

PENGID-Bayonne,N.J

PLAINTIFF'S
EXHIBIT

WRG-102

W.R.GRACE (MAX WILLIAMS)
DEPOSITION OF JULIE YANG

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEBRASKA

C.A. No. 86-0714

MAX G. WILLIAMS and MAUREEN D. WILLIAMS

v.

NATIONAL GYPSUM COMPANY, ET AL

DEPOSITION of JULIE C. YANG, a witness called on behalf of the Plaintiffs, taken pursuant to the Rules of Civil Procedure of the United States District Courts, before Linda A. Johnson, Registered Professional Reporter and Notary Public in and for the Commonwealth of Massachusetts, at the offices of Casner, Edwards & Roseman, 30 Federal Street, Boston, Massachusetts, on Friday, March 18, 1988, commencing at 11:15 a.m.

APPEARANCES:

BARON & BUDD (by Fred Baron, Esq., and Lisa A. Blue, Esq.),
8333 Douglas Avenue, 10th Floor, Dallas, Texas 75225,
for Max G. Williams and Maureen D. Williams.

CASNER, EDWARDS & ROSEMAN (by Robert S. Kutner, Esq., and
Donna B. MacKenna, Esq.),
30 Federal Street, Boston, Massachusetts 02110,
for W. R. Grace & Co.

FRANCES M. CAWLINA ASSOCIATES
Certified Shorthand Reporters
34 Emerson Place
Boston, Massachusetts 02114
(617) 227-0777

APPEARANCES, CONT'D

GROSS, WELCH, WHEELER, KAUFMAN & RAY

(by Thomas A. Stepka, Esq.),
300 Commercial Federal Tower, 2123 South 70th Street,
Omaha, Nebraska 68123-2342,
for W. E. Grace & Co.

FOLSBERRY, WHITE, VARDENIAN & SHALTON

(by Cathy J. Dean, Esq.),
Country Club Plaza, 4705 Central,
Kansas City, Missouri 64112,
for National Gypsum Company and U.S. Gypsum Company.

KITCH, SAUBIER, BRUTCHAS, WAGNER & KENNEY, P.C.

(by William A. Baillargeon, Esq.),
One Woodward Avenue, Detroit, Michigan 48226,
for Owens-Corning Fiberglas.

MADAN AND MADAN (by Richard J. Conner, Esq., and

Jeffrey W. Armstrong, Esq.),
One Post Office Square, Boston, Massachusetts 02109,
for Procter Industries.

I N D E X

<u>Testimony of:</u>	<u>Page</u>
Julie C. Yang	
Examination by Mr. Baron	4

Exhibits

<u>Plaintiffs'</u>		
<u>Exhibit No.</u>	<u>Description</u>	<u>For Iden.</u>
18	12/13/72 memo from J. C. Yang to H. C. Duecker	29
19	12/19/72 memo from J. C. Yang to H. C. Duecker	29
20	6/26/73 memo from J. C. Yang to H. C. Duecker	35
21	7/26/73 memo from H. C. Duecker to H. A. Brown	35
22	8/31/73 memo from J. C. Yang to O. F. Stewart	35

1 JULIE C. YANG,

2 a witness called on behalf of the plaintiffs, first having
3 been duly sworn, on oath deposes and says as follows:

4 Examination by Mr. Baron

5 Q If you would, state your name for the record, please.

6 A Julie C. Yang, Y-a-n-g.

7 Q My name is Fred Baron. I'm here representing the
8 plaintiff in some cases that have been filed against W. R.
9 Grace Company, for whom you are testifying today, as I
10 understand it. You are employed by W. R. Grace, are you
11 not?

12 MR. KUTNER: Can we just incorporate the same
13 objections to the deposition notices as we asserted in the
14 deposition of Mr. Cintani?

