FILE NAME: Owens Illinois (OWILL)

DATE: 1988

DOC#: OWILL113

DOCUMENT DESCRIPTION: Legal - Exhibits from Testimony of David Kirstein

CAUSE NO. E-149,835

JUDY BLACKBURN, INDIVIDUALLY AND AS ADMINISTRATRIX OF THE ESTATE OF GERALD LESLIE BLACKBURN, DECEASED FLORENCE BLACKBURN GLEN D. BLACKBURN RONALD K. BLACKBURN and MELANIE J. BLACKBURN, INDIVIDUALLY	§ § § § § § § §	IN THE DISTRICT COURT OF JEFFERSON COUNTY, TEXAS
V.	§	
ACandS, INC., ET AL	§	172nd JUDICIAL DISTRICT

PLAINTIFFS' NOTICE OF ORAL DEPOSITION OF DAVID KIRSTEIN

TO: David Kirstein, Trudeau Institute, 100 Algonquin Avenue, Saranac Lake, NY 12983.

PLEASE TAKE NOTICE that the Plaintiffs in the above-referenced cause of action will take the oral deposition of the person named below at the time and place designated in this notice pursuant to the Texas Rules of Civil Procedure.

WITNESS:	David Kirstein, Custodian of Records
DATE.	Friday, August 28, 1998, continuing from day to day until completed
TIME:	10:00 a.m. (EDT)
PLACE:	Trudeau Institute 100 Algonquin Avenue Saranac Lake, NY 12983
COURT REPORTER:	Sarah J. Perkett 1800 Old Street Road Au Sable Chasm, NY 12933 (518) 834-3013

The deponent is requested to bring any and all documents relating, referring or pertaining to asbestos.

You are invited to appear and cross-examine the witness.

Respectfully submitted,

The Law Offices Of Herschel L. Hobson
2190 Harrison
Beaumont, Texas 77701
Ph. #: (409) 838-6410/Fax #: (409) 838-6084

By: ______________
Herschel L. Hobson
TBA# 09744600

ATTORNEY FOR PLAINTIFFS

PLAINTIFF'S EXHIBIT
Kirstein A
8-28-98

Certificate of Service

I hereby certify that a true and correct copy of the above and foregoing instrument has been duly forwarded to all counsel of record on this 17th day of August, 1998.

Herschel L. Hobson

\\mike\d\dmword\depos\blackburn-nod, david kirstein.doc

Al Walker

502-476-7679 [8]
7

De Fayette Fe[illegible]

Carolyn

Aug 27th
9:00
1:00

464-6770

PLAINTIFFS' CROSS-NOTICE OF ORAL DEPOSITION OF DAVID KIRSTEIN

TO. DAVID KIRSTEIN, Trudeau Institute, 100 Algonquin Avenue, Saranac Lake, NY 12983

PLEASE TAKE NOTICE that the Plaintiffs in the above-referenced causes of action will take the oral deposition of the person named below at the time and place designated in this notice pursuant to the Texas Rules of Civil Procedure.

WITNESS	DAVID KIRSTEIN, Custodian of Records
DATE	FRIDAY, AUGUST 28, 1998, continuing from day to day until completed
TIME.	10:00 a.m. (EDT)
PLACE:	Trudeau Institute 100 Algonquin Avenue Saranac Lake, NY 12983
COURT REPORTER:	Sarah J. Perkett 1800 Old Street Road Au Sable Chasm, NY 12933 (518) 834-3013

The deponent is requested to bring any and all documents relating, referring, or pertaining to asbestos or silica.

You are invided to appear and cross-examine the witness.

Respectfully submitted,

JOSEPH C. BLANKS, P.C.
P.O. Drawer 999
DOUCETTE, TX 75942
(409)837-9707 FAX 837-9045
Texas Bar No. 02456770
S.D.Tex. #2110

/JCB/

Joseph C. Blanks
Attorney for Plaintiff

CERTIFICATE OF SERVICE

I served a true copy of the above on all attorneys of record Aug 22, 1998 19 48 GMTby telecopier or first class mail, CRRR

/JCB/

Joseph C. Blanks

PLAINTIFF'S EXHIBIT
Kirstein B
8-28-98

To: Shepard Hoffman

IN THE 60TH JUDICIAL DISTRICT JEFFERSON COUNTY, TEXAS

- Allen et al. v. Amer. Petrofina, Inc. et al.; B-126,986
- G. Broussard v. AC&S, Inc., et al; A-144,426-A (Consolidated w/ B-145,587)
- Dekerlegand v. ACandS, Inc. et al.; B-156,670
- Forrestier, et al. v. AC&S, Inc., et al; A-144,426 (Consolidated B-126,986)
- Hicks, et al. v. Beth. Steel Corp., et al.; A-134,614 (Consolidated B-126,986)
- Limon v. Transbulk Carriers, Inc. et al.; B-153,163
- Mire v. Mobil Oil Corp.; B-132,431
- Powers v. American Optical, et al.; B-134,025
- Provost, et al. v. Amoco Corp. et al.; B-154,096
- Scott v. American Optical Corp., et al.; B-141,242
- Willbanks, et al. v. AC&S, Inc., et al.; B-148,523

IN THE 58TH JUDICIAL DISTRICT JEFFERSON COUNTY, TEXAS

- Barnard, et ux. v. Allied-Signal, Inc., et al.; E-141,216 (Consolidated A-134,614)
- Ebanks v. AC&S, Inc., et al.; A-142,945 (reassigned to 60th District Court)
- Jones, et al. v. AC&S, Inc., et al.; A-151,231
- Schmidt, et al. v. Aetna Cas. & Surety, et al.; A-150,405 (Consol. A-145,280-B-C-D)
- Stinnett v. Chevron USA, Inc. et al.; A-155,205
- Thornton v. A.P. Green Indus., Inc. et al.; A-157,405
- Washington v. American Cast Iron Pipe Company, et al.; A-153,063
- Williams v. Owens Corning Fiberglas Corp., et al.; A-158,755

IN THE 136TH JUDICIAL DISTRICT JEFFERSON COUNTY, TEXAS

- Doucet v. E.I. Dupont De Nemours, e al., D-156,143
- Soape v. Atlantic Richfield Co., et al.; D-157,235

IN THE 172ND JUDICIAL DISTRICT JEFFERSON COUNTY, TEXAS

- Blackburn, et al. v. AC&S, Inc., et al.; E-149,835
- Gilbert v. American Optical Corp., et al.; E-153,066

IN THE 56TH JUDICIAL DISTRICT GALVESTON COUNTY, TEXAS

- Millican, et al. v. ACandS, Inc. et al.; 97-CV-0501

IN THE 239TH JUDICIAL DISTRICT BRAZORIA COUNTY, TEXAS

- Loonam, et al. v. ACandS, Inc. et al.; 1864*JG97

IN THE 148TH JUDICIAL DISTRICT NUECES COUNTY, TEXAS

- Denkeler, et al. v. AC&S, Inc., et al.; 96-3348-E

IN THE 71st JUDICIAL DISTRICT HARRISON COUNTY, TEXAS

- Fleming, et al. v. Air Liquide of America, Inc et al.; 95-0906

IN THE 134TH JUDICIAL DISTRICT DALLAS COUNTY, TEXAS

- Shelley et ux. v. Air Liquide of America, Inc. et al.; 95-08-889

IN THE UNITED STATES DISTRICT COURT (M.D. LA.) B-M2

- Verna G. LaLonde vs. Delta Field Erection Co., et al., 96-3244

IN THE 34TH JUDICIAL DISTRICT COURT OF ST. BARNARD PARISH, LA.

- Winningkoff, et al. v. American Cyanamid Co., et al.; No. 81-663

IN THE 19TH JUD. DISTRICT COURT OF E. BATON ROUGE PARISH, LA.

- Napoli, et al. v. Armstrong World Industries, Inc. et al.; No. 440,853, Dvs. J

IN THE 19TH JUDICIAL DISTRICT COURT OF CALCASIEU PARISH, LA.

- Broussard, et al. v. Hartford Accident & Indemnity Co., et al.; No. 97-5160

FILE COPY

Please take notice of these revisions to depositon notices served 8/22-8/23/98:
Re: **James Hammond** 9/4/98: to be at CSR. Inc., in Houston, 3730 Kirby Drive, 77098
Re: **William Krebs** 9/1/98 deposition must be postponed until **9/17/98**.
Re: **David Kirsten** deposition noticed for 8/28/98 will begin at **Noon**, not 10:00 a.m.

GloDep Group Glode824.doc Forr deps

PLAINTIFF'S EXHIBIT
Kirsten 8
8-28-98

Aug 24, 1998 21:46 GMT: from Joseph C. Blanks, attorney for Plaintiffs
To: Shepard Hoffman,
IN THE 60TH JUDICIAL DISTRICT JEFFERSON COUNTY, TEXAS
• Allen et al. v. Amer. Petrofina, Inc. et al.; B-126,986
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• Loonam, et al. v. ACandS, Inc. et al.; 1864*JG97
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• Denkeler, et al. v. AC&S, Inc., et al.; 96-3348-E
IN THE 71st JUDICIAL DISTRICT HARRISON COUNTY, TEXAS
• Fleming, et al. v. Air Liquide of America, Inc. et al.; 95-0906
IN THE 134TH JUDICIAL DISTRICT DALLAS COUNTY, TEXAS
• Shelley et ux v. Air Liquide of America, Inc. et al.; 95-08-889
IN THE UNITED STATES DISTRICT COURT (M.D. LA.) B-M2
• Verna G. LaLonde vs. Delta Field Erection Co., et al., 96-3244
IN THE 34TH JUDICIAL DISTRICT COURT OF ST. BARNARD PARISH, LA.
• Winningkoff, et al. v. American Cyanamid Co., et al.; No. 81-663
IN THE 19TH JUD. DISTRICT COURT OF E. BATON ROUGE PARISH, LA.
• Napoli, et al. v. Armstrong World Industries, Inc. et al.; No. 440,853, Dvs. J
IN THE 19TH JUDICIAL DISTRICT COURT OF CALCASIEU PARISH, LA.
• Broussard, et al v Hartford Accident & Indemnity Co., et al.; No. 97-5160

OWENS-ILLINOIS GLASS COMPANY

"FIRST IN GLASS"

MANUFACTURER OF GLASS PRODUCTS

GENERAL OFFICES

TOLEDO

February 12, 1943

Dr. L. U. Gardner,
Saranac Laboratories,
Saranac Lake, New York.

Dear Sir:

You will recall an extensive investigation which you conducted for this company several years ago as to the air hygiene aspects of fiberglas.

We have now in the pilot plant stage a new material regarding which we need some guidance as to what is indicated as necessary from that same standpoint. The material is a hydrous calcium silicate.

Silica of 200 mesh per inch and finer is incorporated with calcium hydroxide in a water suspension. After sufficient preliminary reaction to convert a portion of the reactants to a gelatinous form of such consistency as to suspend the remainder of the reactants and avoid settling, the material is poured into molds which are then placed in a steam cylinder similar to those commonly used in the manufacture of sand lime brick and subjected to 125 lbs. per square inch pressure of steam and its resultant temperature for approximately ten hours. During this time a crystallization occurs although the material is still wet when removed from the cylinder. It is then dried and yields a porous mass which can be sawed like lumber.

It is intended to use this material for certain interior structural uses, also as an industrial thermal insulating material for pipe, etc.

The material contains no free calcium hydroxide but does contain a very slight amount of unreacted silica, presumably the larger particles of silica which have persisted while the available calcium hydroxide has been consumed in the formation of the hydrous calcium silicate.

The following points merit consideration:

1. - Does the hydrous calcium silicate of itself constitute any air hazard from an air hygiene standpoint?

2. - Are the few residual particles of silica of such size and frequency as to constitute a hazard?

3. - It should be considered from the standpoint of employees working in the plant where the material is made or where it may be sawed to desired dimensions, and also considered from the standpoint of applicators or erectors at the point of use.

PLAINTIFF'S EXHIBIT
Kirstein-1
8-28-98

000320

OWENS-ILLINOIS GLASS COMPANY

Dr. L. U. Gardner,
Saranac Lake, New York.

February 12, 1943

We are forwarding to you by mail two samples - one which will represent the material which collects in our dust-collecting system, and the other represents material, presumably finer, which has settled from the atmosphere in a finishing room where cutting of the material is done.

We would like to have your opinion tentatively as to the situation for our present needs and your suggestion as to a suitably comprehensive program to permit a final determination of its status.

The writer recalls very pleasantly having lunch with you and Mr. Walters at Baltimore a few years ago during a meeting of the American Ceramic Society.

Very truly yours,

U. E. Bowes

Director of Research

U. E. Bowes
jg

cc - Mr. A. C. Hirth
Mr. M. M. Olander
Mr. H. H. Renn
Mr. David Innes - Berlin

February 23, 1943

Mr. U. E. Bowes
Director of Research
Owens-Illinois Glass Company
Toledo, Ohio

Dear Mr. Bowes:

I was very much interested in your letter of February 12th describing the action of synthetic calcium silicate which you are developing.

The samples of material just arrived this afternoon and we have had a preliminary work at them. I would suspect that they might be a source of respiratory difficulty but that point cannot be answered until we obtain considerable more information.

We will subject the samples to chemical and X-ray analysis to be sure that there is no free silica in them. Incidentally, may I ask in what form the silica component worked? Did you start with an amorphous silica or was it quartz? At the same time we will attempt to reduce some of the samples to the size that can be injected into the lungs of guinea pigs to see whether it is capable of producing a pulmonary fibrosis. The physical properties suggest that it might act like asbestos but of course, one would not care to anticipate this outcome without actual trial.

Preliminary animal work should be far enough advanced after 3 or 4 months to determine whether it would be desirable to plan upon an inhalation experiment. If the calcium silicate should be capable of causing fibrosis, then one should ascertain whether it can be inhaled from the atmosphere. In the mean time, I would regard it with suspicion and see that those who were working in the pilot plant or otherwise exposed were protected by respirators if there are appreciable concentrations in the atmosphere.

I am extremely interested in this material because as you know, I have been attempting to discover substances having physical properties similar to asbestos which may or may not cause tissue reactions. Thus far, we have found that chrysotile asbestos is unique, but on superficial inspection your product seems to behave more like asbestos that anything we have discovered. As soon as our analyses are completed, I will write you further.

PLAINTIFF'S EXHIBIT
Kirstein-2
8-28-98

000319

I am extremely interested in this material because as you know, I have been attempting to discover substances having physical properties similar to asbestos which may or may not cause tissue reactions. Thus far, we have found that chrysotile asbestos is unique, but on superficial inspection, your product seem to behave more like asbestos than anything we have discovered. As soon as our a analyses are completed, I will write you further,

Very truly yours,

Leroy U. Gardner, M. D.
Director

LUG:RBH

OWENS-ILLINOIS GLASS COMPANY

"FIRST IN GLASS"

MANUFACTURER OF GLASS PRODUCTS

GENERAL OFFICES

TOLEDO

March 1, 1943

Dr. Leroy U. Gardner,
The Saranac Laboratory
for the Study of Tuberculosis,
Saranac Lake, N. Y.

Dear Dr. Gardner:

Referring to your letter of February 23rd.

We do add the silica in the form of quartz, and Xray studies which we have had conducted at M.I.T. in our study of the structure of the material do indicate some quartz remaining. We also use a certain percentage, usually 10 to 20 per cent, of Chrysotile asbestos as a reinforcing agent.

Under the conditions under which the reaction occurs, we would expect that the particles of quartz which remain after the reaction is completed would be the larger particles which had not yet been consumed in the reaction by the time that the available calcium hydroxide had all been consumed. If it will be helpful, we can arrange to dissolve the matrix so that the particles of quartz remaining can be examined independently as to size.

Will you give me an estimate of the cost of such portion of the investigation as we might expect to complete during the course of this year for inclusion in our budget for the remainder of the year. This is merely to conform with the accounting procedures, and is not intended in any way to restrict the scope of the investigational work that should be conducted to investigate the matter in the most effective way possible.

Very truly yours,

U G Bowes

Director of Research

U. E. Bowes
jg

PLAINTIFF'S EXHIBIT
Kirstein-3
8-28-98

00031?

March 3, 1943

Mr. U. E. Bowes
Owens-Illinois Glass Company
Toledo, Ohio

Dear Mr. Bowes:

Your letter to Dr. Gardner came this morning. Dr. Gardner is out of town at the moment but will return about the 10th of March and will write you at that time.

Yours very truly,

Secretary to Dr. Gardner

PLAINTIFF'S EXHIBIT
Kirstein-4
8-28-98

000310

March 12, 1943

Mr. U. E. Bowes
Director of Research
Owens-Illinois Glass Company
Toledo, Ohio

Dear Mr. Bowes:

Thank you very much for your further information on the composition of your synthetic insulating material.

I am disappointed to hear that what we thought to be synthetic asbestos proved to be chrysotile which had been added as a reenforcing agent.

The fact that you are starting with a mixture of quartz and asbestos would certainly suggest that you have all the ingredients for a first class hazard. However, the particle size of the former will, of course be determined.

The asbestos may or may not be in such form as to be inhalable. We ourselves, will be able to get rid of the matrix I think so that we can determine the particle size of the quartz.

I would extimate that the cost of making the preliminary tests and particle size determination and so on would not exceed $300. With this information in hand, you can then decide whether you care to go into an experiment of a larger scale for which our charge is $5,000 for the first year and less in the succeeding ones as the number of animals to be kept under observation decreases.

I trust that this suggestion may meet with your approval.

Very truly yours,

Leroy U. Gardner, M. D.
Director

LUG:RBH

PLAINTIFF'S
EXHIBIT
Cirstein-5
8-28-98

000317

OWENS-ILLINOIS GLASS COMPANY

"FIRST IN GLASS"

MANUFACTURER OF GLASS PRODUCTS

GENERAL OFFICES

TOLEDO

June 25, 1943

Dr. Leroy U.Gardner,
The Saranac Laboratory
for the Study of Tuberculosis,
Saranac Lake, New York.

Dear Dr. Gardner:

Have you anything further that you could report to us as yet regarding the study of the hydrous calcium silicate which we sent to you some months ago.

It was my impression that you planned to make some further studies, and while we appreciate that the investigation has not had an opportunity to proceed to completion, we would appreciate anything you might be able to give us in the way of a progress report.

Very truly yours,

U. E. Bowes

Director of Research

U. E. Bowes
jg

PLAINTIFF'S EXHIBIT
Cirstein -6
8-28-98

000?1

June 29, 1943

Dr. U. E. Bowes
Director of Research
Owens-Illinois Glass Company
Toledo, Ohio

RE: Experiments on "Hydrous Calcium Silicates"

Dear Dr. Bowes:

In reply to your letter of June 25, I can report that samples of both Rotoclone and Sander dusts have been injected into guinea pigs to determine whether they would be tolerated and how we might best plan further experiments to determine whether they are likely to cause chronic disease of the lungs.

Chemical, Petrographic and X-ray Diffraction Analysis gave the following approximate composition for the two samples:

Rotoclone Dust

Quartz - particle size 6 to 80μ; little under 10μ......	12%
Calcite - altered perhaps by heat	3%
Chrsotile - extremely fine	25
Hydrated Calcium Silicate	50
Glass?	10
Diatomaceous Earth	Trace

Sander Dust

Quartz - particle size 6 to 120μ	7.5%
Calcite - altered	3.0
Fibrous Material - Coarse, matted to-gether Chrysotile	25.0
Wood? Fibre	20-40
Hydrated Calcium Silicate	25-35?

PLAINTIFF'S EXHIBIT Kirstein-8 8-29-98

000311

Both of these materials proved difficult to reduce to a size suitable for injection purposes without crushing which our experience has demonstrated will destroy the biological activity of asbestos; one of the suspicious components. However, this was obviously over-come and suspensions of 200 mesh particles were prepared for injection. The resultant suspensions in physiological salt solution were alkaline; the rotoclone sample about pH 7.5 and the sander sample about 9. These values will be checked as soon as our potentiometer which is temporarily out of order can be repaired.

As was anticipated, the injection of materials of this degree of alkalinity caused immediate difficulties. Three of five pigs injected into the peritoneal cavity with the rotoclone sample died of peritonitis, 2 to 4 weeks later, and with the still more alkaline sander dust, four of the five died within 6 to 9 days. When the two materials were introduced directly into the lungs by a tube through the windpipe, the alkalinity of the sander dust was apparently too high to be well tolerated, 3 of the 5 animals died of acute pneumonia during the 2 week injection period (3 doses were administered during this time). The slightly lower alkalinity of the rotoclone sample apparently made it tolerable and there were no accidental deaths.

These acute reactions to relatively large quantities of the "hydrous calcium silicate" are as indicated, probably due to the pH. of the dust suspension and probably have little bearing upon the problem before us. By inhalation the quantity of fine dust entering the lungs in unit time would presumably be too small to produce a chemical pneumonia from alkalinity alone. The results to date are at least temporarily assumed to result from the highly artificial methods of testing.

The chronic effects in which we are chiefly interested will require more time for development. We are dealing with a mixture that contains free silica and asbestos as well as hydrated calcium silicate, fibre etc. Both asbestos and quartz are pulmonary irritants capable of causing progressive pulmonary fibrosis. Although our analysis revealed little quartz of a particle size capable of causing lung damage (3μ and under), we do not know whether such particles could be produced in the manufacture or use of this product. Furthermore, it is generally assumed that the accelerated solubility of quartz in an alkaline medium increases its toxicity.

This we have never been able to confirm by experiment but it still may be true and further observation of your product's action should shed more light upon this question. Asbestos fibres, on the other hand, seem to lose their capacity to irritate when subjected to alkaline treatment.

We have just killed two animals that received, 1 month ago, rotoclone and sander dusts respectively by tube into the lungs. Grossly, there is plenty of tissue reaction but its nature cannot be determined until microscopic sections are available. These may give some indication of the future trend of events but it will take at least another 5 months before one knows definitely whether silicosis, asbestosis or other chronic pulmonary disease are likely to develop.

Before making further plans for assay of this material I want to see these microscopic sections which should become available within a week. There are still enough animals in the various groups alive so that we should be able to decide whether it is necessary to undertake a large scale inhalation experiment.

Very truly yours,

Leroy U. Gardner, M. D.
Director

LUG:[illegible]

June 29, 1943

Dr. W. E. Bowes
Director of Research
Owens-Illinois Glass Company
Toledo, Ohio

RE: Experiments on "Hydrous Calcium Silicates"

Dear Dr. Bowes:

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Sander Dust

Quartz - particle size 6 to 120μ	7.5%
Calcite - altered	5.0
Fibrous Material - Coarse, matted to-gether Chrysotile	25.0
Wood? Fibre	20-40
Hydrated Calcium Silicate	25-35?

PLAINTIFF'S EXHIBIT Kirstein-7 8-28-98

000308

This we have never been able to confirm by experiment but it still may be true and further observation of your product's action should shed more light upon this question. Asbestos fibres, on the other hand, seem to lose their capacity to irritate when subjected to alkaline treatment.

We have just killed two animals that received, 1 month ago, rotoclone and sander dusts respectively by tube into the lungs. Grossly, there is plenty of tissue reaction but its nature cannot be determined until microscopic sections are available. These may give some indication of the future trend of events but it will take at least another 5 months before one knows definitely whether silicosis, asbestosis or other chronic pulmonary disease are likely to develop.

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Very truly yours,

Leroy U. Gardner, M. D.
Director

LUG:RME

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The chronic effects in which we are chiefly interested will require more time for development. We are dealing with a mixture that contains free silica and asbestos as well as hydrated calcium silicate, fibre etc. Both asbestos and quartz are pulmonary irritants capable of causing progressive pulmonary fibrosis. Although our analysis revealed little quartz of a particle size capable of causing lung damage (3 μ and under), we do not know whether such particles could be produced in the manufacture or use of this product. Furthermore, it is generally assumed that the accelerated solubility of quartz in an alkaline medium increases its toxicity.

OWENS-ILLINOIS GLASS COMPANY

"FIRST IN GLASS"

MANUFACTURER OF GLASS PRODUCTS

GENERAL OFFICES

TOLEDO

July 6, 1943

Dr. Leroy U.Gardner,
The Saranac Laboratory,
Saranac Lake, New York.

Dear Dr. Gardner:

We are glad to receive your letter of June 29th giving a preliminary report, and will await with interest your further observations. We wish you to continue your investigations as diligently as possible until you can give us some clear-cut appraisal of the status of this material.

In some previous correspondence you mentioned the fact that chrysotile when enhaled behaves differently than some of the other forms of asbestos. No doubt you are familiar with the facts regarding the gelation of chrysotile in water. In our product, it has had ample opportunity to complete its hydration and gelation. It is possible that our material for this reason might behave differently than chrysotile as mined.

Should you so desire, we could arrange to have our research personnel who are working on this material review the gelation characteristics of it for you.

Very truly yours,

U E Bowes
Director of Research

U.E.Bowes
jg

PLAINTIFF'S EXHIBIT
Kirstein-9
8-28-98

000308

July 8, 1943

Dr. O. E. Bowes
Director of Research
Owens-Illinois Glass Company
Toledo, Ohio

Dear Dr. Bowes:

Thank you very much for your letter of the 6th.

We are acquainted with the fact that chrysotile gels on treatment with water but as far as we have been able to determine, at least partial gelation does not affect its capacity to irritate tissues.

We have injected it in suspensions of physiological salt solution and found that it would produce as much as or more fibrosis of the lungs as when inhaled as dry dust.

I would be very pleased indeed if your research personnel could furnish us with any data on the gelation characteristics of chrysotile which they have developed.

Very truly yours,

Leroy U. Gardner, M. D.
Director

LUG:REH

000307

July 8, 1943

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Owens-Illinois Glass Company
Toledo, Ohio

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Very truly yours,

Leroy U. Gardner, M. D.
Director

LUG:REH

PLAINTIFF'S
EXHIBIT
Kirstein-10
8-28-98

OWENS-ILLINOIS GLASS COMPANY

"FIRST IN GLASS"

MANUFACTURER OF GLASS PRODUCTS

GENERAL OFFICES

TOLEDO

May 24, 1944

Dr. Leroy U. Gardner,
The Saranac Laboratory
for the Study of Tuberculosis,
Saranac Lake, New York.

Dear Dr. Gardner:

Some months ago we submitted to you some samples of hydrous calcium silicate, and you gave us some preliminary observations regarding it. At that time we suggested that you proceed with a complete study of the matter, and we are interested to know how far this has progressed.

Very truly yours,

W G Bowes

Director of Research

W.E.Bowes
js

PLAINTIFF'S EXHIBIT
Kirstein-11
8-28-98

000293

May 31, 1944

Mr. U. E. Bowes
Director of Research
Owens-Illinois Glass Company
Toledo, Ohio

RE: Hydrous Calcium Silicate
Animal Experiments

Dear Mr. Bowes:

I am only just now in a position to submit a final report on the results of our animal assay of the physiological effects of your product designated "Hydrous Calcium Silicate".

As received the material was too coarse for animal injection tests. After further reduction in size it proved to be quite toxic when injected into guinea pigs so that it was necessary to repeat many of the tests. However, enough animals survived for a sufficient period so that the general characteristics of the tissue reaction could be evaluated. Such reaction had none of the appearances of a silicosis but did resemble asbestosis.

One would conclude that if the dust of this material were ground sufficiently fine to be inhaled in appreciable quantities it would probably produce a pulmonary disease simulating asbestosis. However, the appended data indicate that in the samples submitted the particle size of the components was such that inhalation of most of the components would be difficult. You are in a better position than we to know whether these samples are representative of the air-borne dust in your plant. In my opinion the dust of this "hydrous calcium silicate" is potentially dangerous if in processing the material the particle size is reduced considerably below that in the samples submitted.

The appended report contains details of the physical and chemical characteristics of the dust samples and of the animal tests made to test its physiological activity.

I enclose a statement for our services.

Very truly yours,

PLAINTIFF'S EXHIBIT
Kirstein-12
8-28-98

Leroy U. Gardner, M. D.
Director

LUG:RH

000300

P. S. If you could refer me to any literature on the effects of water o. asbestos and its subsequent gelation it would be appreciated.

On February 2, 1943 we received from Owens Illinois Glass Co., two samples of a new product designated as "Hydrous Calcium Silicate" for assay of physiological hazard of inhalation of inhaled dust. They were labeled respectively "Sander Dust" and "Rotoclone Dust."

Preliminary inspection indicated that they were mixtures of particulate and fibrous materials, the latter having the characteristics of asbestos. A combined petrographic and X-ray diffraction analysis revealed the following approximate compositions:

ROTOCLONE DUST

	X-RAY	PETROGRAPHIC	APPROXIMATE SIZE ETC.
Quartz	12%	20 to 30%	6 to 80 microns. Little less than 10.
Calcite	3	10 to 20	Altered (by heat?)
Glass?	–	10	----------------------------------
Chrysotile (Asbestos)	25	40	Few single fibres less than 50 microns More less than 20 microns. Most of the single fibres more than 100 microns. Much in unopened bundles.
Hydrated Ca Silicate	50	--	----------------------------------
Diatomite	Trace	--	----------------------------------

SANDER DUST

Quartz	7.5%	5 to 10%	6 to 120 microns
Calcite	3	10	Altered
Fibres			
Chrysotile	25	--	Similar to that from rotoclone
Wood	—	20 to 40	Coarse, matted togetner
Hydrated Ca Silicate	25 to35?	--	----------------------------------

ANIMAL ASSAYS

The material as received was too coarse to be injected into animals and had to be reduced to proper particle size. Grinding was not feasible owing to the presence of chrysotile whose structure and irritating properties are destroyed by prolonged grinding. We were therefore compelled to reduce it by prolonged cutting with scissors, sieving through a 200 mesh screen and adjusting the proportion of fibres and particulate matter in the product to that of the original specimens.

Portions of each sample were made up in physiological salt solution in strengths of 5 and 10% for guinea pig injection. The pH of the rotoclone sample was 7.5 which should cause no tissue irritation. That of the sander dust was 9 which is too alkaline to be well tolerated. The 10% suspensions were injected intraperitoneally, a single dose of 2 c.c. ie. 500 mg of dust. The 5% suspensions were administered directly into the lungs by tracheal catheter, 3 doses of 0.5 c.c each at intervals of 6 days, a total of 75 mg of dust.

Intraperitoneal injections of neither sample were well received; 60% of those treated with the rotoclone sample died within 2 to 3 weeks and 80% of the ones getting the sander dust were dead in 3 days. All these pigs showed acute inflammatory changes about masses of dead cells where large accumulations of the dust had localized. The early result could not be evaluated except for the fact that it never occurs after the injection of quartz or asbestos alone. However, there were 3 animals that survived for 8 months, 2 receiving rotoclone dust and one, sander dust. In neither of them was there any suggestion of silicosis on gross or microscopic examination. An asbestotic change is not recognizable outside of the lungs and hence would not be expected in this group.

Intratracheal injections were somewhat better tolerated particularly in the case of the rotoclone sample where there were only 2 deaths among 6 animals and these occurred 6 to 10 months after completing the injections. Of the sander dust animals 3 died of acute reaction during the period of injection, presumably on account of the high alkalinity. One was killed 1 month and another 4 months after completing the injections.

Both samples produced fibrosis within and about the terminal bronchioles in all animals surviving for 1 month or more. This reaction was generally comparable to that observed on injecting pure chrysotile asbestos. Typical asbestosis bodies were present in small numbers and the distribution of the lesions was typical of injection asbestosis. The only difference was a tendency for the fibrous tissue to be more dense and somewhat hyalinized after 6 to 10 3/4 months. This effect is probably attributable to the quartz in the mixture. Nothing suggestive of silicotic noduler fibrosis could be discovered either within the lungs or the associated tracheobronchial lymph nodes.

Summary: After further reduction in size the two samples of this mixture of asbestos, wood fibre, quartz and hydrated calcium silicate is toxic on intraperitoneal and intratracheal injection into guinea pigs. The high alkalinity of the sander dust probably accounts for the earlier deaths in the case of intraperitoneal injection where a large dose is concentrated in a localized cavity and absorption is rapid. However, the deferred deaths from the rotoclone sample with a pH of only 7.5 suggests some other injurious property.

ANIMAL ASSAYS CONT'D

The chronic effects in the few animals surviving for a month or more are apparently due to the fibrous components of the dust and their nature indicates that asbestos is responsible. This is somewhat modified either by previous treatment of water or by the associated quartz but there is nothing suggestive of silicotic nodular fibrosis. If the hydrous calcium silicate has any part in the picture such part is not recognizable.

Whether manufacture or use of this product would ever reduce particle size to the extent that we have done is outside of the province of this study. If it should a potential hazard would be created. However, study of the two samples submitted suggests that most of the asbestos fibre is either very long or is composed of unopened bundles of fibre, neither one of which is readily inhalable.

Leroy U. Gardner, M. D.
Director, Saranac Laboratory

May 31, 1944

Owens-Illinois Glass Company
Toledo, Ohio

To Saranac Laboratory, Dr.

Complete Study of Samples of Hydrous Calcium Silicate $250.00

Leroy U. Gardner, M. D.
Director, Saranac Laboratory

Pd - June 17/44

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES - TOLEDO, OHIO

November 21, 1944

Dr. Leroy U. Gardner,
The Saranac Laboratory for the
Study of Tuberculosis,
Saranac Lake, New York.

Dear Dr. Gardner:

Mr. Eirth and I enjoyed very much our discussion with you at Pittsburgh, and we will assume that you will proceed with whatever investigations are necessary to establish the degree to which the material we are manufacturing at Berlin, New Jersey, constitutes a hazard either to employees engaged in the manufacture of it or to others in the use or installation of it.

Regarding the latter phase, we assume that it will be necessary for us to make certain tests while the material is being sawed or otherwise handled during application, and we will appreciate any instructions or suggestions you may give us as to the extent to which investigations should be made by us.

Very truly yours,

U E Bowes

Director of Research

U.E.Bowes
je

PLAINTIFF'S EXHIBIT
Kirstein-14
8-28-98

00029

MANUFACTURER OF GLASS METAL AND PLASTIC PRODUCTS

Duraglas CONTAINERS • Ⓘ METAL CONTAINERS • Libbey Safedge TUMBLERS • INSULUX GLASS BLOCK

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES - TOLEDO, OHIO

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Very truly yours,

U E Bowes

Director of Research

U.E.Bowes
JE

PLAINTIFF'S EXHIBIT
Kirstein-14
8-28-98

000293

November 27, 1944

Dr. U. E. Bowes
Owens-Illinois Glass Company
Toledo, Ohio

Dear Dr. Bowes:

It was a pleasure to have had opportunity to discuss the K-Lo problem with you and Mr. Hirth in Pittsburgh the other day and am keenly interested in your proposals for further investigation of any hazards which might be associated with exposure to dust of this material.

To summarize our discussion I may state that in my opinion such an investigation should include (1) an inspection of manufacturing processes at the new plant in Berlin, New Jersey, (2) a study of the behavior of K-Lo dust in atmospheric suspension including such features as the effect of humidity, tendency to flocculate and settle, the relative proportions of fibres and particles in air floated dust, etc., and (3) daily exposure of a large number of experimental animals to high concentrations of dust of this material to determine first, whether it can be inhaled into the lungs in significant quantities and second, whether it will produce serious pathological reaction.

On investigation of our situation here I believe we will be in a position to start such a study about January 1, 1945. By that time we hope to have the necessary number of guinea pigs and white rats available. For the moment our supply is very limited.

Our engineer will plan to visit Berlin, New Jersey as soon as his schedule will permit and I also shall expect to do so when I am in the vicinity which should not be too far distant. We will want to collect several hundred pounds of dust in order to insure material of uniform composition for the entire experiment. Probably as you suggest dust from the collector system in your factory would be satisfactory for the purpose unless it should be grossly contaminated with other dust. The exact amount that we shall need would have to be determined after we experiment with it to discover how readily it will produce a dust cloud in our experimental room. I would suggest that you send us about ten pounds of collector dust for preliminary investigation.

We should contemplate exposing at least 150 guinea pigs, 50 white rats and perhaps 10 rabbits 8 hours daily 6 days a week over a period of one or two years. The nature of the results would determine the duration of the experiment. If the one year results are negative or minimal it will be necessary to continue the exposure for at least

PLAINTIFF'S EXHIBIT
Kirstein -15
8-28-98

000295

another year in order to make certain that this material does not slowly penetrate and accumulate within the lungs to cause chronic tissue reactions. As in previous experiments this test will involve sacrifice of groups of exposed animals at intervals during the exposure; gross microscopic and chemical analyses of their tissues.

In view of the fact that there may be some uncombined silica in the mixture I believe that 50 of the guinea pigs with a like number of undusted controls should be infected with tubercle bacilli to discover whether there is any alteration of susceptibility to such infection.

The cost of this experiment will be $5,000.00 a year plus the necessary travel expenses of our engineer for plant inspection. Should you desire to undertake it I would suggest that payment be made quarterly to the Saranac Laboratory. You would, of course, supply the necessary dust for investigation. The Laboratory will keep you informed of the progress of the work and on its completion furnish a complete report of all details of the study. It is hoped that the results may be such that you might wish to have us publish our findings but it is understood that nothing will be published without your authorization.

Very truly yours,

Leroy U. Gardner, M. D.
Director

LUG:RH

cc to Mr. A. C. Hirth

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES - TOLEDO, OHIO

December 8, 1944

Dr. Leroy U. Gardner
Saranac Laboratory for
the Study of Tuberculosis,
Saranac Lake, New York.

Dear Dr. Gardner:

We have your letter of November 27th outlining the investigation you suggest in connection with the dust originating at our Berlin, New Jersey, Plant. You may consider this letter as authorization to proceed with the program as outlined.

When the time comes for either you or your engineer to visit the plant at Berlin, New Jersey, will you please notify Mr. David Innes who is in charge of that plant and will give any information desired and secure any samples desired.

Very truly yours,

Director of Research

U. E. Bowes
js

cc - Mr. A. C. Wirth
Mr. David Innes - Berlin

PLAINTIFF'S EXHIBIT
Kirstein-16
9-28-98

000294

MANUFACTURERS OF GLASS METAL AND PLASTIC PRODUCTS

Duraglas CONTAINERS • METAL CONTAINERS • Libbey Safedge TUMBLERS • INSULUX GLASS BLOCK

December 28, 1944

Mr. David Innes
Owens-Illinois Glass Company
~~Berlin, New Jersey~~

Dear Mr. Innes:

Our Industrial Hygiene Engineer, Mr. Thomas M. Durkan, will go to Philadelphia this week-end and will call you for an appointment on Tuesday, January 2nd to inspect the plant and lay out a program to serve as a basis for our proposed experimental work with K-Lo.

I trust that as Mr. Bowes suggests that it may be possible for you to meet him and arrange for his visit.

Sincerely yours,

Leroy U. Gardner, M. D.
Director

LUG:RH

ccs to Mr. Bowes and
Mr. Hirth

PLAINTIFF'S EXHIBIT
Kirstein-18
8-28-98

000298

March 29, 1945

Mr. David Innis
Owens-Illinois Glass Company
Berlin, New Jersey

Dear Mr. Innis:

Our inhalation experiment with K-Lo is well under way and everything is progressing satisfactorily. We have decided to use the finest fraction of which you sent us a sample. If we could have about one hundred pounds in the immediate future this would carry us along for at least a year. It would probably take another two or perhaps three hundred pounds to complete the experiment.

I trust that you may be able to supply it shortly so that the work may progress without interruption.

Very truly yours,

Leroy U. Gardner, M. D.
Director

LUG:RH

cc to Mr. Hirth

PLAINTIFF'S EXHIBIT Kirstein-19 8-28-98

00029

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES - TOLEDO 1, OHIO

April 18, 1946

Dr. Leroy U. Gardner, Director,
Saranac Laboratory for
the Study of Tuberculosis,
Saranac Lake, New York.

Dear Dr. Gardner:

Have you any further information on the hygienic aspects of the hydrous calcium silicate which we furnished you sometime ago.

It is my recollection that at our discussion in Pittsburgh about a year ago you were to continue such tests and experimentation as occurred to you to be needed.

Very truly yours,

U. E. Bowes

Director of Research

U.E.Bowes:jg

cc - Mr. A. C. Hirth

PLAINTIFF'S EXHIBIT
Kirstein-20
8-28-98

000288

THE SARANAC LABORATORY
OF THE EDWARD L. TRUDEAU FOUNDATION
SARANAC LAKE, N.Y.

LEROY U. GARDNER, M.D.
DIRECTOR

May 5, 1946

Memorandum to: Mr. Manfred Bowditch

From: L. R. Blinn

Re: Owens-Illinois Glass Company
Experiment No. 1012 - K-Lo

It appears that the above company has overlooked payments on the contract as set forth in Dr. Gardner's letter to Mr. U. E. Bowes, Director of Research, under date of November 27, 1944, from which I quote: "The cost of this experiment will be $5,000. a year plus the necessary travel expenses of our engineer for plant inspection. Should you desire to undertake it, I would suggest that payment be made quarterly to the Saranac Laboratory, etc." On December 8, 1944, Mr. Bowes advised: "You may consider this letter as authorization to proceed with the program as outlined." The experiment was started approximately February 15, 1945. An interim report was sent by Dr. Gardner on May 13, 1946, and another report is due now, upon receipt of which the company will consider renewal for one to two years.

Mr. Dayton was not apprised of the agreement in 1944, therefore quarterly statements to remind the company of payments due were not sent. In getting material together for Dr. Vorwald during his recent visit and checking the status of this account, it was discovered that Owens-Illinois owes us $10,000 for 1945 and 1946. This was discussed with Dr. Vorwald and he requested Mr. Delahant to furnish certain data in connection with the experiment so that he might review the material and write a letter (which he will send to us for final copy on our stationery) recommending continuation of experiment for another year and reminding Owens-Illinois of the above oversight. Mr. Delahant has supplied the necessary information and I have forwarded it to Dr. Vorwald.

June 26, 1946

You will recall, we have a contract to read films (approximately 500 per year) for this company at $2.50 per man. We read considerably more than that amount in 1946, for which this company paid us $2645.76, including transportation of films.

In December, 1945, Owens-Illinois contributed $1,000 to our building fund.

I believe the above will give you a complete picture of this account.

CC: A. J. Vorwald, M.D.
Mr. Roy Dayton

PLAINTIFF'S EXHIBIT
Kirstein-21
8-28-98

000287

SUMMARY OF

ANIMAL INHALATION EXPERIMENTS ON K-Lo

May 13, 1946

The experiment was started fifteen months ago, exposing 100 guinea pigs eight hours daily, six days a week, to atmospheric concentrations of K-Lo varying from 100 to 125 million particles per cubic foot of air.

Acute bacterial pneumonias began to develop after three weeks with such heavy mortality that it seemed unwise to make any replacements by introducing new animals to contract the infection. At first it appeared that perhaps the dust might be responsible for the pneumonia, as the dust, which coated the walls of the rooms, apparently produced a surface impervious to water and condensation of moisture was excessive. However, this hypothesis is apparently not valid, for in an adjoining room, housing animals from the same stock but exposed to diatomaceous earth, the incidence of pneumonia was even higher. We are, therefore, forced to conclude that many apparently healthy animals taken from our breeding rooms at the time must have harbored latent infections of the lungs.

Six months after starting the experiment twenty-five new normal guinea pigs, twenty-five guinea pigs infected with attenuated tubercle bacilli, and forty white rats were introduced into the dust room and again acute pneumonias developed in the guinea pigs, but not in the rats. The immunity of the latter suggests that the guinea pigs died from the lighting up

PLAINTIFF'S EXHIBIT Kirstein-23 8-28-98

of latent infections which were then transmitted from one pig to another.

By April of this year 40% of the first 100 pigs, 25% of the second group of 25 normal pigs, and 20% of the 25 tuberculous animals had died of pneumonia. There have been no deaths during the past month and we have just decided to replenish the stock by breeding the apparently resistant survivors. To introduce new stock from outside sources would only invite disaster.

In spite of this unfortunate occurrence, there have been periodic sacrifices of animals not infected with pneumonia to follow the course of the dust reaction and associated infection.

The dust is inhaled in appreciable amounts, although not enough has yet accumulated (12 months) to influence the weight of lung ash appreciably. Analysis of the ash, however, demonstrates its presence. The average values at twelve months for the three major constituents are as follows:

SiO_2 - - - 10.5%

CaO - - - 2.9

MgO - - - 3.1

In guinea pigs tissue reaction after fourteen months of exposure is still too slight to be visible except on microscopic examination. Such reaction consists of localized collections of large dust cells packed with particles of K-Lo. The walls of the air spaces about them show a limited amount of chronic inflammation and it is not anticipated that fibrosis will subsequently develop. Reaction in the lymph nodes draining the lungs is minimal. In white rats tissue changes are similar. At the present time there is nothing to suggest that reaction comparable to asbestosis or silicosis will ultimately develop.

Associated tuberculous infection has not yet been altered enough to be appreciated grossly. The last two animals sacrificed eight months after infection suggest that there may be some slight tendency for the tubercles to spread. The outcome can only be evaluated as their disease progresses.

We still have twenty-five non-infected guinea pigs now exposed to dust for fifteen months, fourteen more pigs and thirty white rats exposed for almost nine months, and fifteen pigs infected with tubercle bacilli and exposed to dust for nine months. These, together with the anticipated offspring from the breeding animals now in the dust room, should be sufficient for a satisfactory completion of the experiment.

It is my feeling that the exposures should be continued for at least another year, since there is now some question about the effect upon associated tuberculous infection, and we should also be able to affirm with confidence that this dust is not capable of producing fibrosis or other significant reaction in the lungs.

December 24, 1946

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

One of my present chores is to bring together into a single focus a great many things that were beautifully coordinated in Roy Gardner's head, but were not known in detail to others here. One of these is the situation relative to the animal experimentation on K-Lo which we have been carrying on for your company. This was brought to a head when one of our men told me this morning that we had only a ten days' supply of K-Lo dust on hand, his understanding being that the animal work was to continue for some time.

The most recent correspondence on this subject which I can find in the files is a letter written by Roy on May 13 last, to Mr. U. E. Bowes in which he says that he believes "we should continue these observations for at least another year so that we may say with assurance that K-Lo is or is not harmless". There is no indication of a reply to this letter so I imagine that the subject was discussed by telephone or verbally at some meeting.

Another of our men tells me that he was told some time ago that your company is no longer producing K-Lo in this form and that there is therefore no point in continuing the animal work with it. I of course do not know whether Roy had in mind keeping our present batch of exposed animals (about 25) alive for a time and then sacrificing them to see whether there has been a further spread of tuberculous infection.

In order that we may know your company's attitude on this investigation, I would greatly appreciate your setting me straight on the above, so that whatever steps are proper may be taken.

Since I am writing you, it is perhaps worthwhile to ask whether anything further has transpired with regard to the situation at your Pacific [illegible] plant, about which you wrote to Roy on August 21, and he replied on the 23rd. This sounds like a subject for a most interesting minor experiment.

PLAINTIFF'S EXHIBIT Kirstein-24 8-29-98

000284

Mr. W. G. Hazard 12/24/46
Industrial Relations Div.
Owens-Illinois Glass Co. Toledo, 1, Ohio.

I understand that you and Dr. Shook are coming here in January. I am looking forward with no little pleasure to seeing you again and to getting to know Dr. Shook.

Best Wishes for the New Year.

Sincerely,

Manfred Bowditch
Field Director

MB:AD

cc: Dr. Packard
Mr. Delahant

1/2 AR Another box of K-Lo found in attic

See 1946 file

Dr. Packard -

You will recall that this K-40 work was spoken of by Tony as a major job to be continued.

It now appears that it is probably all over.

Three of your men had quite varying impressions of the status of the investigation.

12/2[illegible] [illegible]

00[illegible]283

WESTERN UNION

JOSEPH L. EGAN
PRESIDENT

1220

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LONG SY95 DL PD= TOLEDO OHIO 3 511P 1947 JAN 3 PM 6 00

MANFRED BOWDITCH=

THE SARANAC LABORATORY SR=

RELET DECEMBER 24 WOULD APPRECIATE YOUR CONTINUING KAYLO ANIMAL EXPERIMENTS MN PRESENT BASIS DR SHOOK AND I WOULD LIKE VISIT SARANAC WEEK OF FEBRUARY 3 TO DISCUSS FUTURE PROGRAM ADDITIONAL KAYLO BEING SHIPPED YOU IMMEDIATELY FROM OUR BERLIN NEW JERSEY PLANT KAYLO IS STILL BEING PRODUCED IN SAME FROM AS ORIGINAL MATERIAL USED AT BEGINNING OF YOUR EXPERIMENTS=

W G HAZARD OWENS ILLINOIS GLASS CO.

1/4 ENP [illegible]
ARD (via ELG) do
ELG 3-V [illegible] supply

Phone No. 613
Phoned by da
[illegible] by
[illegible]

24 3 MN. SHOOK. NTO PC.

PLAINTIFF'S EXHIBIT
Kirstein-26
8-28-98

000282

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

January 4, 1947

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio.

E+P #1012

Dear Bill:

I have received your day letter asking that our animal experiments with K-Lo continue, that you and Dr. Shook would like to come here the week of February 3 and that a further supply of K-Lo is being sent to us from your Berlin, N. J. plant.

The work with K-Lo is continuing and I find that there is no urgent need of an additional supply of the material being sent us on a rush basis since a a small additional lot has just been located tucked away in a corner. I am sorry to have alerted you unnecessarily in this regard.

