas chromatographs identified or suspected of containing asbestos be treated through one of the methods outlined in this report so as to prevent possible operator or worker exposure and negate the need to comply with governmental regulation.

Richard J. Geisen

RICHARD J. GEISEN
INDUSTRIAL HYGIENIST

Approved by:

John Foderaro

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MANAGER - FIELD SERVICES

RJG/jch
7/16/76

Haskell Lab Report No. 505-76
Date Issued: 16 July 1976

DUP 0973649

DU 045253