15 MR. BARON: Certainly we can. As I understand,
16 you're objecting to all of them except the Williams case.

17 MR. KUTNER: Yes.

18 MR. ARMSTRONG: As is Proko.

19 MR. BARON: That's fine.

20 Q It's Dr. Yang, is it not?

21 A Yes.

22 Q Dr. Yang, how are you presently employed?

23 A I'm employed by W. R. Grace as a manager in research,
24 material research, in the Analytical Department, heading

1 the department.

2 Q How long have you been employed by W. R. Grace?

3 A Since November, '82. '72.

4 Q If I could, I'd like to go over your background briefly
5 with you. Where did you attend undergraduate school?

6 A I went to graduate school first at University of Indiana,
7 or Indiana University, in Bloomington, Indiana. I have a
8 master degree from Indiana University in--let me think
9 about a year.

10 Q Sometime way back, then?

11 A Way back. '52, I think. Then I went to University of
12 Illinois, Urbana, Illinois. I have my Ph.D. in chemistry,
13 1955.

14 Q Okay. Following obtaining your Ph.D. in chemistry in 1955
15 from the University of Illinois, did you take employment
16 with anyone?

17 A Yes. I was employed at Johns-Manville in the corporate
18 basic research group at the research center as a senior
19 research chemist, and then promoted to a research
20 associate. I stayed with Johns-Manville until 1972.

21 Q Okay. And were you working in the New York office or did
22 you ever go out to the Denver office?

23 A Neither.

24 Q Which one?

1 A I worked in Manville, New Jersey, the research center.

2 Q What was your primary responsibility in Manville, New
3 Jersey?

4 A I was in basic research as a silicate chemist. I worked
5 with all kinds of minerals and synthetic materials which
6 contain silicates.

7 Q Did any of your research involve materials that would be
8 asbestiform in nature?

9 A Yes, because all--

10 MR. KUTNER: You've answered the question.

11 Q Okay. Why?

12 MR. KUTNER: I'll object.

13 MR. BARON: She was answering the question.

14 Q Why don't you go ahead.

15 A Well, all the asbestos are silicates.

16 Q Would it be fair to say, then, from the time that you
17 joined Johns-Manville in--1955, was it?

18 A '55, yes.

19 Q --'55 until the time that you left in 1972, your work
20 included research on asbestos fibers?

21 MR. KUTNER: Objection.

22 A Work included asbestos fibers?

23 Q Yes.

24 A Work included asbestos. I would qualify that answer.

1 Q What's the difference between asbestos and asbestos
2 fibers?

3 A I am talking about in a general sense of all the asbestos
4 minerals.

5 Q Right.

6 A Rather than--

7 Q The five crystalline forms.

8 A Rather than just fibers.

9 Q All right. Are there forms of asbestos that are not
10 fibrous?

11 A Yes.

12 Q What form?

13 A Massive.

14 Q Which one?

15 A I said, massive forms. They are--all the asbestos
16 minerals has the massive form and fibrous forms.

17 Q Well, for us poor laymen, you're familiar with something
18 called chrysotile asbestos, are you not?

19 A Yes.

20 Q What is chrysotile asbestos?

21 A Chrysotile asbestos is a magnesium silicate hydrate with
22 $3\text{Mg} \cdot 0.2 \text{SiO}_2 \cdot 0.2 \text{H}_2\text{O}$.

23 Q Did you during your career with Johns-Manville have the
24 opportunity to do studies on chrysotile asbestos?

1 A Chrysotile asbestos? Yes, I do. Did.

2 Q In fact, Johns-Manville was the owner of a very large mine
3 that mined chrysotile asbestos in Canada, did it not?

4 MR. KUTNER: Objection.

5 A Yes.

6 Q Did you ever visit that mine in Jeffrey? No, it's in
7 Asbestos, isn't it.

8 A Yes.

9 Q On numerous occasions?

10 A No.

11 Q How many times?

12 A Twice.

13 Q And during what years, do you recall?

14 A In the '50s, early '50s.

15 Q Now, are we talking about the mine in Asbestos, Quebec?

16 A Yes.

17 Q Is that known as the Jeffrey Mine? Is that what it's
18 called?

19 A Yes.

20 Q The mineral that is extracted from the ground that is
21 milled at the Johns-Manville facility there in Asbestos
22 would be called chrysotile asbestos, correct?