I have checked with Dr. Packard and we will be delighted to see you and Dr. Shook here at the time that you mention. Please let us know when your travel plans are matured, so that there will be no conflict with other engagements. If you so wish, I would be glad to arrange your hotel accommodations for you.

Sincerely yours,

Manfred Bowditch
Field Director

MB:AD

cc. Dr. Packard
Mr. Dalahaut

PLAINTIFF'S EXHIBIT
Kirstein-27
8-28-98

000281

Exp.1012

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

January 8, 1947

Mr. Manfred Bowditch, Field Director
The Saranac Laboratory
Saranac Lake, New York

Dear Manfred:

Thank you for your recent letter.

If you and Dr. Packard expect to be relatively free on Wednesday, February 5, Dr. Shook and I would like to visit Saranac and review with you some of our dust problems. We would arrive on the morning train, February 5, and leave the evening of the same day.

If this, for any reason, is not a convenient date, don't hesitate to let us know and suggest another one because our plans are flexible.

Sincerely yours,

OWENS-ILLINOIS GLASS COMPANY

Bill

Industrial Relations Division

W.G.Hazard:M

PLAINTIFF'S EXHIBIT Kirstein-28 8-28-98

000280

INSULUX GLASS BLOCK · Duraglas CONTAINERS · Libbey Safedge TUMBLERS

PLASTIC PRODUCTS · CLOSURES

January 10, 1947

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

I have yours of January 9. Wednesday, February 5, will be entirely convenient to Dr. Packard and to me, but I am sorry that you and Dr. Shook plan to be here for only the day. The Adirondacks at this time of year have much to commend them and it seems too bad that you cannot combine a day's business with at least a day's pleasure and sight seeing. A couple of our friends from Monsanto Chemical Company who are coming here presently are doing just that.

If you decide to take my sage advice and wish a room for the night, let me know.

Sincerely yours,

Manfred Bowditch
Field Director

MB:AD

cc: Dr. E. N. Packard

PLAINTIFF'S EXHIBIT
Kirstein-29
9-28-98

000279

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

January 27, 1947

Mr. Manfred Bowditch, Field Director
The Saranac Laboratory
Saranac Lake, New York

Dear Manfred:

Thank you for your letter of January 10. Dr. Shook and I expect to be in Saranac Lake February 5 as planned.

We appreciate your suggestion to stay over and enjoy some of the recreation that Saranac has to offer at this time of year. While it looks to me as though this would be a golden opportunity--nevertheless I'm afraid it's going to be necessary for both of us to leave Wednesday night.

We are looking forward to seeing you and Dr. Packard.

Sincerely yours,

OWENS-ILLINOIS GLASS COMPANY

Bill

Industrial Relations Division

W.G.Hazard:M

PLAINTIFF'S EXHIBIT
Kirstein-30
8-28-98

000278

K-Lo

January 30, 1947

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

Thank you for your letter of January 27. I am sorry that you and Dr. Shook cannot stay around for a while.

A dinner and meeting of the Osler Club, one of our two local medical societies and a really stimulating group, is scheduled for the evening of February 5. I look forward to the pleasure of having you and Dr. Shook as my guests at the dinner. The meeting will be over in plenty of time for you to catch your train.

Sincerely yours,

Manfred Bowditch
Field Director

MB:AD

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

February 6, 1947

Mr. Manfred Bowditch, Field Director
The Saranac Laboratory
Saranac Lake, New York

Dear Manfred:

Dr. Shook and I have just got back to the office after our trip to Saranac Lake. We both want to thank you for your courtesy in showing us around yesterday and in planning a full and interesting visit. Personally I feel as though I had been exposed to much wisdom and sage counsel--and I just hope I can retain a reasonable amount.

It was a pleasure to meet the members of your staff and your colleagues.

We are hoping for the best when we get your report on the results of the Kaylo experiments in the next few months--at which time we can discuss the future of this program. Perhaps in your report you can recommend what additional work you feel should be done.

As mentioned earlier--send a statement for the review of the Patsy Perrella case here to us--rather than to the Fairmont plant as would be done for the routine reading of plant X-rays.

Thank you especially for your hospitality last evening, and for making it possible to attend the meeting of the Osler Club--at which I for one learned many new things not only about pioneering medicine, but the North country.

With personal regards to you and Mrs. Bowditch,

Sincerely yours,

OWENS-ILLINOIS GLASS COMPANY

Bill

Industrial Relations Division

W.G.Hazard:M

PLAINTIFF'S EXHIBIT Kirstein-32 8-28-98

00027

To: E. M. Packard, M. D. February 8, 1947

From: Manfred Bowditch

Exp. 1012

SUBJECT: OWENS-ILLINOIS GLASS COMPANY

The purpose of this memorandum is to get into the files a record of the visit here last Wednesday of Dr. Charles Shook and Mr. W. G. Hazard of the Owens-Illinois Glass Company, Toledo. These men came here principally to look into our dusting experiments with their product "Kaylo". They also wished to discuss the Perrella case.

The present status of the Kaylo work was very fully outlined to them by Mr. Delahant and it was understood that, when we are ready to make a further report in about two months, consideration will be given to continuation of the dusting for one or perhaps two additional years. Both men expressed themselves as quite ready to recommend this to the company if it appeared at all desirable.

The Perrella films have been returned to Toledo. Dr. Pascucci's interpretation has been received; the further comments by Dr. Wright are awaited.

In addition to the above subjects, I took occasion to question Mr. Hazard with regard to some work by the laboratory on dusts from the sand plant at Pacific Grove, California which had been suggested by him last summer. He said that there had been delay in this, due to lack of dust sampling equipment at the plant, but that we would hear further on this as soon as they could send us dust samples.

I quote the following from a letter received today from Mr. Hazard:

"Dr. Shook and I have just got back to the office after our trip to Saranac Lake. We both want to thank you for your courtesy in showing us around yesterday and in planning a full and interesting visit. Personally I feel as though I had been exposed to much wisdom and sage counsel—and I just hope I can retain a reasonable amount.

We are hoping for the best when we get your report on the results of the Kaylo experiments in the next few months—at which time we can discuss the future of this program. Perhaps in your report you can recommend what additional work you feel should be done.

As mentioned earlier—send a statement for the review of the Patsy Perrella case here to us—rather than to the Fairmont plant as would be done for the routine reading of plant x-rays."

It is obvious from this last paragraph that they are prepared to pay a higher fee in connection with the Perrella case than our routine $2.50 charge.

PLAINTIFF'S EXHIBIT Kirstein-33 8-28-98

000274

Memorandum to:
E. N. Packard, M. D.

2-8-47

However, all concerned here seem to agree that the good-will features of handling this as a routine matter make it well worthwhile to do so.

MB:AD

cc: Wright
Delahaut
Durham

000275

February 10, 1947

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Exp. 1012

Dear Bill:

Thank you for yours of the 6th. We enjoyed your visit enormously and are counting on your return with Dr. Shook next summer.

A more definite (and I hope not too unfavorable) report on Kaylo should be ready for you in a couple of months and we can undoubtedly make recommendations as to further work at that time.

I note your request with regard to a statement on the review of the Patsy Perrella case. Though this was obviously given far more of our time and attention than is usual, we prefer to handle it as a routine interpretation and make only the customary $2.50 charge. Under these circumstances, should the bill go to Toledo or to Fairmont?

We will hope to receive some dust samples from the Pacific Grove plant when they get the equipment necessary to collect them.

Sincerely yours,

MB:AD

Manfred Bowditch
Field Director

PLAINTIFF'S EXHIBIT
Kirstein-34
8-28-98

000273

May 5, 1947

Captain Arthur J. Vorwald (MC) USNR
2514 Que Street, N.W.
Apartment 210
Washington 7, D. C.

Re: Owens-Illinois Glass Company
Experiment 1012 - K-Lo

Dear Dr. Vorwald:

Attached you will find the information you requested from Mr. Delahant with regard to the above experiment. I am also enclosing a copy of Dr. Gardner's summary of May 13, 1946, referred to in Mr. Delahant's memorandum, and a copy of my note to Mr. Bowditch. I believe you now have the whole story and we ~~now~~ await the suggested form of letter to be sent to this company.

Sincerely yours,

LB
Encs.

OWENS-ILLINOIS GLASS COMPANY

TOLEDO 1, OHIO

Experiment 1012 K-Lo Inhalation

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1. What has been done:

    a. Dust alone - 2 yrs. 2 1/2 mos. - Guinea Pigs.
    b. Dust and Rl simultaneously - 18 mos. - Guinea Pigs.
    c. Rats - dust only - 18 mos.

2. What is going on now:

    a. Dust alone - Guinea Pigs (15 survivors after 26 1/2 mos.
    (12 survivors after 20 + mos.
    b. Rl reactivations - Started January 29, 1947 - no sacrificing as yet.

3. What study has been done on present material - what remains to be done.

    a. Report by Dr. Gardner, May 13, 1946, includes:
        i. Microscopic - dust alone - 14 mos.
        ii. Rl and dust - 8 mos. - microscopic.
        (Gross reported verbally by A.B.D. to Dr. Shook and Mr. Hazard during their visit to the Laboratory - February 5, 1947).
        iii. Dr. Gardner suggested experiment run another year.

    b. Bring microscopic studies up-to-date:
        i. Dust alone - Guinea Pigs - at least to 2 yrs.
        ii. Rl and dust - to 18 mos.
        iii. Dust alone - Rats - to 18 mos.

4. Suggestions for future investigation - contemplated length of time:

    a. Continue to conclusion Rl reactivation.
    b. Add group of Guinea Pigs - 6 mos. dust, then Rl inhalation, and continue in dust with appropriate number of controls, especially since dust plus infection appears to be of paramount importance.
    c. If started immediately, should be concluded in 15 to 18 mos.

COMMENT: Brief introductory study of material by Dr. Vorwald on recent visit suggests that final report may be somewhat more favorable than the results intimated by A.B.D. on February 5, 1947.

A. B. Delahant

000272

5-6-47

THE SARANAC LABORATORY
OF THE EDWARD L. TRUDEAU FOUNDATION
SARANAC LAKE, N.Y.

LEROY U. GARDNER, M.D.
DIRECTOR

May 5, 1947

Memorandum to: Mr. Manfred Bowditch

From: L. R. Blinn

Re: Owens-Illinois Glass Company
Experiment No. 1012 - K-Lo

It appears that the above company has overlooked payments on the contract as set forth in Dr. Gardner's letter to Mr. U. E. Bowes, Director of Research, under date of November 27, 1944, from which I quote: "The cost of this experiment will be $5,000. a year plus the necessary travel expenses of our engineer for plant inspection. Should you desire to undertake it, I would suggest that payment be made quarterly to the Saranac Laboratory, etc." On December 8, 1944, Mr. Bowes advised: "You may consider this letter as authorization to proceed with the program as outlined." The experiment was started approximately February 15, 1945. An interim report was sent by Dr. Gardner on May 13, 1946, and another report is due now, upon receipt of which the company will consider renewal for one to two years.

Mr. Dayton was not apprised of the agreement in 1944, therefore quarterly statements to remind the company of payments due were not sent. In getting material together for Dr. Vorwald during his recent visit and checking the status of this account, it was discovered that Owens-Illinois owes us $10,000 for 1945 and 1946. This was discussed with Dr. Vorwald and he requested Mr. Delahant to furnish certain data in connection with the experiment so that he might review the material and write a letter (which he will send to us for final copy on our stationery) recommending continuation of experiment for another year and reminding Owens-Illinois of the above oversight. Mr. Delahant has supplied the necessary information and I have forwarded it to Dr. Vorwald.

You will recall, we have a contract June 26, 1946 to read films (approximately 500 per year) for this company at $2.50 per man. We read considerably more than that amount in 1946, for which this company paid us $2645.76, including transportation of films.

In December, 1945, Owens-Illinois contributed $1,000 to our building fund.

I believe the above will give you a complete picture of this account.

CC: A. J. Vorwald, M.D.
Mr. Roy Dayton

PLAINTIFF'S EXHIBIT
Kirstein-36
8-28-98

000276

August 26, 1947

Memorandum to: Mr. Bowditch

From: Roy Dayton

Re: Owens-Illinois Glass Company

Reviewing some of our outstanding contracts, I find that my records do not show any payment on account of the large research agreement between Owens-Illinois Glass Company and the Saranac Laboratory. As I understood the situation, the company was to pay us $5000.00 in 1945, $5000.00 in 1946 and would probably renew the agreement for another one or two years, depending on reports submitted on progress of the work. You will remember that no one except Dr. Gardner knew of this arrangement and it did not come to light until some weeks after his death. I believe you were to have interviewed some of the Owens-Illinois men and submit this memorandum for such action you may think best.

RD:AD

CC: Dr. Packard

CC: Dr. Vorwald

PLAINTIFF'S EXHIBIT
Kirstein-37
8-28-98

000268

MEMORANDUM

August 27, 1947

To: Mr. Roy Dayton
From: Manfred Bowditch
Subject: Mercy General Hospital
Owens-Illinois Glass Co.

Replying to your two memoranda of August 26th relative to the above subjects, Dr. Vorwald tells me that he is writing to the Mercy General Hospital and that he feels that any letter to the Owens-Illinois Glass Company must await the report which is due them from us.

MB:AS

PLAINTIFF'S EXHIBIT
Kirstein-38
8-28-98

000268

..e Kaylo Oct. 10, 1947

Memo to: Dr. A. J. Vorwald
From: A. B. Delahant

In a conversation with Mr. William Hazard of the Illinois-Owens Glass Co. during the recent Symposium the following data came to light:

1. The Illinois-Owens Glass Co. has received no report of the progress of the Kaylo experiments being conducted by The Saranac Laboratory since last February 1947.

2. Mr. Hazard was pleased to learn that this experimental investigation is continuing.

3. It is his belief that his company is willing to continue support of this work to its final conclusion

4. The company would appreciate suggestions along what lines this further program of investigation should follow, if any be necessary.

5. Upon introduction of the subject by Mr. Hazard, the status of the financial support of this project was briefly discussed. He claimed that little information on this subject was available in the company files and suggested that a clarification of the financial arrangements be made by The Saranac Laboratory to the Owens-Illinois Glass Co.

Factors which might be of interest regarding a future program:
Since tuberculous infection plus dust inhalation appears to be of prime importance in these studies and since our results have not been entirely conclusive, it might be developed thus:

1. Repeat of the R1 plus dust simultaneously
2. Repeat of R1 Reactivation
3. Introduce series which would superimpose tuberculous infection by inhalation on tissue already exposed to various periods of dust.
4. Explore the biological activity of hydrous calcium silicate (Particle size might present some difficulties - in which case it might be possible to turn to the intratracheal injections.)

PLAINTIFF'S EXHIBIT
Kirstein-39
8-28-98

October 30, 1947

OWENS ILLINOIS GLASS COMPANY

TOLEDO, OHIO

Interim Report on Animal Inhalation Experiments with KAYLO

__SUMMARY:__ The first inhalation experiment with this dust was begun in February, 1945. Due to a high incidence of fatal pneumonia, another similar experiment was started in August, 1945. Both of these experiments were designed to test the effect of the dust alone by inhalation in guinea pigs. In August, 1945, also, an experiment was begun to test the effect of inhaled dust on tuberculous infection in guinea pigs. In October, 1945, a group of white rats was placed in the dust room in order to study the effect of Kaylo inhalation in this species.

It may be said here that there is no evidence to suggest that the dust alone when inhaled into the lung produces pulmonary fibrosis in rats in an 18 month period, or in guinea pigs in a 30 month period. The results of the experiment in which dust exposure and tuberculosis were combined are inconclusive and further work should be done before a definite statement can be made as to the possible effect of the dust on tuberculous infection. All these experiments are virtually completed, although several animals in the original groups are being kept alive for more prolonged exposure.

__INVESTIGATIONS:__

A. __Petrographic and x-ray diffraction analyses of the dust supplied and used.__ Analyses were carried out initially and periodically during the course of the experiment. The composite of such analyses reveals the following:

__Samples from the supply carton__

Quartz <1% (approximately)
Chrysotile and Serpentine 15 - 20%; largely fibrous. The fibers and bundles present are usually several millimeters long and seldom are less than 300 μ
Calcite 5%

000244

Balance consisted of clay-like masses which gave a definite x-ray diffraction pattern not unlike a hydrous calcium silicate.

Samples collected from the atmosphere of the chamber.

Quartz 1%
Chrysotile and Serpentine 10 - 15%; less fibrous material than in sample above; many fibers are shorter than 20 µ.
Calcite 10%
Balance consisted of clay-like masses which gave a definite x-ray diffraction pattern not unlike a hydrous calcium silicate.

The analyses reveal several points of interest:

The low quartz content (1%) indicates that the amount of crystalline free silica in the dust is practically negligible as a possible cause of silicosis.

Although diatomaceous earth is one of the materials from which KAYLO is made, only a trace, probably much less than 1%, is unaltered and appears in the final product in its original form. Nearly all has been changed by the manufacturing process into another chemical compound, calcium silicate.

Most of the material consisted of clay-like masses which gave a definite x-ray pattern similar to that of a hydrous calcium silicate.

About 10 to 15% of the atmospheric dust in the experimental dust room was chrysotile or serpentine. Both of these minerals produce the same x-ray pattern. From petrographic examination of the original material, it appears that chrysotile, which is a fibrous mineral, is present in much greater amounts than the non-fibrous serpentine. In the atmospheric dust also, the fibers still predominate over the non-fibrous serpentine.

In the original material, the fibers were present in bundles often several millimeters long; not many were shorter than 300 µ. The fibrous portion of the atmospheric sample, however, consisted mostly of shorter bundles and of fibers, relatively few in number, which were generally about 10 to 40 µ in length.

B. Techniques of Investigation.

Two species of animals were introduced into the dust chamber assigned to this investigation. They included guinea pigs and white rats, animals which the Saranac Laboratory has used routinely in its studies apropos pneumoconiosis. Appropriate quantities of the original material supplied by the company were introduced into the dust generator of the chamber and pilot runs were made to ascertain the character and concentration of the air-borne dust produced. Having established the desired concentration, the animals were then introduced and throughout the course of the investigation dust counts were taken periodically.

The average concentration of the air-borne material was 122 million particles per cubic foot of air. This figure varied somewhat from month to month, ranging from a lower limit of 99 million to an upper of 122 million particles. This range is not unique for this material but has been observed also with most agents which we have employed. It results no doubt from day to day variations in atmospheric conditions which cannot be precisely controlled with our present methods. Nevertheless, we have elected to continue with such methods, believing that to do otherwise would introduce factors uncommon to actual industrial exposure.

The results of the experiments will be presented under the following headings:

I. KAYLO inhalation alone in guinea pigs.
II. KAYLO inhalation alone in white rats.
III. KAYLO inhalation and simultaneous tuberculosis infection in guinea pigs.
IV. Conclusions.

I. KAYLO inhalation alone in guinea pigs:

The course of this experiment through the first fourteen months was discussed in a summary written by Doctor Gardner in May, 1946. In this report he described the difficulty encountered with acute pneumonia in the guinea pigs and concluded that it was an accidental epidemic. His conclusion is supported by the fact that subsequently only four animals have died of pneumonia. This occurred, however, only after all apparently sick guinea pigs were disposed of, the apparently well pigs isolated, the dust room thoroughly cleaned, aired and disinfected, and all the cages sterilized. A third and new series of guinea pigs were introduced after control of the epidemic described. Throughout the course of the study, all animals were exposed continuously to the chamber cloud for eight hours a day, five and one-half days a week.

Thus far, a total of thirty-nine pigs have been killed in order to follow the course of the pulmonary reaction resulting from the deposition of inhaled dust in the lung. The period elected for study ranged from two to thirty months. Over this period no definite gross changes occurred in the lungs. The tracheobronchial lymph nodes have enlarged slightly, but remained soft. Microscopic study of the lungs reveal gradually increasing numbers of dust-containing macrophages. These inactive "dust cells" are found characteristically in clumps within groups of adjacent air spaces. The intervening alveolar walls are only slightly thickened by accumulated lymphocytes, but there is no undue proliferation of tissue histiocytes and connective tissue. Fibrosis is not present. Occasional multinucleated giant cells are seen. In addition, there are a very few elongated segmented brown structure which take an iron stain and are clearly asbestosis bodies. Microscopic study of the tracheobronchial lymph nodes reveals clusters of inactive "dust cells" similar to those demonstrated by the lung. There is no apparent over development of connective tissue, and again fibrosis is conspicuous by its absence.

Results of the chemical analyses carried out on the lungs of the exposed pigs sacrificed at the various periods are recorded in the following table:

TABLE I.

CHEMICAL ANALYSIS OF GUINEA PIG LUNGS

Animal Number	Time Exp.	Dry Matter Ash %	Dry Matter SiO_2 %	Dry Matter MgO %	Dry Matter CaO %	Ash SiO_2 %	Ash MgO %	Ash CaO %
2	2 mo.	4.42	0.24	0.07	0.08	5.57	1.59	1.85
6	2 mo.	4.94	.20	.08	.06	4.06	1.62	1.23
10	4 mo.	4.47	.22	.09	.09	4.87	1.99	1.99
11	4 mo.	4.42	.19	.08	.08	4.42	1.89	1.89
16	6 mo.	4.13	.25	.08	.08	5.83	2.00	2.00
18	6 mo.	3.74	.20	.08	.10	5.36	2.19	2.68
28	8 mo.	4.59	.31	.08	.13	6.84	1.77	2.75
34	8 mo.	4.34	.28	.11	.11	5.36	2.43	2.43
43	10 mo.	4.68	.46	.21	.14	10.12	4.30	3.04
56	10 mo.	4.81	.41	.14	.11	8.14	3.02	2.20
45	12 mo.	4.86	.53	.22	.14	10.80	4.65	2.80
46	12 mo.	4.99	.51	.08	.16	10.25	1.60	3.17
67	18 mo.	4.83	.59	.26	.09	12.27	5.31	1.83
68	18 mo.	4.90	.86	.32	.10	17.65	6.56	2.06
105	21 mo.	5.12	.64	.11	.19	12.54	2.03	3.68
108	21 mo.	5.23	.54	.08	.15	10.30	1.45	2.90
49	24 mo.	5.02	.66	.06	.13	12.70	1.20	2.54
50	24 mo.	4.71	.60	.08	.14	12.52	1.72	2.92

TABLE I

In view of the observations recorded above, certain pertinent comments appear to be warranted. The microscopic studies of the lungs and tracheobronchial lymph nodes make it obvious that dust was suspended in the atmosphere of the chamber and that portions of that dust were inhaled and gained access into the lungs of the animals exposed. This is further substantiated by the chemical analyses of the lungs which show a gradually increasing amount of the various mineral components of the dust used in direct proportion to the exposure times. In the case of SiO_2, for example, the pigs sacrificed after ten months exposure revealed a two to three-fold increase. The MgO and CaO content also increased but the increments are inconsistent and less manifest.

The silica component of the mineral dust is of such low concentration that a significant pulmonary reaction would hardly be expected in consequence of its presence in the lung. This proved to be the case even in those animals exposed for a period of twenty-four months and revealing an average total of 12.61% SiO_2 of the lung ash. The character of the tissue response at thirty months is comparable and it is anticipated that the SiO_2 content will not be appreciably different.

Undoubtedly some of the dust cells constituting the mild cellular reaction observed may be in consequence of the serpentine components of the dust deposited in the lung. This, however, cannot be verified since serpentine is a relatively benign dust and fails to produce reaction other than mere dust laden macrophages. This interpretation is in accord with Doctor Gardner's observation that the silicate serpentine is a biologically inert substance producing at best a mild reaction consisting of small widely scattered local collections of dust laden phagocytes and an occasional giant cell without other cellular reaction and without fibrosis.

The presence of a rare curious body (asbestosis body) indicates that some of the air-borne fibrous component of the chrysotile gained access to the lung. However, the absence of cellular reaction or fibrosis about the terminal bronchioles would indicate that the inhaled quantity of such fibers was of extremely low intensity and insufficient to produce permanent damage. This view is supported by the petrographic and x-ray diffraction studies which disclosed that a major amount of the chrysotile component of the dust consisted of structures too large for dispersion into the breathing atmosphere and for easy access into the lung.

In consequence of the experimental studies with guinea pigs to determine the biological activity of KAYLO, it may be tentatively concluded that KAYLO alone fails to produce significant pulmonary damage when inhaled into the lung.

II. KAYLO inhalation alone in white rats:

This species was used because the rat is known to develop fibrosis from quartz inhalation more rapidly than other animals. Forty rats were used in this experiment and, as indicated by Doctor Gardner in his report in May, 1946, no difficulty with early development of pneumonia was experienced. In fact, during the first thirteen months of the experiment no spontaneous deaths occurred. From thirteen to eighteen months, about 40% of the animals died with terminal bronchiolitis and lobular pneumonia. This is of no significance, however, because it is well known that laboratory rats beyond the age of one year are subject to this type of lesion.

The results of exposure to KAYLO were followed by killing four rats at each of the following periods: six, nine, twelve, fifteen and eighteen months. The duration of the experiment was eighteen months and all animals have been killed.

The reaction to the dust throughout the experiment has consisted of focal collections in the pulmonary alveoli of macrophages containing particles and spicules of dust. As the duration of exposure increased, the only observed change was an increase in the number of such foci. Similar dust filled macrophages were seen in the tracheobronchial lymph nodes. In no animal was there any tissue reaction of the sort seen in silicosis or asbestosis.

Chemical analyses of the lungs of these rats show that the SiO_2 reached the average level of 16.6% of the lung ash within nine months and subsequently diminished. This is difficult to explain, since in the same period the percentage of SiO_2 in guinea pigs' lungs exposed simultaneously (see Table I) was increasing.

The table of these results follows:

TABLE II.

KAYLO INHALATION

SILICA DETERMINATIONS OF LUNG TISSUE IN RATS ONLY

Animal No.	Group	Ash in Dry Tissue %	SiO_2 in Dry Tissue %	SiO_2 in Ash %	Duration of Exposure
1012-202	IV	4.8	0.663	14.0	6 months
1012-201	IV	4.6	0.735	16.1	6 months
1012-205	IV	4.6	0.86	18.3	9 months
1012-206	IV	3.8	0.528	13.9	9 months
1012-209	IV	4.2	0.55	13.2	12 months
1012-210	IV	4.4	0.655	15.0	12 months
1012-215	IV	4.2	0.443	10.5	15 months
1012-223	IV	4.2	0.562	13.3	15 months
1012-225	IV	3.1	0.43	13.7	18 months
1012-234	IV	3.9	0.44	11.3	18 months

TABLE II

In commenting upon Part II of the investigation using white rats as the experimental animals, reference is made to the comments recorded under Part I, which apply.

III. KAYLO inhalation and simultaneous tuberculous infection in guinea pigs.

This experiment was carried out by the use of only one of the three methods which have been found valuable in determining the effect of dust on the course of tuberculosis. In this case the animals were infected with tubercle bacilli by inhalation and immediately placed in the dust room. Thus, we are testing the effect of the early accumulation of dust on the early course of tuberculosis. The other two methods available consist in exposing the animals to either the dust or the infection alone for several months, subsequently exposing them to the other agent. We may then study the effect of accumulated dust on the early course of tuberculosis, or the effect of dust on healing tuberculous lesions.

In the experiment which has been completed twenty-five animals were used. Of these, five died within ten months of the pneumonia which has been a problem throughout all the experiments with this dust. Four others were killed because they were in poor condition, and it was hoped to cut down the incidence of pneumonia by removing them from the room. These four also showed some evidence of pneumonia.

Of the remaining sixteen animals, eleven were killed in order to follow the course of the infection. One was killed at one month and two were killed at six, nine, twelve, fifteen and eighteen months. Two died at fourteen months, apparently from progressive tuberculosis; these will be discussed further below. Two animals died, one at thirteen and one at seventeen months, of undetermined causes, but not from tuberculosis.

Of the animals killed to follow the course of the infection, the lesions were isolated, encapsulated and regressing in all except one of the two killed at fifteen months. In this animal, lesions were widespread throughout the lung, but were associated with the production of fibrosis, indicating a tendency to heal.

The interpretation of the results of this experiment is complicated by the accessory factor that some of the animals were used for breeding during the experiment. This was done in an attempt to develop a strain of animals resistant to the infection which was producing the frequent pneumonias.

A review of the records shows that each of the two animals which died of progressing tuberculous infection had been used as breeders. In addition, the animal which was killed at fifteen months and showed widespread lesions had also been used for breeding.

Four other animals used for breeding during the same period did not show the extensive disease seen in the animals just described.

Thus, it seems hazardous to attempt to attribute the spreading of the tuberculous infection entirely either to the effect of the dust or to that of breeding.

IV. Conclusions:

1. It seems clear from the results presented in parts I and II above that KAYLO acts as an inert dust when inhaled by guinea pigs and rats; that is, it is phagocytized by macrophages, but does not injure them or produce fibrosis or anything suggestive of either silicosis or asbestosis. This indicates that the dust will probably be harmless on inhalation in moderate amounts over prolonged periods by normal human beings.

2. The results observed in the experiment concerning the influence of the dust on tuberculous infection are equivocal. Although it is our feeling that this dust exerts little or no adverse influence on tuberculosis, the possibility that it played a part in spreading the infection cannot be excluded.

3. In view of this possibility, further studies concerning this aspect of the problem should be carried out. It is imperative that the original experiment with infection and simultaneous dust exposure be repeated in its entirety. One further study with a small series of guinea pigs is now in progress. It is designed to reveal the influence of the dust on partially healed tuberculosis. However, it is now felt that this experiment should be carried out on a larger scale by increasing the number of animals. Should this expanded investigation be pursued, it might be identified as follows:

a. Repeat experiment to determine the biological activity of KAYLO when inhaled into the lung harboring a tuberculous infection, which otherwise would regress and heal; viz.: Does KAYLO stimulate the disease?

b. Repeat experiment to determine the biological activity of KAYLO when inhaled into the lung harboring a regressing or quiescent tuberculous focus; viz.: Does KAYLO reactivate a focus of infection?

c. Introduce a new experiment to determine the biological activity of KAYLO inhaled into the lung upon infection; viz.: Does KAYLO predispose the lung to tuberculous infection?

4. In addition, it appears important to explore the biological activity of hydrous calcium silicate either by inhalation or at least pilot-wise by injection methods should it be impossible to generate a sufficient cloud of atmospheric dust because of the character of the material.

5. These recommended investigations can be carried out simultaneously and completed in a period of eighteen months to two years. It is anticipated that these studies would remove the doubt raised by the results of the original experiments herein reported and would enable us to conclude finally that KAYLO is inert not only in regard to the production of pulmonary injury, but also in relation to associated tuberculosis.

Arthur J. Vorwald, M.D.
Director of Research
The Edward L. Trudeau Foundation

AJV:LB
cc Mr. [illegible] 12-3-47

October 31, 1947

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

Enclosed herewith you will find an interim report summarizing the experimental investigations which we have pursued apropos the biological activity of KAYLO. I realize that it is long overdue, but feel sure that you appreciate the difficulties which have confronted us. I am happy and pleased that these experiments progressed without undue difficulty. In addition, I derive a rather high degree of personal satisfaction in the accomplishments of my staff. It is primarily they who made this report possible.

Your attention is invited to the conclusions of the report wherein I have tried to express assurance that KAYLO alone is biologically inactive. Yet, my conservatism dictates caution lest the assurance might be too optimistic because of inconclusive experimental evidence apropos the influence of KAYLO upon tuberculosis.

In consequence of that evidence, we have identified certain investigations which should be pursued. They are itemized in paragraphs three and four of the conclusions. I believe they should be undertaken and strongly urge that you authorize us to proceed. In any event, please inform us of your wishes as soon as possible so that we might effect some continuity in our studies concerning KAYLO.

During your recent visit to Saranac Lake, the status of the financial support of this project was briefly discussed. You may recall that our investigations were initiated in accordance with the contract as set forth in Doctor Gardner's letter to Mr. U. E. Bowes, Director of Research, under date of November 27, 1944, to wit:

> "The cost of this experiment will be $5,000. a year plus the necessary travel expenses of our engineer for plant inspection. Should you desire to undertake it, I would suggest that payment be made quarterly to the Saranac Laboratory," etc.

PLAINTIFF'S EXHIBIT Kirstein-41 9-28-98

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On December 8, 1944, Mr. Bowes advised:

"You may consider this letter as authorization to proceed with the program as outlined."

In consequence of the above, the experiments were started approximately on February 15, 1945, and are continuing to date, representing a total period of two years, eight months and fifteen days.

Since the death of Doctor Gardner and as his successor, I have been obliged to review all existing contracts. In doing so, it was disclosed that the Saranac Laboratory has not received any remuneration from the Owens-Illinois Glass Company for its project. Our analysis of the current financial status reveals an arrears of a considerable sum, which is straining our limited budgetary reserve. Heretofore, I have hesitated bringing this matter to your attention, believing it first necessary to submit a report of our work to date.

Please know, Mr. Hazard, that your views regarding our efforts identified in the report would be greatly appreciated. Should you find that our analysis of the financial status is in error, we trust that you will so inform us.

With every good wish,

Sincerely yours,

Arthur J. Vorwald, M.D.
Director of Research
The Edward L. Trudeau Foundation

AJV:LB
Enc.
CC: Mr. U. E. Bowes, Director of Research

THE SARANAC LABORATORY
OF THE EDWARD L. TRUDEAU FOUNDATION
SARANAC LAKE, N.Y.

ARTHUR J. VORWALD, M.D.
DIRECTOR

October 30, 1947

OWENS ILLINOIS GLASS COMPANY

TOLEDO, OHIO

Interim Report on Animal Inhalation Experiments with KAYLO

SUMMARY: The first inhalation experiment with this dust was begun in February, 1945. Due to a high incidence of fatal pneumonia, another similar experiment was started in August, 1945. Both of these experiments were designed to test the effect of the dust alone by inhalation in guinea pigs. In August, 1945, also, an experiment was begun to test the effect of inhaled dust on tuberculous infection in guinea pigs. In October, 1945, a group of white rats was placed in the dust room in order to study the effect of Kaylo inhalation in this species.

It may be said here that there is no evidence to suggest that the dust alone when inhaled into the lung produces pulmonary fibrosis in rats in an 18 month period, or in guinea pigs in a 30 month period. The results of the experiment in which dust exposure and tuberculosis were combined are inconclusive and further work should be done before a definite statement can be made as to the possible effect of the dust on tuberculous infection. All these experiments are virtually completed, although several animals in the original groups are being kept alive for more prolonged exposure.

INVESTIGATIONS:

A. Petrographic and x-ray diffraction analyses of the dust supplied and used. Analyses were carried out initially and periodically during the course of the experiment. The composite of such analyses reveals the following:

Samples from the supply carton

Quartz <1% (approximately)
Chrysotile and Serpentine 15 - 20%; largely fibrous. The fibers and bundles present are usually several millimeters long and seldom are less than 300 μ
Calcite 5%

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Balance consisted of clay-like masses which gave a definite x-ray diffraction pattern not unlike a hydrous calcium silicate.

Samples collected from the atmosphere of the chamber.

Quartz 1%
Chrysotile and Serpentine 10 - 15%; less fibrous material than in sample above; many fibers are shorter than 20 µ.
Calcite 10%
Balance consisted of clay-like masses which gave a definite x-ray diffraction pattern not unlike a hydrous calcium silicate.

The analyses reveal several points of interest:

The low quartz content (1%) indicates that the amount of crystalline free silica in the dust is practically negligible as a possible cause of silicosis.

Although diatomaceous earth is one of the materials from which KAYLO is made, only a trace, probably much less than 1%, is unaltered and appears in the final product in its original form. Nearly all has been changed by the manufacturing process into another chemical compound, calcium silicate.

Most of the material consisted of clay-like masses which gave a definite x-ray pattern similar to that of a hydrous calcium silicate.

About 10 to 15% of the atmospheric dust in the experimental dust room was chrysotile or serpentine. Both of these minerals produce the same x-ray pattern. From petrographic examination of the original material, it appears that chrysotile, which is a fibrous mineral, is present in much greater amounts than the non-fibrous serpentine. In the atmospheric dust also, the fibers still predominate over the non-fibrous serpentine.

In the original material, the fibers were present in bundles often several millimeters long; not many were shorter than 300 µ. The fibrous portion of the atmospheric sample, however, consisted mostly of shorter bundles and of fibers, relatively few in number, which were generally about 10 to 40 µ in length.

B. Techniques of Investigation.

Two species of animals were introduced into the dust chamber assigned to this investigation. They included guinea pigs and white rats, animals which the Saranac Laboratory has used routinely in its studies apropos pneumoconiosis. Appropriate quantities of the original material supplied by the company were introduced into the dust generator of the chamber and pilot runs were made to ascertain the character and concentration of the air-borne dust produced. Having established the desired concentration, the animals were then introduced and throughout the course of the investigation dust counts were taken periodically.

The average concentration of the air-borne material was 122 million particles per cubic foot of air. This figure varied somewhat from month to month, ranging from a lower limit of 99 million to an upper of 122 million particles. This range is not unique for this material but has been observed also with most agents which we have employed. It results no doubt from day to day variations in atmospheric conditions which cannot be precisely controlled with our present methods. Nevertheless, we have elected to continue with such methods, believing that to do otherwise would introduce factors uncommon to actual industrial exposure.

The results of the experiments will be presented under the following headings:

I. KAYLO inhalation alone in guinea pigs.
II. KAYLO inhalation alone in white rats.
III. KAYLO inhalation and simultaneous tuberculosis infection in guinea pigs.
IV. Conclusions.

I. KAYLO inhalation alone in guinea pigs:

The course of this experiment through the first fourteen months was discussed in a summary written by Doctor Gardner in May, 1946. In this report he described the difficulty encountered with acute pneumonia in the guinea pigs and concluded that it was an accidental epidemic. His conclusion is supported by the fact that subsequently only four animals have died of pneumonia. This occurred, however, only after all apparently sick guinea pigs were disposed of, the apparently well pigs isolated, the dust room thoroughly cleaned, aired and disinfected, and all the cages sterilized. A third and new series of guinea pigs were introduced after control of the epidemic described. Throughout the course of the study, all animals were exposed continuously to the chamber cloud for eight hours a day, five and one-half days a week.

Thus far, a total of thirty-nine pigs have been killed in order to follow the course of the pulmonary reaction resulting from the deposition of inhaled dust in the lung. The period elected for study ranged from two to thirty months. Over this period no definite gross changes occurred in the lungs. The tracheobronchial lymph nodes have enlarged slightly, but remained soft. Microscopic study of the lungs reveal gradually increasing numbers of dust-containing macrophages. These inactive "dust cells" are found characteristically in clumps within groups of adjacent air spaces. The intervening alveolar walls are only slightly thickened by accumulated lymphocytes, but there is no undue proliferation of tissue histiocytes and connective tissue. Fibrosis is not present. Occasional multinucleated giant cells are seen. In addition, there are a very few elongated segmented brown structure which take an iron stain and are clearly asbestosis bodies. Microscopic study of the tracheobronchial lymph nodes reveals clusters of inactive "dust cells" similar to those demonstrated by the lung. There is no apparent over development of connective tissue, and again fibrosis is conspicuous by its absence.

Results of the chemical analyses carried out on the lungs of the exposed pigs sacrificed at the various periods are recorded in the following table:

TABLE I.

CHEMICAL ANALYSIS OF GUINEA PIG LUNGS

Animal Number	Time Exp.	Dry Matter				Ash		
		Ash %	SiO_2 %	MgO %	CaO %	SiO_2 %	MgO %	CaO %
2	2 mo.	4.42	0.24	0.07	0.08	5.57	1.59	1.85
6	2 mo.	4.94	.20	.08	.06	4.06	1.62	1.23
10	4 mo.	4.47	.22	.09	.09	4.87	1.99	1.99
11	4 mo.	4.42	.19	.08	.08	4.42	1.89	1.89
16	6 mo.	4.13	.25	.08	.08	5.83	2.00	2.00
18	6 mo.	3.74	.20	.08	.10	5.36	2.19	2.68
28	8 mo.	4.59	.31	.08	.13	6.84	1.77	2.75
34	8 mo.	4.34	.28	.11	.11	5.36	2.43	2.43
43	10 mo.	4.58	.46	.21	.14	10.12	4.30	3.04
56	10 mo.	4.81	.41	.14	.11	8.14	3.02	2.20
45	12 mo.	4.86	.53	.22	.14	10.80	4.65	2.80
46	12 mo.	4.99	.51	.08	.16	10.25	1.60	3.17
67	18 mo.	4.83	.59	.26	.09	12.27	5.31	1.83
68	18 mo.	4.90	.86	.32	.10	17.65	6.56	2.06
105	21 mo.	5.12	.64	.11	.19	12.54	2.03	3.68
108	21 mo.	5.23	.54	.08	.15	10.30	1.45	2.90
49	24 mo.	5.02	.66	.06	.13	12.70	1.20	2.54
50	24 mo.	4.71	.60	.08	.14	12.52	1.72	2.92

TABLE I

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In view of the observations recorded above, certain pertinent comments appear to be warranted. The microscopic studies of the lungs and tracheobronchial lymph nodes make it obvious that dust was suspended in the atmosphere of the chamber and that portions of that dust were inhaled and gained access into the lungs of the animals exposed. This is further substantiated by the chemical analyses of the lungs which show a gradually increasing amount of the various mineral components of the dust used in direct proportion to the exposure times. In the case of SiO_2, for example, the pigs sacrificed after ten months exposure revealed a two to three-fold increase. The MgO and CaO content also increased but the increments are inconsistent and less manifest.

The silica component of the mineral dust is of such low concentration that a significant pulmonary reaction would hardly be expected in consequence of its presence in the lung. This proved to be the case even in those animals exposed for a period of twenty-four months and revealing an average total of 12.61% SiO_2 of the lung ash. The character of the tissue response at thirty months is comparable and it is anticipated that the SiO_2 content will not be appreciably different.

Undoubtedly some of the dust cells constituting the mild cellular reaction observed may be in consequence of the serpentine components of the dust deposited in the lung. This, however, cannot be verified since serpentine is a relatively benign dust and fails to produce reaction other than mere dust laden macrophages. This interpretation is in accord with Doctor Gardner's observation that the silicate serpentine is a biologically inert substance producing at best a mild reaction consisting of small widely scattered local collections of dust laden phagocytes and an occasional giant cell without other cellular reaction and without fibrosis.

The presence of a rare curious body (asbestosis body) indicates that some of the air-borne fibrous component of the chrysotile gained access to the lung. However, the absence of cellular reaction or fibrosis about the terminal bronchioles would indicate that the inhaled quantity of such fibers was of extremely low intensity and insufficient to produce permanent damage. This view is supported by the petrographic and x-ray diffraction studies which disclosed that a major amount of the chrysotile component of the dust consisted of structures too large for dispersion into the breathing atmosphere and for easy access into the lung.

In consequence of the experimental studies with guinea pigs to determine the biological activity of KAYLO, it may be ~~tentatively~~ concluded that KAYLO alone fails to produce significant pulmonary damage when inhaled into the lung.

II. KAYLO inhalation alone in white rats:

This species was used because the rat is known to develop fibrosis from quartz inhalation more rapidly than other animals. Forty rats were used in this experiment and, as indicated by Doctor Gardner in his report in May, 1946, no difficulty with early development of pneumonia was experienced. In fact, during the first thirteen months of the experiment no spontaneous deaths occurred. From thirteen to eighteen months, about 40% of the animals died with terminal bronchiolitis and lobular pneumonia. This is of no significance, however, because it is well known that laboratory rats beyond the age of one year are subject to this type of lesion.

The results of exposure to KAYLO were followed by killing four rats at each of the following periods: six, nine, twelve, fifteen and eighteen months. The duration of the experiment was eighteen months and all animals have been killed.

The reaction to the dust throughout the experiment has consisted of focal collections in the pulmonary alveoli of macrophages containing particles and spicules of dust. As the duration of exposure increased, the only observed change was an increase in the number of such foci. Similar dust filled macrophages were seen in the tracheobronchial lymph nodes. In no animal was there any tissue reaction of the sort seen in silicosis or asbestosis.

Chemical analyses of the lungs of these rats show that the SiO_2 reached the average level of 16.6% of the lung ash within nine months and subsequently diminished. This is difficult to explain, since in the same period the percentage of SiO_2 in guinea pigs' lungs exposed simultaneously (see Table I) was increasing.

The table of these results follows:

TABLE II.

KAYLO INHALATION

SILICA DETERMINATIONS OF LUNG TISSUE IN RATS ONLY

Animal No.	Group	Ash in Dry Tissue %	SiO_2 in Dry Tissue %	SiO_2 in Ash %	Duration of Exposure
1012-202	IV	4.8	0.668	14.0	6 months
1012-201	IV	4.6	0.735	16.1	6 months
1012-205	IV	4.6	0.86	18.3	9 months
1012-206	IV	3.8	0.528	13.9	9 months
1012-209	IV	4.2	0.55	13.2	12 months
1012-210	IV	4.4	0.655	15.0	12 months
1012-215	IV	4.2	0.443	10.5	15 months
1012-223	IV	4.2	0.562	13.3	15 months
1012-225	IV	3.1	0.43	13.7	18 months
1012-234	IV	3.9	0.44	11.3	18 months

TABLE II

In commenting upon Part II of the investigation using white rats as the experimental animals, reference is made to the comments recorded under Part I, which apply.

III. KAYLO inhalation and simultaneous tuberculous infection in guinea pigs.

This experiment was carried out by the use of only one of the three methods which have been found valuable in determining the effect of dust on the course of tuberculosis. In this case the animals were infected with tubercle bacilli by inhalation and immediately placed in the dust room. Thus, we are testing the effect of the early accumulation of dust on the early course of tuberculosis. The other two methods available consist in exposing the animals to either the dust or the infection alone for several months, subsequently exposing them to the other agent. We may then study the effect of accumulated dust on the early course of tuberculosis, or the effect of dust on healing tuberculous lesions.

In the experiment which has been completed twenty-five animals were used. Of these, five died within ten months of the pneumonia which has been a problem throughout all the experiments with this dust. Four others were killed because they were in poor condition, and it was hoped to cut down the incidence of pneumonia by removing them from the room. These four also showed some evidence of pneumonia.

Of the remaining sixteen animals, eleven were killed in order to follow the course of the infection. One was killed at one month and two were killed at six, nine, twelve, fifteen and eighteen months. Two died at fourteen months, apparently from progressive tuberculosis; these will be discussed further below. Two animals died, one at thirteen and one at seventeen months, of undetermined causes, but not from tuberculosis.

Of the animals killed to follow the course of the infection, the lesions were isolated, encapsulated and regressing in all except one of the two killed at fifteen months. In this animal, lesions were widespread throughout the lung, but were associated with the production of fibrosis, indicating a tendency to heal.

The interpretation of the results of this experiment is complicated by the accessory factor that some of the animals were used for breeding during the experiment. This was done in an attempt to develop a strain of animals resistant to the infection which was producing the frequent pneumonias.

A review of the records shows that each of the two animals which died of progressing tuberculous infection had been used as breeders. In addition, the animal which was killed at fifteen months and showed widespread lesions had also been used for breeding.

Four other animals used for breeding during the same period did not show the extensive disease seen in the animals just described.

Thus, it seems hazardous to attempt to attribute the spreading of the tuberculous infection entirely either to the effect of the dust or to that of breeding.

IV. Conclusions:

1. It seems clear from the results presented in parts I and II above that KAYLO acts as an inert dust when inhaled by guinea pigs and rats; that is, it is phagocytized by macrophages, but does not injure them or produce fibrosis or anything suggestive of either silicosis or asbestosis. This indicates that the dust will probably be harmless on inhalation in moderate amounts over prolonged periods by normal human beings.

2. The results observed in the experiment concerning the influence of the dust on tuberculous infection are equivocal. Although it is our feeling that this dust exerts little or no adverse influence on tuberculosis, the possibility that it played a part in spreading the infection cannot be excluded.

3. In view of this possibility, further studies concerning this aspect of the problem should be carried out. It is imperative that the original experiment with infection and simultaneous dust exposure be repeated in its entirety. One further study with a small series of guinea pigs is now in progress. It is designed to reveal the influence of the dust on partially healed tuberculosis. However, it is now felt that this experiment should be carried out on a larger scale by increasing the number of animals. Should this expanded investigation be pursued, it might be identified as follows:

a. Repeat experiment to determine the biological activity of KAYLO when inhaled into the lung harboring a tuberculous infection, which otherwise would regress and heal; viz.: Does KAYLO stimulate the disease?

b. Repeat experiment to determine the biological activity of KAYLO when inhaled into the lung harboring a regressing or quiescent tuberculous focus; viz.: Does KAYLO reactivate a focus of infection?

c. Introduce a new experiment to determine the biological activity of KAYLO inhaled into the lung upon infection; viz.: Does KAYLO predispose the lung to tuberculous infection?

4. In addition, it appears important to explore the biological activity of hydrous calcium silicate either by inhalation or at least pilot-wise by injection methods should it be impossible to generate a sufficient cloud of atmospheric dust because of the character of the material.

5. These recommended investigations can be carried out simultaneously and completed in a period of eighteen months to two years. It is anticipated that these studies would remove the doubt raised by the results of the original experiments herein reported and would enable us to conclude finally that KAYLO is inert not only in regard to the production of pulmonary injury, but also in relation to associated tuberculosis.