23 A Yes.

24 Q The chrysotile asbestos as it came out of the mill was

1 packaged in bags and sold to customers throughout the
2 world, right?

3 MR. KUTNER: Objection.

4 A That's an observation. I don't know whether that's all
5 the case or not.

6 Q Well, you knew they were in the business of selling it,
7 didn't you?

8 A Yes, but I don't know how they pack it.

9 Q You never saw a bag of asbestos that was coming out of the
10 mine?

11 A I did.

12 Q It was packaged in either a burlap or a kraft bag, was it
13 not?

14 A I didn't remember.

15 Q Okay. Do you understand what tremolite is?

16 A Yes.

17 Q What is tremolite?

18 A Tremolite is also a magnesium silicate hydrate.

19 Q Very similar crystalline structure, is it not, to
20 chrysotile?

21 MR. KUTNER: Objection.

22 A No, one is amphibole, one is serpentine.

23 Q Did you ever do any research pertaining to tremolite
24 contamination of chrysotile while you were at

1 Johns-Manville?

2 A No.

3 Q Do you know whether Johns-Manville conducted research on
4 tremolite contamination of chrysotile?

5 A No.

6 Q What type of research did you do on chrysotile?

7 A I make synthetic chrysotile.

8 Q You were attempting to make synthetic chrysotile?

9 A Yes.

10 Q Was that accomplished?

11 A Yes.

12 Q What year?

13 A Probably in the '50s. I don't remember the exact year. I
14 have the publication.

15 Q What was the purpose of making synthetic chrysotile?

16 A We will, the company's basic interest is, since they have
17 a lot of chrysotile in the mine, they want to know the
18 formation, how it can be done, and what size we can make
19 it into and what type of cost we have to make the
20 material.

21 Q And particularly on the issue of cost, were you able to
22 determine whether synthetic chrysotile was an economically
23 viable product?

24 MR. KUTNER: Objection.

1 A No.

2 Q Why not?

3 A It costs us many--because chrysotile is not a very easy
4 mineral to make, since the fiber doesn't grow very fast;
5 and it's in submicroscopic lens, so the characterization
6 needs electromicroscopy to see it. Then the cost is very
7 high.

8 Q Very high. Would it be fair to summarize in layman's
9 terms that one of the reasons that Johns-Manville never
10 got into the synthetic-chrysotile business was because
11 chrysotile breaks down into such small fibrils that in
12 order to make a synthetic material it would be too
13 expensive?

14 MR. KUTNER: Objection.

15 A That's not my decision what to do.

16 Q No, I didn't ask you whether that was your decision, but
17 did you understand that that was the basis for the
18 economic decision?

19 MR. KUTNER: Objection.

20 A I don't understand what's the company's decision.

21 Q But is it fair to say that chrysotile breaks down into
22 fibers, or is fibrous, and that those fibers break down
23 into fibrils that are extremely small in size?

24 MR. KUTNER: Objection.

1 A That has nothing to do with the synthetic-material
2 comparison.

3 Q All right. Let's put the synthetic material aside. What
4 I want to know is: Chrysotile is generally a fibrous
5 material, is it not?

6 A Yes.

7 Q When I say it's a fibrous material, what do you define the
8 term "fibrous" to mean?

9 A When you look under the microscope, it has the fibrous
10 morphology.

11 Q Now, do you know what the term "fibril" means?

12 A Yes.

13 Q What does it mean?

14 A It means small, individual fiber.

15 Q The product of the fibers is the fibrils, correct?

16 MR. KUTNER: Objection.

17 A The product of the fibers--

18 Q --is fibrils. In other words, the fibrils band together
19 to form the fiber.

20 A But the fibers are a product too.

21 Q They are indeed. But the fibrils come from the fibers?

22 A But you cannot classify fibrils as product. I would say
23 fibers are product.

24 Q Fibrils have very little commercial significance, I

1 understand that, in terms of the commercial sense of
2 fibers. But when we're talking about a fibril, a fibril
3 results from the use of fibers?

4 MR. KUTNER: Objection.

5 Q It may not be a commercially viable material, but it's
6 what comes off of the fibers, is that right?

7 A Yes.

8 Q Okay. When I talk about fibrils from chrysotile, what
9 size dimension are we generally talking about? Less than
10 five micrometers?

11 A Not necessarily.

12 Q What size?

13 A It can be that. Can be less.

14 Q Generally is, is it not?

15 A The fibrils?

16 Q Yes.

17 A Will be less, yes.

18 Q They're almost exclusively less than five, are they not?

19 A I don't know, because I never looked at so many of them to
20 tell you whether it's an exclusive or not.

21 Q All right. Well, when fibrous chrysotile is mixed and
22 stirred up with another product, you'll find an escape of
23 fibrils from the fibers, will you not?

24 MR. KUTNER: Objection.

1 A Wait a minute. I have nothing to do with the mixing or
2 the forming of any of the products whatsoever.

3 Q All right, I understand you don't. But I'm asking you, as
4 somebody who is an expert in the area of asbestos fibers,
5 would you not expect that the by-product of the mixing of
6 chrysotile fibers would be at least some concentration of
7 fibrils?

8 MR. KUTNER: Objection.

9 A I have to classify your question first, because I'm not an
10 expert in the asbestos fibers.

11 Q All right. Let's talk about that. You are not an expert
12 on asbestos fibers?

13 A I'm an expert in silicate chemistry.

14 Q Now, the question was: Are you an expert on asbestos
15 fibers?

16 MR. KUTNER: Objection.

17 A No.

18 MR. KUTNER: Are you asking in the sense--

19 MR. BARON: She just answered.

20 MR. KUTNER: Well, I was asserting an objection.
21 Are you asking in the sense of a legal conclusion as to
22 expertise for purposes of testifying? If so, I object to
23 the question on that basis.

24 MR. BARON: Finished?

1 MR. KUTNER: Yes.

2 MR. BARON: Okay.

3 Q Why are you not an expert on asbestos fibers?

4 MR. KUTNER: Objection. Same objection.

5 A Because if you are talking about a general term about
6 asbestos fibers, it includes the fibers' in-the-air
7 properties and, you know, its airborne properties and
8 other things. I'm not a CIH. I cannot answer that area.

9 Q All right. So you're really not an expert on dust?

10 A Correct.

11 Q And you're not an expert on how fibers break into fibrils
12 and get airborne?

13 MR. KUTNER: Objection.

14 Q Is that right?

15 A Correct.

16 Q Now, would it be fair to say that from the day that you
17 began working with Johns-Manville Corporation in 1955, you
18 were aware that asbestos had been associated with lung
19 diseases?

20 A No.

21 Q When did you first become aware of that?

22 A When the Mount Sinai people, Dr. Selikoff and Nicholson
23 and Art Langer and Arthur Rowe, came to give a
24 presentation at Johns-Manville. That's in the early '70s.

1 Q All right. So you worked for Johns-Manville from 1955
2 until the early 1970s and never knew that asbestos would
3 cause lung problems?

4 MR. KUTNER: Objection. I think the question's
5 argumentative.

6 Q Is that right?

7 A I may read something somewhere else, but it's not
8 conclusive of anything.

9 Q All right. So as far as you were concerned,--and I'm only
10 asking you about you, not anybody else--as far as you were
11 concerned, you yourself up at least until 1970 had formed
12 no opinion as to whether asbestos was hazardous to human
13 beings?