Arthur J. Vorwald, M.D.
Director of Research
The Edward L. Trudeau Foundation

AJV:LB

Uruguay #2

~~Keto~~ Kayla

Exp 10/12

1 - Progress Report due. with possible Final Report

2 - Possibly additional investigation

3 - People have not contributed toward their contract as far we know

4/ Bill Hazard. is the "major donor" a very good friend of the lab. + interested in further support. -

PLAINTIFF'S EXHIBIT Kirstein-42 8-28-98

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OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

November 4, 1947

Arthur J. Vorwald, M. D.
Director of Research
Edward L. Trudeau Foundation
Saranac Lake, New York

Dear Dr. Vorwald:

Thank you for your letter of October 31 and the Interim Report on Animal Inhalation Experiments with Kaylo, dated October 30. We have passed the extra copies of these on to Mr. Bowes.

The report is very impressive - as well as gratifying. We appreciate the fine quality of work that has gone into the animal experimentation.

In the next day or two we expect to discuss the report and future activities with Mr. Bowes. Undoubtedly the experiments should be continued along the lines mentioned in paragraphs 3 and 4 of the conclusions - however, we will write you further about this, as well as about the financial arrangements.

With personal regards,

Sincerely yours,

OWENS-ILLINOIS GLASS COMPANY

W. G. Hazard

Industrial Relations Division

W. G. Hazard:et

CC- Mr. U. E. Bowes - Kaylo Division

PLAINTIFF'S EXHIBIT
Kirstein-43
8-28-98

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OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

November 4, 1947

The Saranac Laboratory of
The Edward L. Trudeau Foundation,
Saranac Lake, New York.

Attention of Dr. Arthur J. Vorwald.

Gentlemen:

Mr. Hazard has referred to me your letter and report of October 31st.

We are very surprised to learn that this work has gone on for this period of time without payments being made to you. When Dr. Gardner proposed a basis and suggested quarterly payments, we assumed that you would submit invoices quarterly. Usual accounting and disbursement practices necessitate an invoice.

At the time of our discussion with him at Pittsburgh in the fall of 1944, the initial experiments had already been conducted indicating that the material per se probably would involve no hazard by itself, but it was deemed advisable to carry it on for an additional period to have the evidence on a broader base. We believe that you should have kept us informed of the progress of this and the extent of the work under way.

The scope for the year 1945 was explained to us in advance by Dr. Gardner. What is the extent of the work conducted in 1946 and thus far in 1947? Nov. 27, 1944

Very truly yours,

U E Bowes

Manager of Division

PLAINTIFF'S EXHIBIT Kirstein-44 8-28-98

U.E.Bowes:jg

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November 11, 1947

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

In Doctor Vorwald's absence, I know he would wish me to thank you for your very kind letter of November 4.

Doctor Vorwald is embarrassed at his delay in getting out the reports to the various companies, but his schedule has been such a heavy one that there aren't enough hours in the day to do all he would like. He appreciates no end your patience and will be pleased, I know, to read your letter on his return on Friday, November 14.

Sincerely yours,

(Mrs.) Lillian R. Blinn
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director of Research
The Edward L. Trudeau Foundation

LB

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PLAINTIFF'S EXHIBIT
Kirstein-45
8-28-98

November 11, 1947

Mr. U. E. Bowes
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Bowes:

Your letter of November 4 has been received in Doctor Vorwald's absence and will be brought to his attention on his return to the Laboratory on Friday, November 14.

In answer to the last paragraph of your letter with regard to the extent of the work conducted in 1946 and thus far in 1947, we would refer you to Doctor Gardner's letter to you and report of May 13, 1946, and to the recent interim report of Doctor Vorwald dated October 30, 1947. Doctor Gardner outlined in his communication the progress of the experiment from its beginning (February, 1945 to May, 1946) and mentioned that it should be continued for at least another year to determine whether or not Kaylo is harmless. The recent report of Doctor Vorwald reviewed the findings up to October, 1947 and suggested further studies with this material, particularly in regard to its effect upon tuberculous infection.

If the above does not cover your question, I am sure Doctor Vorwald will be glad to go into the matter further on his return.

We realize, of course, that our accounting department should have submitted quarterly invoices to you, but apparently there was some slip-up somewhere and they were not apprised of the terms of the a reement. We deeply regret this oversight. This only came to light on Doctor Vorwald's arrival on July 1, when, in order to orient himself and realize his obligations, he reviewed all existing contracts. Doctor Vorwald ix extremely sorry that his heavy schedule h s prevented him from discharging his responsibilities more promptly.

PLAINTIFF'S EXHIBIT
Kirstein 46
8-28-98

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Mr. U. E. Bowes
Owens-Illinois Glass Company

November 11, 1947

If you have any other questions and you will write to Doctor Vorwald, I know he will make every effort to answer them.

Sincerely yours,

(Mrs.) Lillian R. Blinn
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director of Research
The Edward L. Trudeau Foundation

LB

000238

November 28, 1947

Mr. U. E. Bowes
Owens-Illinois Glass Co.
Toledo 1, Ohio

Dear Mr. Bowes:

On my return to the laboratory I find your letter of November 4 and the reply thereto which was formulated by my secretary.

I am sure that you appreciate the difficulties experienced by all of us in consequence of the sudden and untimely death of Doctor Gardner. There is no doubt in my mind that he contemplated writing you concerning our investigation in the interest of your company. Unfortunately the financial status of that investigation was called to my attention only after my arrival here some few months ago. It has been no easy task to accomplish all of the obligations and commitments assumed by Doctor Gardner. The long interval between his death and the appointment of his successor was productive of many serious oversights. They related primarily to administrative aspects rather than the technical and scientific. Fortunately the experiments continued satisfactorily in accordance with the design which Doctor Gardner inaugurated before his death. The administrative function had experienced, however, considerable degeneration. Such experience is certainly not unique especially where it involves a most active organisation such as Doctor Gardner had developed. In consequence, the financial reserve of the organisation was in rather precarious condition. I hesitated presenting the facts to you realizing that your financial support for the investigations approved originally by you was in arrears, due perhaps to oversight on your part or to a mutual misunderstanding between parties of the original contract. It seemed best that I present the facts clearly in an effort to strengthen our financial status as quickly as possible. The precarious state in which I found it was due in large measure to failure on our part in recovering for expenses involved in experimental work accomplished.

Believe me, Mr. Bowes, I appreciate your degree of surprise which my letter of October 31 to Mr. Hazard occasioned. However, my surprise on learning the facts was no less severe.

I should be pleased to hear from you, Mr. Bowes, especially as to your wishes concerning our continuation of the investigations as outlined in the conclusion of the interim report.

Sincerely yours,

PLAINTIFF'S EXHIBIT
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8-28-98

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Arthur J. Vorwald, M. D.
Director of Research
The Edward L. Trudeau Foundation

AJV:AS
cc: Mr. W. G. Hazard

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

December 1, 1947

Dr. Arthur J. Vorwald,
Director of Research,
The Edward L. Trudeau Foundation,
Saranac Lake, New York.

Dear Dr. Vorwald:

Replying to your letter of November 28th.

The most unsatisfactory phase of the question to me was to agree upon a program and a rate for it per year and then have it continue along without reasonably regular progress reports and with no invoices to bring the matter to our attention. We have no way of knowing whether the activity over the entire period was comparable with that of the initial period or not.

What is your interpretation of the amount now due you up to the beginning of the present quarter?

Very truly yours,

U.E. Bowes

Manager of Division

U.E.Bowes:jg

cc - Mr. W. G. Hazard

PLAINTIFF'S EXHIBIT
Kirstein-48
8-28-98

00023?

(1)

Re. Reply to Mr. Bowes' letter of 12/1/47

The cost of animal experiments includes a great variety of activities which might be listed as follows:

1. Price of animals
2. Housing, ~~and~~ feeding and care of animals
3. ~~Handling~~ Histological work, including materials and labor.
4. Chemical analysis of dust, and animal tissues.
5. Studies of atmospheric dust concentrations.
6. Professional study and analysis of results.

May we assure you that work in these various phases has continued constantly throughout the period of this investigation, although ~~these~~ in the early stages of the experiment there were many more animals than at present, there was less chemical and interpretational work to be done. At present these latter activities are increased, while the animals are in smaller numbers.

Thus you will understand that although the field of greatest ~~efforts~~ activity may vary from time to time, the overall effort, and hence the expense, is virtually constant.

In view of this fact, and in accordance with the contract originally agreed upon, the total ~~cost~~ up to the beginning of the present quarter is as follows: 000232

Feb 1945 - Feb. 1946	5,000.00
Feb. 1946 - Feb 1947	5,000.00
Feb. 1947 - Nov. 1947	3,750.00
Total	13,750.00

3 - 6 - 9

$3 \overline{)5,000}$ = 1666.67

$4 \overline{)5,000}$ = 1250

1250 × 3 = 3750

We deeply regret the oversight, which clearly was ours, that resulted in omission of payments over the course of the experimental period.

We also regret the fact that no formal report was issued between May, 1946 and the present one. However, we hope you will understand that there was no indication for Dr. Gardner to write one before he died in Oct., 1946 and that from then to the present there was noone on the staff competent to have interpreted the pathological changes, analyzed all the results, and made a formal report.

That the work was proceeding on the original scale was indicated in a letter to Mr Hazzard from Mr. Bowditch on Dec. 24, 1946, and at a visit to this laboratory made by Mr Hazzard and Dr. Shook on Feb 5, 1947.

I hope you will understand the reasons for the long delay in issuance of a formal report and I would like to make it clear that the professional staff is now adequate to enable us to make progress reports as indicated.

December 12, 1947

Mr. U. E. Bowes
Owens-Illinois Glass Co.
Toledo 1, Ohio

Dear Mr. Bowes:

In response to your letter of December 1, and with reference to mine of November 28 and the interim report of October 30,1947, permit me to relay to you certain of our views with regard to the experiments which we have continued in the interest of your company.

The cost of animal experiments which we have been pursuing during the past few years with respect to Kaylo includes a great variety of activities which might be listed as follows:

1. Price of animals.
2. Housing, feeding and care of animals.
3. Histological work including materials and labor.
4. Chemical analyses of dust and animal tissues.
5. Continued studies of atmospheric dust concentrations.
6. Professional study and analysis of results.

May we assure you that these activities have continued constantly throughout the period of the investigation. Although in the early stages of the experiment there were many more animals than at present, there was less chemical and interpretational work to be done. The tempo of activities identified under 3,4, and 6 above has been accelerated and at present is being maintained at a high level. This is true irrespective of the fact that the number of animals involved under 1 and 2 above are in much smaller numbers. Thus you will understand that although the field of greatest activity may vary from time to time, the overall effort and expense remains relatively constant.

In view of this fact and in accordance with the contract originally agreed upon, the total cost up to the beginning of the present quarter is as follows:

February 15,1945 to February 15,1946	$ 5,000.
February 15,1946 to February 15,1947	5,000.
February 15,1947 to November 15,1947	3,750.
Total	$13,750. - check

rec'd 1/8/48
advised by
Mr. Hayter

PLAINTIFF'S
EXHIBIT
Kirstein-50
8-28-98

000230

We deeply regret the oversight which clearly was ours in failing to send you quarterly statements over the course of our investigations. We also regret the fact that no formal report was issued between May, 1946, and the recent one dated October 30, 1947. However, we trust you will understand that there was no indication for Doctor Gardner to write one before he died in October, 1946, and that from that time to the present, every effort has been made to formulate an interim report. In consequence, the latest report of the record of our investigation as of October 30,1947, was accomplished.

Be assured that the work is continuing at the present time to establish the fact that Kaylo is biologically inert. We are not certain, however, as to its influence upon a tuberculous process. This is a very important phase of the investigation and is one in which, we believe, your company is interested. We would have a deep sense of regret should you elect to discontinue the program.

Sincerely yours,

Arthur J. Vorwald, M.D.
Director of Research
The Edward L.Trudeau Foundation

AJV:ko

cc - Mr. W.G.Hazard
cc - Mr. Hayton 1/8/48 (when check was rec'd)
LRB

Memo for Dr. Vorwald:

Re: Owens-Illinois Glass Cos. obligation of $5000. a year for research. Experiment 1012 - K-Lo.

Agreement authorized by letter of Mr. Bowes dated December 8, 1944, following correspondence with Dr. Gardner.

Experiment started approximately February 15, 1945, and has therefore been running for two years,. ten and one-half months, as of December 31, 1947.

There is due the Saranac Laboratory, therefore, on basis of the 1944 agreement:

2 full years, at $5000.00	$10,000.00
10 1/2 months, at $5000.00 per yr..	4,375.00
Total	14,375.00

In view of the fact that many industrial concerns wish to know the amount of outstanding obligations at the end of the calendar year (which is also, usually, their fiscal year) it might be well to send to Owens-Illinois Glass Company a statement containing the above figures, so that the Company will have it in hand, and we shall have placed it on the record, before December 31, 1947.

Roy Dayton.

DEC 29 1947

000229

PLAINTIFF'S EXHIBIT Kirstein-51

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

December 25, 1947

Mr. Manfred Bowditch
Administrative Head of Laboratories
Trudeau Sanitarium Foundation
Trudeau, New York

Dear Mr. Bowditch:

We wish to take this opportunity of expressing our appreciation of your continued cooperation and assistance. 1947 has been a most satisfactory year in so far as our Medical Service program is concerned. A large percentage of our success has been traceable to organizations like yours where a helping hand has always been available. Thanks.

May I extend the heartiest of ChristmasGreetings and the finest of New Years' Salutations to you and your staff.

Sincerely yours,

INDUSTRIAL RELATIONS DIVISION

C F Shook

Medical Director

C. F. Shook, M. D.
jb

PLAINTIFF'S EXHIBIT
Kirstein 52
8-28-98

000228

INSULUX GLASS BLOCK PLASTIC PRODUCTS Duraglas CONTAINERS CLOSURES Libbey Safedge TUMBLERS

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

January 9, 1948

Dr. Arthur Vorwald, Director of Research
Trudeau Foundation
Saranac Lake
New York

Dear Dr. Vorwald:

We have been asked by a plant that makes a considerable number of ~~the~~ replacements in their fluorescent tube lamps whether there is any chance of harmful exposure to beryllium dust when the dead tubes are broken up. They say that they let the worn-out lamps accumulate for several weeks, and then break them all at once. Considerable dust is generated.

Do you think any special precautions should be taken during this operation?

We have never seen this problem mentioned in any of the industrial hygiene journals. However, if there is anything to it, we would like to circularize all our plants.

With kindest regards,

Sincerely yours,

W. G. Hazard
INDUSTRIAL RELATIONS DIVISION

W. G. Hazard:et

PLAINTIFF'S EXHIBIT
Kirstein 53
8-28-98

000222

January 19, 1948

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

Enclosed herewith is a copy of my letter to Mr. U. E.Bowes. It makes manifest our deep appreciation for the reimbursement and indicates also our sincere regret for the oversight on our part in failing to notify the company concerning the fiscal methods relative to our investigations. I want you to have, however, a more personal note expressing our gratitude for your most loyal confidence in our ability to pursue studies apropos Kaylo. Without such confidence, I am sure that the Owens-Illinois Glass Company would have denied us the privilege to be of service to them. They might have taken issue also with our fiscal analysis concerning reimbursement for the investigations by the Laboratory in behalf of the company.

At the moment we are somewhat in a quandary concerning the recommendations for further study which were included in our interim report dated October 30, 1947. Having had no word we cannot make plans for our operations during the current fiscal year.

The experiments under way at the present time in the dust house assigned to Kaylo will be completed finally in May of this year. The investigations concerning the influence of Kaylo on tuberculosis will continue until July. If the recommendations are approved by your company, we should introduce them as soon as possible lest there be an undue gap in our program.

PLAINTIFF'S
EXHIBIT
Kirstein-54

000220

Perhaps, Mr. Hazard, you would elect to act again in our behalf and relay to us some information concerning conditions of our investigations concerning Kaylo. Perhaps also you will accept our every good wish,

Sincerely yours,

Arthur J. Vorwald, M.D.
Director of Research
The Edward L. Trudeau Foundation

AJV:kc
Enc.

January 19, 1948

Mr. U. E. Bowes
Owens-Illinois Glass Co.
Toledo 1, Ohio

Dear Mr. Bowes:

Please accept my sincere apology for failure to acknowledge receipt of your check for $13,750. We are indeed most grateful to you and your company for the reimbursement, yet we are distinctly conscious of the embarrassment which it occasioned. Our oversight in not having made representation to your company long since is regretable. I hope that it has not harmed our relationships which we cherish most highly.

In view of the above it appears advisable to record clearly certain aspects, lest in failing to do so at this time we experience similar misunderstandings at some future date. It is difficult for me to enter into these discussions without some degree of frankness which I trust you will understand is primarily a business license.

It is my interpretation that the check covers a period of two years and nine months, that is from February 15, 1945, to November 15,1947. Reference was made to this in my letter to you of December 12,1947. The experiments are continuing and will extend well into the current fiscal year. The agreement currently in effect terminates on the 15th of February. Thus from a financial standpoint it appears that a sum of $1,250. might be expected at that time. Should your views, Mr. Bowes, be contrary to this interpretation, please do not hesitate to advise me.

The interim report which we submitted on October 30,1947, included certain recommendations for continued studies in behalf of Owens-Illinois Glass Company. We anticipate that the company wishes us to expand our investigations as identified in Part 4, Paragraph 3 of that report. Thus far, however, we have had no word concerning your wishes and are at a loss to make plans for introducing them into our investigative studies. In this regard, we should also appreciate your advice.

PLAINTIFF'S EXHIBIT
Kirstein-55
8-28-98

000224

Sincerely yours,

Arthur J. Vorwald, M.D.
Director of Research
The Edward L. Trudeau Foundation

AJV:kc
CC: Mr.W.G.Hazard

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

January 28, 1948

Dr. Arthur J. Vorwald
The Saranac Laboratory
Saranac Lake, New York

Dear Dr. Vorwald:

Thanks for your letter of January 19. Yesterday we discussed the future Kaylo program with Mr. Bowes. I believe he's writing you about it. I think he is going to authorize the Saranac Laboratory to go ahead with further studies as outlined in your report of October 30, 1947.

We hope to keep in close touch with you on the results of these experiments, and appreciate the thought and skill that go into conducting them. We are sure that at their conclusion the health aspects of Kaylo will have been authoritatively settled.

Sincerely yours,

W. G. Hazard

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

PLAINTIFF'S EXHIBIT
Kirstein-56
8-28-98

000226

INSULUX GLASS BLOCK   Duraglas CONTAINERS   Libbey Safedge TUMBLERS
PLASTIC PRODUCTS   CLOSURES

FORM 64

AMERICAN STRUCTURAL PRODUCTS COMPANY
SUBSIDIARY OF

OWENS-ILLINOIS GLASS COMPANY

OFFICES IN PRINCIPAL CITIES

A.S.P.Co.
REQN. NO. ASE-1

PURCHASE ORDER NUMBER
AS-170

DATE 2/3/48

The Saranac Laboratory
of the Edward L. Trudeau Foundation
Saranac Lake, New York

IMPORTANT
SEND INVOICE IN TRIPLICATE
TO ~~OWENS-ILLINOIS GLASS COMPANY~~
PURCHASING DEPT.
AMERICAN STRUCTURAL PRODUCTS COMPANY
SUBSIDIARY OF OWENS-ILLINOIS GLASS COMPANY
P. O. Box 1035
Toledo 1, Ohio

SHIP TO Mr. U. E. Bowes, President
American Structural Products Company
AT P. O. Box 1035
Toledo 1, Ohio
VIA

YOU REPRESENT THAT THE GOODS PURCHASED HEREUNDER ARE FREE FROM PATENT INFRINGEMENT.

IMPORTANT

Please mail Invoice and Bill of Lading as above instructed immediately after forwarding shipment.

OR

Instruct your Shipping Department (or your Shipping Point) to mail immediately to Purchasing Department at Receiving Plant a shipping memorandum or postal notice, which will bear reference to this order, and show fully all information in regard to what has been shipped, origin, destination, routing and packing.

Address all correspondence relative to this order to the purchasing department.

In making this purchase the validity of any patents is not recognized.

Order Number MUST be Shown
On all Packages
On all Invoices
On all Correspondence

Advise Approximate Shipping Date

Continue experiments on Inhalation of Kaylo Dust by Animals as outlined on Pages 10 and 11 of your Interim Report of October 30, 1947

Work to be continued until December 31, 1948, unless conclusive results should result before that time

Invoice quarterly at the rate of $5,000.00 per year

Check due on Quarter Nov. 15 to 15 Feb -

paid Bill

Sales Tax Exempt
F.O.B. Saranac Lake, N.Y.
Terms: Net

a/c A.S.P.Co. 02-8811
DD/sf
U. E. Bowes

PLAINTIFF'S EXHIBIT
Kirstein-57
8-28-98

000219

AMERICAN STRUCTURAL PRODUCTS COMPANY
SUBSIDIARY OF
OWENS-ILLINOIS GLASS COMPANY
PURCHASING DEPARTMENT
BY Donald [illegible]

MANUFACTURERS OF

INSULUX GLASS BLOCK   Duraglas CONTAINERS   Libbey Safedge TUMBLERS
PLASTIC PRODUCTS   CLOSURES

February 9, 1948

Mr. W. G. Hazard
Industrial Relations Department
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

Before leaving for Rochester to give a Gardner Memorial Lecture, Doctor Vorwald asked me to answer your recent letter regarding the disposal of dead fluorescent tubes and to say that one of the lamp manufacturers is preparing a bulletin concerning this matter. As soon as we receive our copy we will send one to you.

In the meantime, Doctor Vorwald suggests that you treat the dust created in the breaking up of the tubes as hazardous material and that you be governed accordingly.

You will no doubt hear further from Doctor Vorwald in this connection in the very near future.

Sincerely yours,

(Mrs.) Lillian R. Blinn
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director of Research
The Edward L. Trudeau Foundation

LB

000221

PLAINTIFF'S
EXHIBIT
Kirstein-58
9-28-98

TRUDEAU SANATORIUM
DEPARTMENT OF RADIOLOGY

AGRIPPA G. ROBERT, M.D.
DIRECTOR

TRUDEAU, N.Y.

February 20, 1948.

Mr. William G. Hazard,
Industrial Relations Division,
Owens-Illinois Glass Company,
Toledo 1, Ohio.

Dear Mr. Hazard:

Dr. Vorwald has passed along to me a copy of your letter to him dated February 12. Needless to say, I am sorry that you have been inconvenience, either by the invoices or by the delay in receiving reports on certain of your films.

With regard to the invoices. we can easily list the names of the various individuals examined during each month, and we shall be very glad to do so in the future. One copy of such list will accompany the separate invoice sent to each plant, and another will be attached to the recapitulation of charges for all plants, which I understand is forwarded to your office. In this way, there should appear a clear record of the charges rendered.

With regard to the delay in reports, I can only apologize with the statement that our commitments have been extremely heavy during the past few months, and that to date I have had no associate. I hope that the latter situation will be shortly remedied, but in any event we shall make a special effort to render reports on the films belonging to your companies, more promptly. I realize full well the inconveniences which may have arisen because of the delays, and hope that these may be avoided in the future.

With warm personal regards and good wishes, I remain

Very sincerely yours,

AGRIPPA G. ROBERT, M. D.

AGR:S
CC to Dr. Vorwald

PLAINTIFF'S EXHIBIT
Kirstein-59
8-28-98

000223

File

March 3, 1948

Mr. U. E. Bowes
Owens-Illinois Glass Co.
Toledo 1, Ohio

Dear Mr. Bowes:

We wish to thank you for your purchase order AS-170, dated February 3, 1948, authorizing us to continue the inhalation experiments with Kaylo dust as outlined on Pages 10 and 11 of our interim report of October 3, 1947. We particularly invite your attention to the final paragraph of this letter summarizing certain pertinent points having reference to the additional work identified below.

The new experiments mentioned in that report are concerned principally with the effect of inhaled Kaylo dust on pulmonary tuberculosis and we should like to review briefly the studies we propose to carry out. As mentioned in previous correspondence, the original experiments with Kaylo alone will be completed in May and those dealing with the influence of Kaylo on tuberculosis will continue until June. However, we shall begin the new series of experiments immediately, or as soon as a supply of normal animals becomes available, in order not to delay the investigation. Thus, for a period of a few months both the original and the new experiments will be carried on simultaneously.

The new studies we plan to make are as follows:

a. <u>To determine whether Kaylo stimulates tuberculosis.</u>

A group of normal guinea pigs will be infected by inhalation with the R_1 strain of tubercle bacillus and then placed in the dust room. At intervals of about 3 months a few animals will be sacrificed in order to study the development of the tuberculous disease.

b. <u>To determine whether Kaylo reactivates a focus of tuberculous infection in the lungs.</u>

A group of guinea pigs, after being infected with the R_1 organism, will be left in normal air until the disease process in the lung has healed. They will then be transferred to the dust room. Sacrificings will be made at regular intervals to find

000215

PLAINTIFF'S EXHIBIT
Kirstein-60
8-28-98

out whether exposure to Kaylo dust reactivates the healed tuberculous disease.

c. To determine whether Kaylo predisposes the lung to tuberculous infection.

Several groups of guinea pigs will be placed in the dust room and allowed to inhale Kaylo dust. After 2 months of exposure one group will be infected by inhalation with the H_1 organism; after 4 months a second group, and after 6 months a third group will be infected. Regular sacrificings will reveal whether or not the background of dust exposure affects unfavorably the usual course of the tuberculous infection.

d. To investigate the biological activity of hydrous calcium silicate.

It was our intention to investigate also the biological activity of the hydrous calcium silicate which is one of the components of Kaylo. Such an investigation would be desirable if it is found that Kaylo has an unfavorable effect on tuberculous infection because only a single component of the material might be responsible for that condition. Thus far, however, we have been unable to identify which of the hydrous calcium silicates is present in Kaylo. If Kaylo should prove to be inert, then biological tests with hydrous calcium silicate would be unnecessary; if Kaylo is not inert but affects unfavorably tuberculous infection, perhaps the experimental department of the Owens-Illinois Glass Company could prepare a small quantity of hydrous calcium silicate for use in animal experiments. This need not be done if the experiments with Kaylo itself yield negative results.

In your purchase order AS-170, which authorizes us to carry on the experiments with Kaylo, it is stated that work is to be continued until December 31, 1948, unless conclusive results are established before that time, and that payments are to be made quarterly at the rate of $5,000 per year.

Based upon our experience with other dusts, it appears quite unlikely that definite and final conclusions concerning the effect of Kaylo on tuberculosis can be reached by December 31st of this year. As indicated in the last paragraph of our interim report, eighteen months to two years of investigation are ordinarily required and for some dusts, especially those like Kaylo which appear to be realitvely inert, an even longer period of study is often employed in order to rule out the possibility of a delayed or slowly-developing reaction. We realize that as a matter of administrative policy, you may prefer not to make commitments beyond the current year, but we do wish to point out that biological reactions to inhaled dust and to tubercle bacilli proceed very slowly and that final conclusions cannot safely be based upon too short a period of observation.

In the original proposal for the inhalation experiment with Kaylo, as outlined by the late Dr. Gardner in his letter of November 27, 1944, it was stated that the charge for the investigation would be $5,000 per year. Since that time costs of experimental work, as in all other fields of activity, have increased considerably and a recent analysis by our accountant has revealed that the expense of conducting an inhalation experiment in one of our dust rooms, including such items as price and care of animals, professional study of tissue by histological, chemical and other techniques, and review of findings, is at least $10,000 per year. Consequently, we feel justified in asking that the financial support of the additional experimental investigations with Kaylo be increased to $7,000 per year, the new arrangement to take effect with the quarter beginning May 1, 1948.

The current experiments being conducted under the contract initiated by Dr. Gardner in 1945 were to terminate on February 15, 1948. However, they are being extended to June 1st of this year to compensate somewhat for the delay occasioned by intercurrent pneumonia among the experimental animals introduced into the initial experiments in February, 1945. This delay was referred to in our recent interim report to you. My letter of January 19th makes mention also of certain financial aspects pertaining to this work.

In conclusion, Mr. Bowes, permit me to summarize, lest there be a misunderstanding which I wish to avoid in view of previous complications.

The 1945 agreement terminates officially, on February 15, 1948, but the work will be extended to June 1, 1948, for which the sum of $1,250 is still outstanding.

The 1948 agreement approved by purchase order AS-170, dated February 3, 1945, is for the annual rate of $5,000, established in 1944. It is based upon the proposal for additional investigations incorporated in our recent interim report, submitted on October 30, 1947, in which we failed to quote the budgetary requirements necessary for the additional work outlined. In view of increasing costs of all our investigations, we invite financial support of $2,000 above that 1945 figure, thus requesting a total of $7,000 annually for two years, beginning the second quarter, May 1, 1948, and terminating May 1, 1950.

We are very appreciative of the support given our endeavors in the past and trust you will allow us to continue the work approved, but with the financial support identified herewith.

With every good wish to you.

Sincerely yours

Arthur J. Vorwald, M. D.
Director of Research
The Edward L. Trudeau Foundation

AJV:bw

cc: Mr. M. G. Hazard
cc: Mr. Dayton

AMERICAN STRUCTURAL PRODUCTS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

SUBSIDIARY OF

OWENS-ILLINOIS GLASS COMPANY

March 31, 1948

Dr. Arthur J. Vorwald, Director,
The Saranac Laboratory of the
Edward L. Trudeau Foundation,
Saranac Lake, New York.

Dear Dr. Vorwald:

There has been some unavoidable delay in my replying to your letter of March 3rd in which you ask that we extend our commitment for two years from May 1, 1948, at the rate of $7,000.00 per year.

Frankly, my reason for confining the definite commitment to one year is my lack of confidence in the way this entire transaction has been handled. We first submitted to your laboratories this problem on February 12, 1943. By the end of our proposed extension of one year, you will have had the assignment six years and will have been paid approximately $20,000.00.

My original conversation with Dr. Gardner certainly did not give me any reason to expect that it was a seven-year job to evaluate this one material. It seems to me that we might reasonably expect to have had in five years from the time we gave your laboratories this project some definite report that would be of value to us. After some hesitation, it was my judgement to extend the assignment for one year and review its status at that time.

Please understand that I am not presuming to be competent to judge the ease or difficulty of work of this kind, but we set out in February 1943 to determine the status of this material, and the handling of it has been quite unsatisfactory.

Very truly yours,

President

U.E.Bowes:jg
cc - Mr. W. G. Hazard

000214

PLAINTIFF'S EXHIBIT
Kirstein-61
8-28-98

April 26, 1948

Mr. U. E. Bowes, President
American Structural Products Company
Toledo 1, Ohio

Dear Mr. Bowes:

I appreciate the frank comments in your letter of March 31 and sense considerable disappointment on your part concerning the manner in which our investigations were conducted and the results obtained.

It is my impression that this stems in large part from certain administrative and financial difficulties precipitated perhaps by mutual misunderstanding. I am unable to identify a weakness in our scientific approach and must take exception to your view that reports of value to you have not been forthcoming.

It disturbs me greatly to have you entertain any degree of disappointment concerning our studies apropos the biological activity of an industrial dust. Therefore, I should like to present a summary of our efforts in your behalf and trust that it will influence you to change your views.

1. February 2, 1943 - Two samples of "Hydrous Calcium Silicate" (Rotoclone Dust and Sander Dust) - received from Owens-Illinois Glass Co.

2. May 31, 1944 - Report submitted by the Saranac Laboratory identifying the investigations made and the results thereof.

    (1) Rotoclone Dust:

        a. X-ray diffraction studies

        b. Petrographic studies

        c. Animal assays

000211

PLAINTIFF'S EXHIBIT
Kirstein-62
8-28-98

(2) Sander Dust:

a. X-ray diffraction studies

b. Petrographic studies

c. Animal assays

3. June 17, 1944 - Received a check for this service $250.00

Extended Studies

1. December, 1944 - Authorized to proceed with investigations at $5,000. per year.

2. February, 1945 - Experiments started.

3. May 13, 1946 - First report submitted giving evidence that inhaled Kaylo fails to produce pulmonary fibrosis. No evidence of effect on an associated tuberculous infection.

4. October, 1946 - Death of Doctor Gardner.

5. February 5, 1947 - Visit by Mr. Hazard and Doctor Shook to determine status of investigations.

6. October 30, 1947 - Second report submitted. Conclusions: Kaylo acts as an inert dust when inhaled into the lung. Its influence on a tuberculous infection is equivocal.

7. January 8, 1948 - Received a check for . . . . $13,750.00 to cover period of investigations from February 15, 1945 to November 15, 1947, inclusive (refer my letter December 12, 1947).

000212

The investigations to date show rather conclusively that Kaylo is an inert dust per se and incapable of producing a fibrosis on inhalation into the lung. This information is of definite value even though we cannot as yet give assurance that Kaylo fails to stimulate a tuberculous process in the lung. I have every expectation that our current studies will enable a very definite opinion in that regard.

I agree that our investigations have taken a long time, but the nature of the studies dictates prolonged observations to make as certain as possible the potentialities of the dust when inhaled into the lungs. This can be determined only after months of observation. It must be so by reason of the fact that the daily increments of dust localized in the lungs by inhalation are of very low magnitude and the inflammatory response of the pulmonary parenchyma to such localizations is so sluggish. Believe me, it demands extreme patience on our part to wait until the desired period of time has elapsed to warrant positive conclusions concerning the potential toxicity of dust when inhaled.

I am certain, Mr. Bowes, that you are aware of the above and that you appreciate also the impossibility of forecasting either the results of research or the time necessary to conduct it. All we can hope for is a confidence that the investigations will be pursued as rapidly and efficiently as possible.

Again, Mr. Bowes, I would be pleased to have your comments. We are proceeding with the investigations in accordance with your authorization.

Sincerely yours,

Arthur J. Vorwald, M.D.
Director of Research

AJV:LB

CC: Mr. W. G. Hazard

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

September 21, 1948

Dr. A. J. Vorwald
The Saranac Laboratory
Saranac Lake, New York

Dear Dr. Vorwald:

When Dr. Shook was at Saranac recently he talked with certain persons who were conducting the animal experiments on Kaylo dust. Some questions came up as to the composition of Kaylo—and we are listing them below with answers:

1. Is the dust now being used of the same composition as the material that was originally supplied?

   There was, to the best of our knowledge, no significant difference in the compositions of the lots of Kaylo dust supplied, with this possible exception: the asbestos portion of the more recent dust may have contained a greater ratio of amosite to chrysotile.

2. Does Kaylo contain tri- or di-calcium silicate?

   Apparently a comparison of the effect of portland cement and of kaylo dust gave rise to the inquiry if Kaylo contains tri- or di-calcium silicate. The answer is no. Kaylo contains a hydrated mono-calcium silicate. This compound tends to hydrolyze in water to give a maximum pH of about 10.5. The anhydrous tri- and di-calcium silicates, which are constituents of cement, give rise to pH values of 12.3 and of 11.5 respectively.

3. Is Santocel, on which the Trudeau Laboratory is now conducting similar tests, about the same in composition as Kaylo?

   Santocel is essentially 100% amorphous silica. Kaylo, on the other hand, contains no free silica except for only occasional grains of residual or unreacted quartz. These grains

000208

are, for the most part, relatively coarse. Kaylo may be considered as being 80 to 85 per-cent of hydrated mono-calcium silicate of sub-microscopic crystal size, and of 15 to 20 per-cent of asbestos of the amosite and chrysotile varieties.

If there are any further questions on the above, we hope you will drop us a line.

With kindest regards,

Sincerely yours,

W. G. Hazard

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

cc - Dr. C. F. Shook - Toledo
Mr. U. E. Bowes - Toledo

September 24, 1948

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

Thank you very much for your letter of September 21 to Doctor Vorwald in which you answer several questions concerning the composition of Kaylo. This will be brought to his attention when he returns from Europe, about the middle of October.

Sincerely yours,

(Mrs.) Lillian R. Blinn
Executive Secretary to Doctor Vorwald

LB

cc Dr. Shook

PLAINTIFF'S EXHIBIT
Kirstein-64
9-28-98

000207

October 6, 1948

Doctor Vorwald:

In making up the forecast for next year, Mr. Wagner called me on the telephone today to inquire re the status of Owings Illinois Glass. You will recall, Mr. Bowes failed to answer your last letter in explanation of the contract, but the cost as set forth in your letter of March 3 was to be $7,000 per year for two years - to take effect with the quarter beginning May 1, 1948.

In February, 1948, we received an order from the Company authorizing the continuation of experiments at the rate of $5,000. to be invoiced quarterly. Your letter of March 3 (copy of which went to Mr. Dayton's office) is in reference to this order.

A letter dated March 31, from Mr. Bowes in reply to yours of the 3rd, mentioned he confirmed a commitment for one year because he wasn't satisfied with the transaction as a whole. A letter from you on April 26 went into detail, but no replied has been received.

As I understand it, we are going ahead with the experiments; Mr. Delahant is getting in shape for Doctor Pratt all the material covering the contract which terminated officially Feb. 15, 1948, but which was not concluded until June, 1948, as set forth in your letter of March 3 (page 3).

Now it appears that the bookkeeping department has not billed Owens Illinois for the $1250. due on February 15, 1948 on the old contract. I mentioned to Mr. Wagner that this was unfortunate in lieu of the past slipup on the billing; that now, perhaps, it would be better to wait until we send out our report and include the bill.

Since on the order for the new contract, to commence May 1, 1948, we were specifically requested to bill quarterly, as mentioned in your letter of March 3, a bill is past due on the new contract, but since we have never been authorized on the $7,000. basis, I am wondering whether you brought this up at the time of Dr. Shook's visit.

I expressed to Mr. Wagner that it was my understanding as a result of this particular unfortunate account, that they were to automatically bill all contractors and that is why we send them a copy of the proposals, and acceptances.

It is too bad that both bills are due at this time, and I am wondering whether in this particular case we hadn't better send the bill on the new contract after the first six months' period with a report of our studies.

I believe, Doctor Vorwald, the Bookkkeeping Department should be instructed to bill quarterly all of our accounts unless otherwise advised. It was my understanding such instructions had been issued on your arrival as a result of this particular account.

ARB

PLAINTIFF'S EXHIBIT Kirstein-65 8-28-98

000206

October 22, 1948

Memorandum: Mr. Dayton

From: Doctor Vorwald

Subject: Owens-Illinois Glass Co.'s Contract

1. I believe the complication regarding the above contract can be straightened out as follows:

   A. The Laboratory will prepare a final report in regard to the contract which terminated on February 15, 1948, and at that time will inform you so that you may submit a statement for $1250. to be enclosed with that report.

   B. The Saranac Laboratory will also prepare an interim report in accordance with the agreement in effect as of May 1, 1948, which we will assume is on a basis of $5,000. annually. At that time a bill should be prepared to cover the first six months in the amount of $2500. and should accompany the report.

2. Should you identify any mechanism which might be more satisfactory, please advise.

AJV:LB

PLAINTIFF'S EXHIBIT
Kirstein-66
8-28-98

000216

INTERIM REPORT

REGARDING THE BIOLOGICAL ACTIVITY

OF KAYLO DUST

to the

OWENS-ILLINOIS GLASS COMPANY

TOLEDO, OHIO

by

THE SARANAC LABORATORY

SARANAC LAKE, NEW YORK

OCTOBER 30, 1948

Submitted by:

Arthur J. Vorwald, M. D., Director
The Edward L. Trudeau Foundation

In cooperation with:

Philip C. Pratt, M. D.
Thomas M. Durkan, M. E.
Anthony B. Delahant

cc. A B Delahant
P. C. Pratt

INTRODUCTION

One year ago, on October 30, 1947, an interim report was submitted, covering the progress of certain animal experiments with Kaylo over a total period of 30 months. It was necessary at that time to recommend further experiments concerning certain phases of the problem. The present report deals with the final phases of the experiment then in progress and with the early observations made in the new series of experiments.

The original experiment has now been completed and the conclusions drawn are based upon the results of a full three years' exposure to an atmospheric suspension of Kaylo dust. Previous experience has shown that this is the required period over which exposures to a dust of doubtful biological activity must be continued before final conclusions are warranted. This experiment, in fact, constitutes an example of the importance of such prolonged study for, as is to be shown below, the findings at three years were strikingly different from those at two and one-half years and the tentative conclusion reached at that time must now be altered. Thus, at the time of the previous report, the evidence indicated that Kaylo acted as an inert dust in normal rats and guinea pigs; resulting only in the formation of clumps of dust cells, without fibrosis. However, it will be shown below that Kaylo is capable, on prolonged inhalation, of producing asbestosis in the lungs of guinea pigs, and that it should be handled industrially as a hazardous dust.

This report will be presented in four sections as follows:

A. Final observations, dust inhalation in normal guinea pigs.

B. Discussion.

C. Conclusions.

D. Progress report on new series of experiments.

A. <u>Final observations, dust inhalation in normal guinea pigs.</u>

Reference to the Interim Report of October 30, 1947, will reveal that two groups of normal guinea pigs were placed in the dust room: one group in February 1945 and the second in August 1945. The animals were exposed to atmospheric suspensions of Kaylo dust for eight hours daily, five and one-half days a week throughout the experiment. The dust concentration, which varied somewhat from time to time, has averaged 116 million particles per cubic foot of air over the entire course of the experiment to date.

A brief review of the observations described on page 4 of the previous report will reveal that up to thirty months the reaction in guinea pigs was limited to the accumulation of clumps of macrophages, containing dust particles, in groups of adjacent air spaces. While occasional multinucleated giant cells were seen, there was no undue proliferation of tissue histiocytes and fibrosis was absent. A few unmistakable asbestosis bodies were identified. In general, the accumulation of cells of the types described above and their persistence as such over a full three year period, without the development of fibrosis, has been found to indicate that the agent responsible for them is not capable of producing fibrosis. Such agents are now considered to be "biologically inert," since the mere cellular accumulation has not been shown to affect pulmonary function or resistance to disease.

However, of nine animals sacrificed subsequent to thirty months in the present experiment, all have shown not only the above lesions but also have developed true fibrosis of a type characteristic of the response of guinea pigs to asbestos. This is a rather diffuse type of fibrosis which forms chiefly about the small air ducts, known as bronchioles, from which the air spaces, or alveoli, of the lung arise. The appended photomicrographs show the nature of the lesions being discussed. This condition is identical with asbestosis as can be seen by comparing

Figure 2 with Figure 3.

The lesions in the tracheobronchial lymph nodes showed no change between thirty months and three years.

Chemical analysis of the lungs of guinea pigs that had inhaled Kaylo dust for periods up to 36 months yielded the data given in Table 1. It will be noted that as the period of exposure became longer the ash value gradually increased, indicating an accumulation of mineral matter in the lungs. There was a pronounced increase in the silica component up to about 30 months and then a slight decrease. The reason for this condition, which has been observed in experiments with other dusts, is not entirely clear. Since only two animals were analyzed for each exposure period, individual values were occasionally out of line but the general trend was clearly indicated.

B. Discussion.

The final observations in this experiment with Kaylo inhalation in normal guinea pigs, reported above and illustrated in the figures, prove that Kaylo is capable of producing the characteristic reaction, asbestosis. It is evident, therefore, that a considerable portion of the asbestos component in Kaylo remains unchanged during the manufacturing process or, if it is changed, that the altered product maintains its capacity to cause fibrosis. While the lesions up to 30 months showed no fibrosis, certain aspects of them were compatible with a preliminary stage in the development of asbestosis. These aspects were masked by the inert type of reaction to the materials other than asbestos in the dust. The characteristic early stage of the reaction to asbestos is the predilection of the fibers to localize in the lumen and wall of the small air ducts, known as terminal bronchioles. This is in contrast to particulate materials, which localize chiefly

000194

in the actual air spaces, or alveoli. In the present experiment the greatest portion of the inhaled dust, being particulate, lodged in the alveoli and masked the peribronchiolar deposition of some of the fibrous component. In retrospect, it is possible to discern that there is more evidence of dust cell activity in the region of the bronchioles than is characteristic of the reaction to an inert particulate dust. Little significance was attached to this at the time of the previous report because there was no evidence of the development of fibrosis.

The differences between the early reaction to Kaylo and that to asbestos may be interpreted as a modification of the lesions by the particulate components of Kaylo. "Modification" of silicosis is well recognized when lesions of that disease develop following inhalation of a mixed dust containing quartz together with materials of an inert nature, such as iron oxide.

It is of importance to note that while the peribronchiolar reactions observed incriminate Kaylo as capable of producing asbestosis, they exclude the possibility that it may cause silicosis, since, over a full three year period, there is in no animal any focus of hyaline nodular fibrosis characteristic of the reaction to quartz. Furthermore, it may be added that the animals show no evidence of the type of diffuse fibrosis which has been observed in this laboratory to follow inhalation of diatomaceous earth dust. In regard to hydrated mono-calcium silicate, a major constituent of Kaylo, it may be said that while there is no pointed evidence as to its effect on pulmonary tissue, there is much evidence to show that a variety of silicates, including some forms of calcium silicates, are biologically inert. It seems likely that the calcium silicate in Kaylo should conform with this previous experience.

Thus, the possibility expressed by Doctor Gardner in his early consideration of this problem, that Kaylo might produce two pneumoconioses, asbestosis and silicosis, with the resultant safety hazards, has been adequately studied, and concern over the latter condition can be dismissed. Further consideration must be given to asbestosis, however.

The laboratory has recently completed a large amount of work with asbestos, which has been reported to certain other supporting companies, but not as yet published. The following discussion of the problem is drawn largely from that work, and we would request that these comments be considered confidential. It is felt that the following information may be of aid to the Owens-Illinois health department in formulating a safety program, which certainly is necessary in view of the results of this Kaylo experiment.

Asbestosis, both in man and animals, is a chronic, slowly developing peribronchiolar fibrosis, which in late stages extends from the original site of localization into the surrounding alveoli. The bronchiolar localization is apparently due to the fibrous nature of the mineral. Experimental studies indicate that the chief mode of action is by mechanical irritation of tissue by the fibers. The structure of these fibers, and the capability of repeated longitudinal division to molecular strands, is important in the mechanism of action, since the solid fibers of glass wool are not capable of producing the fibrosis. Chemical action is of little or no importance in causing reaction, since chrysotile rendered particulate by cutting and separation does not initiate fibrosis.

Certain investigations have indicated that a seemingly negligible proportion of fibrous asbestos is sufficient to produce the characteristic reaction. Thus, an inhalation experiment was carried out with ball-milled asbestos in which an attempt was made to eliminate all fibers from the material. It was found to be impossible to break up all of the fibers and about one per cent of the air suspended dust consisted of fibers. The characteristic peribronchiolar fibrosis developed in the exposed animals after forty months. Thus, it appears that very small numbers of fibers are capable of producing asbestosis, although the development of the lesions is delayed. The present experiment with Kaylo is also an example of this fact.

The important matter of progression of reaction after exposure to asbestos dust ceases has been extensively investigated. The results indicate that in contrast to silicosis, where progression continues for some time, there is no significant degree of progression in extent of the lesions. Rather, the size of the lesions decreases in asbestosis due to the tendency of the fibrous tissue to contract after the stimulus to its production is removed. The irritation of tissue by an asbestos fiber is apparently arrested within a few months after it enters the lung by the formation of the "asbestosis body" (a coating of the fiber by iron-containing material), with the result that the existing fibrous tissue contracts. Whether this contraction exerts a beneficial or deleterious effect on lung function is now under investigation.

Unfortunately, the studies with asbestos have not as yet completely clarified the problem of its effect on associated tuberculous infection. It appears that Kaylo may exert a slightly more marked adverse influence on the infection than does pure asbestos. The difference may well be due to the presence of the small amount of quartz in Kaylo or perhaps to other incidental factors. One purpose of the studies now under way is to clarify this problem.

G. Conclusions.

1. Kaylo, because of its content of an appreciable amount of fibrous chrysotile, is capable of producing asbestosis and should be handled as a hazardous industrial dust.
2. Kaylo does not produce silicosis in animals.

3. Kaylo does not produce the diffuse cellular fibrosis of the lungs now recognized as resulting from inhalation of diatomaceous earth.

B. Progress Report on new series of experiments.

The three phases of the experiment, as outlined in the report of October 30, 1947 and in a letter dated March 3, 1948, are now under way. While little of significance has developed thus far, a review of the work is presented here. Progress and results to date of these experiments are given below under the title of each phase.

(1) The effect of Kaylo inhalation on tuberculous infection initiated at the onset of dust exposure.

Thirty experimental animals were infected with the attentuated strain (R_1) of tubercle bacillus used in this type of experiment and were placed in the dust room the next day. Thirty-three control animals were infected at the same time and kept in normal air. Of the experimental animals, six are now dead, two having been sacrificed at two months, two at four months and two having died.

One death occurred at five weeks due to intercurrent pneumonia. The other was so recent that sections have not yet been prepared.

The animals killed at two months showed lesions comparable with those in the controls, both grossly and microscopically. The animals killed at four months have not been studied microscopically, but on gross examination the lesions appear similar in the two groups.

(2) The effect of Kaylo inhalation on regressing tuberculous lesions in guinea pigs.

In this phase of the experiment, twenty-five guinea pigs were infected, and groups of them were kept in normal air for two, four and six months before being placed in the dust room. At the present time the first two groups have been placed in the dust room; the third is to go in on December 15, 1948.

Only two animals of the first group have been sacrificed as yet, after two months in the dust. Microscopic observations have not been made, but in the gross, the lesions were comparable with those in control animals.

(3) The effect of accumulated Kaylo in the lungs on a subsequent tuberculous infection.