14 MR. KUTNER: Objection.

15 Q Is that right?

16 A Yes.

17 Q Okay. Who did you work for at Johns-Manville?

18 A I worked for Fred Pansuk.

19 Q Oh, you worked for Fred Pansuk, who was the president at
20 one time at Johns-Manville?

21 A He was head of the basic research section, too,
22 originally.

23 Q All right. And did he ever discuss with you health
24 effects of asbestos?

1 A No.

2 Q Who else did you work with?

3 A Sid Spiel.

4 Q Okay, I don't know him. Who else did you work with?

5 A Jim Lineweber.

6 Q Have you read any of the books on Johns-Manville's
7 activity with asbestos-related disease prior to 1970?

8 A No.

9 Q So as of today, you know very little about what
10 Johns-Manville knew about asbestos prior to 1970?

11 MR. KUTNER: Objection.

12 Q Is that right?

13 A Correct.

14 Q Let me suggest to you that there are some very fine
15 studies about the people that you worked with and that you
16 would recognize very much, one a book called Outrageous
17 Misconduct. Have you seen that book?

18 A No.

19 Q Never ever seen it?

20 A No.

21 Q Don't know anything about it?

22 A No.

23 Q Mr. Pansuk is very graphically described in that book,--

24 MR. KUTNER: Objection.

1 Q --and the work that he did at Johns-Manville,--

2 MR. KUTNER: Objection.

3 Q --and I would recommend it to you.

4 MR. KUTNER: I would caution Mr. Baron not to
5 suggest that the witness do anything that may impair the
6 witness's abilities to testify on behalf of Grace.

7 MR. BARON: Okay.

8 Q So I take it you were not involved in any of the animal
9 experiments that were going on at Johns-Manville from
10 about 1952 forward concerning asbestos inhalation?

11 A No.

12 Q If you worked at the Manville New Jersey facility, then
13 you must have known Hugh Jackson.

14 MR. KUTNER: Objection.

15 A Hugh Jackson?

16 Q Who was the head of safety at the New Jersey Manville
17 facility. Do you recall him?

18 A I don't think he was the head of that at that time. I
19 don't know that group at all.

20 Q You know Cliff Sheckler?

21 A No.

22 Q Okay. Who was plant manager at Manville?

23 A I don't know that either.

24 Q Okay. Did you ever know Kenneth Wallace Smith?

1 A Kenneth Wallace--
2 Q Wallace Smith, Dr. Kenneth Wallace Smith,--
3 A No.
4 Q --who is medical director of Johns-Manville Corporation?
5 A No, I don't.
6 (Mr. Conner replaced Mr. Armstrong at the
7 deposition.)
8 Q And I take it you also did not know Vandever Brown, who is
9 general counsel of Johns-Manville?
10 A Never heard of him.
11 Q Really? You've never heard that name?
12 A No.
13 Q That's incredible.
14 MR. KUTNER: Only attorneys know him.
15 Q Wow! Did you ever know of the Serenac Laboratory for
16 Study of Tuberculosis? Do you ever do any studies with
17 Serenac Laboratory?
18 A I know a former colleague's worked for Serenac.
19 Q Who is that?
20 A Don Bailey.
21 Q Were you aware that in the 1930s, Johns-Manville was
22 conducting dust experiments at the Serenac Laboratory to
23 determine the hazards of asbestos?
24 A I have no slightest idea.

1 Q Did any of your studies while you were at Johns-Manville
2 pertain to the health effects of asbestos?

3 A No.

4 Q Would it be fair to say that all of your studies were
5 centered around product development?

6 MR. KUTNER: Objection.

7 A My studies was mostly on cement chemistry.

8 Q Okay. Now, I think you indicated that you left there in
9 '72?

10 A Correct.

11 Q Why did you leave?

12 A Because the company moved to Denver.

13 Q Moved outside of Denver, actually, in the woods. But you
14 were in Manville, not in New York?

15 A Correct.

16 Q The Manville plant did not close and did not move, did it?

17 A But we never worked in the Manville plant. Manville plant
18 and the research center are two entirely separate
19 identities.

20 Q So the research center did move to outside of--

21 A The whole research moved to Littleton.

22 Q Right, Littleton.

23 Q And was it purely an issue that you didn't want to go to
24 Littleton, Colorado?

1 A Correct.

2 Q Is that the reason why you didn't move?

3 A That's my personal reasons.

4 Q I understand. How did you work out employment with
5 W. R. Grace? Who contacted you, or how did you contact
6 somebody?

7 A Grace contacted me, because I worked in a lot of
8 committees on cementitious material. I'm in the basic
9 research on cement and concrete in National Science
10 Academies Committee.

11 Q Was that the National Academy of Sciences?

12 A Yes.

13 Q By the way, were you a member of the New York Academy of
14 Sciences?

15 A No.

16 Q So you served on committees in the National Academy of
17 Sciences on cement-type materials?

18 A Cement and concrete, yes.

19 Q Did any of those committees involve discussions of the
20 health effects of cement or concrete materials?

21 A No.

22 Q Did you ever study any aspect of the health effects of
23 cement or concrete?

24 A No.

1 Q So again, so we can be sure we've covered the ball park,
2 would it be fair to say that before you went to work at
3 W. R. Grace, you had never had any direct involvement in
4 ascertaining the safety of materials that you worked with?

5 MR. KUTNER: Objection.

6 A Officially, yes. What you said is true. But of course,
7 when you work with chemicals, regardless what kind of
8 chemicals, a chemist has to be careful what he works with.

9 Q That's true, and you worked with asbestos from time to
10 time, did you not?

11 A Very rarely.

12 Q Let's talk about that. Prior to 1972, when you came to
13 Grace, what percentage of your total employment with
14 Johns-Manville was spent working with asbestos?

15 A Five percent.

16 Q When you worked with asbestos, would you work with raw
17 fibers?

18 A I don't work with raw fibers or asbestos. I work with
19 synthetic material.

20 Q Okay. So let's try to be even narrower. At any time
21 prior to 1972, did you ever work with natural, naturally
22 occurring asbestos fiber?

23 A Sometimes.

24 Q When?

1 A I really don't remember the years.

2 Q Okay. As a percentage of your 17 years with
3 Johns-Manville, what percent of your time was spent
4 working with naturally occurring asbestos fibers?

5 MR. KUTNER: Objection.

6 Q Less than one percent?

7 A I would say a little bit more than that.

8 Q And was that exclusively with chrysotile, or did you work
9 with other crystalline structures of asbestos?

10 A With chrysotile only.

11 Q So you never worked with tremolite?

12 A No.

13 Q When you went to work for W. R. Grace in 1972, when was it
14 that you began?

15 A November.

16 Q November of '72?

17 A Yes.

18 Q And what division of W. R. Grace did you go to work for?

19 A Construction Product Division, in the research, R & D.

20 Q And who was your supervisor?

21 A Dr. H. C. Duecker, D-u-e-c-k-e-r. He is the vice
22 president in charge of R & D.

23 Q What was your first project for W. R. Grace?

24 A My position hired at W. R. Grace was a senior group leader

1 in charge of rock-processing chemicals, which means the
2 cement and concrete additives. That's what I was working
3 on.

4 Q At any time while you have been with W. R. Grace has your
5 worked involved chrysotile asbestos?

6 A No.

7 Q So from today backwards, you've never worked with
8 chrysotile asbestos?

9 MR. KUTNER: With Grace?

10 MR. BARON: With Grace.

11 A No.

12 Q With any other company from 1972 to the present?

13 A No.

14 Q You've been with Grace consistently, have you not?

15 A Yes.

16 Q Any other form of asbestos that you've worked with?

17 A Tremolite.

18 Q Okay. When did you begin working with tremolite?

19 A Maybe '74.

20 Q And what was the reason that you began your work with
21 tremolite?

22 A I was shown some of the impurities, contaminants, in Libby
23 vermiculite.

24 Q By whom?

1 A By Dr. Duecker.

2 Q And did he tell you why he was showing you the tremolite
3 contamination of the vermiculite?

4 A He didn't tell me the reason, but they were trying to cut
5 down all the impurities present in vermiculite in order to
6 get a better yield from their mined product.