Thirty normal guinea pigs were placed in the dust room on May 12, 1948, and on August 12, 1948 were infected with the attenuated tubercle bacilli. Five animals were sacrificed at this time for chemical analysis to establish the amount of dust inhaled. Control animals were infected on the same date. Animals were sacrificed recently, two months after infection. Grossly, the lesions in the experimental and control animals were comparable, but again microscopic observations have not been made.

The results to date in this experiment are of little significance, since the disease is a chronic one and any changes due to the inhalation of dust of any nature are known to be slow. However, it can be said that the experiment is progressing very satisfactorily, and that we anticipate none of the complications which interfered with the interpretation of the previous experiment in regard to the effect of Kaylo on experimental tuberculosis.

Fig. 1 - Kaylo inhalation, 30 months. 200X

The photo shows a cross section of a bronchiole just above and slightly to the left of center. The other spaces are alveoli. Note the dark masses within some of the smaller spaces, especially to the right of the bronchiole. These are the macrophages and multinucleated giant cells, described in the text. Note the thinness of the wall of the bronchiole; it is virtually normal as is apparent on comparison with Figure 5. An asbestosis body is present in this field, and is revealed in Figure 4 at higher magnification.

000200

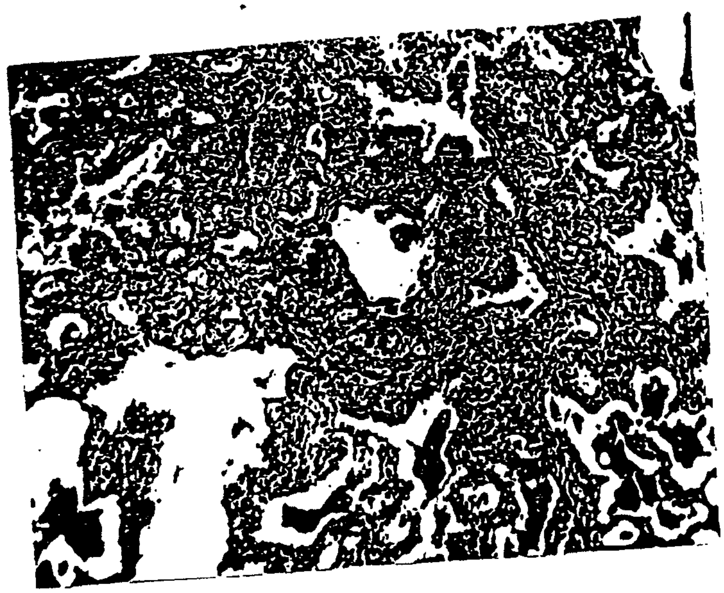

Fig. 2 - Kaylo inhalation, 36 months. 200X

The bronchiole in this photomicrograph is just above and to the right of center. Note the thickness of the tissue between its lumen and that of the adjacent alveoli in comparison with the bronchiolar walls in Figures 1 and 5. Fine strands of fibrous tissue can be seen here, but they are more apparent, because less dense, in the area at the right of the field where fibrosis has extended to adjacent alveolar walls.

000201

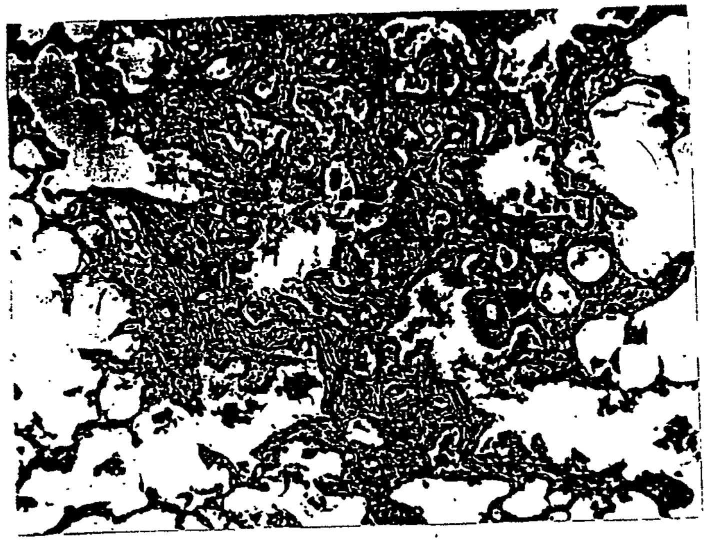

Fig. 3 - Asbestos inhalation, 30 months. 200X

The bronchiole in this photomicrograph is just above and to the left of center. Note the thickening of its wall as in the Kyle animal at 36 months. Strands of fibrous tissue are apparent within the wall of this bronchiole, as well as in the adjacent alveolar walls.

000202

Fig. 4 - Kaylo inhalation, 30 months. 1200X

This higher magnification of part of the field shown in Figure 1 reveals a typical form of "asbestosis body," the curved dark elongated structure to the right of center.

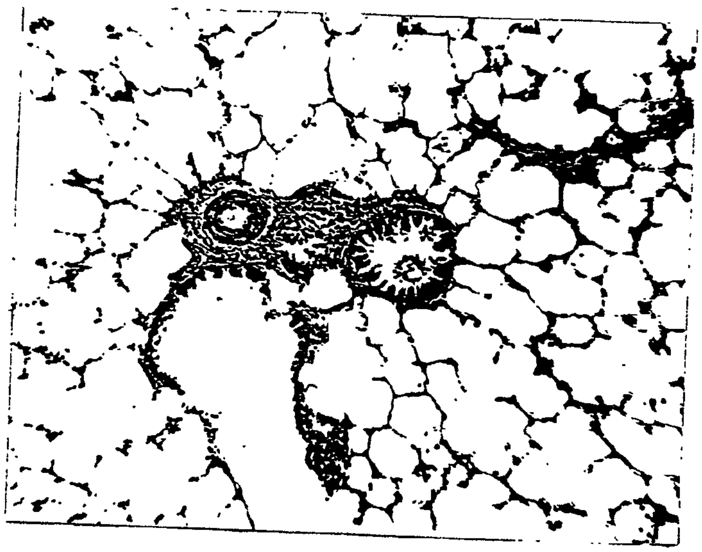

Fig. 5 - Normal guinea pig lung. 200X

This field shows two bronchioles, one in longitudinal, the other in cross section. The small associated blood vessel is seen above the former bronchiole. Compare the thickness of the wall of these bronchioles, with that of the bronchioles in Figures 1, 2, and 3. Note also the empty alveoli and thin alveolar walls.

000204

Table 1

ANALYSES OF LUNGS OF GUINEA PIGS

EXPOSED TO DUST IN

INHALATION EXPERIMENT WITH KAYLO DUST

Animal Number	Duration of Exposure	Ash of Dry Tissue	Per Cent of Dry Tissue			Per Cent of Ash		
			SiO_2	CaO	MgO	SiO_2	CaO	MgO
	months	per cent	per cent	per cent	per cent	per cent	per cent	per cent
2	2 mos.	4.42	0.24	0.08	0.07	5.57	1.85	1.59
6		4.94	0.20	0.06	0.08	4.06	1.23	1.62
10	4 mos.	4.47	0.22	0.09	0.09	4.87	1.99	1.99
11		4.42	0.19	0.08	0.08	4.42	1.89	1.89
16	6 mos.	4.13	0.25	0.08	0.08	5.63	2.00	2.00
18		3.74	0.20	0.10	0.08	5.36	2.68	2.19
28	8 mos.	4.59	0.31	0.13	0.08	6.84	2.75	1.77
34		4.34	0.28	0.11	0.11	6.49	2.43	2.43
43	10 mos.	4.58	0.46	0.14	0.21	10.12	3.04	4.30
56		4.81	0.41	0.11	0.14	8.42	2.20	3.02
45	12 mos.	4.86	0.53	0.14	0.22	10.80	2.80	4.65
46		4.99	0.51	0.16	0.08	10.25	3.17	1.60
67	18 mos.	4.83	0.59	0.09	0.26	12.27	1.83	5.31
68		4.90	0.86	0.10	0.32	17.65	2.08	6.56
105	21 mos.	5.12	0.64	0.19	0.11	12.54	3.68	2.03
108		5.23	0.54	0.15	0.08	10.30	2.90	1.45
49	24 mos.	5.02	0.66	0.13	0.06	12.70	2.54	1.20
50		4.71	0.60	0.14	0.08	12.52	2.92	1.72
114	27 mos.	5.13	0.82	0.14	0.19	15.93	2.57	3.76
119		4.78	0.46	0.12	0.15	9.55	2.41	3.08
72	30 mos.	5.62	1.10	0.14	0.05	19.56	2.56	0.92
76		5.53	1.12	0.13	0.05	20.25	2.28	0.91
121	33 mos.	5.70	0.97	0.13	0.21	17.10	2.25	3.77
122		5.38	0.59	0.12	0.17	11.00	2.28	3.25
80	36 mos.	5.63	0.85	0.16	0.19	15.10	2.89	3.28
87		5.36	0.67	0.11	0.17	12.45	2.11	3.17
88		5.43	0.54	0.16	0.15	9.92	2.86	2.38

000205

November 16, 1948

Memorandum to: Mr. Dayton

From: L. R. Blinn

Re: OWENS-ILLINOIS GLASS COMPANY

Doctor Vorwald suggests that you issue new statement in accordance with the second page of the attached letter to Mr. Bowes, dated November 16, 1948, and forward from your office.

LB

000187

PLAINTIFF'S EXHIBIT
Kirstein-68
8-28-98

November 16, 1948

Mr. U. E. Bowes
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Bowes:

Enclosed you will find three copies of a report on the results of animal experiments with Kaylo dust. As is our custom, we have summarized briefly material previously presented, including our interim report dated October 30, 1947, and have given detailed discussion only of subsequent developments. When all experiments have been completed, we expect to prepare a final report which will include details of each phase so that all data will be available in one place. However, the experimental study of the effects of inhaled Kaylo dust on normal uninfected animals is now finished and conclusions expressed on that subject are final rather than tentative.

In the report issued one year ago, which describes the findings in animals that inhaled Kaylo dust for periods up to 30 months, the following tentative conclusion was made:

> "In consequence of the experimental studies with guinea pigs to determine the biological activity of Kaylo, it may be tentatively concluded that Kaylo alone fails to produce significant pulmonary damage when inhaled into the lung."

During the 30 to 36 months period, however, definite indication of tissue reaction appeared in the lungs of animals inhaling Kaylo dust and therefore, I regret to say, our tentative conclusion quoted above must be altered. In all animals sacrificed after more than 30 months of exposure to Kaylo dust unmistakable evidence of asbestosis has developed, showing that Kaylo on inhalation is capable of producing asbestosis and must be regarded as a potentially-hazardous material. It should be noted that since neither silicosis nor the diffuse pulmonary fibrosis caused by inhaled diatomaceous earth was observed, the quartz and diatomaceous earth components of the dust apparently do not produce their typical lesions.

In order to present more information on the subject asbestosis, certain evidence derived from our experimental work with asbestos dust has been discussed. As these findings have not yet been released for publication, I request that, while using them as required in formulating a safety program, you regard them as confidential.

PLAINTIFF'S EXHIBIT
Kirstein-69
8-28-98

The new series of experiments with respect to the influence of Kaylo on tuberculous infection are well under way and are progressing satisfactorily. It is, of course, too early to expect significant results on which to base even tentative conclusions.

At this time may I review briefly the financial arrangement for conducting the investigation with Kaylo? The research program up to this year was carried on under a contract, initiated in 1945, by which the experiments would be subsidized with a grant of $5,000. per year. As pointed out in my letter of March 3, 1948, the contract terminated officially on February 15, 1948, but the investigation would be continued without charge until June because the original experiments were started late. Since a check was received which took care of the subsidy up to November 15, 1947, there is due on the old contract the sum of $1,250. for the final quarter of the contract (from November 15, 1947 to February 15, 1948). We have delayed sending an invoice for the final quarter until all work could be finished and a final report submitted. Following the termination of the experiment in June, it has required several months to do the histological work, study the tissue sections, collate the data and prepare the report which accompanies this letter.

We are including in the report a brief review of the new experiments in which the effect of inhaled Kaylo dust on tuberculous infection is being studied. Your purchase order 18-170 authorizing this experiment at $5,000. for one year is dated February 3, 1948, but owing to a shortage of animals and other unavoidable delays the actual experimental work did not get under way until May. Hence we have concluded that financial support for this new program should be dated from May 1, 1948. For reasons outlined in my letter of March 3, I suggested a two-year contract at $7,000. per year. Your letter of March 31 acknowledged this but failed to confirm the extra amount of $2,000. involved. Nevertheless, we have proceeded at the old rate and are endeavoring to absorb the increased cost from our Foundation reserve.

In a few days our accounting department will forward a statement of the payments now due in support of the research program, as follows:

Original experiment, begun February 15, 1945, at rate of $5,000. annually	
For final quarter (November 15, 1947 to February 15, 1948)	$1,250.
New experiment, begun May 1, 1948, at rate of $5,000. annually	
For first quarter (May 1, 1948 to August 1, 1948)	$1,250.
For second quarter (August 1, 1948 to November 1, 1948)	$1,250.
	$3,750.

I realize that our findings regarding Kaylo are less favorable than anticipated. However, since Kaylo is capable of producing asbestosis, it is better to discover it now in animals rather than later in industrial workers. Thus the company, being forewarned, will be in a better position to institute adequate control measures for safeguarding exposed employees and protecting its own interests.

Sincerely yours,

Arthur J. Vorwald, M.D.
Director

AJV:LB
Encs. (3)

CC: Mr. Dayton

December 11, 1948

Mr. David Innis
Owens-Illinois Glass Company
Berlin, New Jersey

Dear Mr. Innis:

We have about a month's supply of Kaylo on hand. Will you please arrange to have shipped to us approximately another 100 pounds at your earliest convenience for continuation of our experimental program.

Sincerely yours,

(Mrs.) Lillian R. Blinn
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director

LB

Rec'd
1/6/49
223

000186

AMERICAN STRUCTURAL PRODUCTS COMPANY

GENERAL OFFICES • TOLEDO 1, OHIO

SUBSIDIARY OF

OWENS • ILLINOIS GLASS COMPANY

DRAWER F

BERLIN, NEW JERSEY

December 13, 1948

Mrs. Lillian R. Blinn
The Saranac Laboratory
Saranac Lake, New York

Dear Mrs. Blinn:

Your letter of December 11 to Mr. Innes has been referred to me for reply. We will send you the material you requested in a few days.

Since Mr. Innes is now at another plant, future requests should be directed to the undersigned. Please note that the name of the company has been changed to that shown on the letter-head.

Very truly yours,

E. C. Shuman

E. C. Shuman
Director of Research

ECS:ef

Give some idea as to product record

000183

PLAINTIFF'S EXHIBIT
Kirstein-71
8-28-98

December 28, 1948

American Structural Products Company
Drawer F
Berlin, New Jersey

Attn: Mr. E. C. Shuman
Director of Research

Gentlemen:

We have received the three cartons of Kaylo requested in our letter of December 11.

The Kaylo previously sent for our dusting experiment was a powder with the following approximate composition, as shown by x-ray diffraction analysis:

Quartz	less than 1%	
Asbestos (chrysotile)	15-20	approx. (fibers, frequently less than 3 microns)
Calcite	5	approx.

The balance, presumably a hydrous calcium silicate, consisted of aggregates, 100 microns and under in size.

Since we have received the brick form of Kaylo, we are wondering if you might not send us the material which we have previously received, and what disposition should be made of the material we have just obtained from you.

Sincerely yours

Arthur J. Vorwald, M.D.
Director

AJV:bw

PLAINTIFF'S EXHIBIT Kirstein-72 8-28-98

000182

AMERICAN STRUCTURAL PRODUCTS COMPANY

GENERAL OFFICES - TOLEDO 1, OHIO

SUBSIDIARY OF

OWENS-ILLINOIS GLASS COMPANY

DRAWER F
BERLIN, NEW JERSEY

December 30, 1948

Dr. Arthur J. Vorwald
The Saranac Laboratory
Saranac Lake, New York

Dear Dr. Vorwald:

I am sorry that the Kaylo block was sent to you when, as a matter of fact, it was Kaylo dust which you wanted. We are sending you three (3) cartons of Kaylo dust and suggest that you ship back the Kaylo block at your convenience.

Very truly yours,

E C Shuman

E. C. Shuman
Director of Research

Block ret'd
Dust rec'd
1-6-49
AB

ECS:ef
cc: Mr. H. G. Finley - Berlin

000179

PLAINTIFF'S EXHIBIT
Kirstein-73
8-28-98

THE TRUDEAU FOUNDATION

FOR

THE CLINICAL AND EXPERIMENTAL STUDY OF PULMONARY DISEASE

AT SARANAC LAKE, NY.

THE SARANAC LABORATORY
THE TRUDEAU FOUNDATION
THE TRUDEAU SCHOOL

AT TRUDEAU, N.Y.

THE DEPARTMENT OF PHYSIOLOGY
THE DEPARTMENT OF BIOCHEMISTRY
THE DEPARTMENT OF RADIOLOGY
THE TRUDEAU LABORATORY

January 20, 1949

Memorandum to: Dr. Vorwald
From: Roy Dayton

Re: Owens-Illinois Glass Company-1949 period

We have today received a standing order dated January 19, 1949 to cover the interpretation of x-ray films as requested during the year 1949 at $2.50 each.

This constitutes a renewal for this year of the contract for film readings.

RD:AD

Memo to Dr. Vorwald
From Administrative Office

File contract

Re: Payment on Kaylo experiment, Owens-Illinois Glass Co

A check in theamount of $1250.00 has been received from American Structural Products Company, in payment of our invoice dated February 1, 1949. This covers the third quarter, November-December, 1948 and January, 1949.

American Structural Products Company is a subsidiary of Owens-Illinois Glass Company.

RD.

MAR 11 1949

00[illegible]174

PLAINTIFF'S EXHIBIT
Kirstein-75
8-28-98

THE SARANAC LABORATORY
OF THE EDWARD L. TRUDEAU FOUNDATION
SARANAC LAKE, N.Y.

ARTHUR J. VORWALD, M.D.
DIRECTOR

000175

INTERIM REPORT

REGARDING THE BIOLOGICAL ACTIVITY

OF KAYLO DUST

to the

OWENS-ILLINOIS GLASS COMPANY

TOLEDO, OHIO

by

THE SARANAC LABORATORY

SARANAC LAKE, NEW YORK

April 30, 1949

Submitted by:

Arthur J. Vorwald, M.D., Director
The Edward L. Trudeau Foundation

In cooperation with:

Philip C. Pratt, M.D.
Thomas M. Durkan, M.E.
Anthony B. Delahant

I. INTRODUCTION

The following brief interim report of the progress of experiments at the Saranac Laboratory, concerns the effect of Kaylo inhalation on the course of tuberculosis. The study is being carried out in three phases, in accordance with the procedure outlined first in the interim report of October 30, 1947, Section 5 under "Conclusions."

As the detailed review below will indicate, the experiment is progressing satisfactorily, and has now run for slightly more than 6 months. At this stage of an experiment such as is underway, one is not justified in attempting to evaluate the results, with the purpose of drawing conclusions. Previous experience has shown that under some conditions, experimental tuberculous lesions may appear quiescent at 6 months, but may subsequently exacerbate and progress. Under other circumstances the opposite course may rarely occur, that is, lesions may show slight early progression (never marked) with subsequent healing. Only an overall view of the course of the infection over a period of at least 18 months or 2 years can provide acceptable evidence.

II. MATERIALS AND METHODS

Experiments concerning the influence of the inhalation of dusts on the course of tuberculous infection are carried out in guinea pigs, with the aid of a particular type of tubercle bacilli, known to bacteriologists as the R_1 strain. This strain was isolated by workers

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in this institution some 20 years ago and has been used extensively in this and other laboratories since then.

It has been shown that bacteria of the R_1 strain have lost much of their virulence, or ability to produce progressive disease, in guinea pigs. Yet the bacilli are not truly avirulent, since they do cause lesions which develop over a period of about 2 months, following which gradual healing occurs during the next 18 to 24 months or longer. An occasional animal, about 1 in 20 to 30, will develop progressive tuberculosis following infection, suggesting that the virulence of this organism for the guinea pig is remarkably close to that of human tubercle bacilli for Man.

Guinea pigs for the present experiment were infected by causing them to inhale an atomized suspension from a culture of these organisms diluted to the point where it contained 8 to 10 bacilli per oil immersion microscopic field. The required number of guinea pigs was infected from a single culture, and was then divided into 5 groups of experimental and control animals as outlined below.

The experimental animals were exposed to the inhalation of Kaylo dust in the same dust room which has been used throughout this experiment. Dust has been generated in the same manner as before, the atmospheric concentration having averaged 205 million particles per cubic foot.

The 5 groups of animals of which this experiment is comprised include three different time relationships between date of infection and date of dust exposure, and two groups of controls. Only two

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control groups are needed, because one of these serves for two of the experimental groups which can conveniently be infected on a single day from the same culture. The third experimental group, however, must be infected 8 months later, and must, therefore, have its own control group. All the animals are from a single stock, of comparable age and weight, and are kept on the same diet.

The groups, and the purpose for which each was set up, are as follows:

Group I - Guinea Pigs. Infection, with immediate daily dust exposure.

The purpose of this phase of the study is to ascertain the effect of dust accumulation on concurrently developing tuberculous infection.

Group II - Guinea Pigs. Infection, with dust exposure beginning 2, 4 and 6 months later.

The purpose of this phase of the study is to ascertain the effect of dust accumulation on tuberculous infection in various stages of healing.

Group III - Guinea Pigs. Infection, without subsequent dust exposure.

The purpose of this group, as has been stated, is to serve as a guide, or control, in interpreting the course of the disease in the animals of Groups I and II.

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Group IV - Guinea Pigs. Dust exposure for three months followed by tuberculous infection.

The purpose of this phase of the study is to ascertain the influence of accumulated dust on the course of a superimposed tuberculous infection.

Five animals of this group were killed after the initial period of dust exposure for histological and chemical study. Table 6 reveals the results of chemical analysis, performed with two of the animals following fixation in formalin. The levels are somewhat higher than those noted in the early stages of the experiment reported previously, presumably because the atmospheric dust concentration has been higher. Histologic examination revealed the early response to Kaylo inhalation described in previous reports, namely, accumulation of scattered dust cells in alveoli. Occasional asbestos fibers were noted, but no asbestosis bodies.

Group V - Guinea Pigs. Infection without dust exposure.

These pigs served as controls to Group IV.

III. RESULTS

In the interest of brevity, the data accumulated to date from observation of all the animals is presented in the appended tables. Tables 1 to 5 cover Groups I to V, respectively. Brief comments are introduced below to emphasize the significance of the recorded data.

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Table 1. The results recorded here are to be compared with those in Table 5. It will be noted that there is much more intercurrent pneumonia in the animals exposed to Kaylo than in the controls. This phenomenon has been a problem in all experiments with Kaylo, as all who have been connected with the experimental program are aware. It is now believed that this pneumonia in guinea pigs is related to the presence of asbestos fibers in sufficient numbers to cause asbestosis as has been shown by previous phases of this study. Pneumonia among guinea pigs, but not in other species, has often been a problem in other experiments with asbestos minerals. The last death from pneumonia occurred 5 months ago, and it now appears that the remaining animals may be resistant to it.

In regard to the course of the tuberculous infection, itself, it may be pointed out that only 2 experimental animals have shown microscopic evidence of progressive disease, one of these being at 2 months, when it is not uncommon to see it even in controls. The other was at 8 months. Only one animal has shown gross evidence of spreading disease at the time of autopsy, that being the last animal to die. This observation cannot be confirmed microscopically as yet.

The differences between Groups I and III, are not significant, and it may be said that up to the present, the course of tuberculous infection has not been altered by the inhalation of Kaylo.

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Table 2. The results recorded here are to be compared with those in Table 5. The results obtained to date reveal a single animal with microscopic evidence of spreading disease. This is even less pronounced than that seen in one of the controls, and certainly does not indicate an adverse influence from Kaylo inhalation.

Table 3. Control data for Tables 1 and 2. The data recorded for animal number 73 which died at 6-1/2 months reveal that it is one of the occasional animals encountered with excessive susceptibility to R_1 infection.

Table 4. The results recorded here are to be compared with those in Table 5. It will be noted that three animals revealed microscopic evidence of spreading lesions, not noted in the controls. This was of slight degree, and only subsequent developments can reveal the significance of these early changes. It is of interest that animal number 96, which is recorded as a 2 plus, showed also a number of lesions undergoing definite healing. It is not unlikely that this is an indication of the future trend of the lesions in this group.

Table 5. The results recorded here are to be compared with those in Table 4.

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IV. DISCUSSION AND RECOMMENDATIONS

Salient points which have been noted to date have been emphasized in the brief paragraphs concerning each of the tables. The evidence to date does not indicate an adverse influence on tuberculosis due to inhalation of Kaylo.

At the present time, however, the evidence is inconclusive, since there is no way to predict, from the early course of an experiment such as this, what the ultimate results may be. As was mentioned in the introduction to this report, we have observed in other experiments cases in which lesions appeared to be spreading after about 6 months, but subsequently healed. The opposite course of events has also occurred. In the former case, experience has shown that such agents as caused this course of events constituted no recognizable industrial hazard. It is strongly recommended, therefore, that this experiment be continued to a total period of at least 18 months or, preferably, 2 years as was suggested when the work was originally contemplated, in order to obtain reliable evidence concerning the effect of Kaylo dust inhalation on tuberculous lesions. This would entail prolonging the experiment for another 6 months, or preferably 14 months, to reach the desired total period of 24 months.

Table 1

KAYLO + R_1 SIMULTANEOUS

Animal Number	Mode of Death	Duration	Gross: Lungs	Gross: Bronchial Node	Gross: Spleen	Gross: Liver	Gross: Hepatic Lymph Node	Microscopic: Lungs	Microscopic: Bronchial Node	Microscopic: Spleen	Microscopic: Liver	Microscopic: Hepatic Lymph Node
4	D	1-1/2 mo.	pn +	+	0	0	0	Tissue autolyzed				
(1	K	2 mo.	+	+	0	0	+	+	+	+	+	+
(2	K	2 mo.	+	+	0	0	+	++	+	+	+	+
6	D	3-3/4 mo.	(pn?)	+	0	0	0	pn	0	0	0	0
(3	K	4 mo.	+	+	0	0	+	+	0	0	0	0
(5	K	4 mo.	+	+	0	0	+	+	+	0	0	+
24	D	4-1/2 mo.	(pn?)	+	+++	+	+	pn	+	?	++	++
25	D	5-1/3 mo.	(pn?)	+	0	0	+	pn	0	+	0	0
10	D	6 mo.	pn +	+	0	0	+	Tissue autolyzed				
(7	K	6 mo.	0	+	0	0	0	0	+	0	0	0
(8	K	6 mo.	+	+	0	0	0	+	+	0	0	+
30	D	6+ mo.	pn +	?	0	0	0	pn	0	0	0	0
14	D	7 mo.	pn +	+	0	0	0	Tissue autolyzed				
22	D	7-2/3 mo.	pn	?	0	0	0	Tissue autolyzed				
(9	K	8 mo.	+	+	0	0	+					
(13	K	8 mo.	+	+	0	0	+	++	+	+	0	-
28	D	8-1/2 mo.	++	+	+	+	+					

13 remain for subsequent study

KEY:
- D = died
- K = killed for sampling
- Pn = intercurrent pneumonia
- 0 = no tuberculous lesions seen
- + = healing or healed tubercles
- ++ = scattered isolated spreading tubercles
- +++ = many spreading tubercles
- ++++ = confluent tuberculosis

Where microscopic observations are not recorded, histologic preparations have not been completed, unless otherwise stated.

Table 2

DUST + R_1 REACTIVATION

Animal Number	Mode of Death	Duration Infection	Duration Dust	Gross Lungs	Gross Bronchial Node	Gross Spleen	Gross Liver	Gross Hepatic Lymph Node	Microscopic Lungs	Microscopic Bronchial Node	Microscopic Spleen	Microscopic Liver	Microscopic Hepatic Lymph Node
				In dust 2 mo. after infection									
47	D	2-1/4 mo.	1/4 mo.	pn +	+	0	0	0	+	+	+	+	+
34	D	3-1/3 mo.	1-1/3 mo.	+	+	0	0	0	Tissue autolyzed				
(31	K	4 mo.	2 mo.	+	+	0	0	+	+	+	0	0	0
(32	K	4 mo.	2 mo.	+	+	0	0	+	+	+	0	0	+
(35	K	6 mo.	4 mo.	+	+	0	0	0	++	+	0		0
(36	K	6 mo.	4 mo.	+	+	0	0	0	+	+	0	0	0
(37	K	10 mo.	8 mo.	+	+	0	0	0					
(38	K	10 mo.	8 mo.	+	0	0	0	0					
			2 remain										
				In dust 4 mo. after infection									
(45	K	8 mo.	4 mo.	+	+	0	0	+	0	0	0	0	+
(48	K	8 mo.	4 mo.	+	+	0	0	+	+	0	0	0	0
			8 remain										
				In dust 6 mo. after infection									
51	D	11 da.	0	0	0	0	0	0					
49	D	10 mo.	4 mo.	+	+	0	0	0					
(50	K	10 mo.	4 mo.	+	+	0	0	+					
(52	K	10 mo.	4 mo.	+	+	+	0	+					
			8 remain										

KEY:
- D = died
- K = killed for sampling
- Pn = intercurrent pneumonia
- 0 = no tuberculous lesions seen
- + = healing or healed tubercles
- ++ = scattered isolated spreading tubercles
- +++ = many spreading tubercles
- ++++ = confluent tuberculosis

When microscopic observations are not recorded, histologic preparations have not been completed, unless otherwise stated.

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Table 3

INFECTION CONTROLS TO GROUPS I AND II

Animal Number	Mode of Death	Duration	Gross: Lungs	Gross: Bronchial Node	Gross: Spleen	Gross: Liver	Gross: Hepatic Lymph Node	Microscopic: Lungs	Microscopic: Bronchial Node	Microscopic: Spleen	Microscopic: Liver	Microscopic: Hepatic Lymph Node
62	D	1-1/2 mo.	+	+	0	0	0	Tissue autolyzed				
57	K	2 mo.	+	+	0	0	0	+	+	+	+	+
58	K	2 mo.	+	+	0	0	0	+	+	+	+	0
59	K	4 mo.	+	+	0	0	+	+	0	0	0	0
60	K	4 mo.	+	+	+	0	+	+	++	+	+	+
63	K	6 mo.	+	+	0	0	0	+	+	0	0	0
64	K	6 mo.	+	+	0	0	0	+	0	0	0	0
73	D	6-1/2 mo.	+++	+	+	+	+	+++	++	+++	++	++
87	D	6-2/3 mo.	pn ?	+	0	0	+	Tissue autolyzed				
65	K	8 mo.	+	+	0	0	0	+	0	0	0	0
66	K	8 mo.	[illegible]	+	0	0	0	+	0	0	0	0
88	D	9-1/2 mo.	+	+	0	0	0					
61	K	10 mo.	0	+	0	0	0					
74	K	10 mo.	+	+	0	0	+					

20 remain

KEY:

- D = died
- K = killed for sampling
- Pn = intercurrent pneumonia
- 0 = no tuberculous lesions seen
- + = healing or healed tubercles
- ++ = scattered isolated spreading tubercles
- +++ = many spreading tubercles
- ++++ = confluent tuberculosis

Where microscopic observations are not recorded, histologic preparations have not been completed, unless otherwise stated.

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Table 4

KAYLO 3 MONTHS + R_1 INFECTION

Animal Number	Mode of Death	Duration in Dust	Gross: Lungs	Gross: Bronchial Node	Gross: Spleen	Gross: Liver	Gross: Hepatic Lymph Node	Microscopic: Lungs	Microscopic: Bronchial Node	Microscopic: Spleen	Microscopic: Liver	Microscopic: Hepatic Lymph Node
107	K	3 mo.)										
108	K	3 mo.)										
109	K	3 mo.)	No infection See text									
110	K	3 mo.)										
111	K	3 mo.)										
91	D autolyzed	4 mo.	pn 0	+	0	0	0	pn 0	+	0	0 (fat)	0
(92	K	5 mo.	pn +	+	0	0	+	pn +	+	0	0	+
(93	K	5 mo.	+	+	0	0	+	++	++	0	0	0
{ 94	K	7 mo.	++	+	0	0	+	+	+	0	0	0
{ 95	K	7 mo.	++	+	0	0	+	++	+	0	0	+
(96*	K	9 mo.	++	+	0	0	+	++	+	0	0	0
(97	K	9 mo.	+	+	0	0	+	+	+	0	0	0
114	D	10 mo.	pn ++	+	0	0	+	pn +	0	0	0	0
105	D	10-3/4 mo.	pn +	-	0	0	0					
(112	K	11 mo.	+	+	0	0	0					
(113	K	11 mo.	+	+	0	0	0					

14 remain alive

* Some lesions healed

KEY:

D = died
K = killed for sampling
Pn = intercurrent pneumonia
0 = no tuberculous lesions seen

\+ = healing or healed tubercles
++ = scattered isolated spreading tubercles
+++ = many spreading tubercles
++++ = confluent tuberculosis

Where microscopic observations are not recorded, histologic preparations have not been completed, unless otherwise stated.

Table 5

INFECTION CONTROLS TO GROUP IV

			Gross					Microscopic				
Animal Number	Mode of Death	Duration	Lung	Bronchial Node	Spleen	Liver	Hepatic Lymph Node	Lung	Bronchial Node	Spleen	Liver	Hepatic Lymph Node
121	K	2 mos.	+	+	0	0	+	+	++	+	0	+
122	K	2 mos.	+	+	0	0	+	+	++	+	0	+
127	D	4 mos.	pn +	+	0	0	0	Tissue autlysed				
123	K	4 mos.	+	+	0	0	+	+	0	0	0	+
124	K	4 mos.	+	+	0	0	+	+	+	0	+	+
125	K	6 mos.	+	+	0	0	0	+	+	0	0	0
126	K	6 mos.	+	+	0	0	0	0	0	0	0	0
132	D	6-2/3 mo.	+	0	0	0	+	+	0	0	0	0
145	D	7+ mo.	pn +	?	0	0	+					
128	K	8 mo.	+	+	0	0	0					
129	K	8 mo.	+	+	0	0	0					
137	D	8-1/2 mo.	pn +	+	0	0	0					

13 remain

KEY:

D	=	died	+	=	healing or healed tubercles
K	=	killed for sampling	++	=	scattered isolated spreading tubercles
Pn	=	intercurrent pneumonia	+++	=	many spreading tubercles
0	=	no tuberculous lesions seen	++++	=	confluent tuberculosis

When microscopic observations are not recorded, histologic preparations have not been completed, unless otherwise stated.

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Table 6

CHEMICAL ANALYSES OF LUNGS

OF ANIMALS FROM GROUP IV

Reported in Per Cent

Animal Number	Exposure	Ash of Dry Tissue	Total SiO_2 of Dry Tissue	CaO of Dry Tissue	MgO of Dry Tissue	Total SiO_2 of Ash	CaO of Ash	MgO of Ash
109	3 months	4.39	0.29	0.06	0.29	6.55	1.37	6.63
111	3	4.54	0.34	0.06	0.25	7.40	1.39	5.55

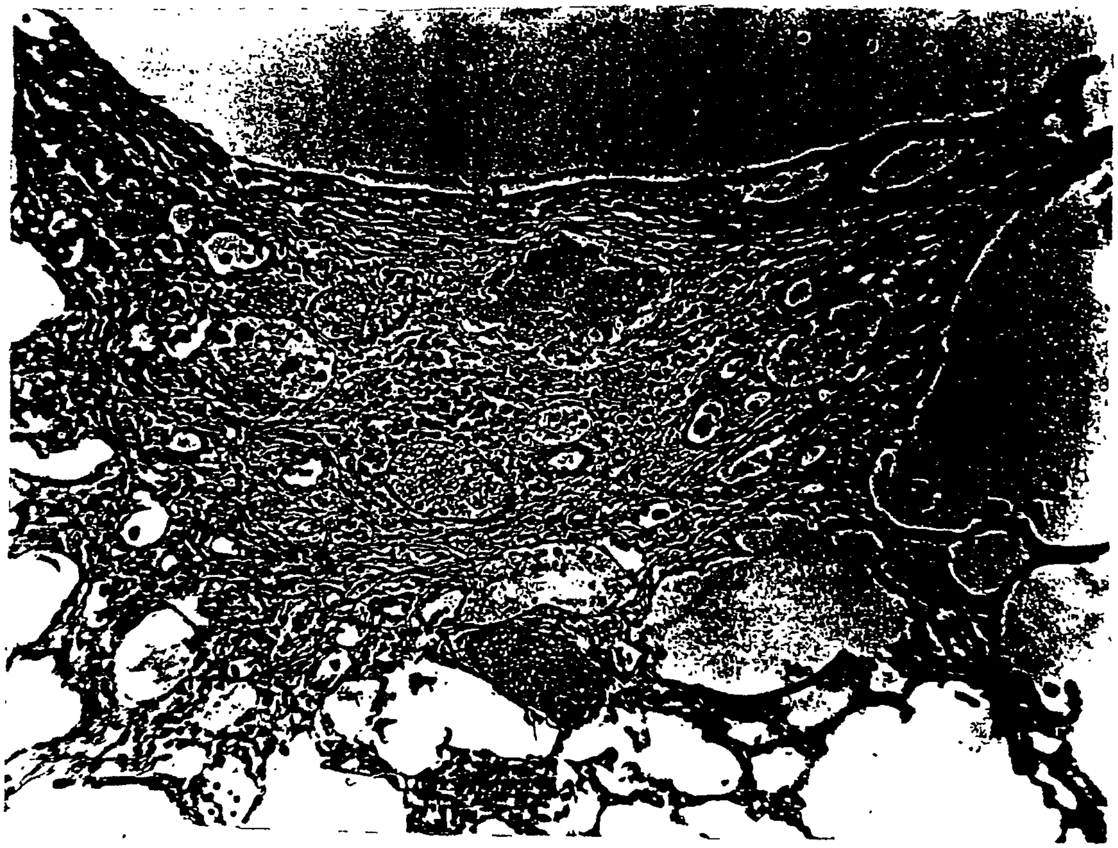

Fig. 1 - Photomicrograph of tubercle in guinea pig lung 4 months after simultaneous infection and exposure to Kaylo dust. (Group I)

The lesion is located just beneath the pleura, and consists of a central area of tuberculous caseation, surrounded by lymphocytes, and, peripherally, distinct fibrous tissue deposition. Note the adjacent empty alveoli, with walls of normal thickness. This is a healing lesion.

Enlarged slightly from 100 X.

Fig. 2 - Photomicrograph of tubercle in control guinea pig lung killed 4 months after infection, with no dust exposure. (Group III)

The lesion is located deep in the lung rather than beneath the pleura. Note the essential similarity to the lesion seen in Fig. 1.

Enlarged slightly from 100X.

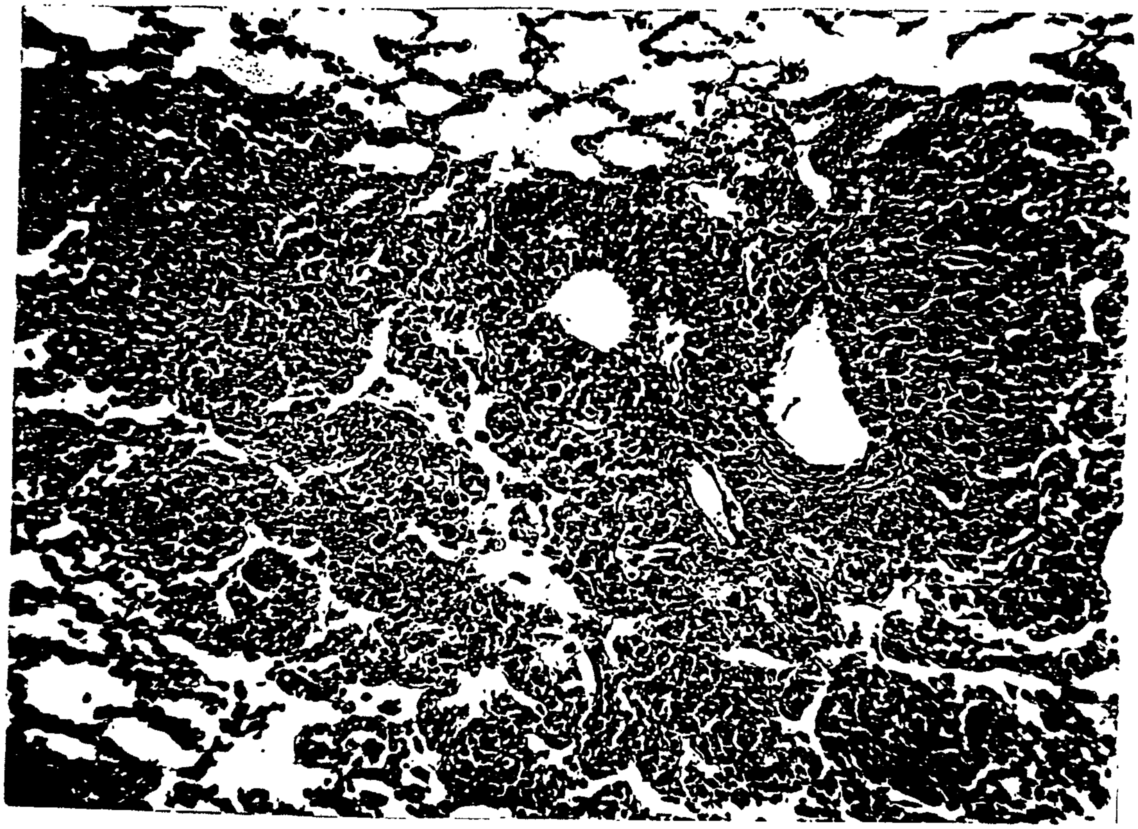

Fig. 3 - Photomicrograph of tubercle in guinea pig lung 4 months after simultaneous infection and exposure to quartz dust.

The cellular reaction is much different from that in Figs. 1 and 2. This is the appearance of active spreading tuberculosis, without caseation, made up chiefly of epithelioid cells, and without peripheral fibrous tissue deposition.

Enlarged slightly from 100X.

SARANAC LAKE, May 2, 1949. 19

THE TRUDEAU FOUNDATION
FOR
THE CLINICAL AND EXPERIMENTAL STUDY OF PULMONARY DISEASE

IN ACCOUNT WITH

Owens-Illinois Glass Co.

Toledo 1, Ohio.

Attention: Mr. U. E. Bowes.

April	30:	Second Kaylo Experiment, begun May 1, 1948, at rate of $5,000.00 annually: Fourth quarter, February-March-April, 1949	$1,250.00

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PLAINTIFF'S EXHIBIT
Kirstein-77
8-28-98

May 3, 1949

Mr. W. E. Bowes, President
American Structural Products Company
P.O. Box 1035
Toledo 1, Ohio

Dear Mr. Bowes:

It pleases me to forward herewith an interim report of our investigations concerning Kaylo dust in accordance with the program submitted to you in our proposal dated October 30, 1947. This was approved by your Purchase Order No. AS-170, dated February 3, 1948. A statement for the final quarter of the year's program is enclosed.

Our findings to date are summarized on page 7 of the attached report. As you will note, the experimental evidence indicates that Kaylo dust when inhaled into the lung seems to alter the course of a tuberculous infection. However, that evidence is inconclusive since it is derived from observations on animals that have been sacrificed during the brief period of only eight months. Experience dictates that at least eighteen months to two years must elapse to determine conclusively the effect of inhaled dust upon a chronic infectious process such as pulmonary tuberculosis. This was stressed by us in the original proposal.

With reference to the charts, it will be noted that a number of animals are still alive in each phase of the study under way. It would be illogical to sacrifice them to terminate the experiment at this time.

In view of the above, we urge that the program be continued for another year so that conclusive evidence, which we seek, will be available. The program can be continued on the same financial basis as heretofore. Please inform us of your wishes so that we might proceed accordingly.

Incidentally, we are submitting four copies of the report with the thought that you might bring it to the attention of Mr. Hazard and Doctor Shook. I believe they would appreciate seeing it because of their interest in our work.

Sincerely yours,

Arthur J. Vorwald, M.D.
Director

AJV:LB
Encs. (4)
CC: Mr. W. G. Hazard
Dr. C. F. Shook

PLAINTIFF'S EXHIBIT
Kirstein-78
8-28-98

000155

AMERICAN STRUCTURAL PRODUCTS COMPANY

GENERAL OFFICES ★ TOLEDO 1, OHIO

SUBSIDIARY OF OWENS-ILLINOIS GLASS COMPANY

May 9, 1949

Dr. Arthur J. Vorwald, Director,
The Saranac Laboratory of
The Trudeau Foundation,
Saranac Lake, New York.

Dear Sir:

This will acknowledge your letter of May 3rd together with your invoice of April 30th and four copies of your interim report on The Biological Activity of Kaylo Dust, also dated April 30th.

Mr. Bowes is out of the city for several weeks rest on doctors' orders, and I shall call his attention to the report and your letter when he returns.

I am handing copies of the report to Dr. Shook and Mr. Hazard as you requested, and will process the invoice for payment.

Very truly yours,

Josephine Grice

Secretary to U. E. Bowes

J.Grice

PLAINTIFF'S EXHIBIT Kirstein-79 8-28-98

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Dr. Vorwald:

The Owens-Illionis Glass Company contract expired, according to our records, on April 30 and has been paid for in full at the rate of $5,000.00 per year.

The new contract, beginning May 1, was to have been at $7,000.00 per year, according to preliminary discussions.

Can you tell me whether the new contract was actually effectuated at $7,000.00?

JUN 18 1949

PLAINTIFF'S EXHIBIT

00[illegible]

June 29, 1949

Mr. U. E. Bowes, President
American Structural Products Company
P.O. Box 1035
Toledo 1, Ohio

Dear Mr. Bowes:

Under date of May 9, 1949, Miss Grice advised you would be out of the city for several weeks' rest on doctors' orders. I trust your rest has been beneficial and that once again you are feeling fit.

We are wondering whether you have had an opportunity to read our interim report regarding The Biological Activity of Kaylo Dust, sent to you under our letter of May 3, and whether you have made a decision with regard to the continuation of the program, as recommended on page 7 of the report. We would greatly appreciate some word from you in this regard as soon as possible.

Sincerely yours,

Arthur J. Vorwald, M.D.
Director

AJV:LB

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PLAINTIFF'S EXHIBIT
Kirstein-81
8-28-98

June 29, 1949

Memorandum: Mr. Dayton

From: Doctor Vorwald

Re: Your memorandum of June 18, 1949

Subject: AMERICAN STRUCTURAL PRODUCTS COMPANY (formerly Owens-Illinois Glass Company) - contract of:

1. So that the above might be clarified in the minds of all of us, please refer to the following:

   a. Letter to Mr. Bowes dated May 3, 1949: "The program can be continued on the same financial basis as heretofore."

   b. Letter to Mr. Bowes dated November 16, 1948 - page 2 — rate $5,000.

   c. Memorandum to you of October 22, 1948.

2. Up to this time we have not received authorization for continuation of the program for the period May 1949 to May 1950. Under date of May 9, 1949, we received a letter from Mr. Bowes' secretary stating that Mr. Bowes was out of the city for several weeks' rest on doctors' orders and that she would call the matter to his attention immediately upon his return. We are writing him again today in an effort to obtain authorization for continuation of their program for another year.

AJV:LB

000152

PLAINTIFF'S EXHIBIT Kirstein 82 8-28-98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

July 6, 1949

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Doctor:

Since the animal experiments on Kaylo dust began, you have corresponded with and sent reports to Mr. U. E. Bowes, President of the American Structural Products Company, a subsidiary of Owens-Illinois Glass Company, and the operator of the Berlin and Sayreville plants--where Kaylo is manufactured.

Recently there has been a change in our organization and the Berlin and Sayreville, New Jersey, plants are now in the Kaylo Division of Owens-Illinois. Mr. C. W. Howard of that division is going to handle the health aspects of Kaylo.

We'd appreciate it if you would send correspondence on this subject and the reports of your investigations, as well as quarterly invoices, to Mr. Howard instead of to Mr. Bowes. His address is:

Mr. C. W. Howard
Director of Industrial Relations
Kaylo Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Mr. Howard would like very much to visit Saranac in the near future in order to meet you and your staff and to learn firsthand how the toxicological research on Kaylo is conducted. We believe this would be a fine chance for you and he to get acquainted with each other and to discuss all the aspects of the Kaylo investigations.

We are not sure yet when Mr. Howard wants to go to Saranac, but we thought it would be well to mention this now. What would be a convenient time from your standpoint for such a visit?

With personal regards,

Sincerely yours,

W. G. Hazard

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

cc - Mr. C. W. Howard - Toledo

cc - Mr. Dayton 7/14/49

000148

PLAINTIFF'S EXHIBIT Kirstein 83 8-28-98

July 8, 1949

Memo to: Lillian R. Blinn and Helen R. Smith

From: Clarence L. Wagner

Subject: Change of name - American Structural Products Company

The following communication was received as of this morning:

OWENS-ILLINOIS GLASS CO.
Kaylo Division

P.O.Box 7
Sayreville, N. J.

July 6, 1949

The Trudeau Foundation
6 Church Street
Saranac Lake, New York

Gentlemen:

As of July 1, 1949, the American Structural Products Company will be known as the Owens-Illinois Glass Company, Kaylo Division. Will you kindly, therefore, process our invoices accordingly.

Thank you.

Very truly yours,

OWENS-ILLINOIS GLASS COMPANY, KAYLO DIVISION

Signed
W. C. England
Purchasing Agent

PLAINTIFF'S EXHIBIT
Kirstein-84
8-28-98

000149

SARANAC LAKE, N.Y., July 9, 1949

THE TRUDEAU FOUNDATION

FOR

THE CLINICAL AND EXPERIMENTAL STUDY OF PULMONARY DISEASE

IN ACCOUNT WITH

Owens-Illinois Glass Co.

Kaylo Division, Toledo 1, Ohio

Attn.: Mr. C. W. Howard, Director of Industrial Relations

Continuation of Kaylo Experiment begun May 1, 1948, at rate of $5,000.00 annually:	
First quarter: May 1, 1949 to July 31, 1949	$1,250.00

000150

PLAINTIFF'S EXHIBIT Kirstein 85 8-28-98

July 14, 1949

Mr. C. W. Howard
Director of Industrial Relations
Kaylo Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Howard:

Some few weeks ago we forwarded to Mr. Bowes an interim report dated April 30, 1949, concerning our investigations with regard to Kaylo dust. We have since learned from Mr. Hazard that you are now going to handle the health aspects of Kaylo, and we assume that a copy of our report has been turned over to you.

Our program is continuing under the assumption that authorization will be forthcoming from you, and we are enclosing our statement for the first quarter (May 1, 1949 to July 31, 1949) of the continuation program. As you will note, the rate is in accordance with the proposal originally submitted to Mr. Bowes.

We are eager to have you visit our operations here in Saranac Lake. Almost any time during the last three weeks in August and the first two weeks in September will be convenient for me. As soon as you decide on a date, if you will let me know, I will keep that time open for you.

All of us are looking forward to the pleasure of meeting you.

Sincerely yours,

Arthur J. Vorwald, M.D.
Director

AJV:LB
Enc.
CC: Mr. W. G. Hazard
cc - Mr Horton

000147

PLAINTIFF'S EXHIBIT
Kirstein-86
8-28-98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

July 21, 1949

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Doctor Vorwald:

Thank you for your letter of July 14, in which you enclosed your statement for the first quarter (May 1, 1949 to July 31, 1949) for the continuation of the Kaylo dust experiment, at a rate of $5,000 annually.

In compliance with the second paragraph of your letter, please be advised you are authorized to continue the experiment at the same annual rate until May 1, 1950. Please forward quarterly statements as heretofore.

I look forward with interest to a visit with you some time during the latter part of August, or the first part of September. I will contact you well in advance of my visit in order for it to be convenient with you.

Yours very truly,

KAYLO DIVISION

C W Howard

C. W. Howard, Director
Industrial Relations

cw

CC: W. G. Hazard

cc: Mr. Dayton 7-25-49 (bw)

000146

PLAINTIFF'S EXHIBIT
Kirstein-87
8-28-98

INTERIM REPORT

REGARDING THE BIOLOGICAL ACTIVITY

OF KAYLO DUST

---

to the

Owens-Illinois Glass Company

Toledo, Ohio

---

by

The Saranac Laboratory

Saranac Lake, New York

January 1, 1950

(The report has reference to
results of studies up to
November 1, 1949.)

Submitted by:

Arthur J. Vorwald, M.D., Director
The Edward L. Trudeau Foundation

In cooperation with:

Philip C. Pratt, M.D.
Thomas M. Durkan, M.S.
Anthony B. Delahant
Edward C. J. Urban, M.S.E.

This interim report is essentially a supplement to the previous report dated April 29, 1949. It is submitted at this time in accordance with a plan to issue reports at intervals of about six months.

In the interest of brevity general statements as to the methods used and purposes of each phase of the experiments under way are omitted and the reader is referred to the preceding report for discussions of these points. It may be stated that the conduct of the experiment has been maintained as it was in earlier stages, and that dust counts during the interval since the last report have averaged 179 million particles per cubic foot of air.

In general, the observations made over the past six months conform to those noted previously. However, only tentative conclusions are warranted at this time. It seems clear that only after all animals have been examined at the end of the full exposure can the results be evaluated.

The results to date are presented in tables as in the previous report. Certain comments concerning each table follow:

Table 1. (Compare with Table 3.) In the interval since the last report, four additional experimental animals on being sacrificed have shown spreading of their lesions while the controls have consistently revealed healing or healed lesions. Others of the experimental group have failed to show evidence of spread. While the observations over this period suggest a slightly adverse influence of the dust on the course of the tuberculous infection, the

evidence is by no means conclusive, and only subsequent developments and a survey of the results in the entire series of animals can provide a basis for a positive statement as to the influence of Kaylo on a simultaneous tuberculous infection.

Table 2. (Compare with Table 3.) Two of the three animals in phase I (in dust 2 months after infection) of the reactivation experiment which were killed after 12 months in the dust room showed gross evidence of spreading disease. This observation remains to be confirmed by microscopic study. In the other two phases (in dust 4 months and 6 months after infection), no spreads have been noted. Here, too, the evidence is obviously incomplete and does not warrant evaluation at this time.

Table 3. (Compare with Tables 1 and 2.) No spreading disease has been noted in the six animals killed since the last report. The course of the infection in the controls is thus seen to be in accord with previous experience.

Table 4. (Compare with Table 5.) The table reveals that the animals sacrificed or dying after dust exposure of eleven or more months have consistently harbored spreading lesions. While some of these are yet to be confirmed microscopically, the consistency of the findings suggests rather strongly that under these conditions (infection initiated after 3 months of dust exposure) Kaylo has a distinctly adverse influence on the course of the disease.

Table 5. (Compare with Table 4.) The control animals again reveal that the infection is following its usual course. One animal, killed at 10 months after infection, showed slight microscopic evidence of spreading disease. As noted in the previous report, it is not uncommon for an occasional control animal to develop progressive disease following this type of infection.

In view of the above findings and for purposes of this report, it seems appropriate to present for comparison the chemical and petrographic analyses of Kaylo and of long fiber asbestos (Table 6).

COMMENT

At the present time the evidence suggests that Kaylo dust may have a slightly adverse effect upon tuberculous infection. This effect is by no means as pronounced as that of quartz, since similar experiments with quartz result in progressive spreading of the lesions in virtually all animals after 8 or more months of exposure. The lesions in animals exposed to quartz dust are usually sufficiently extensive to cause death of some animals in the period from 12 to 15 months.

The future course of the lesions in the present experiment cannot be predicted. They may heal during the next 9 months, but it is felt somewhat more likely that animals to be sacrificed will show an increasing incidence of spreading disease.

Table 1

KAYLO + H_1 SIMULTANEOUS

Animal Number	Mode of Death	Duration	Gross: Lungs	Gross: Bronchial Nodes	Gross: Spleen	Gross: Liver	Gross: Hepatic Lymph Node	Microscopic: Lungs	Microscopic: Bronchial Nodes	Microscopic: Spleen	Microscopic: Liver	Microscopic: Hepatic Lymph Node
4	D	1-1/2 mo.	pn +	+	0	0	0	Tissue autolyzed				
(1	K	2 mo.	+	+	0	0	+	+	+	+	+	+
(2	K	2 mo.	+	+	0	0	+	++	+	+	+	+
6	D	3-3/4 mo.	(pn?)	+	0	0	0	pn	0	0	0	0
(3	K	4 mo.	+	+	0	0	+	+	0	0	0	0
(5	K	4 mo.	+	+	0	0	+	+	+	0	0	+
24	D	4-1/2 mo.	(pn?)	+	+++	+	+	pn	+	?	++	++
25	D	5-1/3 mo.	(pn?)	+	0	0	+	pn	0	+	0	0
10	D	6 mo.	pn +	+	0	0	+	Tissue autolyzed				
(7	K	6 mo.	0	+	0	0	0	0	+	0	0	0
8	K	6 mo.	+	+	0	0	0	+	+	0	0	+
30	D	6+ mo.	pn +	?	0	0	0	pn	0	0	0	0
14	D	7 mo.	pn +	+	0	0	0	Tissue autolyzed				
22	D	7-2/3 mo.	pn	?	0	0	0	Tissue autolyzed				
(9	K	8 mo.	+	+	0	0	+	++	++	+	0	+
(13	K	8 mo.	+	+	0	0	+	++	+	+	0	-
28	D	8-1/2 mo.	++	+	+	+	+	++	++	+++	++	++
(11	K	12 mo.	+++	+	+	+	+	+++	+	++	+	+
(12	K	12 mo.	+	+	0	0	+	+	++	0	0	+
17	D	13-2/3 mo.	0	0	0	0	0					
20	D	14 mo.	pn 0	0	0	0	0					
(15	K	15 mo.	+	+	0	0	0					
(16	K	15 mo.	++	+	0	0	0					

7 remain for subsequent study

KEY:

D = died
K = killed for sampling
Pn = intercurrent pneumonia
0 = no tuberculous lesions seen

\+ = healing or healed tubercles
++ = scattered isolated spreading tubercles
+++ = many spreading tubercles
++++ = confluent tuberculosis

Where microscopic observations are not recorded, histologic preparations have not been completed, unless otherwise stated.

Table 2

DUST + R_1 REACTIVATION

Animal Number	Mode of Death	Duration: Infection	Duration: Dust	Gross: Lungs	Gross: Bronchial Nodes	Gross: Spleen	Gross: Liver	Gross: Hepatic Lymph Node	Microscopic: Lungs	Microscopic: Bronchial Nodes	Microscopic: Spleen	Microscopic: Liver	Microscopic: Hepatic Lymph Node
				In dust 2 mo. after infection									
47	D	2-1/4 mo.	1/4 mo.	pn +	+	0	0	0	+	+	+	+	+
34	D	3-1/3 mo.	1-1/3 mo.	+	+	0	0	0	Tissue autolyzed				
(31	K	4 mo.	2 mo.	+	+	0	0	+	+	+	0	0	0
(32	K	4 mo.	2 mo.	+	+	0	0	+	+	+	0	0	+
(35	K	6 mo.	4 mo.	+	+	0	0	0	++	+	0		0
(36	K	6 mo.	4 mo.	+	+	0	0	0	+	+	0	0	0
(37	K	10 mo.	8 mo.	+	+	0	0	0	+	+	0	0	0
(38	K	10 mo.	8 mo.	+	0	0	0	0	+	+	0	0	-
(33	K	14 mo.	12 mo.	+	+	0	0	0					
(39	K	14 mo.	12 mo.	++	+	0	0	+					
(40	K	14 mo.	12 mo.	++	+	0	0	0					
				In dust 4 mo. after infection									
(45	K	8 mo.	4 mo.	+	+	0	0	+	0	0	0	0	+
(48	K	8 mo.	4 mo.	+	+	0	0	+	+	0	0	0	0
(41	K	12 mo.	8 mo.	+	+	0	0	0	+	+	0	0	0
(42	K	12 mo.	8 mo.	+	+	0	0	0	+	+	0	0	0
				In dust 6 mo. after infection									
51	D	11 da.	0	0	0	0	0	0	Tissue autolyzed				
49	D	10 mo.	4 mo.	+	+	0	0	0	+	+	0	0	0
(50	K	10 mo.	4 mo.	+	+	0	0	+	+	+	0	0	0
(52	K	10 mo.	4 mo.	+	+	+	0	+	+	+	+	+	+
(53	K	14 mo.	8 mo.	+	+	0	0	0					
(54	K	14 mo.	8 mo.	+	+	0	0	0					

KEY:
- D = died
- K = killed for sampling
- Pn = intercurrent pneumonia
- 0 = no tuberculous lesions seen
- + = healing or healed tubercles
- ++ = scattered isolated spreading tubercles
- +++ = many spreading tubercles
- ++++ = confluent tuberculosis

Where microscopic observations are not recorded, histologic preparations have not been completed, unless otherwise stated.

Table 3

INFECTION CONTROLS TO GROUPS I AND II

Animal Number	Mode of Death	Duration	Gross: Lungs	Gross: Bronchial Nodes	Gross: Spleen	Gross: Liver	Gross: Hepatic Lymph Node	Microscopic: Lungs	Microscopic: Bronchial Nodes	Microscopic: Spleen	Microscopic: Liver	Microscopic: Hepatic Lymph Node
62	D	1-1/2 mo.	+	+	0	0	0	Tissue autolyzed				
(57	K	2 mo.	+	+	0	0	0	+	+	+	+	+
(58	K	2 mo.	+	+	0	0	0	+	+	+	+	0
(59	K	4 mo.	+	+	0	0	+	+	0	0	0	0
(60	K	4 mo.	+	+	+	0	+	+	++	+	+	+
(63	K	6 mo.	+	+	0	0	0	+	+	0	0	0
(64	K	6 mo.	+	+	0	0	0	+	0	0	0	0
73	D	6-1/2 mo.	+++	+	+	+	+	+++	++	+++	++	++
87	D	6-2/3 mo.	pn ?	+	0	0	+	Tissue autolyzed				
(65	K	8 mo.	+	+	0	0	0	+	0	0	0	0
(66	K	8 mo.	+	+	0	0	0	+	0	0	0	0
88	D	9-1/2 mo.	+	+	0	0	0	Tissue autolyzed				
(61	K	10 mo.	0	+	0	0	0	+	0	0	0	0
(74	K	10 mo.	+	+	0	0	+	+	+	+	+	+
83	D	10-1/2 mo.	+	+	0	0	0	Tissue autolyzed				
(89	K	12 mo.	+	+	0	0	0	+	0	0	0	+
(90	K	12 mo.	+	+	0	0	0	+	0	-	0	0
(67	K	14 mo.	+	+	0	0	+					
(68	K	14 mo.	+	+	0	0	0					
(69	K	15 mo.	+	+	0	0	0					
(70	K	15 mo.	+	+	0	0	0					

KEY:

D	= died	+	= healing or healed tubercles
K	= killed for sampling	++	= scattered isolated spreading tubercle
Pn	= intercurrent pneumonia	+++	= many spreading tubercles
0	= no tuberculous lesions seen	++++	= confluent tuberculosis

Where microscopic observations are not recorded, histologic preparations have not been completed, unless otherwise stated.

Table 4

KAYLO 3 MONTHS + R_1 INFECTION

Animal Number	Mode of Death	Duration: Dust	Duration: Infection	Gross: Lungs	Gross: Bronchial Nodes	Gross: Spleen	Gross: Liver	Gross: Hepatic Lymph Node	Microscopic: Lungs	Microscopic: Bronchial Nodes	Microscopic: Spleen	Microscopic: Liver	Microscopic: Hepatic Lymph Node
107	K	3 mo.		No infection									
108	K	3 mo.		See text									
109	K	3 mo.											
110	K	3 mo.											
111	K	3 mo.											
91	D autolyzed	4 mo.	1 mo.	pn 0	+	0	0	0	pn 0	+	0	0 (fat)	0
92	K	5 mo.	2 mo.	pn +	+	0	0	+	pn +	+	0	0	+
93	K	5 mo.	2 mo.	+	+	0	0	+	++	++	0	0	0
94	K	7 mo.	4 mo.	++	+	0	0	+	+	+	0	0	0
95	K	7 mo.	4 mo.	++	+	0	0	+	++	+	0	0	+
96*	K	9 mo.	6 mo.	++	+	0	0	+	++	+	0	0	0
97	K	9 mo.	6 mo.	+	+	0	0	+	+	+	0	0	0
114	D	10 mo.	7 mo.	pn ++	+	0	0	+	pn +	0	0	0	0
105	D	10-3/4	7-3/4	pn +	-	0	0	0	Tissue autolyzed				
112	K	11 mo.	8 mo.	+	+	0	0	0	+	+	0	0	+
113	K	11 mo.	8 mo.	+	+	0	0	0	++	+	0	+	+
98	K	13 mo.	10 mo.	++	+	0	0	+	+++	+	+	+	+
106	K	13 mo.	10 mo.	++	+	0	0	+	++	+	0	0	+
115	D	14-1/2	11-1/2	+++	+	0	0	0					
99	K	15 mo.	12 mo.	++	+	0	0	+					
100	K	15 mo.	12 mo.	++	+	0	0	+					

* Some lesions healed

KEY:

D = died
K = killed for sampling
Pn = intercurrent pneumonia
0 = no tuberculous lesions seen

\+ = healing or healed tubercles
++ = scattered isolated spreading tubercles
+++ = many spreading tubercles
++++ = confluent tuberculosis

Where microscopic observations are not recorded, histologic preparations have not been completed, unless otherwise stated.

Table 5

INFECTION CONTROLS TO GROUP IV

Animal Number	Mode of Death	Duration	Gross: Lungs	Gross: Bronchial Nodes	Gross: Spleen	Gross: Liver	Gross: Hepatic Lymph Node	Microscopic: Lungs	Microscopic: Bronchial Nodes	Microscopic: Spleen	Microscopic: Liver	Microscopic: Hepatic Lymph Node
(121	K	2 mos.	+	+	0	0	+	+	++	+	0	+
(122	K	2 mos.	+	+	0	0	+	+	++	+	0	+
127	D	4 mos.	pn +	+	0	0	0	Tissue autolyzed				
(123	K	4 mos.	+	+	0	0	+	+	0	0	0	+
(124	K	4 mos.	+	+	0	0	+	+	+	0	+	+
(125	K	6 mos.	+	+	0	0	0	+	+	0	0	0
(126	K	6 mos.	+	+	0	0	0	0	0	0	0	0
132	D	6-2/3 mos.	+	0	0	0	+	+	0	0	0	0
145	D	7+ mos.	pn +	?	0	0	+	Tissue autolyzed				
(128	K	8 mo.	+	+	0	0	0	+	0	0	0	0
(129	K	8 mo.	+	+	0	0	0	+	+	0	0	0
137	D	8-1/2 mo.	pn +	+	0	0	0	Tissue autolyzed				
(130	K	10 mo.	+	+	0	0	+	+	+	0	0	-
(131	K	10 mo.	+	+	0	0	+	++	+	0	0	+
(133	K	12 mo.	+	+	0	0	0					
(134	K	12 mo.	+	+	0	0	0					

9 remain

KEY:

D = died
K = killed for sampling
Pn = intercurrent pneumonia
0 = no tuberculous lesions seen

+ = healing or healed tubercles
++ = scattered isolated spreading tubercles
+++ = many spreading tubercles
++++ = confluent tuberculosis

When microscopic observations are not recorded, histologic preparations have not been completed, unless otherwise stated.

Table 6

ANALYSES OF KAYLO

(as received)

Chemical

SiO_2	43.80%
Fe_2O_3	1.69
Al_2O_3	1.97
TiO_2	0.12
MnO	0.09
CaO	24.94
MgO	7.10
Loss $<105^{\circ}$ C.	4.52
$>105^{\circ}$ C.	15.19
	99.42

Petrographic

Most of the material consists of clay-like masses which give a definite x-ray pattern not unlike a hydrous calcium silicate. The quartz content is low (probably less than 1 per cent). About 5 per cent of calcite is present.

Approximately 15-20 per cent of the material is chrysotile or serpentine, which is largely fibrous. The fibers and bundles present are usually several millimeters long and are seldom shorter than 0.3 millimeter.

ANALYSES OF LONG-FIBER ASBESTOS

(as received)

Chemical

SiO_2	38.40%
Fe_2O_3	5.32
Al_2O_3	0.78
MnO	0.08
CaO	0.31
MgO	40.18
Na_2O	0.06
K_2O	0.06
CO_2	0.57
H_2O	14.00
	99.76

Petrographic

The material contains about 75 per cent of fibrous asbestos, probably chrysotile, with some serpentine and small amounts of calcite, magnetite and chloritic or micaceous minerals. Only a trace of quartz was seen. There were shreds of non-separated fibers 10 to 50 microns long and 5 to 15 microns wide.

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

January 5, 1950

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Doctor:

We are wondering whether you could give us some word about how the animal experiments on the inhalation of Kaylo dust are developing. The last progress report we have is dated April 30, 1949.

At the end of this report the recommendation is made that the experiments be continued for another eight months—or possibly 14 months. Since eight months would take the work through December of last year, and since that is so recent that the microscopic examinations may not be completed yet, perhaps you could give us right now more or less of an informal progress report.

Our Kaylo Division is reviewing its policies on medical procedures for the people in their Sayreville, New Jersey, plant. Before any major changes are made in our present medical program, Dr. Shook and Mr. Howard want to know how your animal dusting experiments are progressing.

With personal regards,

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

1/6/50
Called
Mr Wagner
getting out
list to date
ERB

P.S. Incidentally, our records show that the last check we sent you was in July 1949. It was our recollection that we were going to pay for this quarterly—on receipt of quarterly statements from your laboratory. Could you check this for us?

cc - Mr. C. W. Howard
Dr. C. F. Shook

PLAINTIFF'S EXHIBIT
Kirstein-89
8-28-98

January 12, 1950

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

In reply to your letter of January 5, we are enclosing herewith an interim report concerning our studies on Kaylo.

As you will note, the results to date, although not conclusive, indicate that Kaylo stimulates a tuberculous process in the lung. This stimulation is considerably less than that due to quartz; however, it is nevertheless significant. This unusual finding disturbs me because it is not in accord with the results which we anticipated. The chemical and petrographic analysis of Kaylo is not too unlike asbestos, as indicated in Table 6. In view of this, we had thought that it would act like asbestos and fail to stimulate a tuberculous process. However, that does not seem to be the case, irrespective of the fact that Kaylo produces less pulmonary fibrosis than does asbestos. At the moment, I am at a loss to explain this difference. It may be due to the calcium silicate component of the Kaylo, but many forms of calcium silicate which we have studied have thus far failed to stimulate a tuberculous process, and I doubt whether it is doing so in this case.

Subsequent findings may show that this stimulation is only a temporary one and that, in final analysis, the tuberculous lesion will retrogress and heal even under the influence of Kaylo. Should this be the case, I will notify you as soon as we observe it.

With every good wish to you,

Sincerely yours,

000134

Arthur J. Vorwald, M.D.
Director

PLAINTIFF'S EXHIBIT
Kirstein-90
8-28-98

AJV:LB
Encs. (4)
P.S. We are forwarding copies of this letter and report to Mr. Howard and Doctor Shook, believing that you would wish us to in order to keep them informed. The extra copies enclosed herewith are for distribution where you see fit.
A.J.V.

CC: Mr. C. W. Howard
Dr. C. F. Shook

Jan. 21, 1950

Memo to Dr. Vorwald
from Donald Bailey

Subject: Kaylo; shipment received 1/6/49
Started Dusting 9/26/49

X-ray diffraction shows the same components found in earlier batches. However, many of the fibers are shorter and appear somewhat less flexible. This probably represents a difference in the manufacturing process. (The company changed hands prior to Jan. 1949)

The difference is more apparent in a recent air-borne sample, collected 1/17/50.

00[illegible]31

PLAINTIFF'S EXHIBIT
Kirstein-91
8-28-98

THE TRUDEAU FOUNDATION
FOR
THE CLINICAL AND EXPERIMENTAL STUDY OF PULMONARY DISEASE

AT SARANAC LAKE, N.Y.
THE SARANAC LABORATORY
THE TRUDEAU FOUNDATION
THE TRUDEAU SCHOOL

AT TRUDEAU, N.Y.
THE DEPARTMENT OF PHYSIOLOGY
THE DEPARTMENT OF BIOCHEMISTRY
THE DEPARTMENT OF RADIOLOGY
THE TRUDEAU LABORATORY

February 1, 1950

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

Upon recent inquiry from the purchasing agent of your Bridgeton plant with regard to the renewal of the arrangement with the Trudeau Foundation and Owens-Illinois Glass Company for the reading and interpretation of X-ray films at the same rate of $2.50 per film for the calendar year of 1950, we advised that our charge for the type of service rendered heretofore could not be accomplished for less than $4.00 per film. Mr. Meyers, the purchasing agent at Bridgeton, authorized us to bill their plant at this figure. As explained in our letter to him, the Foundation and the Sanatorium have been forced to raise fees in accordance with increasing costs and to offset the increasing operating deficit of all departments, including the Department of Radiology.

It has been called to my attention by our Fiscal Department that your many plants are sending to us a considerable number of films for interpretation and opinion. Upon referring to our records, we note that Doctor Gardner originally agreed to handle the films for your company at a charge of $2.50 per man, in accordance with your letter of June 26, 1946, each plant to be billed for the interpretations of its own men and each plant to pay the cost of transportation of films to and from the Department of Radiology and of telegraphic reports from us to the plant. A recap of the various plant charges was to be forwarded to you. This arrangement has been in effect through December 31, 1949.

Since we have found it necessary to increase the fee to $4.00 per film for the calendar year of 1950, we would appreciate your advice as to the method we should follow to notify your many plants from whom we receive films of the increased fee.

PLAINTIFF'S EXHIBIT
Kirstein-92
8-28-98

000124

Mr. W. G. Hazard
Owens-Illinois Glass Company

February 1, 1950

I am sure, Bill that you will appreciate the problem confronting us. I trust that this arrangment will be agreeable to you and that we may continue to serve you.

With kindest personal regards,

Sincerely yours,

Arthur J. Vorwald, M.D.
Director

AJV:LB
CC: Fiscal Department
Mr. Dayton

SARANAC LAKE, N.Y.. February 1, 1950

THE TRUDEAU FOUNDATION

FOR

THE CLINICAL AND EXPERIMENTAL STUDY OF PULMONARY DISEASE

IN ACCOUNT WITH

Owens-Illinois Glass Co.

Kaylo Division, Toledo 1, Ohio

Attn.: Mr. C. W. Howard, Director of Industrial Relations

Continuation of Kaylo Experiment begun May 1, 1948, at rate of $5,000 annually:	
Third Quarter: Nov. 1, 1949 to Jan. 31, 1950	$1,250.00

PLAINTIFF'S EXHIBIT
Kirstein-93
8-28-98

000132

FLOYD G. GILLIAM
P-46-366

CHEMICAL AND X-RAY DIFFRACTION ANALYSIS OF LUNGS

DRY LUNG

Ash of Dry Lung		3.33%
Total SiO_2		0.99
Quartz	0.04%	
Cristobalite	0.25	
Diatomite	0.63	
Feldspar	0.04	
Sericite	0.04	
Clays	0.04	

ASH

Total SiO_2 of Ash		29.63
Free Crystalline SiO_2	8.6	
Free Amorphous SiO_2	19.0	
Combined SiO_2	2.0	
Fe_2O_3		12.71
Al_2O_3		2.14
P_2O_5		35.98
PaO		1.52
MgO		1.89
K_2O		5.01
Na_2O		9.10
		97.98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

February 14, 1950

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Dr. Vorwald:

We have passed the word along to our plants that the fee for reading X-rays will be $4.00 per man during the calendar year of 1950--as you wrote us February 1.

Thank you for sending us some time ago the progress report on the Kaylo experiment. It has been read with much interest by several people here, and we are all very much concerned to learn how these experiments ultimately turn out.

With personal regards,

Sincerely yours,

W. G. Hazard

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

PLAINTIFF'S EXHIBIT
Kirstein-94
8-28-98

000121

February 17, 1950

Memorandum to: Mr. Wagner

From: Lillian R. Blinn

Subject: Reading of X-ray films for Owens-Illinois Glass Company - Fee

We have a letter from Mr. W. G. Hazard, Industrial Relations Division, Owens-Illinois Glass Company, Toledo, Ohio, in response to ours of February 1, advising:

> "We have passed the word along to our plants that the fee for reading X-rays will be $4.00 per man during the calendar year of 1950—as you wrote us February 1."

LB

PLAINTIFF'S EXHIBIT Kirstein-95 9-28-98

000120

February 24, 1950

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

Before leaving for Australia a few days ago, Doctor Vorwald asked me to write to you with regard to the shipment of Kaylo which we received from your Berlin, New Jersey, plant on January 6, 1949. The X-ray diffraction pattern of samples from this shipment reveals the same components as found in previous shipments. However, many of the fibers are shorter and appear less flexible. We are wondering whether this has been occasioned by a change in the manufacturing process. If this is the case, we should know so that we will be aware of any unanticipated results which subsequently might appear in the animals that are being exposed.

We would appreciate your advise in this regard.

Sincerely yours,

Lillian F. Blinn (Mrs. A.B.)
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director

LB

PLAINTIFF'S EXHIBIT
Kirstein-96
9-28-98

000130

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

March 7, 1950

Mrs. Lillian R. Blinn
The Saranac Laboratory
P. O. Box 551
Saranac Lake, New York

Dear Mrs. Blinn:

We have checked with our technical people and they tell us that there has been no change in the manufacturing process of Kaylo during the last year or so that would make the material received by you last January different from what you had received earlier--and have been using for your animal experiments.

The silica content of all the Kaylo shipped you should be in the form of a combined silica. There is a negligible amount of free silica present--according to the laboratory analyses of our Kaylo Division.

The asbestos that has gone into Kaylo products all along has been in the form of chrysotile. In recent months the chrysotile fibers have been more effectively separated or spiculated before they go into the Kaylo mix than they were earlier in our manufacturing experience. This may mean that today the individual chrysotile fibers are better separated in the product than they were earlier.

After Kaylo is made, the slabs are planed and sawed. The dust from this operation is collected in a cloth dust arrester--and it is some of this material that the Berlin plant has been sending you for animal experimentation.

We are interested in your comment about the appearance of the fibers, and if you find any other indication that the material is different from what you had earlier, please let us know.

Sincerely yours,

W. G. Hazard

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

PLAINTIFF'S EXHIBIT
Kirstein-97
8-28-98

000129

March 10, 1950

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

Thank you for your letter of March 7. Your comment in the third paragraph agrees with our observations. I will bring your letter to Doctor Vorwald's attention on his return from Australia the first of next month.

Sincerely yours,

Lillian R. Blinn (Mrs. A. B.)
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director

LB

003128

PLAINTIFF'S EXHIBIT
Kirstein-98
9-28-98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

April 3, 1950
Dict. 3/31/50

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Doctor: Art

Our purchasing department, after reviewing the volume of work that the X-Ray Laboratory did for our various plants last year (better than 500 films examined), has asked us to get your comments on this question: they are wondering whether an agreement could be worked up for 1950 covering the nature of the services performed by your laboratory, the minimum quantity of films to be presented, and the fee for this service. After such a contract is signed all our plants would be notified and the proper purchasing procedures set up. The advantage to you, as we see it, would probably be that invoices would be processed more promptly.

The reason this question arose was that the purchasing department likes to have an agreement or contract for any transaction that is as big as our X-ray business is. Such a step is not an attempt to get any more favorable fee for the services performed, but merely to put the transactions on a contract basis drawn up in advance, thus avoiding the need for confirming purchase orders <u>after</u> the roentgenological readings are made.

We'd be glad to have your comments on this. It may be that you already have a similar arrangement in effect with some of the other companies for which you act as X-ray consultants.

Personal regards.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

PLAINTIFF'S EXHIBIT
Kiestein-99
8-28-98

000119

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

May 18, 1950
Dict. 5/17/50

Dr. Arthur J. Vorwald
The Saranac Laboratory
Saranac Lake, New York

Dear Doctor:

Because the chest X-ray program that our Kaylo Division has been carrying on for some years is closely tied to the animal experimentation work that you are conducting with Kaylo dust, we'd like very much to be brought up to date on how these experiments are progressing. The expense of chest X-rays for everyone in the Kaylo Division--even those people in the plant office--each year is a considerable item. That program is up for review now.

In time 15 ? before week of May 29 to June 2.?

Would it be possible for Dr. C. F. Shook and the writer to visit you sometime in the next few weeks so we can learn what new developments there are in the animal work?

One other point has come up that we'd like to discuss with you too. Our purchasing department would like to draw up a contract each year with the X-ray Laboratory to cover the chest films that all our plants send to Saranac during the year. This was mentioned in our letter of April 3--which we realize you probably haven't gotten to yet because of the traveling you have been doing in the last few weeks. However, we'd be glad to have your comments on this at your convenience.

Personal regards.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

1950

$4.00 per examination
1 examination complete all film made on one date of one patient

000118

PLAINTIFF'S EXHIBIT
Kirstein-100
8-28-98

May 29, 1950

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Re: Our ltr Feb. 24, 1950
Your ltr Mar. 7, 1950

Dear Bill:

This is merely to bring the matter outlined below to conclusion.

As you recall, the reference letter was prompted by our inquiry concerning a possible change in the manufacturing process of Kaylo to account for the shorter fibers present in a recent batch shipped to us for our investigations. Our records show that we received a batch of Kaylo, January 1947. This lasted until September 1949 at which time we started dusting with another batch which had been received in January 1949. This latter product is the material to which reference was made in our letter of February 24, 1950, to you.

The fact that in recent months you have more effectively separated and spiculated the chrysotile fibers would account for the differences noted by us. From our point of view, probably the most important result of this difference is the fact that it is now possible to produce a higher concentration of dust in our experimental room than was possible with earlier products. During the past number of months we have endeavored to hold this concentration down to an average of 300 million particles per cubic foot of air.

Since the fibers are shorter and seem less flexible, I do not believe they are sufficiently numerous to change the type of tissue response to dust of the first batch. However, in view of the findings it might be well to examine a small sample of a current batch of the material. This is just to be on the safe side.

Sincerely yours

000126

Arthur J. Vorwald, M.D.
Director

AJV:bw

cc: Dr. Shook

PLAINTIFF'S EXHIBIT Kirstein-10 8-28-98

Urgent

Our records show that we received a batch of Kaylo Jan., 1947. This lasted us until Sept., 1949, at which time we started dusting another batch, which had been received Jan., 1949. This latter product is the material to which reference was made in our letter of Feb.24,1950 to Mr.W.G.Hazard.

Mr. Hazard's information that "In recent months the chrysotile fibers have been more effectively separated and spiculated . . ." would account for the difference noted by us. From our point of view, probably the most important result of this difference is the fact that it is now possible to produce a higher concentration of dust in our experimental room than was possible with earlier products. We are endeavoring to hold this concentration down to an average of 300 X 10^6 particles per cubic foot of air.

Since the more recent product contains virtually more fibers than in earlier products, one might expect a difference in response. However, these fibers are shorter and seem less flexible than the chrysotile present in earlier products, and might therefore have little biological significance.

OB
4/11/50

June 1, 1950

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

The Trudeau School currently in session prevented a more prompt answer to your letter of May 18. It finished today and I am now ready to attack the accumulated correspondence.

In reviewing your letter the first order of business is to urge you and Doctor Shook to visit Saranac Lake. My calendar is full up to the middle of June. Select any time after that date which is most convenient for both of you.

The second point which you raise relates to the X-Ray Department and the service by the Foundation for the reading and interpretation of chest roentgenograms of your employees. In commenting upon this matter as requested in your letter of April 3, there is certainly no objection on our part should you prefer that the matter be formalized on a contract basis. In many respects, some formal agreement would ease our administrative duties. I rather expect also that it would satisfy your purchasing department.

The agreement of last year was based on a flat rate of $4.00 per chest case. In explanation, per chest case refers to the roentgenograms of each man at a given date. Thus, the case might consist of only a single film, or it might include a stereo pair, a lateral, and an oblique. The fee of $4.00 would cover the entire lot. If on the other hand two dates were involved, we would consider that as two cases.

We see no reason to change that fee, unless there is some objection on the part of the company. It is indeed a relatively low figure and we keep it there only because of our continued interest in problems relating to the inhalation of dust. The opportunity to study clinical material of this sort is of tremendous help in our research program.

PLAINTIFF'S EXHIBIT
Kirstein-102
8-28-98

000116

The third point concerns the experimental investigations with Kaylo which are about completed. Only a few more animals remain. These will be sacrificed next month. Then we will be ready to prepare the final report. For your information, at this time, I believe the findings permit the following:

> Kaylo dust on inhalation by experimental animals does not produce silicosis irrespective of the small amount of quartz present. It does produce the asbestotic type of reaction in the lungs and, therefore, we believe every precaution should be taken to minimize exposure of industrial employees.
>
> Kaylo dust on inhalation by experimental animals infected with tubercle bacilli (R) produces only a very mild stimulation of the tuberculous infection, much less than that caused by the inhalation of pure quartz. This evidence leads us to believe that in industrial practice the minimal allowable concentration of Kaylo could be far in excess than that accepted for quartz before Kaylo would have an adverse stimulating effect upon a tuberculous infection in exposed employees.
>
> This evidence would support the view that inhalation of Kaylo dust would not be hazardous from the standpoint of tuberculosis, especially provided that the dust hazard is controlled as cited above.

We are looking forward to having you and Doctor Shook with us the latter part of June.

Sincerely yours

Arthur J. Vorwald, M.D.
Director

AJV:bw

cc: Dr. Shook
Kaylo exp. file

PLAINTIFF'S EXHIBIT
Kirsten-103
8-23-88

CLASS OF SERVICE

This is a full-rate Telegram or Cablegram unless its deferred character is indicated by a suitable symbol above or preceding the address.

WESTERN UNION

W. P. MARSHALL, PRESIDENT

1201

SYMBOLS

DL = Day Letter
NL = Night Letter
LC = Deferred Cable
NLT = Cable Night Letter
Ship Radiogram

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CT=TOA305 PD=TOLEDO OHIO 6 1100A=

DR ARTHUR J VORWALD, DIRECTOR=

=THE SARANAC LABORATORY SARANAC LAKE NY=

RELET WOULD FRIDAY JULY 14 BE CONVENIENT WITH YOU FOR DR= SHOOK'S AND MY VISIT TO DISCUSS KAYLO EXPERIMENTS?=

=W G HAZARD OWENS ILLINOIS GLASS=

000115

June 6, 1950

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

Your telegram to Doctor Vorwald was received this afternoon in his absence from the Laboratory while on a business trip to Michigan. It will come to his attention upon his return next Monday, June 11.

In the meantime, I am noting on Doctor Vorwald's calendar the date - July 14 - you and Doctor Shook wish to visit us here. As far as I know, this will be a convenient time for Doctor Vorwald, but I will take the matter up with him to make sure he has not made other commitments about which he neglected to inform me. I will write to you again the first of next week.

Sincerely yours,

Lillian R. Blinn (Mrs. A.B.)
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director

LB

PLAINTIFF'S EXHIBIT
Kirstein-101
8-28-98

000114

June 7, 1950

Memo to: Dr. Arthur J. Vorwald

From: Clarence L. Wagner

Subject: Saranac Laboratory contract with Owen-Illinois Glass Co.
Termination Date - May 1, 1950

Per Mr. C. W. Howard letter dated July 21, 1949 payment of $5,000. would be made for the period of 1 year terminating May 1, 1950.

All payments have been made in accordance with the foregoing and the contract has now expired.

Please indicate below briefly the present status of renewal negotiations.

- - - - - - - - - - - -

Memo to: Clarence L. Wagner   Date June 26, 1950

From: Dr. Arthur J. Vorwald

Conference here in the Saranac Laboratory with Dr. Shook and Mr. Howard scheduled for July 14, 1950, at which time the continuation of contract will be considered.

LRB

PLAINTIFF'S EXHIBIT
Kirstein-105
8-28-98

000113

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

~~Ditto~~ Ditto 3
Oct 11

August 2, 1950

Telephone
Aug. 4, 1950
D. S. Q. with Urban when he returns
Date? then notify Bill

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Art:

It was a treat to spend the day, July 14, with you and the other members of your staff.

We were, of course, most interested in the results of your animal experimentation with Kaylo. These experiments, as we understand it, are now at an end and we are looking forward to seeing the final report as soon as it can be worked up.

On August 17 I have a visit scheduled to the Berlin, New Jersey plant of our Kaylo Division, where they manufacture Kaylo and fabricate it into pipe insulation. On the following day, August 18, I'll be at the Sayreville, New Jersey plant of the Kaylo Division, which is much larger than the Berlin plant and has potentially larger dust exposures. Would it be convenient for Tom Dirkin or Ed Urban to be there also? If so, it might be possible for them to bring their vacuum cleaner air sampler so we can get some samples in the finishing department for free silica determination.

If these dates are not convenient, we could probably arrange a trip sometime later.

Thank you for sending us the dittoed sheet explaining how to ship lung specimens. Some day I hope we can send some to you.

You will remember we left with you a proposed blanket contract to cover the reading of X-rays that come to you from our various plants. The idea was to put in writing what the present practice is--and if the proposed contract does not currently describe our procedures, it should be changed to fit. At your convenience, could you return to us one copy of the letter?

The hospitality of you and your wife was something we are still talking about. I don't think the boys will ever forget their boat ride--

PLAINTIFF'S EXHIBIT
Kirstein-106
8-28-99

003111

and you and Mrs. Vorwald were certainly very kind to arrange the picnic.

All the Hazards send you our best regards.

Sincerely yours,

W. G. Hazard

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

cc - Dr. C. F. Shook - Toledo

October 14, 1950

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

In reviewing my correspondence I find your letter of August 2, 1950, and my note concerning our telephone communication regarding a visit to your Kaylo Division in Berlin, New Jersey. We are wondering what disposition you might wish to make of this matter. As you will recall, we were unable to join you at the plant because both Mr. Urban and Mr. Durkan had previous commitments. At the time, you mentioned that, should these dates be inconvenient, a trip could be arranged sometime later.

Both Mrs. Vorwald and I enjoyed the gift which you sent us and apologize for the delay in acknowledging it. Next year the boys will be older and better able to take the boat out by themselves.

With every good wish to you.

Sincerely yours

Arthur J. Vorwald, M.D.
Director

AJV:bw

cc: C. F. Shook, M.D.

PLAINTIFF'S EXHIBIT
Kirstein-107
8-28-98

000110

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

October 30, 1950

URGENT

Mr. Urban's trip to Camden Nov. 13

Dr. Arthur J. Vorwald
The Saranac Laboratory
Saranac Lake, New York

Dear Art:

You wrote October 14 about the proposed visit of Mr. Durkan or Mr. Urban to our Sayreville, New Jersey, plant. We still feel this trip should be made, both to get their overall comments on our dust control program, and to take some gross air samples for analysis of the dust given off during the packing and shipping operations of Kaylo.

I don't have any set date for a return trip to Sayreville, but would certainly be glad to make a trip there in order to be with Mr. Durkan or Mr. Urban. Perhaps it would be best for them to suggest a date—possibly tying it in with some trip to the New York or Philadelphia area.

Last week your new volume on beryllium arrived and it is certainly a monumental work. Congratulations! I hope all future Saranac symposiums can be written up in the same fashion.

Personal regards to you and Mrs. Vorwald.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

000109

PLAINTIFF'S EXHIBIT
Kirstein-108
9-28-98

To take samples is time-consuming depending on concentration of air

- We have equipment available which we can send to them to take samples either before or after the survey. Mr. Urban can explain how to do this when he makes survey any time after Jan 15.

LRB

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

December 12, 1950

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Art:

Some time ago we mentioned to you that our Kaylo Division wants to gather together in brochure form material on the health aspects of Kaylo dust, and wants to consider the possibility of publishing some of your experimental findings.

As we recall it, you mentioned during the visit that Dr. Shook and I made to Saranac last July that the animal experiments were all completed (and no new ones need be started) and that the results of the several years' program would be written up in final report form. Could you let us know how this project stands?

Could you also let us know how we stand on the finances? Our accounting department reports that they have paid two invoices this year—one in January for $1250 and one in May for $1250.

We still feel that before this work can be finally completed, it would be desirable for one of your engineers to visit our Sayreville plant and, among other things, take some gross air samples for composition analysis. Any time such a trip can be worked into your schedule conveniently, let us know.

One more point—you mentioned last July that all the asbestos work carried on through the years at Saranac was being written up and would be published. Has this been done yet?

Best wishes to you and Mrs. Vorwald for a merry Christmas—with lots of snow in the Adirondack hills—and a happy New Year.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

cc - Dr. C. F. Shook - Toledo

Jan after 15th
See note attached

Sept to be publ... within 5 mon.

PLAINTIFF'S EXHIBIT Kirstein-110 8-28-98

000107

December 18, 1950

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

Your letter of December 12, poses many questions, and I will try to answer them in the order presented.

With regard to the brochure, we believe it advisable to wait until all of our experimental studies with Kaylo have been collated and written up in the report to the company. With that report it will be much easier to write something for the brochure.

The final report concerning the investigation on Kaylo is being prepared and I hope to finish it as soon as possible. Of recent date it has been delayed because of new problems resulting from the International Situation.

The finances are in good order as your accounting department fulfilled your agreement with the last check for $1250 issued to us in May of this year. It is now up to us to complete the study, by finishing the final report.

Our paper concerning the investigation of "asbestos" has been in the hands of the publisher for some time. It is to appear in the Archives of Industrial Hygiene and Occupational Medicine. When it was accepted, Professor Philip Drinker informed us that it would appear within five months. We expect it to appear in the near future.

With respect to the visit to Sayreville, it will be possible for Mr. Urban and Mr. Durkan to conduct a study of the plant any time after January 15, 1951. Either one or both will bring the necessary equipment. Please set the date as soon as possible

PLAINTIFF'S EXHIBIT Kirstein 711 6-28-98

000105

My every good wish to you Bill, Lib, Nick, Sam and David for all good things on Christmas and for the New Year. Should Madge know of this I am sure that she would not want to be forgotten. She joins me in thanking you again for the lovely cocktail glasses the design of which is especially appropriate at this time of the year.

Cordially

Arthur J. Vorwald, M.D.
Director

AJV:bw

cc: Dr. C. F. Shook - Toledo

Mr. Urban
Mr. Durkan

December 19, 1950

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
P. O. Box 1035
Toledo 1, Ohio

Dear Bill:

In order to make our studies of Kaylo more complete we would like to have electron micrographs of the dust. Unfortunately we do not have an electron microscope. However, if I remember correctly, your company has access to such an instrument. We would appreciate it if you could arrange to have electron micrographs prepared for us. For this purpose we are sending to you, under separate cover, a sample of Kaylo dust, bearing our number MD-78. This is material collected from the atmosphere of our experimental dust room.

Sincerely yours

Arthur J. Vorwald, M.D.
Director

AJV:bw

000097

PLAINTIFF'S EXHIBIT
Kirstein-112
9-28-98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

December 26, 1950

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Art:

We have sent your sample MD-78 of Kaylo dust to our General Research Laboratory for electron microscope pictures. We will send them to you as soon as they are ready.

If it's all right with you, we'd like to set a definite date for the visit to Sayreville after the first of the year. set for Jan 30 31

Best regards.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.C.Hazard:M

000096

PLAINTIFF'S EXHIBIT Kirstein-113 8-28-98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

January 15, 1951

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Art:

I expect to be at the Sayreville, New Jersey plant of our Kaylo Division Monday, January 29. I am wondering whether it would be possible for your engineers to arrange a trip there Tuesday, January 30, or Wednesday, January 31, so as to look over our Kaylo operations.

It doesn't matter to me whether they arrive Tuesday or Wednesday--whichever would be more convenient for them. They could easily see the plant in one day and perhaps might do all their work in one day. If many samples are needed, however, the visit perhaps should be lengthened out. I can stay with them for as long as they need.

If for any reason these dates are not suitable, don't hesitate to say so.

Personal regards.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

PLAINTIFF'S EXHIBIT
Kirstein-114
8-28-98

000104

WESTERN UNION

SYA029 CTA475 1951 JAN 19 PM 3 51

CT=TOC139 DL PD=TOLEDO OHIO 19 307P=

A J VORWALD, DIRECTOR=

THE SARANAC LABORATORY SARANACLAKE NY=

RE OUR PROPOSED VISIT SAYREVILLE, NEW JERSEY, WOULD IT BE CONVENIENT FOR YOUR ENGINEERS TO MEET ME AT THE SAYREVILLE PLANT TUESDAY MORNING, JANUARY 30?=

=W G HAZARD OWENS ILLINOIS GLASS CO=

000102

1/19/51
Replying your wire Mr [illegible] & Mr Urban will meet you Sayreville Plant Tues Jan 30

No. LT3		To Miss Hagan
By n	At 5:35	To Be [illegible]

PLAINTIFF'S EXHIBIT
Kirstein-115
8-28-98

Toledo Ohio

Regarding our proposed visit Sayreville, N.J. Would it be convenient for your engineers to meet me at the Sayreville Plant Tuesday A.M. Jan. 30.

W. G. Hazard
Owens-Illinois Glass Co.

Co no

[illegible]

[illegible] Sayre[illegible]

[illegible] - 30

TL [illegible] 1/19/51

00[illegible]

January 22, 1951

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

This will confirm our telegram of January 19 in reply to yours of that date. Our Mr. Durkan and Mr. Urban plan to meet you at the Sayreville plant on Tuesday, January 30, and, if necessary, will be able to stay over on Wednesday.

With warm personal regards,

Sincerely yours,

Arthur J. Vorwald, M. D.
Director, The Trudeau
Foundation and The
Saranac Laboratory

AJV:lr
cc: Mr. Durkan
Mr. Urban

009131

PLAINTIFF'S
EXHIBIT
Kirstein-116
8-28-98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

January 22, 1951

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Dr. Vorwald:

Mr. Hazard went out of town this last weekend and at that time he was awaiting final arrangements on the Sayreville trip.

The plans are now complete and he will be staying at the Roger Smith Hotel in New Brunswick Monday night, January 29. He suggests that Mr. Durkin and Mr. Urban get in touch with him at the hotel when they arrive and then they can all go to the plant together Tuesday morning.

Sincerely yours,

Maude Ley
INDUSTRIAL RELATIONS DIVISION

M.Ley

000100

PLAINTIFF'S EXHIBIT
Kirstein-117
8-28-98

January 23, 1951

Memorandum to: Mr. Durkan
Mr. Urban

From: Doctor Vorwald

Subject: Owens-Illinois Glass Company - Sayreville trip

We have been advised by Miss Maude Ley of the Industrial Relations Division of Owens-Illinois Glass Company that the plans are now complete and Mr. Hazard will be staying at the Roger Smith Hotel in New Brunswick - Monday night, January 29. Mr. Hazard suggests that you get in touch with him at the hotel when you arrive and that then you can all go to the plant together on Tuesday morning.

AJV:LB

000698

PLAINTIFF'S EXHIBIT
Kirstein-118
8-28-98

January 25, 1951

Mr. W. G. Hazard
c/o Roger Smith Hotel
New Brunswick, New Jersey

Dear Mr. Hazard:

This is simply to tell you that Mr. Durkan and Mr. Urban plan to arrive in New Brunswick on Tuesday morning, January 30, around 9:00 o'clock — earlier if the Saranac Lake train is on time. They will go directly to the hotel to meet you and would appreciate your reserving for them two single rooms.

I am sending a copy of this letter to you in care of your Toledo office.

Sincerely yours,

Lillian H. Elias (Mrs. A.B.)
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director

CC: Mr. Durkan
Mr. Urban

000098

PLAINTIFF'S EXHIBIT
Kirstein-119
8-28-98

January 31, 1951

Memorandum To: Doctor Vorwald

From: E.C.J. Urban

Subject: Preliminary Industrial Hygiene Survey,
Owens-Illinois Glass Company
Kaylo Division Plant, Sayreville, N.J.

The survey work was requested by Mr. W. Hazard of the Owens-Illinois Glass Company, Toledo, Ohio, office.

Members of The Saranac Laboratory staff participating in the survey were: T.M. Durkan and E.C.J. Urban.
The following individuals were contacted at Sayreville.

Mr. O.W. Pfeifer, Plant Manager
Mr. William Barker, Personnel Manager
Mr. P.E. Gillis, Safety Director
Mr. John Roades, Quality Control Engineer

The survey was made in the company of Mr. W. Hazard. Its purpose was to examine the plant operations with the view of discovering any hazards to health which might exist as the results of the raw materials handled and the finished product produced.

Raw Materials

1. Diatomaceous Earth
   The products of several U.S. manufacturers including Johns-Manville. The earth was not a "pure" product (100% SiO_2) but contained contaminants as clays.
2. Silica flour (high grade of free crystalline SiO_2 ground to a fine size) from Pennsylvania Pulverizer Company.
3. Tripoli (small quantities) from Illinois Mineral Company.
4. Lime, Warren Company, Balfont, Pennsylvania.
5. Asbestos, Chrysotile, Johns-Manville-Quebec, Canada
   Asbestos, Amosite (iron bearing) South Africa.
6. Kayolin (clay) small amounts from Georgia.
7. Cement, commercial grades.

Finished Products

"Kaylo" product in tile forms for structural uses. Reinforced with wire for roofing. Sheets for fire-proof doors and panels. In round forms for pipe insulation covering. Two types of "Kaylo" were made. "Light density" and "Heavy density". Both contain different mixtures of the same original components.

The quality of the finished product is judged by structural

PLAINTIFF'S EXHIBIT
Kirstein-120
8-28-98

strength, density, hardness and moisture absorption.

Seven dust counts were taken in strategic locations throughout the plant. Seven sites were selected at which air-borne sample collections will be made (vacuum cleaner on filter paper), by Mr. John Roades. The samples will be forwarded to The Saranac Laboratory for analysis.

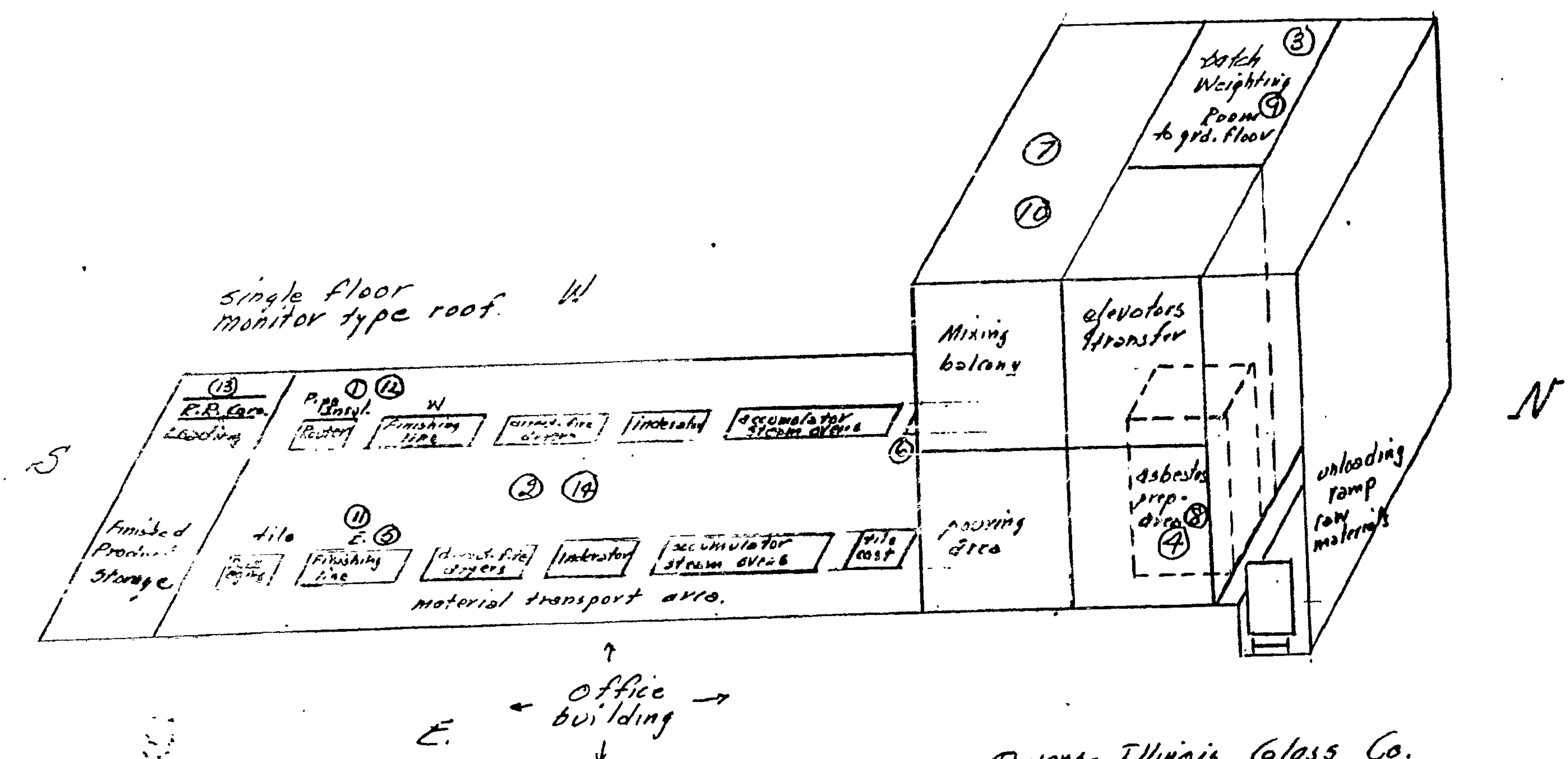
The sketch, Fig. I, shows the locations of dust counts #1 to 7 inclusive and the air-borne sample collections #8 to 14 inclusive.

Bulk samples of all the main raw products used and of Light and Heavy Kaylo grades were also obtained for analysis.

We believe that two main health hazards must be considered in this plant. Asbestos (long fiber) and crystalline free silica.

Mr. Hazard requested six (6) copies of a formal report of this survey be sent to him. The cost of this work was not discussed.

ECJU:lr
cc: T.M. Durkan



Owens-Illinois Glass Co.
Kaylo Division
Sayreville, N. J.

by: E.C. J. Urban
1/30/51.

000086

EXPENSE ACCOUNT

Date: January 31, 1951

Memorandum to: Fiscal Department

From: E.C.J. Urban

Purpose: Preliminary Industrial Hygiene Survey
Owens-Illinois Glass Company
Kaylo Division Plant, Sayreville, New Jersey

Dates: Leave Saranac Lake - 1-29-51 Survey Plant 1-30-51 Return 1-31-51

Meeting Place: Sayreville, New Jersey

MONEY ADVANCED	$ —
Plane	$
RR	
Pullman	43.60
Automobile Mileage	
Taxi	1.35
Hotel	
Meals (4)	6.25
Telephone	
Porters and checking	1.00
TOTAL EXPENSES	$52.20
BALANCE DUE	$52.20

(x) Request reimbursement
( ) Check enclosed

Charge to: Owens-Illinois Glass Acct.

Not [illegible] [illegible]
[illegible]
[illegible]

Signature: Edward C. J. Urban

PLAINTIFF'S EXHIBIT
Kirstein-121
8-28-98

000C88

EXPENSE ACCOUNT

Date February 5, 1951

Memorandum to: Owens Illinois Glass Company

From: T. M. Durkan

Purpose: Dust survey of Kaylo plant at Sayreville, N.J.

Dates: January 30, 1951

Meeting Place:

FUNDS ADVANCED . . . . $

Plane . . . . $	
N Y C Round trip 32.66	
RR . . . . . 5.76 - 2 Round trips N Y - New Brunswick	38.42
Pullman . . N Y C	8.62
Automobile	
Taxi	0.75
Hotel	
Meals	3.74
Telephone	
Baggage	1.25
. . . .	

TOTAL EXPENSES. . $ 52.78

BALANCE DUE . . . $

(✓) Request reimbursement
( ) Check enclosed

Charge to: Owens-Ill. Glass

Not to bill until advised to do so

TMD

Signature: T. M. Durkan

006639

File

February 6, 1951

Memorandum To: Doctor Vorwald

From: E.C.J. Urban

Subject: Owens-Illinois Glass Company, Preliminary Survey, (Append to Memo of January 31, 1951, on the same subject)

Summary of Dust Counts taken in the plant during survey 1/30/51, by T.M. Durkan, E.C.J. Urban. Accompanied by Mr. W. Hazard of the Owens-Illinois Company.

All collections were made in 95% Ethyl Alcohol using the Midget Impinger.

Sample #1, 2:45 P.M. 10 min. sampling time.
Router machine cutting Kalyo blocks into pipe insulation forms. Sample of exposure of two minutes at router machine outlet removing pipe insulation forms and applying cloth coatings. A light glue was sprayed onto the forms with compressed air spray guns to adhere the cloth to the Kaylo. The cutting parts of the machine were enclosed by sheet metal housings and exhausted by a central suction system. The exhaust points were checked by smoke tests and found to have strong suctions. This same central exhaust system also served the West finishing line which was not in operation at the time. The exhaust points of the West line were closed off by dampers. This substantially increased the volumes of exhaust at the Router machine.

The router unit was located in the open plant area. Moderately heavy accumulations of Kaylo dust covered the under carriage of the machine. The operators discarded broken pieces of insulation by throwing them into open containers. Several containers were filled in a short time and the excess discards fell to the floor. Housekeeping in the machine area was only fair.

Dust count: 4.4 m.p.p. cu. ft. (less than 10μ. These particles appeared to be almost entirely 3μ and less in length.)
.08 m.p.p. cu.ft. (10 to 20μ in length)

Suggest: Minimum exhaust rates which would provide effective dust collection for each branch of the dust control system be determined. The suction of these branches should be checked periodically. Static pressure measurements can be used as indicators.

PLAINTIFF'S EXHIBIT Kirstein -122 8-20-98

001690

Improve housekeeping in the router machine area by periodically cleaning the dust from the machine carriage and providing a sufficient number of containers for disposal of waste material. Instruct the men to use frequent changes of clean work clothes and gloves.

Sample #2, 3:10 P.M. 10 min. sampling time.
General air sample along center aisle between direct-fired driers and inderator units. Housekeeping was good. The units were of a completely enclosed construction. Only a slight volume of steam was noted to escape into the general air.

Dust count: 3.4 m.p.p. cu. ft. (Under 10μ. Most of the particles were 3μ and less in length)
.16 m.p.p. cu. ft. (10 to 20μ in length)

Sample #3, 3:30 P.M. 8 min. sampling time.
General air in Batch Weighing Room Area. No weighing was being done. The time of sampling was close to the changing of shifts. Other normal activity was going on. The housekeeping in the area was in fair to good order. The general ventilation conditions were also good. The dumping points of the dust storage bins into the weighing containers were each provided with exhaust systems. These exhaust points were checked by smoke tests and the suctions were found to be only fair. During an inspection made earlier in the day, visible amounts of dust were seen to escape into the general room air during weighing from the dumping points.

Dust count: 8.4 m.p.p. cu. ft. (Under 10μ. Most of the particles were 5μ and less in length)
.26 m.p.p. cu. ft. (approx. 10μ in length)

Suggest: Determine minimum exhaust rates for each branch of the dust control system. Check suction periodically for proper operation.

Sample #4, 4:00 P.M. 8 min sampling time.
Operators exposure in the Asbestos unbagging room. Complete cycle of work was done, including opening a 200 lb. bag of Amosite long fibre Asbestos, dumping it on a platform, feeding the riffle table and feeding Asbestos into the hammer mill. The room was completely enclosed and exhausted from two points in the ceiling. The door was open to admit bags of Asbestos and the intake ventilating air. A visible cloud of dust in the air

was evident during the unbagging operation. Moderately heavy accumulations of fibre were present on the machine surfaces and walls through-out the room. The operator wore a filter-type respirator approved by the U.S. Bureau of Mines during the unbagging work. He was stationed in the incoming air to the room during this work.

Dust count: 6.9 m.p.p. cu. ft. (less than 10µ. Most of the particles were 5µ and less in length)
.14 m.p.p. cu. ft. (averaging about 10µ in length)

Suggest: Re-design the exhaust system for the room and re-locate the suction hoods close to the points where the dust is produced. It might be feasible to dump the Asbestos bags into a small hopper and chute rather than onto an open platform. The hopper could have a rotary feeding device for moving the Asbestos onto the riffle tables. The tables should be partly enclosed by plastic hoods and exhausted. Housekeeping in the area should be improved by periodically cleaning the room of the accumulated dust. The operations in this room unquestionably are associated with a potential asbestos hazard.

Sample #5, 4:15 P.M. 5 min. sampling time.
East Finishing Line. Operators exposure while turning Kaylo structural tiles by hand on a conveyor belt located in the center of the finishing line. All adjacent tile smoothing operations were enclosed and provided with exhausts. Moderate quantities of dust were raised when the man turned the tiles. The Finishing Line was located in the open plant area. Housekeeping was good.

Dust count: 8.3 m.p.p. cu. ft. (less than 10µ. Most of the particles were less than 5µ).
.48 m.p.p. cu. ft. (10 to 15µ in length.
One particle was 100µ)

Suggest: Install a suction hood in front of the operator at this point. The men working on the more dusty jobs should change their work clothing and gloves frequently.

Sample #6, 4:45 P.M. 10 min. sampling time.
Pre-Hardener and Tile pouring machine, B unit. General air in area of 3 men operating the unit. A wet slurry Kaylo was poured into moulds and then passed through a steam chest into the pre-hardener. The steam conditions around the machine were moderately heavy.

Dust count: 2.2 m.p.p. cu. ft. (less than 10µ. Most particles were under 5µ).
.45 m.p.p. cu. ft. (averaged 5 to 15µ).

000092

Sample #7, 4:55 P.M. 10 min. sampling time.
General air in west end and center of the mixing balcony. Two men were doing normal work. One man added lime, silica, and cement to a mixer unit from several portable containers. All the mixer units were covered. Accumulations of dust from spillage were present on all the mixer units and parts of the floor area.

Dust count: 5.2 m.p.p. cu. ft. (less than 10µ. Most of the particles were under 5µ).
0.0 m.p.p. cu. ft. (larger than 10µ).

Suggest: Improve housekeeping in area by periodical cleaning Instruct the men to use care and avoid spilling dry dust.

Summary of Dust Counts, m.p.p. cu.ft.

	Less than 10µ	Greater than 10µ
Router	4.4	.08
Center Aisle	3.4	.16
Bulk Weighing Rm.	8.4	.26
Asbestos unbagging	6.9	.14
East Finishing Line	8.3	.48
Pre-Hardener	2.2	.45
Mixer Balcony	5.2	0.0

Summary and Conclusions:

The results of the few dust counts taken confirm the opinion of the Industrial Hygiene Engineer that considerable attention has been given in this plant to the control of dust.

In 1946 the Department of Health for the State of New Jersey advised that they follow a "Sanitary Code" which recommended the following threshold limits for dust exposure.

Asbestos	5 m.p.p. cu. ft.
Silica (more than 70%)	5 m.p.p. cu. ft.
" (40% to 70%)	10 m.p.p. cu. ft.
" (5% to 40%)	20 m.p.p. cu. ft.
All dusts (less than 5% Silica)	50 m.p.p. cu.ft.

The American Conference of Governmental Industrial Hygienists recently developed a code for dusts which is as follows:

Asbestos	5 m.p.p. cu. ft.
Silica	
high (above 50% free SiO_2)	5 m.p.p. cu. ft.
medium (5 to 50% free SiO_2)	20 m.p.p. cu. ft.
low (below 5% free SiO_2)	50 m.p.p. cu. ft.
Total dust (below 5% free SiO_2)	50 m.p.p. cu. ft.

It is our belief that the main hazard to health of workers in this plant arises from exposure to long-fibered asbestos. (Fibers 10µ and longer). To a lesser degree, the other hazards present are caused by the dusts of crystalline free silica (Silica flour and Tripoli) and diatomaceous earth. Although present practices are effective for the control of air borne dusts we feel that the following suggestions will aid in further reducing dustiness and maintaining levels of a low order.

1. Periodic inspection of all local exhaust systems including static pressure tests at strategic locations to check and maintain the proper performance of each section.

2. Re-design the dust control system connected with the asbestos preparation work.

3. Improve housekeeping methods particularly in these areas where asbestos, crystalline free silica, and diatomaceous earth are handled. It was noted during the survey, for example, that bags of these minerals were stored in large piles throughout the plant area where ever space was available. Some of the bags were broken and covered with dusts. This practice tends to contaminate the entire plant atmosphere.

4. The employees working at the points in the production system which create dust should be educated in dust suppression practices. These men should also be instructed to change their work clothes at least once each week or more frequently if needed.

5. Dust count surveys should be made in the plant periodically, at intervals of once each month, until the maintenance of low levels of dustiness is assured. These surveys can later be reduced in frequency to three-month intervals.

ECJU;lr
cc: Mr. Durkan

Bill for this + other service must be processed - C. P.

February 26, 1951

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

As you recall, Mr. Durkan and I made an industrial hygiene survey of the Kaylo Division Plant of your company in Sayreville, New Jersey on January 30, 1951. Later arrangements were made with one of the local men, Mr. Reades, to obtain six samples of air borne dusts from selected locations in the plant with a filter collection device which we left there for the purpose.

We are anxious to complete our observations and would appreciate your advice as to the progress of this sample collection work.

With kindest regards,

Sincerely yours,

Edward C. J. Urban
Industrial Hygiene Engineer

ECJU:lr
cc: Mr. William Barker

PLAINTIFF'S EXHIBIT
Kirstein-123
8-28-98

009087

PLAINTIFF'S EXHIBIT
Kirstein-124
8-28-98

Owens-Ill

3/28/51

Mr. Vorwald

Tom tells me Bill Hazard called yesterday from N. J. to inquire about ~~our~~ recommendations re: survey of Kaylo plant. He was on way to plant and merely wished to know if we had anything to report. Notified we had received samples but had not completed analyses.

LUB

000082

Formal report
Week of May 14
Send bill at same time

May 2, 1951

Tel: Fairfax 6543 ← Owens Illinois

Mr. W.G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

Your letter of April 30 has been received in Doctor Vorwald's absence while on a business trip to the middle west and will be brought to his attention on his return the first of next week.

I have discussed the matter of the analyses of the dust samples taken at the Sayreville, New Jersey plant of your Kaylo Division with Mr. Durkan. As you requested, he will endeavor to have some information in your hands by Saturday of this week.

Sincerely yours,

Lillian R. Bunn (Mrs. A.B.)
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director

LRB:lr

cc: Mr. Durkan

PLAINTIFF'S EXHIBIT
Kirstein-125
8-28-98

000073

Called Bill Hazard on phone Sat. May 4, told him dust count at finishing line was 8 million, dust composition was quartz 3-5%, chrysotile 5-10%, amosite 5-10%, clay-like masses (kaylo) 55-65, carbonates 15-25. dust from box car was quartz 4-7%, chrysotile 3-4%, amosite 25-35%, clay-like masses (kaylo) 30-40%. From wt. of dust collected (5 g in 6 hrs) we estimated dust conc. at about 40 million in box car. Bill said this was about ~~what their~~ dust counts showed. Mentioned that there appeared to be a possible asbestosis hazard in box car, not in finishing line.

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

April 30, 1951

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Art:

Next Tuesday, May 9, I expect to be again at the Sayreville, New Jersey plant of our Kaylo Division. You will recall that Tom Durkan and Ed Urban made some extensive field tests there some time ago. We understand, however, they have been tied up with rush work and haven't been able to complete the analysis.

I am wondering whether they have any of the analyses made yet which show the percent asbestos dust in gross air samples taken in the finishing department and in box cars while the latter are being loaded with Kaylo roof tile. The percent of asbestos in the air at these points has been of great interest to us and we are not sure our own tests made in the past are reliable. Perhaps Tom might have some information on this which he could wire to us before we leave for the plant next Monday.

It was good to see you last week in Atlantic City, even though it was a fleeting glimpse.

Personal regards.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

000081

PLAINTIFF'S EXHIBIT
Kirstein-126
8-28-98

May 2, 1951

Mr. W.G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

Your letter of April 30 has been received in Doctor Vorwald's absence while on a business trip to the middle west and will be brought to his attention on his return the first of next week.

I have discussed the matter of the analyses of the dust samples taken at the Sayreville, New Jersey plant of your Kaylo Division with Mr. Durkan. As you requested, he will endeavor to have some information in your hands by Saturday of this week.

Sincerely yours,

Lillian R. Blinn (Mrs. A.B.)
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director

LRB:lr

cc: Mr. Durkan

000030

PLAINTIFF'S EXHIBIT
Kirstein-127
8-28-98

REPORT

KAYLO DIVISION PLANT

Owens-Illinois Glass Company

Sayreville, New Jersey

May 29, 1951

INDUSTRIAL HYGIENE SURVEY

by

The Saranac Laboratory

Saranac Lake, New York

Submitted by:

Arthur J. Vorwald

Arthur J. Vorwald, M.D.
Director, The Trudeau Foundation and
The Saranac Laboratory

In cooperation with:

Edward C. J. Urban
Thomas M. Durkan
Donald A. Bailey

Report of Industrial Hygiene Survey
of
Kaylo Division Plant, Owens-Illinois Glass Company
Sayreville, New Jersey

A survey of the Kaylo Division plant of the Owens-Illinois Glass Company, located at Sayreville, New Jersey, was made on January 30, 1951 by T. M. Durkan and E. C. J. Urban of The Saranac Laboratory in company with W. G. Hazard of the Owens-Illinois Company. The purpose of the survey was to observe the plant operations and to discover whether any hazards to health might be created by dust liberated from the raw materials handled or from the finished products manufactured. Dust counts of atmospheric samples taken at seven strategic locations with the midget impinger apparatus were made to determine the concentration of air-suspended dust to which the workmen were exposed. Seven samples of atmospheric dust sufficient for analysis were collected on paper filters with a vacuum cleaner device so that the amount of hazardous free silica and asbestos constituents in the air-floated material could be estimated. The filters were of a specially prepared paper which effectively retained dust particles as small as .01 microns in size. One of these filter paper samples was taken on January 30, while the dust survey was being made, but the other six were collected later by John Roades of the Owens-Illinois Company. The raw materials also were examined and their composition was determined approximately.

Composition of Raw Materials and Finished Product

The composition and particle size of the principal raw materials which are used in the manufacture of the product Kaylo are indicated in table 1. In addition to the materials listed, small amounts of kaolin

000065

and cement are required but these two items are not related to any dust hazard.

Of the six raw materials described in table 1, all except quick lime must be regarded as potentially hazardous and capable of causing a serious pneumoconiosis. Inhalation of amosite or chrysotile can produce asbestosis and inhalation of silica flour or tripoli can cause silicosis. Diatomaceous earth on inhalation is capable of producing a diffuse fibrosis which is unlike silicosis or asbestosis but which may be quite disabling.

The finding that the sample of amosite had a quartz content of 21 per cent is quite surprising. It is thus apparent that exposure to this commercial form of amosite may present a potential hazard not only from asbestos fibers but also from free-silica particles.

The finished product, Kaylo, appears to consist principally of a crystalline form of calcium silicate which yields a characteristic x-ray diffraction pattern. Petrographic and chemical examination revealed, however, that other constituents are present in the material. A sample of light grade Kaylo was shown by analysis to have a quartz content of about 5 per cent; for the heavy grade the value was about 5 per cent. Both grades also contained moderate amounts of asbestos. In a sample of the light grade the asbestos was in the form of chrysotile which comprised approximately 5 to 20 per cent of the sample. For a sample of the heavy grade the chrysotile content was estimated to be about 5 to 10 per cent but, in addition, about 3 to 5 per cent of amosite asbestos was seen. Carbonates made up about 1 per cent of each grade of Kaylo.

Concentration and Composition of Atmospheric Dust

The concentration of the atmospheric dust to which the workmen were exposed at various points is shown by the dust counts in table 2. Information pertinent to the operations or conditions at each sampling point are included in the table. A summary of the dust counts is as follows:

Sample		Particles per cu.ft. of air Smaller than 10μ	Larger than 10μ
1	Router machine	4.4 million	0.08 million
2	Center aisle	3.4	0.16
3	Batch weighing room	8.4	0.26
4	Asbestos unbagging room	6.9	0.14
5	East finishing line	8.3	0.48
6	Pre-hardener	2.2	0.45
7	Mixer balcony	5.2	0.00

The composition of the material suspended in the air at seven representative locations is revealed by the analyses in table 3; from the data in table 4 the weight of dust in the atmosphere at those seven locations can be calculated. Thus, the dust load of the general plant air (sample #3A) was 0.2 gram in about 17,000 cu. ft. of air or 0.01 mg. per cu. ft., while the dust load of the atmosphere at the other locations ranged from 0.06 to 0.4 mg. per cu. ft. The hazardous fraction of the dust consisted of the free silica components (quartz and diatomaceous earth) and the asbestos components (amosite and chrysotile). These hazardous constituents generally made up a large portion of each dust sample, as the following table reveals:

Sample		Free silica components per cent	Asbestos components per cent
1A	General weighing area	40-55	3-5
2A	Asbestos tank	10-20	40-50
3A	General plant air	18-30	32-43
4A	Finishing line	3-5	10-20
5A	Router machine	1-3	6-12
6A	Boxcar and truck	4-7	27-39
7A	Asbestos shredding room	22-24	40-50

By correlating the values for concentration and composition of the atmospheric dust at each sampling point a fair idea of the potential dust hazard at those points can be obtained:

			Atmospheric Dust at Sampling Points		
			Concentration	Composition	
Samples			Particles per cu.ft. of air	Free silica components per cent	Asbestos components per cent
1 and	5A	Router machine	4.4 million	1-3	6-12
2 "	3A	Center aisle	3.4	18-30	32-43
3 "	1A	Batch weighing room	8.4	40-55	3-5
4 "	7A	Asbestos unbagging room	6.9	22-24	40-50
5 "	4A	East finishing line	8.3	3-5	10-20
6 "	3A	Pre-hardener	2.2	18-30	32-43
7 "	2A	Mixer balcony; asbestos tank	5.2	10-20	40-50
-	6A	Boxcar and truck	-	4-7	27-39

000C68

Comment

The results of the dust survey, which included the analysis of raw materials and atmospheric dust and a limited number of dust counts, make it apparent that considerable attention had been given in this plant to the control of dust. Exhaust systems of removing the dust had been installed and the amount of dust suspended in the plant atmosphere was revealed by the survey to be at relatively low levels. Since, however, in many areas of the plant hazardous free silica and asbestos minerals comprised a large portion of the air-floated material, it is very important that effective dust control measures be maintained at all times so that the dissemination of unsafe amounts of dust into the atmosphere will be prevented.

A number of agencies have suggested threshold or maximum allowable limits for the concentration of dusts in industrial atmosphere. In 1948 the Department of Health for the State of New Jersey informed The Saranac Laboratory that the Department followed a "Sanitary Code" which recommends certain threshold limits for dust exposure. A somewhat similar code has recently been developed by the American Conference of Governmental Industrial Hygienists. Threshold values established by those codes are as follows:

(The threshold values are given on the next page)

		Maximum Allowable Concentration (Particles per cu.ft. of air)	
		New Jersey code	Am. Conf. Gov. Ind. Hyg. code
Asbestos		5 million	5 million
Free silica:			
	more than 70%	5	—
	" " 50%	—	5
	40% to 70%	10	—
	5% to 50%	—	20
	5% to 40%	20	—
	less than 5%	50	50
Total dust		50	50

A review of the survey data discloses that in certain areas (such as the batch weighing room) free silica comprised a large portion of the dust to which the workers were exposed; in other areas (asbestos tank and boxcar) asbestos was the principal component of the air-suspended material; and in still other localities (center aisle and asbestos unbagging room) substantial amounts of both free silica and asbestos were present in the atmospheric dust. It is thus apparent that although the dust counts of the seven impinger samples were all below 10 million, and therefore relatively low, the rather high quartz or asbestos content of the air-suspended material tended to create in certain areas a condition which might be hazardous, or at least one which approached the maximum allowable limit established by code. Specific examples would be the exposure to free silica in the batch weighing room and to asbestos in the asbestos unbagging room. Also, the concentration of asbestos dust inside the boxcars probably exceeded safe limits. Although a dust count was not made during the survey for that sampling point, the weight of dust collected there with the vacuum cleaner device and filter paper indicates that the dust concentration inside the boxcar was possibly of the order of 50 million or more. Since about one-third of the dust was asbestos, it seems likely that a potentially hazardous condition existed.

Suggestions and Recommendations

1. It is suggested that minimum exhaust ventilation rates which will provide effective dust collection for each branch of the dust control system be determined, unless this has already been done, and that the suction of these branches be checked periodically. Static pressure measurements can be used to measure air flow.

2. The exhaust system for the asbestos unbagging room should be redesigned so that the suction hoods will be located close to the points where the dust is produced to collect it before it contaminates the general air. It might be feasible to dump the asbestos bags into a small hopper and chute rather than on to an open platform. The hopper could have a rotary feeding device for moving the asbestos on to the riffle tables. The tables should be partly enclosed by plastic hoods and should be exhausted. Housekeeping in the area should be improved by periodically cleaning the room of the accumulated dust.

3. Housekeeping practices could be improved in a number of areas of the plant. At the router machine the dust should be removed from the machine carriage regularly and a sufficient number of containers provided for the proper disposal of the waste material. On the mixer balcony care should be taken to avoid spilling dry dust and the area

should be cleaned periodically.

4. Special attention should be given to housekeeping in those areas where silica flour, tripoli, diatomaceous earth and asbestos are handled. It was noted during the survey that bags of these materials were stored in large piles throughout the plant area where space was available. Some of the bags were broken and covered with dust. Dust arising from this source would tend to contaminate the atmosphere of the entire plant.

5. It is recommended that a suction hood be installed in front of the operator who manually turns over the Kaylo tiles on the conveyor belt.

6. All employees working at points where dust is created should be educated in good dust suppression practices. As an added safeguard, it is suggested that those who work at dusty jobs be required to change their work clothing frequently.

7. Since it appears that men loading box cars are probably exposed to a hazardous concentration of air-suspended asbestos fibers, it is recommended that the men wear U.S. Bureau of Mines approved respirators during that operation. It would be preferable, of course, to reduce the dust concentration by exhaust ventilation or some other practicable method if at all possible.

8. Dust count surveys should be made in the plant at regular monthly intervals until a low level of dustiness in each potentially-hazardous area is established. The surveys can then be done less frequently.

9. The maintenance of the working environment in a condition which conforms to regulations promulgated by local health agencies or which is in accord with accepted standards of good practice should not be considered as a complete protection for a worker from acquiring a disease as the result of his occupation. It is strongly recommended that at the Kaylo plant a medical program be maintained which would require a pre-employment examination, including a roentgenogram of the chest, of all prospective employees and a routine chest roentgenogram of all regular workers at intervals of once each year. Such a program should reveal those individuals who are unfit for employment in a dusty trade. Of most importance, any case of disease which might develop in the regularly employed workers would be found early, before it became a serious health problem to the individual and a liability to the management.

Table 1

ANALYSIS OF RAW MATERIALS USED IN THE MANUFACTURE OF KAYLO

Material	Composition	Size of Particles
Amosite	The bulk of the material was fibrous. Many of the fibers were separated; they did not possess the high degree of flexibility of chrysotile. Grains of chlorite or serpentine were adhering to some of the fibers. The sample of the amosite brought back from the Kaylo plant had a quartz content of 21 per cent.	Most of the fibers were several hundred microns to several cm. in length; relatively few were shorter than 50 microns. Many of these short fibers were 1 micron or less in diameter and, unlike chrysotile, were generally straight or only slightly curved. About 5 per cent of the material (by weight) would pass through a 100 mesh screen; in this smaller-than-100 mesh fraction about one-third of the fibers were longer than 20 microns and for every fiber there were about 6 particles.
Chrysotile	More than 90 per cent fibrous chrysotile. Adhering to some of the fibers were grains of chromite (?), carbonates, a few grains of massive serpentine and a trace of olivine. About 0.5% quartz also was present.	The fibers were well separated. Many were several hundred microns long and some were several mm. in length. About 10 per cent of the material (by weight) would pass through a 100 mesh screen; in the smaller-than-100 mesh fraction about one-fourth of the individual fibers were longer than 20 microns and for every fiber there were about 12 particles. In this fraction unopened bundles were about as numerous as the separated fibers.
Diatomaceous earth	Principally natural diatomaceous earth with a trace of quartz. Probably some clays were present. Diatoms were the fresh water variety (?).	Probably more than 90 to 95 per cent of the particles were smaller than 1 micron.
Quick lime	Nearly all lime, with 0.2% quartz and traces of carbonates, feldspar and glass.	Mostly smaller than 2 microns and rarely larger than 10 microns. Many clumps larger than 30 microns were seen.
Silica flour	Almost entirely pure, finely-ground quartz.	Probably more than 95 per cent of the particles were smaller than 5 microns.
Tripoli	Almost entirely cryptocrystalline quartz.	Probably more than 95 per cent of the particles were smaller than 5 microns; only rarely were any larger than 40 microns seen.

Table 2

CONCENTRATION OF ATMOSPHERIC DUST AT VARIOUS SAMPLING POINTS IN PLANT

All samples were taken with the midget impinger. The collecting fluid was 95% ethyl alcohol.

Sample #1: Router machine. Taken at 2:45 P.M.; 10 min. sampling time.

Router machine cutting Kaylo blocks into pipe insulation forms. Sample represented exposure of two men at router machine outlet removing pipe insulation forms and applying cloth coatings. A light glue was sprayed on the forms with compressed air spray guns to make the cloth adhere to the Kaylo. The cutting parts of the machine were enclosed by sheet metal housings which were exhausted by a central suction system. The exhaust points were checked by smoke tests and were found to have strong suction. This same central exhaust system also served the west finishing line, which was not in operation at the time. Since the exhaust points of the west line were closed off by dampers, the volume of exhaust at the router machine was substantially increased.

The router unit was located in the open plant area. Moderately heavy accumulations of Kaylo dust covered the undercarriage of the machine. The operators discarded broken pieces of insulation by throwing them into open containers. Several containers were filled in a short time and the excess discards fell to the floor. Housekeeping in the machine area was only fair.

Dust concentration: particles per cu. ft. of air
4.4 million smaller than 10μ. (Nearly all of these particles appeared to be 3μ or less in length.)
0.08 million larger than 10μ. (10 to 20μ in length.)

Sample #2: Center aisle. Taken at 3:10 P.M.; 10 min. sampling time.

General air sample along center aisle between direct-fired driers and inductor units. The units were of a completely enclosed construction. Only a slight volume of steam was noted escaping into the general air. Housekeeping was good.

Dust concentration: particles per cu. ft. of air
3.4 million smaller than 10μ. (Most of the particles were 3μ or less in length.)
0.16 million larger than 10μ. (10 to 20μ in length.)

Sample #3: Batch weighing room. Taken at 3:30 P.M.; 8 min. sampling time.

General air sample in batch weighing room area. No weighing was being done at time of sampling was close to the changing of shifts. Other normal activity was going on. Housekeeping in the area was in fair to good order and the general ventilation conditions were good. The dumping points of the dust storage bins into the weighing containers were each provided with exhaust systems. These exhaust points were checked by smoke tests and the suction was found to be only fair. During an inspection made earlier in the day visible amounts of dust were seen to escape into the general room air from the dumping points during weighing.

Dust concentration: particles per cu. ft. of air
6.4 million smaller than 10μ. (Most of the particles were 5μ or less in length.)
0.26 million larger than 10μ. (Near 10μ in length.)

Table 2 (Continued)

Sample #4: Asbestos unbagging room. Taken at 4:00 P.M.; 8 min. sampling time.
Exposure of workman in asbestos unbagging room. A complete cycle of work was done including opening a 200 lb. bag of amosite long-fiber asbestos, dumping it on a platform, feeding the riffle table and feeding asbestos into the hammer mill. The room was completely enclosed and was exhausted from two points in the ceiling. The door was open to admit bags of asbestos and intake air for ventilation. A visible cloud of dust in the air was present during the unbagging operation. Moderately heavy accumulations of fiber were present on the machine surfaces and walls throughout the room. During the unbagging operation the operator, who was stationed in the stream of air coming into the room, wore a filter-type respirator approved by the U.S. Bureau of Mines.

Dust concentration: particles per cu. ft. of air
6.9 million smaller than 10μ. (Most of the particles were 5μ or less in length.)
0.14 million larger than 10μ. (Near 10μ in length.)

Sample #5: East finishing line. Taken at 4:15 P.M.; 5 min. sampling time.
Exposure of workman while turning Kaylo structural tiles by hand on a conveyor belt located in the center of the finishing line. All adjacent tile smoothing operations were enclosed and were provided with exhausts. Moderate quantities of dust were raised when the man turned the tiles. The finishing line was located in the open plant area. Housekeeping was good.

Dust concentration: particles per cu. ft. of air
8.3 million smaller than 10μ. (Most of the particles were 5μ or less in length.)
0.48 million larger than 10μ. (Mostly 10 to 15μ in length; one was 100μ long.)

Sample #6: Pre-hardener. Taken at 4:45 P.M.; 10 min. sampling time.
Pre-hardener and tile pouring machine, a unit. General air sample of the area in which three men operated the unit. A wet slurry of Kaylo was poured into molds and then passed through a steam chest into the pre-hardener. A moderate amount of steam was in the atmosphere around the machine.

Dust concentration: particles per cu. ft. of air
2.2 million smaller than 10μ. (Most of the particles were less than 5μ in length.)
0.45 million larger than 10μ. (Up to 15μ in length.)

Sample #7: Mixer balcony. Taken at 4:55 P.M.; 10 min. sampling time.
General air sample in west end and center of the mixing balcony. Two men were doing their normal work. The men added lime, silica and cement to a mixer unit from several portable containers. All the mixer units were covered. Accumulations of dust from spillage were present on all the mixer units and on parts of the floor area.

Dust concentration: particles per cu. ft. of air
5.2 million smaller than 10μ. (Most of the particles were less than 5μ in length.)
0.00 million larger than 10μ.

Owens-Illinois
May 29, 1951

ANALYSIS OF SAMPLES OF ATMOSPHERIC DUST

Sample number	1A	2A	3A	4A	5A	6A	7A
	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Quartz	5-10	5-10	3-5	3-5	1-3	4-7	19
Diatomaceous earth	35-45	5-10	15-[illegible]	-	Tr.	-	3-5
Amosite	3-5	40-50	30-40	5-10	5-10	25-35	40-50
Chrysotile	-	?	2-5	5-10	1-2	2-4	-
Chlorite	2-5	5-10	2-5	Tr.	1-2	Tr.	10-15
Carbonates	5-10	1-2	5-10	15-25	5-6	20-30	3-5
Kaylo (?)*	30-40	25-35	10-20	55-65	10-20	30-40	-
Goethite	-	-	-	Tr.	-	Tr.	10-20
Ferric oxide	-	Tr.	Tr.	-	-	-	Tr.
Opaque	1-2	Tr.	5-10	-	Tr.	-	-
Organic fiber	-	Tr.	3-5	-	Tr.	-	-

*Clay-like masses like those found in the finished product Kaylo.

__Notes:__ Sample 1A. Sample contained considerable diatomaceous earth.

2A. Fibers and bundles of amosite up to several cm. long.

3A. Much of the amosite was between 10 and 100 microns in length.

4A. The amosite occurred mostly as 20 to 100 micron fibers; a few bundles of amosite were noted. The chrysotile was present as partially opened bundles several hundred microns long.

5A. The bulk of sample 5A was an unidentified isotropic material with a low index of refraction. Possibly it was amorphous silica or a less porous form of Kaylo. Much of it occurred as rosette-like masses.

6A. The bulk of the fibrous material appeared to consist of fibers mostly 20 to 100 microns long; some were several hundred microns long.

7A. The amosite occurred as flexible fibers 20 to 100 microns long, also as bundles over 1 hundred microns to several mm. long. Fibers shorter than 20 microns seemed to be less flexible than chrysotile. It is doubtful that much of any chrysotile was present in this sample.

000077

Table 4

DATA FOR SAMPLES OF ATMOSPHERIC DUST

Sample number	Weight of dust collected	Description of sample
1A	1.0	Collected in general weighing area from 10:00 A.M. to 4:30 P.M. (6.5 hrs.) on Jan. 31, 1951.
2A	2.9	Collected at asbestos tank from 10:15 A.M. to 4:30 P.M. (6.25 hrs.) on Feb. 1, 1951.
3A	0.2	General plant air sample collected from 8:25 A.M. to 3:30 P.M. (7.1 hrs.) on Feb. [illegible], 1951.
4A	2.4	Collected at finishing line from 10:30 A.M. to 4:30 P.M. (6 hrs.) on Feb. 5, 1951.
5A	2.9	Collected at router from 9:00 A.M. to 3:00 P.M. (6 hrs.) on Feb. 6, 1951.
6A	5.4	Collected in box car from 8:50 A.M. to 12:40 P.M. (3.8 hrs.) on Feb. 12, 1951 and while loading truck from 1:00 P.M. to 3:00 P.M. (2 hrs.) on Feb. 15, 1951.
7A	1.3	Collected in asbestos shredding room from 1:00 P.M. to 4:00 P.M. (3 hrs.) on Jan. 30, 1951.

NOTE: The samples of atmospheric dust for analysis were collected on a paper filter with a vacuum cleaner. The volume of air sampled was about 2400 cu. ft. per hour.

June 6, 1951

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

The report of our survey of dust conditions at the Sayreville plant of the Kaylo Division has at last been completed and in accordance with your request we are forwarding to you six copies of the report. I am sorry that there has been such a delay in preparing this report and sending it to you. Doctor Vorwald is away from the Laboratory at present but on his return, in about a week, he will undoubtedly write you and comment on the findings.

With best personal regards,

Sincerely yours,

Thomas M. Durkan
Assistant Director
The Saranac Laboratory

TMD:lr

000063

PLAINTIFF'S EXHIBIT
Kirstein-129
8-28-98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

June 8, 1951

Dr. Arthur J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Art:

On June 26 I expect to be back at our Sayreville, New Jersey plant (Kaylo Division) to discuss with Mr. Pfeifer how to further improve dust conditions there.

It would be helpful if we had the results of the tests made by Tom Durkan and Ed Urban at Sayreville some time ago, as well as any recommendations they might have after they saw the plant firsthand. Tom phoned me some preliminary findings a few weeks ago, but—are there any further results available now?

Report mailed June 6, 1951

Incidentally, I may be driving through Saranac next Tuesday, June 12, enroute to our plant at North Troy, Vermont. If we do go through, and if it's at a reasonable time of day, I'll give you a ring.

Personal regards.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

PLAINTIFF'S EXHIBIT
Kirstein-130
8-28-98

000045

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

July 11, 195?

Mr. Thomas M. Durkan
The Saranac Laboratory
Saranac Lake, New York

Dear Tom:

Thank you for sending us the several copies of the report on the work done by you and Ed Urban at our Sayreville, New Jersey plant. A large amount of work went into this job and we appreciate it.

Recently I was at Sayreville when we had a chance to go over some of your findings--in fact, that's the reason I haven't written before this.

Several points came up that I know you can enlighten us on. First, the chemist at Sayreville was amazed at the finding in table 1 that the sample of amosite brought back from Sayreville had a 21% quartz content. Their analyses showed an insignificant quartz content, and they wondered how come. What method was used in making your analysis? Is it 21% by weight? Also, how were the samples shown in table 3 analyzed and are the percents by weight or by count?

In table 3, sample 5A, which was taken at the pipe covering router, showed a 5-10% amosite component. The plant tells me that the Kaylo used in pipe covering has never contained any amosite as a raw material.

In the same table, sample 6A, taken while loading a boxcar with Kaylo roof tile, had 2-4% chrysotile and 25-35% amosite, making a total of 27-39% asbestos. Chemical analyses on similar gross air samples made by our own research laboratory have indicated that the total asbestos component of the dust was 6-10%. We are wondering what your method of analysis was, and whether you have any comments on this rather wide divergence of findings.

I wish we could sit down and discuss some of these results instead of writing about them but, in the meantime, perhaps you could send us your comments on the above.

Personal regards.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

005044

PLAINTIFF'S EXHIBIT
Kirstein-131
8-28-98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

July 13, 1951

Dr. Arthur J. Vorwald, Director
Saranac Laboratory
Saranac Lake, New York

Dear Art:

Last year we had an interim report on the Kaylo dust experiments that you did for us--and Dr. Shook and I discussed the finding with you at Saranac last summer. According to our notes you were going to prepare a final report summarizing the whole investigation. Is our recollection correct and is this final report "in the works"?

Personal regards.

Sincerely yours,

T. Bee

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:k

00C036

PLAINTIFF'S EXHIBIT
Kirstein-132
8-28-98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

August 7, 1951

Mr. Thomas M. Durkan
The Saranac Laboratory
Saranac Lake, New York

Dear Tom:

Some time ago we sent you some questions raised by our Kaylo Division staff on the dust analyses made following the visit of you and Ed Urban to our Sayreville, New Jersey plant. It happens that next Tuesday I expect to be in New Jersey again and I am wondering whether you could drop me a note here at Toledo so I could be fortified when I leave here next Monday.

The last time I wrote it was embarrassing to have your letter and mine cross in the mail. Hope it doesn't happen now.

Personal regards.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

000037

PLAINTIFF'S EXHIBIT
Kirstein-133
8-28-98

August 7, 1951

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

Your letter of July 11 regarding the analyses of dust samples from the Sayreville plant has been received and I am sorry that an answer has been delayed so long. The summer vacation period interferes somewhat with our usual schedule.

It would be best if we could sit down and review our report, as you mention in your letter, but perhaps a few comments on the questions you ask will serve as a substitute for a personal conference.

Percentages on a weight basis. The percentages in all the tables are on a weight basis. Occasionally we may estimate the percentages of the various constituents by making particle counts, but when the results are reported as per cent by particle count, rather than per cent by weight, a note to that effect is included in the report.

Composition of amosite. Like the chemist at the Sayreville plant we were very much surprised to find that the sample of amosite had a quartz content of 21 per cent. At first we thought that such a large amount of quartz represented contamination of the sample, but when it was discovered that the atmospheric dust (sample 9A), collected over a period of 3 hours in the asbestos shredding room, also had a high quartz content, it was obvious that the asbestos contained considerable quartz. For analyzing these samples we employed both petrographic examination and the x-ray diffraction method. Although quartz particles as large as 100 microns were seen in the samples when examined with the petrographic microscope, the lines of the x-ray diffraction patterns were [illegible], indicating that the [illegible] present.

PLAINTIFF'S EXHIBIT

000038

The lines would have been spotty if the sample had contained only large quartz particles.

Since samples of fibrous material [illegible] as easily as granular dusts, the question of poor sampling arose. To eliminate this possibility we repeated the x-ray diffraction analysis of the amosite and of the atmospheric dust ([illegible]), using different portions of the samples. The values obtained for quartz were practically the same as before: 20 and 19 per cent, respectively, as compared with 21 and 19 per cent given in the report.

Atmospheric dust at router. A recheck of sample 5A confirms our previously reported finding that the sample contains amosite. In nearly every microscopic field there are one or more fibers and in some there are several fibers. We differentiate amosite from chrysotile by the higher index of amosite and by the usual occurrence of amosite as straight stiff fibers in comparison with the curved fibers of chrysotile.

Asbestos content of dust in box car. Since our estimate of the amosite and chrysotile content of [illegible], was based merely upon visual examination of the material under the petrographic microscope, the values reported are not very precise. For that reason we listed in the table a range of values such as 5-10 and 35-45 per cent, rather than a single value. It is quite possible, therefore, that our estimated values for the asbestos components are too [illegible]

examination of asbestos samples with x-ray diffraction analysis but have not been very successful in obtaining [illegible] quantitative values. Not only do we lack samples of pure [illegible] minerals with which to obtain standard patterns, but in addition the lines of the diffraction patterns of the asbestos minerals are weak in intensity. Possibly chemical analysis, such as used by your [illegible] laboratory, is the best method for estimating the asbestos content of mixed dust, provided there are only a few components of the dust and the composition of each one is known and is different from the composition of the other components.

Although our estimate of [illegible] per cent for the asbestos content of the atmospheric dust [illegible] in the [illegible] (sample 6A) may be high, [illegible] would not expect the true value to be as low as the 6-10 per cent reported by your laboratory. [illegible] amosite to register a distinct x-ray diffraction pattern, and from this finding we would expect the [illegible] to be greater than 10 per cent. It is unfortunate that we are unable to obtain with the x-ray diffraction method quantitative values for the asbestos minerals that are as reliable as those for [illegible].

Mr. W. G. Hazard -3- August 7, 1951

If the asbestos content of the dust in the locker is only 6-10 per cent instead of 27-32 per cent and the dust count is about 40 to 50 million, then the exposure of men loading the car probably should not be regarded as a definite hazard but rather as only a potential one. Nevertheless, in view of the fact that we are not certain just what atmospheric concentration of asbestos fibers is the limit of safety, it would be well to apply the protective measures suggested in the report, including the wearing of a respirator and, if possible, some method of reducing the amount of atmospheric dust.

Best personal regards to you.

Sincerely yours,

Thomas M. Durkan
Assistant Director

TMD:lr

000040

Mr. Pratt
Please note

August 17, 1951

Mr. W.G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Bill:

I am chagrined to find that I have not answered your letter of July 13 before this time but my schedule has been an especially busy one. You are correct in your understanding that a final report summarizing the investigation of our Kaylo dust experiments is, as you put it, "in the works." While the report is in preparation, due to vacations and a few other hurdles, I do not believe it will be in your hands before sometime next month. Please know, however, that we will get it to you as soon as we possibly can.

With every good wish and kindest personal regards,

Sincerely yours,

Arthur J. Vorwald, M.D.
Director, The Trudeau Foundation
and The Saranac Laboratory

AJV:lr

October 26, 1951

Mr. [illegible] G. Lazard
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Lazard:

Before leaving for San Francisco last night Doctor Vorwald asked me to forward the attached bill. It is being sent directly to you in accordance with your request in a previous letter.

I am very sorry about the delay, but in some way the matter skipped Doctor Vorwald's notice.

Sincerely yours,

[illegible] (Mrs. A.B.)
Executive Secretary to -
Arthur J. Vorwald, M.D.
Director

JRB:[illegible]
Enc.

000033

PLAINTIFF'S EXHIBIT
Kirstein-136
8-28-98

Sar Lab checked and found corr in all total

Industrial Hygiene Survey
Kaylo Division Plant
Owens-Illinois Glass Company
Sayreville, New Jersey

January 1951

Travel expenses from S.L. to Sayreville, N.J. and return
Thomas M Durkan and E.C.J Urban 104.98

Services for one day away from laboratory, two men 100.00

Laboratory work at Sar Lab
Dust counts for 7 samples;
petrographic analysis of 7 samples;
Chemical analysis of 3 samples,
and x-ray diffraction analysis of 2 samples 159.00

Report of survey, interpretation of findings, and recommendations 50.00

Total - $413.98

000034

INTER-OFFICE COMMUNICATION DATE: 9/7/51

TO: A. Vormack

FROM: C.L.H.

SUBJECT: Past Due accounts

Owens - Illinois Glass Co. $134.98

Can disposition be made before close of fiscal year. Consider journal transfer of Larkin & Urban, $52.78 $52.78 to Kaylo Div. Sayreville, N.J.

Mrs. Bolin also has information on this.

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

October 29, 1951

The Trudeau Foundation
P.O. Box 551
Saranac Lake, N. Y.

Attention: Mrs. A. B. Ellen

Gentlemen:

We received this morning your statement for expenses and services of Messrs. Durkan and Urban in connection with their visit to our Sayreville, New Jersey plant. This will be processed for payment.

Before doing so, however, we'd like to check with you on this point: According to our records, all our payments for the animal experiments on Kaylo dust are up-to-date, and complete. Is this correct?

Our Kaylo Division would like to close out the account that was set up some years ago for the Saranac investigations. If there are any unpaid items, we'd like to process them along with the present bill for Messrs. Durkan and Urban's special trip.

We recognize that the final report covering the whole animal experiment program has not yet been prepared in finished form. However, we assume this will not be an additional charge, but has already been covered by the regular quarterly payments that were made as the work was in progress. If this is not the case, will you let us know?

Sincerely yours,

W. G. Hazard

Industrial Relations Division

W.G.HAZARD
GC

PLAINTIFF'S EXHIBIT
Kirstein-137
8-28-98

000C32

October 31, 1951

Mr. W. G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
Toledo 1, Ohio

Dear Mr. Hazard:

This will acknowledge your letter of October 29 with reference to Owens-Illinois Glass Company's account with The Saranac Laboratory.

The contract for the experimental investigation with Kaylo has been paid in its entirety. There will be no charge for the final report, which is now in preparation.

According to our records, the only outstanding bill is the one recently forwarded to you for the Sayreville survey by Mr. Durkan and Mr. Urban.

Sincerely yours,

[illegible] (Mrs. A.B.)
Executive Secretary to
Arthur J. Vorwald, M.D.
Director

LRB:lr

0

000C31

PLAINTIFF'S EXHIBIT
Kirstein-138
8-28-98

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

January 4, 1952

Dr. A. J. Vorwald, Director
The Saranac Laboratory
Saranac Lake, New York

Dear Art:

This letter is attached to a package containing samples of dust and bulk material collected at our Sayreville, New Jersey plant. Attached is a sheet giving a description of the samples.

You will recall when I was in Saranac discussing the Kaylo investigation with you, Tom and Ed, we agreed to run some check analyses on the composition of air-borne dust. These are being sent as a result of this discussion.

The five air samples were collected with an Electrolux vacuum cleaner much like the one Ed uses. In the tin cans are the original filters with the dust still on them. We'd appreciate it if you would return to us a portion of each sample so that we can forward the material to our own research laboratory for study.

Personal regards, and best wishes for a happy and prosperous New Year.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

PLAINTIFF'S EXHIBIT Kirstein-139 12-22-98

000060

Samples of dust from Sayreville, N.J. plant for analysis
Owens-Illinois Glass Company

Our sample no.	Date	Sampling time (hours)	Location
1	12/4-12/5/51	2.33	At asbestos fiberizer. Four bags of amosite were processed on 12/4, and five bags 12/5, while the vacuum cleaner sampler was running.
2	11/15/51	7.5	On B finishing line, at turnover position, where operator turns slabs of core material upside down. Core material contains only chrysotile, not amosite.
3	11/16/51	3.0	At end of B finishing line, offbearer's position, where slabs of core material were being inspected and removed from the conveyor line.
4	11/19/51 11/20/51 12/1/51	2.5 2.0 5.75 10.25	At machine where low density billets were being routed to make pipe covering. Low density billets should contain only chrysotile, but there may be some amosite present.
5	12/3/51	4.0	Inside freight car, during the loading of two cars with roof tile. Roof tile contains both chrysotile and amosite
6	12/4-5/51		Bulk samples of amosite. The paper bag contains a composite. A handful of amosite was taken from each of the nine bags that were emptied during the collection of sample #1, above, plus a handful from each of eleven additional bags that were fiberized those same days.
7			Sample of core material
8			Sample of roof tile.
9			Sample of billets.

000061

Samples of dust from Sayreville, N.J. plant for analysis
Owens-Illinois Glass Company

Our sample no.	Date	Sampling time (hours)	Location
1	12/4-12/5/51	2.33	At asbestos [illegible]. Four bags of amosite were processed on 12/4, and five bags 12/5, while the vacuum cleaner sampler was running.
2	11/15/51	7.5	On B finishing line, at turnover position, where operator turns slabs of core material upside down. Core material contains only chrysotile, not amosite.
3	11/16/51	3.0	At end of B finishing line, offbearer's position, where slabs of core material were being inspected and removed from the conveyor line.
4	11/19/51 11/20/51 12/1/51	2.5 2.0 5.75 10.25	At machine where low density billets were being routed to make pipe covering. Low density billets should contain only chrysotile, but there may be some amosite present.
5	12/3/51	4.0	Inside freight car, during the loading of two cars with roof tile. Roof tile contains both chrysotile and amosite.
6	12/4-5/51		Bulk samples of amosite. The paper bag contains a composite — handful of amosite was taken from each of the nine bags that were emptied during the collection of sample #1, above, plus a handful from each of eleven additional bags that were [illegible] those same days.
7			Sample of core material.
8			Sample of [illegible]
9			Sample of [illegible]

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CONFIDENTIAL

Final Report

INVESTIGATION CONCERNING THE CAPACITY OF INHALED KAYLO DUST TO INJURE THE LUNG

to

Owens-Illinois Glass Company

Toledo, Ohio

by

The Saranac Laboratory

Saranac Lake, New York

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Submitted by:

Arthur J. Vorwald, M.D.
Director, The Saranac Laboratory
and The Trudeau Foundation

In cooperation with:

Thomas M. Durkan, M.E.
Philip C. Pratt, M.D.
Edward C.J. Urban, M.S.E.
Anthony B. Delahant
Donald A. Bailey

2/7/55 - RB

INVESTIGATION CONCERNING THE CAPACITY OF INHALED KAYLO DUST TO INJURE THE LUNG

I. INTRODUCTION

In 1943 the Owens-Illinois Glass Company had developed to the pilot plant stage a new industrial product, known as Kaylo, which could be used as a thermal insulating material and for other applications. According to information supplied by the company, this product was prepared by heating under steam pressure a suspension of calcium hydroxide, silica, and asbestos to form a hydrated calcium silicate. Studies at The Saranac Laboratory showed that although the principal component of Kaylo was the hydrated calcium silicate, some unchanged raw materials, including asbestos and free silica in the form of quartz or diatomaceous earth, were also present in the final product. Before Kaylo was used commercially on a large scale, it was important to determine whether or not any dust liberated from this product during manufacture, handling or fabrication would be likely to constitute a respiratory hazard to exposed individuals. Therefore, a comprehensive investigation was undertaken in which the effect of inhaled Kaylo dust on animals was studied. The investigation was started in February 1945 and was carried on for more than five years. It explored the nature of the pulmonary tissue reaction to inhaled Kaylo dust in normal animals and in animals harboring a tuberculous infection. In this final report of the study the principal findings given in previous interim reports will be reviewed briefly and the conclusions derived from the entire experimental program will be stated.

II. DUSTING MATERIAL USED

The material used for generating atmospheric dust in the experimental dust room was finely-divided Kaylo obtained from the dust collectors of the Berlin, New Jersey plant, in which Kaylo is manufactured. The material was received in separate shipments, as follows:

Lot #1 - Received in January 1945.
#2 - " " February 1947.
#3 - " " January 1949.

A. Composition: The results of chemical and petrographic analysis of a representative sample of the material as received at The Saranac Laboratory, are given in table 1. It will be noted that the only asbestos mineral revealed by the petrographic examination of this sample is chrysotile. Since Kaylo is a commercial product, it is possible that minor alterations in composition may occur from time to time in accordance with changes in the raw materials used. For example, the quartz value for lot #1 of Kaylo was less than 1 per cent but the quartz content of lots #2 and #3 was between 2 to 5 per cent. In the final shipment of Kaylo, received in January 1949 and first used in this experiment in September 1949, the asbestos component contained the mineral amosite as well as chrysotile. The fibers of amosite, in comparison with those of chrysotile, are less flexible and have a higher iron content. However, since experiments with animals have shown that both amosite and chrysotile are capable of causing asbestosis, it is unlikely that the substitution of the one mineral for the other in Kaylo would cause a significant change in the toxic properties of the final product.

B. X-Ray diffraction studies: The X-ray diffraction pattern of samples of two different shipments of Kaylo are shown in fig. 1. The prominent lines present are probably those of a hydrous calcium silicate, which is the principal component of Kaylo. Comparison of patterns a and b discloses that the quartz line is stronger in b than in a, indicating that the Kaylo received in January 1949 has a higher quartz content than has the earlier product, received in January 1946. Faint lines representing calcite and chrysotile are visible in both patterns. Diffraction lines produced by amosite are also present in pattern b.

C. Size-frequency studies: The size-distribution of Kaylo dust is shown by the graph in fig. 2. The lines of the graph represent the parent material in the dust machine and two samples of atmospheric dust collected in the dust room on different days. A magnification of 1200X was used in making the size-frequency counts. It will be noted that about 88 per cent of the particles in the parent material visible at that magnification are smaller than 5 microns in size; the corresponding values for the samples of atmospheric dust are 90 and 95 per cent. This difference in the two samples of atmospheric dust, which were derived from the same parent material, may have been due to the day-to-day variation in humidity inside the dust room.

XII. REVIEW OF PREVIOUS REPORTS

During the course of the investigation with Kaylo dust five interim reports were issued.

The first report, dated May 18, 1946, revealed that in guinea pigs

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that had been exposed to Kaylo dust for periods up to 14 months. The findings at that time suggested that Kaylo dust had a slightly adverse influence on the course of a tuberculous infection in guinea pigs but that the effect was by no means as pronounced as that of quartz dust.

IV. INHALATION EXPERIMENT WITH KAYLO DUST

As a continuation of the previous interim reports and as a summary for this final report, a review of the entire program of study is reported.

In the inhalation experiment (Saranac Laboratory No. 1012, 1100, 1104) groups of guinea pigs, rats, and hamsters were placed in a cubical dust room, 8 feet in dimension, in which an atmospheric suspension of Kaylo dust was maintained. The room was operated for more than five years, from February 1945 to June 1950. About 450 animals were used in the experiment and some of them lived in the dust room for as long as 5 years.

A. Conditions of Exposure

The atmospheric suspension of Kaylo dust was produced by the action of a paddle that rotated inside a hopper, located in a corner of the dust room, which contained the finely divided Kaylo product. The dust cloud generated in this manner floated out into the room where it was maintained for 8 hours on five days of the week and for 4 hours on Saturdays. At regular intervals during the experiment a few animals were killed and the tissues examined grossly and microscopically to determine the nature and the extent of the dust reaction. The tissue was also analyzed chemically to estimate the amount of Kaylo dust retained in the lungs of animals exposed for definite periods of time.

. Dust counts of atmospheric samples collected in the dust room with the midget impinger were made regularly. The concentration of Kaylo dust to which the uninfected animals were exposed was generally within the range of 100 to 125 million particles per cubic foot of air and the overall average was 115 million. In the experiment with infected animals the concentration was higher, the average being 205 million.

B. Exposure of uninfected animals

Three species - guinea pig, rat, hamster - were employed in this phase of the investigation. A summary of the findings is given in table 2.

(1) Guinea pigs. At the beginning of the experiment 100 uninfected guinea pigs were placed in the dust room and 6 months later 25 more were added to replace animals that had died in an epidemic of acute pneumonia. Since this pneumonia occurred at that time also in animals exposed to another dust in an adjacent room, the unfortunate epidemic was considered accidental. Epidemics of this kind, which occurred occasionally in experiments at that time, have since been controlled. Groups of guinea pigs, usually 2 to 4 in number, were killed at 2, 4, 6, 8, 12, 18, 21, 24, 27, 30, 33, and 36 months after the beginning of their exposure to Kaylo dust so that the course of the pulmonary reaction could be followed.

In guinea pigs exposed for periods up to 30 months there was only a mild tissue response to the inhaled Kaylo dust and the reaction was limited to the accumulation of clumps of dust-containing macrophages in groups of adjoining air spaces (fig. 3). The intervening alveolar walls were only slightly thickened by accumulated lymphocytes. Occasional multinucleated

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giant cells were visible but there was no excessive proliferation of tissue histiocytes or deposition of connective tissue. A few asbestosis bodies were seen (fig. 4). Microscopic study of the tracheobronchial lymph nodes, which became enlarged but remained soft, revealed clusters of inactive dust cells similar to those in the lungs but without asbestosis bodies. It is pertinent to point out here that animals exposed to asbestos dust for a similar 30-months period exhibit a severe tissue reaction with the production of fibrosis (fig. 5). For comparison, a lung section of a normal guinea pig is shown (fig. 6).

The 9 animals exposed to Kaylo dust for more than 30 months (3 animals for 33 months and 6 animals for 36 months) showed not only the lesions like those of the 30-months animals but also exhibited a true fibrosis of a type characteristic of the response of guinea pigs to inhaled asbestos fibers. This reaction is a rather diffuse type of fibrosis which forms principally about the bronchioles, the small ducts from which the terminal air spaces, or alveoli, arise. A comparison of fig. 7 and fig. 5 reveals the similarity of the tissue reaction produced in the lungs by Kaylo dust and by asbestos dust. The lesions in the tracheobronchial lymph nodes showed no change between 30 months and 36 months.

(2) Rats. This species was employed because typical nodular fibrosis produced by inhaled quartz dust develops more rapidly in rats than in animals of other species. Forty rats were used and some of them were exposed to Kaylo dust for as long as 18 months. Pneumonia was not a problem during the first year of the experiment but among the rats exposed for 13 to 18 months 16 animals died with terminal bronchiolitis and lobular

pneumonia. Since laboratory rats older than one year, even those not exposed to dust, are commonly subject to this type of lesion, the high mortality rate is not considered significant. In order to follow the progression of the tissue reaction to the inhaled Kaylo dust rats were killed in groups of 4 after 6, 9, 12, 15, and 18 months of exposure. It was revealed (fig. 8) that throughout the experiment the reaction to the dust consisted of focal collections, in the alveoli, of macrophages which contained particles and spicules of dust. The only change observed as the exposure period became longer was an increase in the number of the alveolar foci. Similar dust-filled macrophages were seen in the tracheobronchial lymph nodes. In no animal was there any tissue reaction typical of silicosis. The peribronchiolar fibrosis of asbestosis was not discovered, though occasional asbestosis bodies were observed. In view of other experiments with pure long-fibre asbestos dust, typical peribronchiolar fibrosis would not be expected in 18 months exposure to Kaylo dust.

(3) Hamsters. Twenty hamsters were placed in the dust room and after 3, 9, 12, and 18 months of exposure 2 animals were killed at each period for study; at the 6-months period 3 animals that died from other causes were examined. Histologic examination revealed that the Kaylo dust accumulated very slowly in the lungs. No fibrosis was seen except in one hamster, which had been exposed for 18 months. In that animal there was a trace of peribronchiolar fibrosis so slight that it could be definitely recognized only at high magnification. Asbestosis bodies in small numbers and at the usual sites were present.

C. Exposure of tuberculous animals

There are three types of experiment which are valuable for determining the effect of inhaled dust on the development of tuberculosis in experimental animals. In the simultaneous infection experiment normal animals are infected with attenuated tubercle bacilli by the inhalation method and then are immediately transferred to the dust room. Thus, the tuberculous disease and the reaction to the inhaled dust will develop simultaneously. In the reactivation experiment the animals, after being infected with the tubercle bacilli, are allowed to live in a clean atmosphere for several months before being exposed to dust. During this period the tuberculous disease generally regresses and some healing takes place. Following exposure of the animals to some dusts the lesions may continue to regress or, with other dusts, the tuberculous process may become active and spread. The predisposition experiment is one in which animals are exposed to dust for several months, are then infected, and are immediately returned to the dust room, where their exposure to dust is continued. In this way the effect of a previous dust exposure on the early course of a tuberculous infection can be studied.

For investigating the effect of inhaled Kaylo dust on the course of tuberculous infection a particular attenuated strain of human-type tubercle bacilli, known as the R_1 strain, was employed. This strain has a low degree of virulence for guinea pigs and, in the normal animal, produces a self-limited disease which will progress for 2 to 3 months and subsequently heal. In an animal which has inhaled quartz dust or certain other toxic dusts, however, the disease usually progresses continuously and ultimately causes the death of the animal. Since experience has indicated that tubercle bacilli of the R_1 strain have about the same degree of virulence for the guinea pig as tubercle bacilli of the human strain have for man, it is possible to obtain some correlation between the influence of various dusts on the R_1 tuberculous infection in guinea pigs and the effect of those dusts on a tuberculous disease in industrial workers.

For infecting the animals with tubercle bacilli an inhalation technic was used. A glass tube was fitted over the animal's nose and into this tube a suspension containing a known number of bacilli of the R_1 strain was sprayed with a DeVilbiss atomizer. As the animal breathed, he inhaled the atmospheric suspension of bacilli into the lungs, where they became localized.

(1) Simultaneous infection: guinea pigs infected at the time their exposure to Kaylo dust was started. In the first experiment in which animals were infected with tubercle bacilli at the time that their exposure to Kaylo dust was started (table 3), 25 guinea pigs were used but an epidemic of pneumonia during the first 10 months reduced to 16 the number of animals available for study. Two of these died at 14 months, apparently from progressive tuberculosis, and 2 others died from undetermined causes, but not from tuberculosis. In the remaining 12 animals the course of the tuberculous disease was followed by killing 1 or 2 animals at 1, 6, 9, 12, 15, 18, and 24 months after infection. In 11 of the 12 animals the lesions were isolated, encapsulated, and regressing; in the remaining animal, which was killed at 15 months, the lesions were widespread throughout the lung but fibrosis had been produced, which indicated a tendency to heal. In an attempt to develop a strain of guinea pig resistant to the infection that had caused the pneumonia, some of the animals were used for breeding during

this experiment. The 2 animals that died from progressive tuberculosis (at 14 months) and the single animal, killed at 15 months, that exhibited widespread lesions were all used as breeders during the experiment but 4 other animals in the experiment, which were also employed for breeding, failed to show extensive disease. Owing to the element of uncertainty introduced by this factor of breeding, and also because of the high mortality from pneumonia, it was considered impossible to establish, from this experiment, definite conclusions about the effect of inhaled Kaylo dust upon tuberculosis, and therefore the experiment was repeated.

The simultaneous infection experiment was conducted a second time (table 3) with 30 guinea pigs, instead of 25, and animals were killed in pairs for study at 2, 4, 6, 8, 12, 15, and 24 months after infection. Again the incidence of pneumonia was unusually high, 6 of the animals dying from that cause during the first 8 months of exposure and 2 more during the following 16 months. Of the remaining 22 guinea pigs 4 animals revealed, at 15, 23, and 24 months after infection, a spreading tuberculous disease, of minimal extent (fig. 9), which was confirmed by microscopic examination. Three other animals also had a spreading tuberculosis but in them the disease had extended to the spleen and other organs. These animals were considered exceptional and in the past have been classified as "sports". The term "sport" is given to a guinea pig in which the inhalation infection with the attenuated bacilli is not confined principally to the lungs and tracheobronchial lymph nodes but extends also to other organs and produces in them tuberculous changes of sufficient extent to be recognized in the gross. Since "sports" represent a departure from the normal pattern of tissue reaction to attenuated tubercle bacilli, whether the infection is combined with dust exposure or not, those animals must be excluded in assaying the effect of an inhaled dust upon a tuberculous infection. It is believed that "sports" are animals whose native resistance to the attenuated R_1 organism is unusually low. Support for this belief is given by experience with quartz dust, a definitely hazardous material, which reactivates an inhalation infection produced by attenuated R_1 bacilli but ordinarily is not associated with tuberculous extension to organs other than the lungs and tracheobronchial lymph nodes.

The control non-dusted group (table 3) of guinea pigs for this experiment was infected at the same time as the experimental group of animals subsequently dusted. The same culture of organisms was used for all animals. The tuberculous infection followed its usual course in the control group and resolved in all of the animals except one, a "sport", in which the disease spread.

Although a progressive tuberculous disease was noted in 4 guinea pigs of the second experiment, the degree of extension of the disease in them was slight. The remaining 23 animals, 8 of which died of intercurrent pneumonia, showed no spread and the infection followed the natural course of regression and healing as in the non-dusted control animals. It is believed, therefore, that the inhaled Kaylo dust had no significantly adverse effect on the tuberculosis.

(2) Reactivation infection: guinea pigs, after being infected, lived in clean air for several months before being exposed to Kaylo dust.

In the reactivation experiment (table 4) 26 guinea pigs were infected with the attenuated bacilli and allowed to live in a clean atmosphere. Animals of this group were transferred to the dust room at 2 months (10 animals), 4 months (8 animals), and 6 months (8 animals) after infection. In order to follow the course of the tissue reaction a pair of animals of the first sub-group (2 months in clean air) was killed after only 2 months of dust exposure and, in addition, animals from all groups were killed in pairs after 4, 8, and 12 months of exposure to the dust. Examination of the tissue of the dusted animals failed to reveal a significant reactivation of the tuberculous disease by the inhaled Kaylo dust. Only one animal showed evidence of spreading pulmonary tuberculosis, minimal in extent (fig. 10). That animal was 1 of 3 that had lived in clean air for 2 months after infection and then had been exposed to the dust for 12 months.

In the control group (table 4) the tuberculous disease behaved in the normal manner and healed, with the exception that one animal (a "sport") developed a spreading disease and died from tuberculosis 6 months after infection.

(3) Predisposition infection: guinea pigs were infected 3 months after their exposure to Kaylo dust was started. An experiment of this type is a severe test because a dust that is only very slightly toxic may produce tissue changes which, though minor in character, may be sufficient to alter profoundly the development of a fresh tuberculous infection. In this experiment (table 5) which was designed to study the effect of Kaylo dust accumulated in the lung upon a newly-developing tuberculous disease, 30 guinea pigs were exposed to the dust for 3 months and then were infected with attenuated tubercle bacilli. The dust exposure was immediately resumed and carried on for another 21 months.

During the course of this experiment 5 animals were killed at the end of the preliminary 3 months dusting period. They showed only an occasional clump of dust phagocytes within the alveolar spaces. Of the dusted and infected animals, 7 died from intercurrent pneumonia, which eliminates them for purposes of analysis; 1 animal died at 14 months after infection from spreading tuberculosis; and the remaining 17 animals were killed in pairs at 2, 4, 6, 8, 10, 12, and 16 months and 3 were killed at 21 months after infection. Of the latter group of 17 animals, 1 showed many spreading tubercles, 10 revealed scattered spreading tubercles and 6 exhibited healed tubercles. These findings indicate that a tuberculous infection in guinea pigs that originates several months after a prolonged exposure of the animals to Kaylo dust was initiated may be unfavorably influenced by the inhaled dust. This influence, however, is minimal in degree.

The tuberculous infection in the control animals (table 5) in general regressed and healed. Of the control animals there was, as usual, 1 "sport animal", killed 10 months after infection, which revealed a few scattered isolated tubercles that were of the spreading type.

D. <u>Analysis of tissue of exposed animals</u>

Chemical analysis of the lungs of uninfected guinea pigs that had inhaled Kaylo dust for periods up to 36 months yielded the data reported in table 6. It will be noted that as the period of exposure became longer the ash values gradually increased, thus showing that mineral matter was accumulating in the lungs. There was a pronounced increase in the silica component up to about 3[illegible] months and then a slight decrease. The reason for this condition, which has been observed in experiments with other dusts, is not entirely clear but it seems to be due in part to dilution of the inhaled dust with the inorganic components mobilized as a result of the increased tissue reaction which developed, as already mentioned, in the guinea pigs between 30 and 36 months of exposure to Kaylo dust. Since only 2 animals were analyzed for each exposure period, individual values occasionally were out of line but the general trend was clearly indicated.

V. REVIEW OF EXPERIMENTAL FINDINGS

The findings derived from the various inhalation experiments will be reviewed briefly and some points of significance mentioned.

A. Findings for normal animals inhaling Kaylo dust

The results of the inhalation experiment prove that Kaylo dust, when inhaled into the lungs of guinea pigs for a prolonged period (30 to 36 months), is capable of producing the peribronchiolar fibrosis characteristic of the disease asbestosis. No fibrosis was formed by the inhaled dust in rats or in hamsters, with the exception that fibrosis was barely recognizable in a single hamster exposed for 18 months. In animals exposed for 30 months or less the lesions showed no fibrosis but certain aspects of the lesions, although masked by the reaction to the inert components in Kaylo dust, were compatible with an early stage in the development of asbestosis, a disease in which there is a predilection of the fibers to localize in the terminal bronchioles. This behavior is unlike that of particulate material, which is initially deposited chiefly in the alveoli rather than in the lumens of the bronchioles. Since the major portion of Kaylo dust is particulate, a great deal of it lodged in the alveoli and the reaction overshadowed the developing peribronchiolar response to the asbestos fibers of Kaylo. It was noted that in the region of the bronchioles of animals which were exposed for less than 30 months there was evidence of more dust cell activity than is usual in the reaction to an inert dust. Little significance was attached to this observation at first, however, because there was no indication of fibrosis. The early reaction to Kaylo dust is somewhat different from that to asbestos dust, since the particulate components modify the type of lesion. In silicosis modification of the lesions is a well-recognized condition which follows the inhalation of a mixed dust containing quartz and certain inert material, such as iron oxide.

The rate of pneumonia among the animals exposed to Kaylo dust was unusually high. Since the pneumonia rate has been elevated also in several inhalation experiments conducted with asbestos dust, it is possible that the asbestos component of Kaylo may have an unfavorable influence on the incidence of pneumonia. Verification of this possibility must await further study.

While the experimental investigation proved that Kaylo dust is capable of producing asbestosis, the results showed that the dust will not cause silicosis in animals of the three species tested. In none of the animals, even those exposed for the full 3-year period, was there any focus of the hyaline nodular fibrosis characteristic of silicosis. A study of the exposed animals disclosed also that Kaylo dust did not produce the diffuse fibrosis which follows the inhalation of diatomaceous earth. In regard to the hydrated calcium silicate which is the major constituent of Kaylo it may be said that although there is no specific information about the effect of that compound on pulmonary tissue, there is much clinical and experimental evidence to suggest that it is biologically inert. Furthermore, in the inhalation experiment with Kaylo dust there was no deleterious effect noted which could be attributed to the calcium silicate component of the inhaled material. This observation is supported by our studies concerning similar calcium silicates in cement.

B. Findings for tuberculous animals inhaling Kaylo dust

The inhalation experiments in which tuberculous guinea pigs were exposed to Kaylo dust indicate that when the animals were infected with attenuated tubercle bacilli at the time exposure to the dust was started, or were infected prior to that time, the inhaled Kaylo dust had little or no unfavorable effect of significance on the tuberculous infection. In most of the exposed animals the tuberculous disease healed in a normal manner and in the few animals that exhibited a spreading type of lesion the aggravation of the disease by the dust was minimal.

When the animals inhaled Kaylo dust for several months before being infected, the subsequent accumulation of the dusts in the lungs seemed to have a slightly unfavorable influence on the usual course of the tuberculous disease.

VI. SUMMARY

A. Kaylo dust, when inhaled for a prolonged period, is capable of producing in the lungs of guinea pigs, but not of rats, the peribronchiolar fibrosis typical of asbestosis.

B. The inhalation of Kaylo dust will not cause in guinea pigs, rats, or hamsters either silicosis or the diffuse fibrosis which sometimes follows the inhalation of diatomaceous earth.

C. The inhalation of Kaylo dust does not significantly influence the usual course of tuberculosis in guinea pigs infected with attenuated tubercle bacilli, provided the infection is given to the animals before they are first exposed to the dust. In guinea pigs that have inhaled Kaylo dust for several months before being infected, a continuation of the exposure appears to have a slightly unfavorable effect on the disease.

Table 1

ANALYSIS OF KAYLO

(Analysis of lot #2, received in January 1947)

Chemical analysis

SiO_2	43.80%
Fe_2O_3	1.69
Al_2O_3	1.97
TiO_2	0.12
MnO	0.09
CaO	24.94
MgO	7.10
Na_2O	0.17
K_2O	0.15
Loss below 105°C	4.52
above 105°C	15.19
	99.74

Petrographic and X-ray diffraction analysis

The material consisted principally of clay-like masses which produced a definite X-ray diffraction pattern, presumably that of a hydrous calcium silicate. Quartz particles up to 30 microns in size were present, but they were not numerous and by weight probably made up less than 1 per cent of the sample. About 5 per cent of the material was calcite and approximately 15 to 20 per cent was chrysotile or serpentine, which was largely fibrous. The fibers and bundles present were usually several millimeters in length and were seldom shorter than 0.3 millimeter.

Table 2

SUMMARY OF INHALATION EXPERIMENT WITH KAYLO DUST

Exposure of Uninfected Animals

Nature of Experiment	Animals used	Maximum duration of exposure to Kaylo dust	Results
		months	
Uninfected animals exposed continuously to Kaylo dust until death.	125 g. pigs	36	Peribronchiolar fibrosis, like that of asbestosis, produced after 36 months of exposure. At 30 months of exposure reaction was limited to accumulation of clumps of dust-containing macrophages, without fibrosis. A few asbestosis bodies were seen. Tracheobronchial lymph nodes became enlarged but remained soft and without fibrosis.
	40 rats	18	Focal collections of dust-containing macrophages in the alveoli and in the tracheobronchial lymph nodes. Increase in number of focal collections was the only change observed as exposure period became longer. No silicosis or asbestosis.
	20 hamsters	18	Dust accumulated very slowly. No fibrosis except in one animal which showed very slight fibrous reaction after 18 months of exposure. Asbestosis bodies in small numbers and at usual sites.

Table 3

SUMMARY OF INHALATION EXPERIMENT WITH KAYLO DUST

Exposure of Infected Animals

(Simultaneous infection phase)

Nature of experiment	Animals used	Maximum duration of exposure to Kaylo dust	Results
		months	
Animals infected with tubercle bacilli* at beginning of exposure to Kaylo dust	25 g. pigs	24	Results inconclusive; adverse influence of Kaylo dust on a tuberculous infection not definitely established. Progressive disease in 3 animals that had been used as breeders.
Controls to infection; no exposure to dust	25 g. pigs	0	Infection followed usual course; no spreading disease. No pneumonia.
Animals infected with tubercle bacilli* at beginning of exposure to Kaylo dust. (Repetition of previous experiment)	30 g. pigs	24	Little or no significantly adverse effect of inhaled Kaylo dust on a tuberculous infection was demonstrated. Confirmed spreads, all of slight degree, in 4 of 27 exposed animals; the other 3 exposed animals were "sports".
Controls to infection; no exposure to dust	34 g. pigs	0	Infection followed usual course no spreading disease except in 1 "sport".

*The guinea pigs were infected with tubercle bacilli of the low-virulent R_1 strain.

Table 4

SUMMARY OF INHALATION EXPERIMENT WITH KAYLO DUST

Exposure of Infected Animals

(Reactivation phase)

Nature of experiment	Animals used	Maximum duration of exposure to Kaylo dust	Results
		months	
Animals infected with tubercle bacilli* and then left in clean air for the following periods before being exposed to dust:			
2 months	10 g. pigs	12	No definite evidence of reactivation of the tuberculous infection except in 1 animal, exposed to Kaylo dust for 12 months, that had a slight spread of the disease.
4 months	8	12	No definite evidence of reactivation.
6 months	8	12	No definite evidence of reactivation.
Controls to infection; no exposure to dust	34	0	Infection followed its usual course and resolved in all animals except one, a "sport", in which the disease spread to other organs and caused the death of the animal 6 months after infection.

*The guinea pigs were infected with tubercle bacilli of the low-virulent R_1 strain.

Table 5

SUMMARY OF INHALATION EXPERIMENT WITH KAYLO DUST

Exposure of Animals That Were Infected 3 Months After Their Exposure to Kaylo Dust Was Started

Nature of experiment	Animals used	Maximum duration of exposure to Kaylo dust	Results
		months	
Animals exposed to Kaylo dust for 3 months, then infected with tubercle bacilli*, and the exposure to dust continued	30 g. pigs	3 (before infect.) plus 21 (after infect.)	Spreading disease in 1 animal killed 2 months after infection and in 2 animals dying 14 months after infection.
Controls to infection; no exposure to dust	25 g. pigs	0	Infection followed its usual course and resolved, with the exception that 1 animal, killed 10 months after infection, showed scattered isolated spreading tubercles.

*The guinea pigs were infected with tubercle bacilli of the low-virulent R_1 strain.

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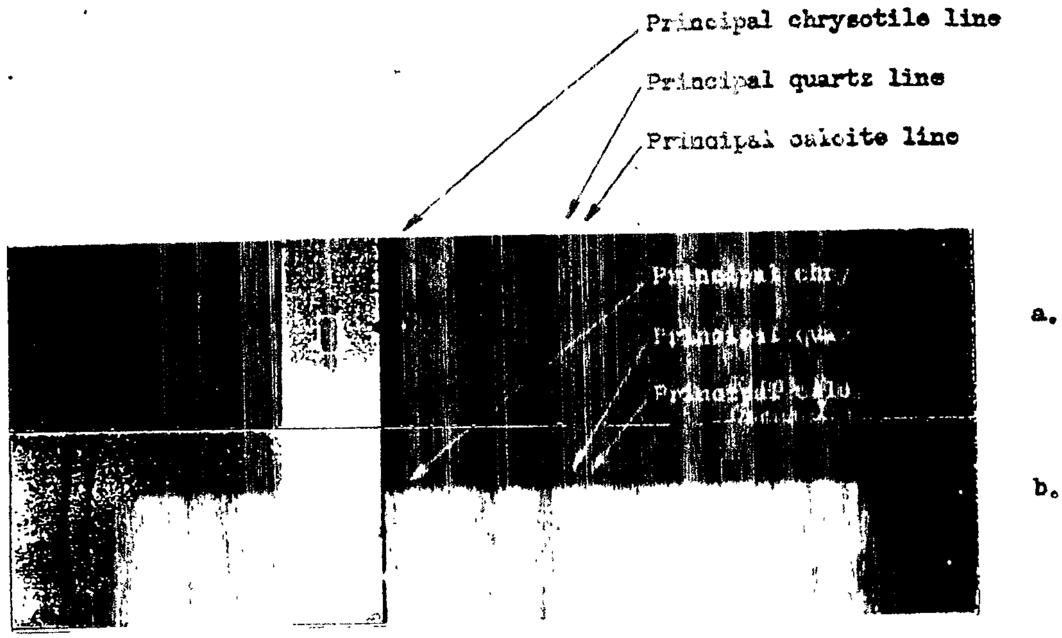
Table 6

ANALYSES OF LUNGS OF UNINFECTED GUINEA PIGS EXPOSED TO DUST
IN INHALATION EXPERIMENT WITH KAYLO DUST

(Exposure of animals to dust was continuous until death)

Period of exposure to dust (months)		2	4	6	8	10	12	18	21	24	27	30	33	36
		%	%	%	%	%	%	%	%	%	%	%	%	%
Amount of ash (% of dried tissue)		4,42 4,94	4,47 4,42	4,33 3,74	4,69 4,64	4,68 4,61	4,66 4,99	4,83 4,60	5,12 5,23	5,02 4,71	5,13 4,78	5,62 5,53	5,70 5,38	5,93 5,56 5,43
Mineral components (% of dried tissue)	SiO_2	0,24 0,20	0,22 0,19	0,26 0,20	0,31 0,28	0,46 0,41	0,68 0,61	0,69 0,56	0,34 0,54	0,38 0,60	0,32 0,46	1,10 1,12	0,27 0,39	0,85 0,57 0,54
	CaO	0,03 0,06	0,09 0,08	0,08 0,10	0,13 0,11	0,14 0,11	0,14 0,18	0,09 0,10	0,19 0,16	0,13 0,14	0,14 0,12	0,14 0,13	0,18 0,12	0,16 0,11 0,16
	MgO	0,07 0,08	0,09 0,08	0,08 0,08	0,08 0,11	0,21 0,14	0,22 0,08	0,28 0,32	0,11 0,08	0,06 0,08	0,19 0,16	0,05 0,05	0,21 0,17	0,19 0,17 0,15
Mineral components (% of ash)	SiO_2	5,57 4,06	4,87 4,42	5,63 5,36	8,34 6,49	10,12 8,42	10,60 10,25	12,27 17,65	12,54 10,30	12,70 12,52	15,98 9,55	19,58 20,25	17,10 11,00	15,10 12,45 9,92
	CaO	1,85 1,23	1,99 1,89	2,00 2,68	2,75 2,43	3,04 2,20	2,80 3,17	1,83 2,06	3,68 2,90	2,54 2,92	2,57 2,41	2,56 2,28	2,25 2,26	2,89 2,11 2,86
	MgO	1,59 1,62	1,98 1,89	2,00 2,19	1,77 2,46	4,30 3,02	4,65 1,60	5,31 6,56	2,03 1,45	1,20 1,72	3,76 3,08	0,92 0,91	3,77 3,25	3,28 3,17 2,38



...e line

... line

...ile line

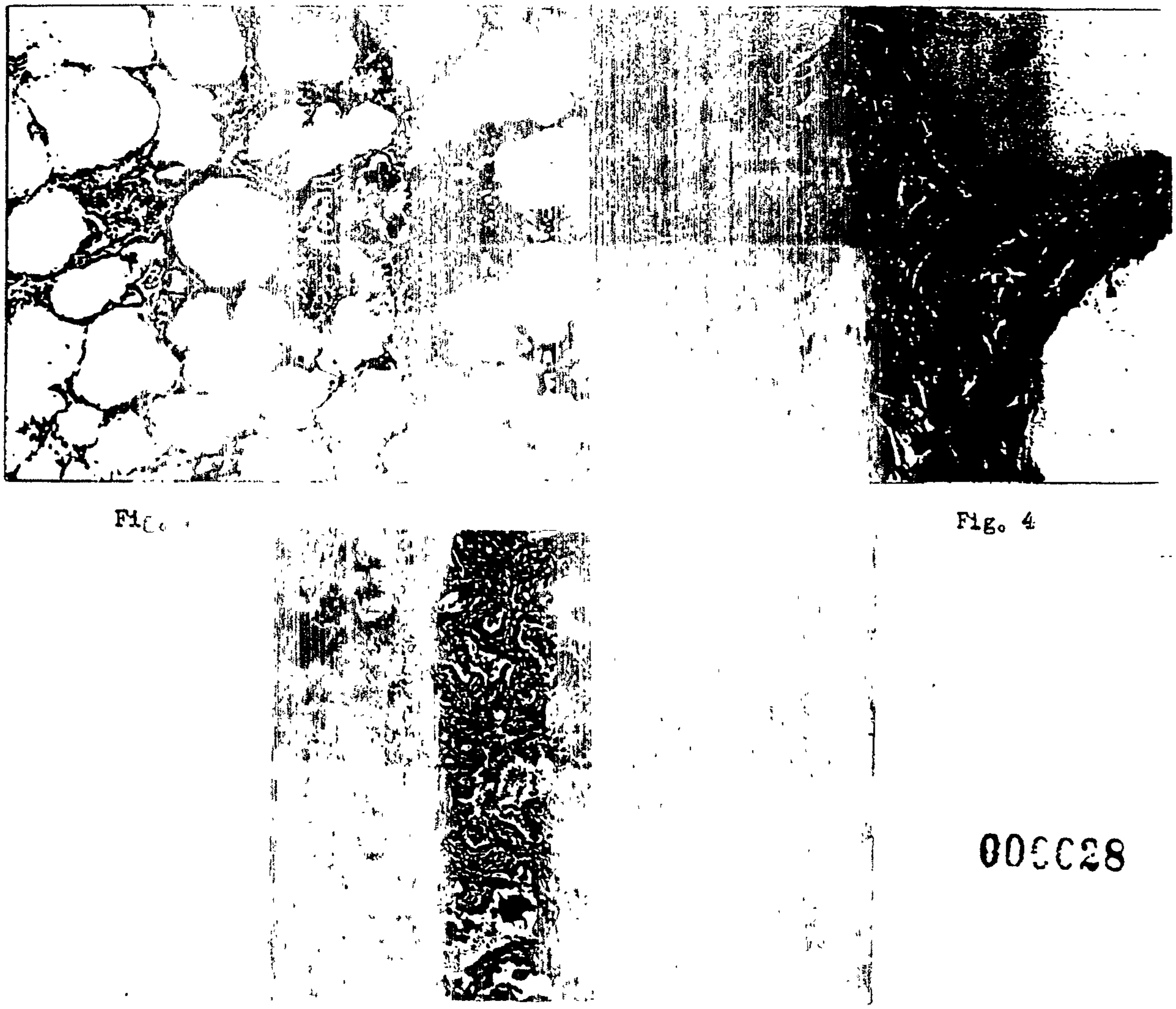
...RAY DIFF...

...yle du...

...yle du...

Both pat...ns conta... ...ate amount of chry... ...d of cal... ...z. Faint lines ... silicate compo... ...le ... addition, the or... ...m of pat... ...k ... corresponding to amosite but the line ... reproduced pattern.

The quar... content ... than 1 per cent and by pattern ... about ...



Fi...

Fig. 4

000028

Fig. 3. Lung ti... ...ea pig ... Kaylo dust by
inhalation and th... ...cross ... ...s shown just
above and slight... ...of cen... ...other spaces
are alveoli. Not... ...sses wi... ...spaces, especially
to the right ... These ... and multi-
nucleated giant ... ...e thinn... bronchicle; it
is virtually ... ...arent on ... ...ssue section
of a normal guinea... ...). An a... ...t in this
field and is rove... 4 at hig... ...X)

Fig. 4. High mag... the tiss... ...g. 3. This
higher magnifica... ...f the fie... typical form
of asbestosis body ... ...urved elo... ...right of
center. (1200 X)

Fig. 5. Lung tiss... ...ea pig ex... ...ding's floats
asbestos dust by ... ...d then ki... ...n this photo-
micrograph is j... ...the lef... thickening
of its walls. Sh... ...ous tissu... ...he wall of
this bronchiole ... ...the adjac... ...0 X)

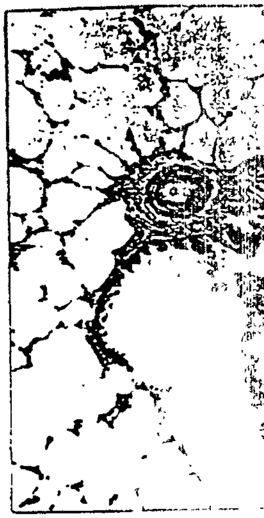


Fig. 6

Fig. 7

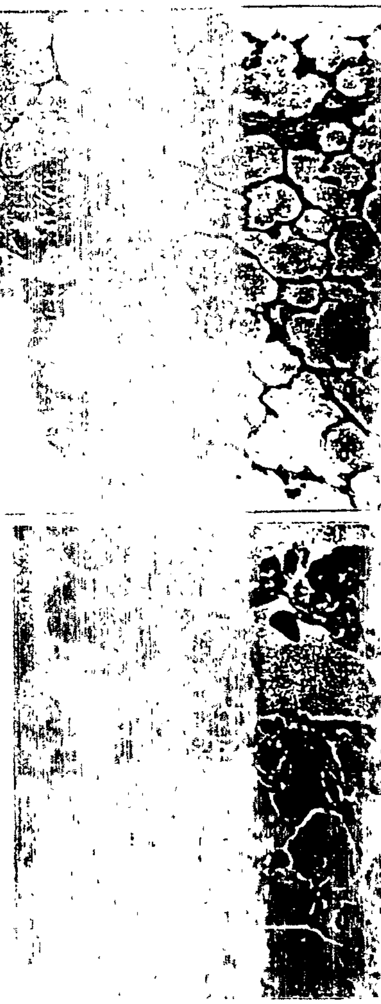


Fig. ...

000C29

Fig. 6. Lung ... l guin... two bronchioles,
one in cross ... ongitudinal section.
The small ... iole in longitudi-
nal section. ... ioles with the
thickness of ... ote also the
empty alveoli ... (200 X)

Fig. 7. Lung ... a pig ... Kaylo dust by
inhalation an ... this ph ... iole is just
above and to ... Not ... ssue between
the lumen of ... the lu ... oli in com-
parison with ... ar wall ... also that the
greatly thick ... alls of ... asbestos dust
for 30 months ... ar to ... xposed to Kaylo
dust for 36 m ... s of ... near the
bronchiole ... aph but ... because they
are less dens ... the righ ... brosis has
extended to ... alls.

Fig. 8. Lung ... xposed ... ust by inhalation
and then kill ... ograph ... n of cells in
alveoli. The ... cells ... of dust. Note
that the alve... hose of ... ous dust cells,
are thin and ...

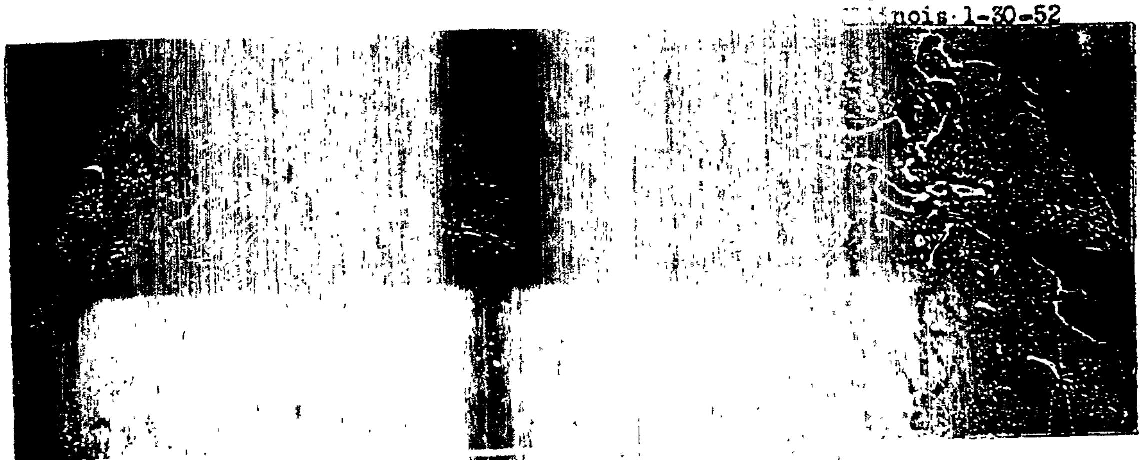


Fig. 10

008C30

Fig. ... ubercle bacilli
and imm... ths, and then
killed. ... routine histologic
prepar... se. The cluster
of dark ... lobe) and at the
right (... i of ... sis. The widely-
distribu... mere ... and are unrelated
to the ... the ... en to be exceeding-
ly small.

Fig. 10. ... a p ... tubercle bacilli
and left ... ns, ... to Kaylo dust by
inhalation ... n the left upper
quadrant ... uberculosis. A
smaller ... sible ... left cephalic
lobe. ... exten ... ess is very
small. (...

Fig. 11. ... a pig ... inhalation for 3
months, ... used to the dust
for an ... kill ... defined dark zones,
irregular ... es ... ulous disease. The
tubercul... extensive noted
in any ... experi... relatively slight
in compa... on whi... sed to quartz dust
under simil... t, all ... to quartz dust would
have died ... infect... mplete loss of
functioni... 5 ...

[illegible] 19[illegible]

Mr. W. [illegible]
Industrial [illegible] Division
Owens-[illegible] Company
Toledo [illegible]

Dear Bill:

[illegible] final report [illegible] concerning the [illegible] Kaylo Dust [illegible]. We are enclosing [illegible] for [illegible]. One copy has [illegible] Shook [illegible] we are retaining [illegible] our files.

The [illegible] of the investigation [illegible] show that Kaylo dust [illegible] of producing [illegible] fibrosis typical of [illegible]. The dust [illegible] unfavorable influence [illegible] infection [illegible] extrapolation from [illegible] experience [illegible] less the results [illegible] indicate that [illegible] should be taken [illegible] against [illegible]. Therefore, control [illegible] be directed [illegible] the amount of atmospheric [illegible], especially at those points of operation where [illegible]. Our [illegible] concerning [illegible] survey [illegible] this regard.

[illegible] this [illegible] in combination [illegible] pertinent [illegible] doing so, however, [illegible] calcium silicate and [illegible] the interest of your company will be safeguarded. [illegible] final [illegible] forwarded to you [illegible] released [illegible]. Your comment [illegible] manuscript.

[illegible] final [illegible] you and others of the [illegible] the privilege [illegible] in the study [illegible] and stimulating.

[illegible]

[illegible]

[illegible]

[illegible]
[illegible]
CC [illegible]

PLAINTIFF'S EXHIBIT
Kirstein-141
8-28-98

[illegible] 1952

Mr. William [illegible]
Industrial [illegible] Division
Owens-Illinois Glass Company
Toledo [illegible], Ohio

Dear Bill,

Analysis of the nine samples of atmospheric dust and bulk [illegible] from the Sayreville, New Jersey plant, which you [illegible] January, has been completed and Doctor [illegible] has asked me to send you the report of our findings. You will note that the samples of amosite, both the [illegible] and the atmospheric dust collected near the fiberizer, contain considerable quartz. This unexpected condition, as you will remember, occurred also in the samples collected at the Sayreville plant a year ago. [illegible] examination of the residue obtained by [illegible] with acid indicates that some of the [illegible] core of the fibers, just as if the free-silica [illegible] had replaced the amosite. We do not [illegible] amosite [illegible] contains so much quartz, [illegible] the free-silica content of future shipments of amosite should be checked.

As [illegible], we are [illegible] the [illegible] atmospheric samples [illegible] sufficient [illegible] each sample [illegible] repeated [illegible].

[illegible] regards

Sincerely [illegible]

Thomas [illegible]
Assist. [illegible]

[illegible]
Encs.
3 [illegible]
2 statements

PLAINTIFF'S EXHIBIT [illegible]

003055

Dr. [illegible]

March 11, 1952

REPORT OF ANALYSES OF DUST AND OTHER MATERIAL

FROM

SAYREVILLE, NEW JERSEY, PLANT OF OWENS-ILLINOIS GLASS COMPANY

The following samples from the [illegible] plant at Sayreville, New Jersey, were received at The Saranac Laboratory on January 18, 1952:

Samples of atmospheric dust:

- #1 At asbestos fiberizer. 21 1/3 hrs. on December 4-5, 1951.
- 2 On B finishing line - turnover position. 7½ hrs. on November 15, 1951.
- 3 At end of B finishing line - [illegible]'s position. 3 hrs. on November 16, 1951.
- 4 At [illegible] where low-density [illegible] were being routed to make pipe coverings. 10¼ hrs. on November 19-20 [illegible] December 1, 1951.
- 5 [illegible] freight car being loaded with roof tile. 4 hrs. on December 3, 1951.

Samples of other material:

- 6 [illegible] of asbestos.
- 7 [illegible].
- 8 [illegible].
- 9 [illegible].

<u>[illegible] Dust Concentration</u>

The material [illegible] samples [illegible] inclusive, is atmospheric dust collected [illegible] filter paper [illegible] fan that drew in about 40 cubic feet of air per minute. The material collected was shaken off the filter paper and weighed and from this weight the concentration of the [illegible] dust was calculated.

000056

Estimation of Dust Concentration (Cont'd)

Sample number	1	2	3	4	5
Weight of dust shaken off filter, grams.	1.3	10.7	6.6	1.7	9.2
Sampling time, hours	2.3	5.5	3	10.3	4
Volume of air sampled, cubic feet	5600	13000	7200	24800	9600
Approximate concentration of dust, mg. per cubic foot of air	0.2	0.8	0.9.	0.07	1.0

It should be noted that, owing to several possible errors, the values for the concentration of dust must be regarded as only approximate estimates. In basing the calculations on the weight of dust shaken off the filter, thereby neglecting the small amount retained by the fibers of the filter, some error was introduced. Also, the quantity of air tested may have differed somewhat from the assumed value of 40 cubic feet per minute.

Composition of Samples of Dust and Other Materials

The composition of the various samples based upon petrographic examination supplemented, when necessary, by chemical analysis and X-ray diffraction examination is as follows:

Sample number	1	2	3	4	5
Quartz	22%	3%	2-4%	1-2%	5%
Amosite	70-75	trace	trace	2-4	5-10
Chrysotile	—	5-15	5-15	1-2	5-15
Kaylo	—	55-65	70-80	70-80	50-60
Carbonates	1-2	20-30	10-20	10-20	15-25
Limonite	2-4	—	—	—	—
Hematite	trace	—	—	2.	—
Opaque	trace	—	trace	trace	1-2
Starch	trace	—	—	—	1-2
Glue (?)	—	—	—	4-8	—
Chlorite	trace	trace	trace	trace	trace

Sample number	6	7	8	9
Quartz	23%	12%	4-8%	2-4%
Amosite	70-75	6-8	3-6	2-4
Chrysotile	—	5-15	2-4	5-15
Kaylo	—	50-60	70-80	70-80
Carbonates	trace	10-20	10-20	5-10
Limonite	3-5	trace	trace	—
Hematite	trace	—	—	—
Opaque	—	trace	trace	trace
Starch	trace	—	—	—
Glue (?)	—	—	—	—
Chlorite	trace	trace	trace	trace

000058

Comment

The values of 22 and 23 per cent for the quartz content of atmospheric asbestos dust at the fiberizer and of bulk amosite, respectively, are in substantial agreement with the corresponding values of 19 and 21 per cent for similar samples collected at the Sayreville plant on January 30, 1951. After treating the samples chemically to remove the fibrous components it was noted that the quartz particles were mostly less than 5 microns in size, with particles occasionally up to 30 microns and rarely up to 50 microns in diameter. Present also were splinters of quartz, some being 100 microns long and 10 microns wide, which evidently represented a replacement of the amosite fibers by quartz. Ordinary petrographic examination of the untreated samples will not reveal the bulk of the quartz present, and for a quantitative estimate X-ray diffraction analysis or chemical treatment should be employed.

In determining the amount of asbestos in the samples chemical, petrographic, and X-ray diffraction procedures were utilized. The iron content of the bulk sample of amosite, reported as Fe_2O_3, was 37.9 per cent, and by comparing this value with the percentage of Fe_2O_3 for a given sample, an estimate of the amount of amosite in that sample could be made. It should be noted that the bulk sample of amosite was only about 75 per cent pure, since 23 per cent was quartz, and other contaminants also were present. The determination of the chrysotile component was based upon petrographic study or X-ray diffraction examination or both. The lines of the diffraction pattern of chrysotile are weak and quantitative values for this component obtained by the X-ray diffraction method are more or less approximate.

TMD:[illegible]

[illegible], M.E.
[illegible]

000059

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES · TOLEDO 1, OHIO

April 8, 1952

Mr. Thomas M. Durkan
The Saranac Laboratory
Saranac Lake, New York

Dear Tom:

Attached is our check No. 29544 covering the analysis of nine dust samples from our Sayreville, New Jersey plant.

Thank you for your letter of March 11 and the report giving the results of your laboratory work. Certainly the values of 22 and 23% for the quartz content of asbestos dust at the fiberizer and of bulk amosite agree closely with the determinations you reported on May 29, 1951. You will recall these recent determinations were made as a check on the earlier analyses.

This high quartz content of amosite was quite bewildering to the technical people in our Kaylo Division. They were so interested that they ran chemical, petrographic and X-ray determinations on the portion of sample No. [illegible] you returned to [illegible]. Our General Research Division describes their results as follows:

"The action of [illegible] on asbestos is severe, tending to result in a silica structure or skeleton being left behind. For this reason, chemical methods for estimating free silica in asbestos are open to question.

We employed an indirect chemical method. We determined the percentages of FeO, Fe_2O_3, MgO, and SiO_2. Then the amount of silica that could be combined with the iron and magnesia in the ratio of (FeO MgO) to SiO_2 of [illegible]:8 was computed. (This ratio is the theoretical for Amosite.) The excess of silica present over that which was accounted for by the [illegible]:8 ratio was considered to be quartz. This value was found to be 9.3%.

Independently, our petrographer and our X-ray technician reported the quartz content to be somewhat under 10%."

By contrast, the "free silica" content by the Hydrofluosilicic Acid Method showed the dust sample (Amosite) to contain 28.9% and a sample of Amosite from the [illegible]oratory [illegible]%. We believe these values to be high for the reasons given earlier.

PLAINTIFF'S EXHIBIT
[illegible]-193

00C053

The X-ray method was by X-ray diffraction, with the quartz lines recorded and measured on photographic film.

Recently the industrial hygiene unit of the Indiana State Board of Health, under the direction of Louis W. Spolyar, was making some dust counts in our Indiana plants and I visited their new laboratory in Indianapolis. They have an impressive layout with some very fine equipment. They offered to run on their X-ray spectrophotometer (using a Geiger counter) any samples that we might have. I took them up immediately and sent them a portion of the same sample No. 1 that your laboratory worked on. Dr. Spolyar's laboratory said they found 6.0% free silica. Howard Bumsted, who did the work, seemed to me quite proficient in the use of the instrument and fairly well experienced.

Do you have any idea why there should be this discrepancy in the results? We are still as much at sea as we were when we talked with you last fall. Our Kaylo people, too, are interested, because one would think a 20% quartz content in amosite would throw off their batch composition.

Our research laboratory also analyzed sample No. 5 and found it to contain 12.9% asbestos. This falls within the range of amosite and chrysotile content that you found.

The asbestos content of this sample, which represents conditions during the loading of box cars with Kaylo roof tile is important because the dust concentrations are around 20 to 50 million particles per cubic foot.

Any comments you may have on the above would be very much appreciated.

Personal regards.

Sincerely yours,

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

May 9, 1952

REPORT OF ANALYSIS OF AMOSITE

FROM

SAYREVILLE, NEW JERSEY PLANT OF OWENS-ILLINOIS GLASS COMPANY

The material analyzed was bulk amosite sent from the Sayreville Plant and received at The Saranac Laboratory on January 18, 1952. The material was a portion of sample [illegible] (see report of analysis by The Saranac Laboratory dated March 11, 1952) for which the quartz content was reported as 23 per cent.

For the present analysis the fibers of the sample were cut into short pieces with scissors and then mixed by grinding in a mortar. In order to preserve some of the fibrous structure for demonstration purposes, only a limited amount of grinding was used. For this reason the material was not uniformly mixed and the duplicate analyses [illegible] check as closely as analyses of [illegible] material.

The analyses were made in duplicate by our standard phosphoric acid method, using a double treatment, supplemented by [illegible]graphic and X-ray diffraction examination of the residues. The results were as follows:

	A.		B.	
Weight [illegible]	[illegible]		0.7012 gm.	
" [illegible] residue	0.236[illegible]		0.2245	
" " 2nd " "	0.1555	22.20%	0.1404	20.02%
" [illegible] residue used for analysis	0.[illegible]			
" [illegible]	[illegible]			
" of [illegible]	0.[illegible]			
" " combined [illegible] ([illegible] x B)	0.[illegible]			
" " [illegible]	[illegible]	[illegible]		(19.6)
Per cent of [illegible]		[illegible]		0.6
" [illegible]		22.[illegible]		(20.2)

From [illegible] it was [illegible] that the quartz content of the [illegible] was about [illegible] sample A and about 98 per [illegible] analysis of the residue of sample A showed that [illegible] content was [illegible] = 98.4 per cent and that [illegible] was [illegible] per cent. The residue [illegible] Company for their examination.

PLAINTIFF'S EXHIBIT
Kirstein-144
8-28-98

X-ray diffraction [illegible] of the [illegible] residue of sample B revealed that the quartz content of that residue is close to 100 per cent. A print of that X-ray diffraction picture and, for comparison, a print of the standard quartz pattern are a part of this report.

The per cent [illegible] silica (quartz) [illegible] by the chemical treatment depends [illegible] the average size of the particles; for samples A and B the [illegible] to be about [illegible] per cent.

The [illegible] may be summarized as follows:

1. Some of the [illegible] scraped from the Sayreville [illegible] Laboratory [illegible] 1952 [illegible] mortar. From this [illegible] designated A and B, were taken for analysis.

2. [illegible] of sample A [illegible] by [illegible] per cent. [illegible] 73 per cent, [illegible]. ([illegible] value for [illegible] was [illegible] cent.)

3. [illegible] content of sample B [illegible] from [illegible] and X-ray diffraction analysis [illegible] per cent. [illegible] also [illegible] 72 [illegible] acid [illegible] methods [illegible] close [illegible] will [illegible].

4. [illegible]

Owens-Illinois [illegible]
Sayreville, [illegible]

May 9, 1952

5. [illegible] in the asbestos occurs in a most [illegible] form — as long [illegible] fibres [illegible] replacement [illegible]

6. [illegible] are under [illegible] so that the Owens-Illinois Company will be able to check the analyses

[illegible]

[illegible] insoluble residue [illegible]

[illegible]

May 10, 1952

Mr. William G. Hazard
Industrial Relations Division
Owens-Illinois Glass Company
General Offices
Toledo 1, Ohio

Dear Bill:

Since receiving your letter of April 8, in which you mentioned differences [illegible] for the quartz content of amosite as reported by your laboratory, [illegible] Spolyar's laboratory and by The Saranac Laboratory, we have been re-analyzing samples of the bulk amosite to determine whether [illegible] there was any substantial error in the value of 25 per cent we submitted. Our report of duplicate analyses, which have just been completed, is enclosed. The slightly lower values obtained--22.0 per cent and 20.[illegible] per cent--could easily be accounted for by non-uniform sampling. I find it difficult to believe, however, that variations [illegible] would be entirely responsible for a reduction to 9.3 per cent [illegible] given in your letter. Of course, [illegible] not bulk material, but our [illegible] at the fiberizer and bulk [illegible] quartz content.

During our [illegible] I [illegible] told you that we were attempting, by chemical means, to [illegible] the quartz from a sample of amosite [illegible] seen and identified [illegible] reducing the chance [illegible] isolating the quartz [illegible], we have recovered from [illegible] 0.1404 grams of "quartz" [illegible] The 0.1555 gram of sample A was used [illegible] of the 0.1404 gram of [illegible] forward it to your Research [illegible] diffraction examination of this [illegible] content is close to 100 [illegible]

In [illegible] Research Division, reported [illegible]

1. The [illegible] structure [illegible] silica is

000C47

removed [illegible] chemical [illegible] industrial samples [illegible] method [illegible] is capable of yielding [illegible] results than the petrographic method alone or the [illegible] method alone.

2. Experience [illegible] that for [illegible] the calculation of the iron [illegible] serious error. In the calculation [illegible] in your [illegible], it was assumed that all of the iron in the sample [illegible] although petrographic [illegible] revealed [illegible] the iron was present as [illegible].

3. Petrographic [illegible] will reveal only a minor portion of the quartz--[illegible] per cent of the sample--because [illegible] are [illegible] not visible.

4. We have [illegible] not employ it any more because we find other [illegible] reliable results.

5. It is not clear why the X-ray diffraction [illegible] made in your laboratory and in Doctor Saelyer's [illegible] produced such low values [illegible]. If a copper [illegible], like ours, was employed [illegible] secondary radiation [illegible] be responsible for the low [illegible] because the technicians [illegible] X-ray [illegible] of this source of [illegible].

We have [illegible] in this [illegible] throw some light on the [illegible] by the three laboratories. [illegible] for the discrepancy.

With [illegible],

[illegible],

[illegible]

TMD:je
Enc.

May 9, 1952

REPORT OF ANALYSIS OF ASBESTOS

FROM

SAYREVILLE, NEW JERSEY PLANT OF OWENS-ILLINOIS GLASS COMPANY

The material analysed was bulk [illegible] from the Sayreville Plant and received at The Saranac Laboratory on January 13, 1952. The material was a portion of sample [illegible] (see Report of Analysis by The Saranac Laboratory dated March 11, 1952) for which the quartz content was reported as 23 per cent.

For the present analysis the fibers of the sample were cut into short pieces with scissors and then mixed by grinding in a mortar. In order to preserve some of the fibrous structure for demonstration purposes, only a limited amount of grinding was used. [illegible] material was not uniformly [illegible] closely as analyses of [illegible]

The analyses were made in duplicate by our standard phosphoric acid method, using a double [illegible] and X-ray diffraction [illegible] residue. [illegible] were as follows:

	A		B	
Weight of [illegible]	[illegible]		0.7012 gm.	
" " 1st [illegible]	0.2[illegible]		0.2245	
" " 2nd " "	0.1555	22.20%	0.1404	20.02%
" " residue [illegible] analysis	0.15[illegible]			
" [illegible]	[illegible]			
" [illegible]	[illegible]			
" " combined SiO_2 ([illegible])	0.07[illegible]			
" " [illegible]	[illegible]	[illegible]		(19.6)
Per cent [illegible]		[illegible]		0.6
" [illegible]		[illegible]		(20.2)

From [illegible] that the quartz content of the [illegible] sample A and about 98 per [illegible] chemical analysis of the residue of sample A showed [illegible] 98.4 per cent and that [illegible] was [illegible] per cent. The residue [illegible] Company for their examination.

009049

X-ray diffraction examination of the [illegible] residue of sample B revealed that [illegible] content of [illegible] is close to 100 per cent. A print [illegible] diffraction pattern [illegible], for comparison, a print of the [illegible] pattern [illegible] of this report.

The [illegible] silica (quartz) dissolved by the chemical treatment depends upon the average size of the particles; for samples A and B the [illegible] to be about [illegible] per cent.

The [illegible] as follows:

1. [illegible] analyzed [illegible] Sayreville plant [illegible] laboratory in January 1952 was ground in a mortar. From this mixture [illegible] [illegible] taken for analysis.

2. [illegible] by [illegible] [illegible] was [illegible] was [illegible])

3. [illegible] of [illegible] [illegible] and X-ray diffraction analysis [illegible]

4. [illegible]

5. [illegible]

6. [illegible]

[illegible]

[illegible]

[illegible]

X-ray diffraction pattern of quartz

X-ray diffraction pattern of [illegible] gm. residue of sample B.

Comparison of these two patterns, which were produced with the same X-ray tube and camera and with nearly the same exposure-time, indicates that the quartz content of the [illegible] gm. residue is near 100 per cent.

For simplicity the diffraction patterns shown are of the quartz alone and of the [illegible] gm. residue alone. When exact quantitative results are sought, an internal standard (often sodium chloride) is added to each sample before it is exposed to the X-ray beam.

OWENS-ILLINOIS GLASS COMPANY

GENERAL OFFICES • TOLEDO 1, OHIO

May 12, 1952

Mr. Thomas M. Durkan
The Saranac Laboratory
Saranac Lake, New York

Dear Tom:

Your report of May 9, together with your interesting letter of May 10, has just arrived. You have certainly made a complete investigation of this mystery—and we appreciate the time that's gone into it.

We are sending the material to our General Research Division for their comments and investigation. We will let you know what develops.

It was good to see you in Cincinnati again.

Sincerely yours,

Bill

INDUSTRIAL RELATIONS DIVISION

W.G.Hazard:M

PLAINTIFF'S EXHIBIT
Kirstein-146
[illegible]

000046

OWENS-ILLINOIS
LIBBEY GLASS PLANT
[illegible] STREET [illegible]

July [illegible], 1956

Dr. G. W. H. Schepers, M.D., D.Sc. [illegible]
The Saranac Laboratory
7 Church Street
Saranac Lake, New York

F-56-682

Dear Doctor:

In accordance with directions of Dr. [illegible] Shook, Medical Director of Owens-Illinois [illegible], I am sending under separate cover the autopsy specimen, Lungs, of Lee Bryrton an employee of the Libbey Glass Division of Owens-Illinois who died July 8, 1956 and whose death certificate states he had Silicosis and Tuberculosis. A form furnished by your Laboratory has been filled out and is enclosed. — Rec'd 7/20/56

The autopsy [illegible] has not yet [illegible] from the pathologist, but will be forwarded as soon as received.

Should additional information be requested we will attempt to obtain it for you.

Respectfully,

K.R. [illegible], [illegible] Phys.

PLAINTIFF'S EXHIBIT
Kirstein-147
8-28-98

55911

1. Bryston, Lee Age. 57 Sex. M.

2. Removed from factory June 30, 1956 because of mental condition. Admitted to Toledo State Hospital July 5, 1956 for the insane.

3. Expired July 8, 1956 at Toledo State Hospital.

4. From 1923 until 1930 he worked at Willys Overland Co. as a Die Setter. For past twenty three years he has been a plant guard for Owens-Illinois Glass Co. - Libbey Division. For two years previously he worked in General Labor.

   (1) Kind and composition of dust. None

   (2) Concentration of dust. None

   (3) Duration of exposure. None

5. Chest roentgenograms. None

6. Electrocardiographic record. None

7. Autopsy Protocol. Report to follow.

8. This man has not complained to the Plant Physician or Nurses at anytime of any chest condition. He had only one Insurance claim for disability and that was in February 1939. He was off about two months. Diagnosis was Influenza and Bronchitis. No other record of loss of time for illness.

Wed. Jan. 18, 1956 2:30 p.m.

Telephone call from Dr. Shook of Owens-Illinois, Toledo. (and Bill Hazard).

They are sending us (today) the lungs of one of their watchman who died. This may be a medico-legal case for silicosis but Dr. Shook doesn't believe the man had silicosis - he had no exposure to silica dust.

The data about the occupational exposure, etc, will be forwarded to us from the Libby plant
Owens Illinois
Toledo

and our report should be sent there.

However, send copies of the report and all pertinent correspondence to Dr. Shook also.

PLAINTIFF'S EXHIBIT
Kirstein-148
8-28-98

Dr. Shook wished to tell Dr. Bristol that he (Dr. Shook) doesn't like the new forms.

Also, films of Lee Bryston will be coming along soon. Would like to get reading as soon as possible - please push it through. Question of silicosis? T.B.?

55913

CLASS OF SERVICE

This is a fast message unless its deferred character is indicated by the proper symbol.

WESTERN UNION (46)

TELEGRAM

W. P. MARSHALL, PRESIDENT

SYMBOLS

DL = Day Letter

NL = Night Letter

LT = International Letter Telegram

1201

The filing time shown in the date line on domestic telegrams is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination

SYA041 DEC086 1956 JUL 30 AM 10 57

DE TOA125 PD=TOLEDO OHIO 30 1038AME=

SARANAC LABRATORY=

7 CHURCH ST SARANAC LAKE NY=

REFERENCE CASE OF LEE BRYSTON, LIBBEY PLANT, TOLEDO. WHEN CAN WE EXPECT REPORT ON POST-MORTEM FINDINGS? THANKS=

C F SHOOK MD OWENS ILLINOIS CO=

Ay 11/30/1 Ay Nov 11/1/01

55910

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

PLAINTIFF'S EXHIBIT Kirstein-149 8-28-98

August 2, 1956

Charles F. Shbok, M.D.
Medical Director
Owens-Illinois Glass Company
Toledo 1, Ohio

Re: Lee Bryston
Saranac Laboratory No. F-56-682
OCD 68

Dear Doctor Shook:

Herewith Part I of my report in respect of Lee Bryston. As I mentioned in my telegram of July 30, due to employees' vacations there will be a little delay in processing the tissue, but I will make every effort to rush my report to you.

The chest roentgenograms in connection with this case have not as yet been received.

With kind regards,

Yours sincerely,

G. W. H. Schepers, M.D., D.Sc.
Director

GWHS:LB
Enc. (3)

CC: E. R. Howard, M.D. - with 3 copies of report
Plant Physician
Owens-Illinois
Libbey Glass Plant
Ash Street
Toledo, Ohio

PLAINTIFF'S EXHIBIT
Kirstein-150
8-28-98

OCD 68

MEDICO-LEGAL OPINION

in
respect
of

OCCUPATIONAL CHEST DISEASE

by

G.W.H. Schepers, M.D., D.Sc., F.C.C.P.
Director
Saranac Laboratory
7 Church Street
Saranac Lake, N.Y.

August 1, 1956

Subject: Lee Bryston - Aged 57
Deceased - July 8, 1956
Employee - Libbey Glass Division, Owens-Illinois Glass Co.
Saranac Laboratory No. P-56-682

Referred by: Charles F. Shook, M.D.
Medical Director
Owens-Illinois Glass Company
Toledo, Ohio

55900

Re: Lee Bryston
OCD 68 - P-56-682
August 1, 1956

PART I

A. MATERIAL STUDIED

Pathological specimen - Lungs - submitted by K.R. Howard, M.D., Plant Physician

The specimen examined consists of the left lung and portions of the right lung, fixed in formalin and received wrapped in cloth and sealed in saran wrap. In the case of the left lung the pulmonary vessels and bronchi had been cut flush with the mediastinal surface.

The pleural surfaces are smooth with small scattered black subpleural isolated foci of pigmentation. In rare foci there is a central whitish portion suggestive of scarring. None of these pleural foci are palpable.

The lung hilus reveals the presence of a firm mass of enlarged glands interposed between secondary branches of the left pulmonary artery. On section this glandular mass is seen to be composed of a conglomeration of several confluent, component glands which are densely adherent to one another and to surrounding blood vessels and bronchi. The texture of the gland mass is friable with several concretions of stony consistency embedded in it. Minute foci of caseation are also present.

The bronchi appear normal but the branches of the pulmonary artery are somewhat distended and isolated atheromatous plaques are present on the exposed surfaces. (Histological examination to follow.)

Along the posterior edge of the upper lobe there is a large, firm, inverted, pyriform mass which had been cut open before the specimen was received by us. This mass, which measures approximately 4 cm in largest vertical diameter, and about 3 cm in width at its base, has a grey appearance, a friable center, no definite capsule, and has blood vessels and bronchi leading into its apex. There are light pleural adhesions over the free surface of this mass but no pleural thickening. On naked eye inspection this mass resembles an old tuberculous focus rather than a silicotic or tuberculo-silicotic process. (Histological report to follow.)

The cut surface of the lung reveals a universally distributed vesicular emphysema and sparse, small foci of pigmentation. Isolated such foci are palpable, especially where they lie close to the mass previously described. Pigmented foci in other areas are not palpable. The largest of the palpable foci measures about 3 mm in diameter.

On section the basal lobe also reveals diffuse vesicular emphysema with some bullous formations toward the apex. A few scattered fibrocaseous nodules are visible and palpable - some measuring up to 4 mm in diameter. At the base of the lobe there appears to be some degree of hypostatic congestion.

The general appearances of the right lobe are similar to those of the left side - emphysema, hypostatic congestion, foci of pigmentation, and isolated, sparse, palpable nodules being present. In addition, there is a mass measuring about 2 cm by 1 cm along the posterior edge of this lobe. It is greyish in appearance and has a friable center (specimen for histological examination).

Re: Lee Bryston
OCD 68 - P-56-682
August 1, 1956

I. MATERIAL STUDIED (cont'd.)

The bronchi in the lung substance do not appear to be diseased. The smaller blood vessels are relatively inconspicuous and several of the medium-sized vessels are occluded apparently on account of ante mortem thrombosis.

Comment: It is possible that the large masses in the lung tissue and the isolated nodules have a pneumoconiotic basis. However, masses and nodules indistinguishable from these by naked eye criteria may be found in individuals who had never been exposed to harmful dusts, but who had developed chronic tuberculosis. A final diagnosis must, therefore, be deferred until the histological and chemical studies have been completed.

GWSchepers Aug 1, 1956

GWHS:mem

(Part II to follow)

55902

A-68

Pathological speciman

Lungs

Name: Bryston, Lee

Shipped by:

Medical Department,

Libbey Glass Division of
Owens-Illinois Glass Co.

Ash St., W. & L. E. R. R.
Toledo, Ohio

55903

THE TRUDEAU FOUNDATION

FOR THE CLINICAL AND EXPERIMENTAL STUDY OF PULMONARY DISEASE

SARANAC LABORATORY
TRUDEAU LABORATORY
TRUDEAU SCHOOL

OFFICE OF DIRECTOR
P. O. BOX 381
SARANAC LAKE, N.Y.

DEPARTMENT OF BIOCHEMISTRY
DEPARTMENT OF PHYSIOLOGY
DEPARTMENT OF RADIOLOGY

September 4, 1956

Charles F. Shook, M.D.
Medical Director
Owens-Illinois Glass Company
Toledo 1, Ohio

Re: Lee Bryston
Saranac Laboratory P-56-682
OCD 68

Dear Doctor Shook

Sections and chemical analyses on the material in this case have now become available.

The large masses referred to in the description of the gross specimen already sent to you have proved to be somewhat atypical conglomerate silicotic nodules. There is no conclusive evidence of tuberculosis or of a tuberculosilicosis. The gutty elements are bone. Bronchi and blood vessels in these masses are extensively deformed, occluded, or disorganized.

There are no discrete silicotic nodules. However, the whole lung parenchyma is the seat of alveolar wall fibrosis and there is atrophic emphysema with focal bullous formation.

Thrombosis of pulmonary arteries and areas of infarction are demonstrable in several of the sections. The thrombi are partly organized but not yet too old. These changes, therefore, may be preagonal in significance only.

The chief nocuous minerals found in the lung tissue are tridymite, cristobalite, and quartz. The amounts of these substances vary rather sharply according to whether the determinations were made on the lung tissue generally or specifically on the areas of massive fibrosis. In the latter areas the lung ash (16.65%) is about double the average (7.4%) for our series of silicotics. On the other hand, in the rest of the lungs the lung ash (3.27%) approximates the average lung ash in normal lungs (3.0%).

The total silica content of the ash (3.16 - 5.11%) is only slightly greater than that for normal persons (0.4 - 8.6%) and far below average for our series of silicotics (19.9%). On the other hand, Doctor Gardner has described silicotics with a total silica content of their lungs as low as 0.3%. The free silica content of the lung ash (1.3 - 2.9%) is likewise below the average for our series of silicotics (9.3%). Again, however, silicosis has been admitted in the presence of but 0.2% free silica.

PLAINTIFF'S EXHIBIT
Kirstein-152
8-28-98

55897

THE SARANAC LABORATORY
For the Study of Tuberculosis, Occupational Disease, and Industrial Hygiene
Founded by EDWARD LIVINGSTON TRUDEAU *in 1885*
7 CHURCH ST., SARANAC LAKE, NEW YORK
P. O. Box 551
Telephone: Laboratory 613
Director 560

Charles F. Shook, M.D.

September 4, 1956

Re: Lee Bryston
Reference: Saranac Laboratory P-56-682
OCD 68

The amounts of tridymite (0.6 - 1.7%) and cristobalite (0.4 - 1.2%) found in the lung ash are very much in excess of what we have previously found. Perhaps these forms of free silica explain the pulmonary pathology. We know that cristobalite and tridymite are many times more potent than quartz as fibrogenic agents.

The occupational history you furnished us over the telephone does not help to explain this case. He probably worked in a ceramic products plant at one time or another in his life to account for the presence of the excessive quantities of high temperature free silica found in his lungs. Could this matter be looked into again, or may we assume that he could have been exposed to these substances while performing his duties as a plant guard?

I will set all this up in a formal report when I return shortly from an out-of-town trip. We do hope you will let us have a look at the X-rays of this most interesting case.

With kind regards,

Yours sincerely,

G. W. H. Schepers, M.D., D.Sc.
Director

GWHS:LB

55868

CHEMICAL, PETROGRAPHIC AND X-RAY DIFFRACTION ANALYSIS OF LUNGS

Name L. Bryston   Case No. P-56-682

	Lung: Left upper lobe	Right lobe	Apical mass
Ash, per cent of dried tissue	3.27	3.28	16.65
Total SiO_2, per cent of ash	5.11	3.16	4.91
per cent of dried tissue	0.17	0.10	0.82
Free SiO_2, per cent of ash	2.9	1.3	2.9
per cent of dried tissue	0.09	0.04	0.48

Kind of minerals in tissue, per cent of ash

	Left upper lobe	Right lobe	Apical mass
Free silica: Quartz	0.5	0.3	0.3
Cristobalite	1.2	0.4	0.9
Tridymite	1.2	0.6	1.7
Mullite	2.3	1.6	1.9
Mica	tr ?	tr ?	tr ?

Component Analysis of Ash, per cent of ash

SiO_2		
Fe_2O_3		
Al_2O_3		
CaO		
MgO		
Na_2O		
K_2O		
P_2O_5		

55869

OWENS-ILLINOIS

GENERAL OFFICES (I) TOLEDO 1, OHIO

September 11, 1956
Dict. 9/10/56

Dr. G. W. H. Schepers
The Saranac Laboratory
Saranac Lake, New York

Dear Dr. Schepers:

Since Dr. Shook is out of town for a few days, we are acknowledging the report you sent last week on Mr. Lee Bryston.

Certainly the finding of unusual amounts of trydimite and crystobolite on chemical analysis of the lungs is most unexpected. We have rechecked with the plant and thus far have no clue as to where he might have been exposed to such dusts.

Around 1927 he worked for a few years as a punch press operator for Willys Overland, then he was unemployed two years, following which he came to work at our Libbey plant--and never worked any place else. During the first year or two of his Libbey employment he was in the general labor group as a clean-up man. In this capacity he did spend a few hours off and on in the batch department, but he never was regularly employed there. For the last 20 or more years he had been a guard and watchman and, so far as we know, never visited the batch department at all.

His brother states that during his two years of unemployment before he came to Libbey, Mr. Bryston was really unemployed and, consequently, didn't have any kind of industrial dust exposure whatsoever.

As for X-rays, the plant has no record that any were ever taken. We have even checked with the local health department, which in recent years has used a mobile X-ray unit for TB case finding. They have no record of ever having X-rayed Mr. Bryston. It's unfortunate, but no X-rays can be found anywhere.

Naturally we are looking forward to seeing your final report. While there is no immediate urgency for this, we would like to see it as soon as convenient so we can reach some conclusion on this case.

Sincerely yours,

W. G. Hazard

W. G. Hazard - Industrial Relations Division
M

PLAINTIFF'S EXHIBIT Kirstein-153 8-28-98

TMD

55871

November 6, 1956

Charles F. Shook, M.D.
Medical Director
Owens-Illinois Glass Company
Toledo, Ohio

Dear Doctor Shook: Re: Lee Bryston

My apologies for the delayed transmission of my report on this most interesting case. I had hoped to receive some x-rays to review and also intended appending a few microphotographs. As our photographer left us earlier this year I have had to train another technician to undertake this task with consequent delays. When I have some good photographs I shall send them to you.

I hope the mystery of this man's exposure can be cleared up.

With kind regards,

Yours sincerely,

G. W. H. Schepers, M.D., D.Sc.
Director

GWHS:mem
Enclosures (6)

PLAINTIFF'S EXHIBIT
Kirstein-155
8-28-98

55872

OCD 68

MEDICO-LEGAL OPINION

in
respect
of

OCCUPATIONAL CHEST DISEASE

by

G. W. H. Schepers, M.D., D.Sc., F.C.C.P.
Director
Saranac Laboratory
7 Church Street
Saranac Lake, N.Y.

November 5, 1956

Subject: Lee Bryston - Aged 57
Deceased - July 8, 1956
Employee - Libbey Glass Division, Owens-Illinois Glass Co.
Saranac Laboratory No. P-56-682

Referred by: Charles F. Shook, M.D.
Medical Director
Owens-Illinois Glass Company
Toledo, Ohio

Tissues Furnished by: K.R. Howard, M.D., Plant Physician
Owens-Illinois Glass Co., Libbey Glass Division
Toledo, Ohio

55873

Re: Lee Bryston
OCD 68 - P-56-682
November 5, 1956

I. GROSS PATHOLOGY

The specimen examined consists of the left lung and portions of the right lung, fixed in formalin and received wrapped in cloth and sealed in saran wrap. In the case of the left lung the pulmonary vessels and bronchi had been cut flush with the mediastinal surface.

The pleural surfaces are smooth with small scattered black subpleural isolated foci of pigmentation. In rare foci there is a central whitish portion suggestive of scarring. None of these pleural foci are palpable.

The lung hilus reveals the presence of a firm mass of enlarged glands interposed between secondary branches of the left pulmonary artery. On section this glandular mass is seen to be composed of a conglomeration of several confluent, component nodes which are densely adherent to one another and to surrounding blood vessels and bronchi. The texture of the mass is friable with several concretions of stony consistency embedded in it. Minute foci of apparent caseation are also present.

The main bronchi appear normal but the main branches of the pulmonary artery are somewhat distended and isolated atheromatous plaques are discernible on the exposed surfaces.

In the region of the posterior edge of the upper lobe there is a large, firm, inverted pyriform mass which had been cut into before the specimen was received at the Saranac Laboratory. This mass, which measures approximately 4 cm in its greatest or vertical diameter, and about 3 cm in width at its base, has a grey appearance, a friable center, no definite capsule, and has blood vessels and bronchi leading into its apex. There are light pleural adhesions over the free surface of this mass but no pleural thickening.

The cut surface of the lung reveals a universally distributed vesicular emphysema and sparse, small foci of pigmentation. Isolated such foci are palpable, especially where they lie close to the mass previously described. Pigmented foci in other areas are not palpable. The largest of the palpable foci measures about 3 mm in diameter.

On section the basal lobe also reveals diffuse vesicular emphysema with some bulla formation toward the apex. A few scattered semiconsolidated nodules are visible and palpable, some measuring up to 4 mm in diameter. At the base of the lobe there appears to be some degree of hypostatic congestion.

The general appearances of the right lobe are similar to those of the left side - emphysema, hypostatic congestion, foci of pigmentation, and isolated, sparse, palpable nodules being present. In addition, there is a mass measuring about 2 cm by 1 cm along the posterior edge of this lobe. It is greyish in appearance and has a friable center.

The bronchi in the lung substance do not appear to be diseased. The smaller blood vessels are relatively inconspicuous and several of the medium-sized vessels are occluded apparently on account of ante mortem thrombosis.

55874

II. HISTOPATHOLOGY

On microscopical examination the large pyriform mass found in the left upper lobe proves to be an atelectatic condensation of a large part of this lobe with superimposed conglomerate silicosis. The mass contains the degenerated remnants of bronchi and large blood vessels and is practically airless, very few small islets of alveoli surviving among the silicotic masses. In this zone the silicotic components comprise three elements. The first or main feature consists of large concentrically lamellated, hyalinized nodules in which there is no evidence of necrosis of the kind associated with tuberculo-silicosis. The secondary element is composed of masses of koniophores, plasma cells and fibrocytes with a light supporting network of collagen bundles and reticulum. These cellular zones tend to be arranged around the periphery of the hyaline nodules and are the main factor in binding them together. Among these cells there are degenerated and semi-degenerated blood vessels and bronchi. These structures constitute the third component of the mass. The bronchi have retained a lumen with an epithelium in some areas. In other parts the respiratory passages can only be identified by the survival of degenerated, variably ossified and calcified cartilagenous masses arranged in roughly circular patterns. In those areas where these bronchi still are patent, the mucosa is degenerated with hyperplasia of the muscularis and marked hypertrophy of the bronchial arteries.

The solidified areas found at other sites in the lung are comparable in a histological sense to the above described mass. They also contain conglomerate hyalinized silicotic nodules, areas in which dust-laden macrophages and fibrocytes predominate and calcified remnants of degenerated bronchi with partly occluded blood vessels.

The lesser nodules found at various sites in both lungs are essentially hyalinized multilamellated collagen bodies of the silicotic kind with surrounding masses of koniophores and fibrocytes. Several of these nodules lie adjacent to small bronchi and a few surround small blood vessels.

The alveolar walls in most parts of the lung show a moderate to marked degree of thickening. In some areas this is due primarily to cellular infiltration. In other regions there is dense collagen deposition. In relation to both these features there is marked reticulum formation. Elastic tissue is conspicuous by its absence. In some areas the thickening of the alveolar walls is partly due to hyperplasia of smooth muscle. Where cellular or fibrous infiltration has not occurred there is moderate distension of alveolar wall capillaries which feature emphasizes the loss of mural capillaries over extensive areas of the pulmonary parenchyma.

These alveolar walls are stretched thin in many areas and are broken down at numerous other sites. This is due to the presence throughout the lung parenchyma of marked hypertrophic emphysema. Some of the distended air spaces represent dilated alveolar ducts and terminal bronchioles.

The pulmonary arteries show hypertrophy of their muscular coats in most parts of the lung. In the hilar region there is additional focal intimal atheromatosis. In some regions the lesser arteries are markedly stenosed through fibrous hyperplasia around them.

55875

II. HISTOPATHOLOGY (cont'd.)

In several of the pulmonary blood vessels thrombosis had occurred. As these clots are only partly organized it is evident that the thrombosis was part of the terminal process and not an essential feature of the main disease process. Small areas of infarction were also present.

The bronchial epithelium reveals predominance of goblet cells. The muscularis mucosae is markedly hypertrophied in most areas but there is no measure of cellular infiltration to the mucosa. The bronchial glands are moderately hypertrophied.

At the pulmonary hilus the bronchi and blood vessels are bonded together by fibrocellular tissue which surrounds conglomerate partly degenerated silicotic nodules. No evidence of tuberculosis could be found in these sections despite the suggestion of caseation found on macroscopic examination. The gritty elements in these lymph glands represent areas of calcification.

III. HISTOCHEMISTRY

(Thomas M. Durkan)

Portions of the left upper lobe, of the right lobe, and of a mass in the apex of the lung were submitted for analysis. The weight of the tissue samples was as follows:

	Left Upper Lobe	Right Lobe	Apical Mass
Weight of tissue (moist)	32.5 gm	89.3 gm	7.6 gm
" " " (dried at 100-105° C)	7.4	19.9	2.5

Each tissue sample after being dried was pulverized, mixed, and divided into two parts. One part was ashed in a muffle furnace and the total silica content of the ash determined by standard methods. The other part was digested with 30 per cent hydrogen peroxide to destroy organic matter and the insoluble material surviving that treatment was subjected to petrographic and x-ray diffraction examination.

Tabulated below are the findings of the analyses and, for comparison, the results of similar analyses for (1) a normal group of individuals not exposed in their occupation to dust, (2) a group exposed to siliceous dust but who did not develop silicosis, and (3) a group of silicotics. For the normal, non-silicotic, and silicotic groups the average value is given and, in parentheses, the range of values is shown.

55876

III. HISTOCHEMISTRY (cont'd.)

Ash Content and Silica Content of Lung Tissue

		Lee Bryston (P-56-682)	Normal Group	Non-silicotic Group	Silicotic Group
Ash content, per cent of dried tissue					
3.27%	Left lobe		3.0% (1.8-6.5)	-	7.4% (3.1-34.8)
3.28	Right lobe				
16.65	Apical mass				
Total silica content, per cent of ash					
5.11%	Left lobe		3.4% (0.4-8.6)	12.7% (1.6-40.0)	19.9% (0.3-62.8)
3.16	Right lobe				
4.91	Apical mass				
Free silica content, per cent of ash					
2.9 %	Left lobe		1.2% (0.1-2.6)	3.3% (0.1-16.6)	9.3% (0.2-33.2)
1.3	Right lobe				
2.9	Apical mass				
Free silica content, per cent of dried tissue					
0.09%	Left lobe		0.03% (0.00-0.16)	0.29% (0.00-1.68)	1.11% (0.02-[illegible].78)
0.04	Right lobe				
0.48	Apical mass				

IV. DISCUSSION

The histological lesions found in this case can be identified as silicotic in type because of the presence of the characteristic whorled nodules and the histochemical demonstration of the presence of excessive quantities of free silica. It is, however, an unusual variety of silicosis insofar as diffuse alveolar mural sclerosis is combined with massive conglomerate lesions, discrete nodulation being sparse only and irregularly distributed. The morphological resemblances are with the type of silicosis encountered in the flux-calcined diatomaceous earth industry and with Shaver's disease.

The mysterious element in this case is the lack of an adequate history of exposure to free crystalline silica. From the analytical findings it appears,

55877

IV. DISCUSSION (cont'd.)

however, that this individual did at some time have a slight to moderate exposure to siliceous dusts. Since the greater part of the silica recovered from the tissue was present as cristobalite, tridymite, or mullite, all of which are high-temperature products, it is probable that his exposure to silica occurred in a plant making ceramic products or during the course of certain operations, such as re-lining kilns, which liberate dust containing the high-temperature forms of free silica. The presence in the lung tissue of a substantial amount of tridymite, a form of free silica which is relatively uncommon but which is present in old bricks from kilns, is worthy of note. Most of the total silica content of the tissue specimens was accounted for by the cristobalite, tridymite and mullite components. It is unlikely, therefore, that this individual had any significant exposure to other siliceous dusts.

These facts narrow the etiology of this disease down to a specific variety of exposure which it should be possible to trace. It is stated that the duties of the deceased included one year as a laborer or cleanup man, during which time he spent a few hours off and on in the batch department. His main employment during his final 20 years of service was, however, as a guard and watchman. It is generally assumed that such guard duties are relatively free of occupational risks. To reconcile the presence of such an advanced degree of silicosis in this man with such a job status one must postulate the possibility that there may be risks attendant on the function of nocturnal guard or watchman which have not previously been suspected. This matter deserves some enquiry. It is conceivable, for instance, that when all the doors or windows of a ceramic plant are shut overnight, nocuous atmospheric substances may be concentrated in the building. Some night watchmen are also assigned duties such as dusting offices or work benches, sweeping floors or tending furnaces or other apparatus that cannot be turned off overnight. It should be possible to ascertain whether such factors were present in this case.

There remains a possibility that the deceased may have carried on a hobby or private backyard or basement industry in which he became exposed to siliceous dusts.

Some emotionally or mentally disturbed individuals have also been known to deliberately expose themselves to toxic substances.

There remains the possibility of an undue degree of susceptibility in this individual if it can be established that disease of the present type has not been previously noted in other employees. On first inspection of the apical mass the presence of bone, cartilage, muscle and bronchi and blood vessels suggested that the lesion was essentially a hamartoma. However, the widespread pulmonary fibrosis and the occurrence of similar lesions at other sites are rather against this possibility, while the demonstration of the combination of four varieties of free silica (tridymite, cristobalite, quartz, and mullite)

IV. DISCUSSION (cont'd.)

confirms the fact that the disease is dominantly of industrial origin. This does not yet dispose of the possibility that the deceased may have been one of those unusual individuals who retain inhaled foreign matter in unusual quantities and react excessively to them. The marked involvement of hilar root glands further suggests the possibility that early exaggerated reaction in these structures may have obstructed the egress of trapped siliceous dust both through blockage of lymphatics and stenosis of bronchi. Such an explanation accounts for the development of massive lesions in atelectatic lung lobes in rare cases of silicosis. There may also have been an infective factor which involved these hilar lymph glands at an early stage. No trace of such infection persisted.

V. DIAGNOSIS

The disease process found in the lungs of the deceased is an aberrant form of silicosis characterized by diffuse mural sclerosis with associated hypertrophic emphysema and focal conglomerate nodular fibrosis with associated regional pulmonary atelectasis, the etiological agents being tridymite, cristobalite, quartz, and mullite.

GWHSchepers
Nov 5, 1956

GWHS:mem

55879