7 Q Did he ever at any time mention to you the reason they
8 were trying to cut out the tremolite was because they were
9 concerned about claims for asbestos exposure?

10 MR. KUTNER: Objection.

11 A I think he did.

12 Q Was that back then in '74 or was that later?

13 A Maybe '73, maybe '74. I don't remember the exact date,
14 because it's a long time ago.

15 Q Now, did he ever show you documents--and I'll hand them to
16 you--the first one is PX-1, which is a study from the
17 Montana State Board of Health, Division of Disease
18 Control, concerning a report on industrial hygiene at
19 Zonolite in Libby, Montana. Have you ever seen that one,
20 PX-1?

21 (Witness examined document.)

22 A No. I never did.

23 Q What about PX-2, which is the same report again in January
24 of 1959?

1 (Witness examined document.)

2 A No. Never saw these before.

3 Q The report from Mr. Gaudin, who is a consulting
4 metallurgist in Cambridge, Massachusetts, which is PX-3,
5 pertaining to asbestos in the Libby ore, have you ever
6 seen that report?

7 (Witness examined document.)

8 A No.

9 Q Here's PX-4, which is a letter from a physician to the
10 manager of Zonolite in Libby pertaining to people who have
11 asbestosis who work at the Zonolite mine. Did you ever
12 see that?

13 MR. KUTNER: Objection.

14 (Witness examined document.)

15 A No.

16 Q Here's another one, PX-7, which is an industrial-hygiene
17 study of the Zonolite Company mine in Libby pertaining to
18 asbestos exposure in 1962. Did you ever see that one?

19 MR. KUTNER: Objection.

20 (Witness examined document.)

21 A No.

22 Q Here's another one, PX-10, industrial hygiene study of the
23 Zonolite Company in Libby, Montana, concerning tremolite
24 asbestosis.

1 MR. KUTNER: Objection.

2 A No.

3 Q Have you ever seen any of those?

4 A No.

5 Q Have you ever been told at any time--well, first of all,
6 you know where Libby, Montana is? You know that
7 W. R. Grace has a mine there?

8 A Sure.

9 Q And that mine produces vermiculite, does it not?

10 A Yes.

11 Q And when you were studying the tremolite contamination of
12 vermiculite, you would get samples from Libby, would you
13 not, from time to time?

14 A Yes.

15 Q Did anyone ever tell you at any time, even up through
16 today, that there were employees of Zonolite's vermiculite
17 mine in Libby who were developing asbestosis from working
18 with the material?

19 MR. KUTNER: Objection. I think Dr. Yang has
20 testified of her areas of responsibility, and her areas
21 didn't include the health consequences of exposure to any
22 element, material, product, or whatever. So I object to a
23 question that, first, has no foundation, and secondly,
24 suggests that the witness should know something that is

1 beyond her job duties.

2 Q Okay. Now you can answer the question.

3 A I don't know it at all.

4 Q So you've never heard anything from anyone that people at
5 the Libby mine were developing asbestosis from the
6 tremolite contamination of the vermiculite?

7 MR. KUTNER: Objection.

8 Q Is that right? I just want to be sure you understood my
9 question.

10 MR. KUTNER: Objection.

11 A Of course you hear about it, but not necessarily from any
12 fixed source.

13 Q All right. So you've heard rumors that people out in
14 Libby were developing asbestosis, but you've never
15 received anything from W. R. Grace, is that right?

16 MR. KUTNER: Objection.

17 A Not rumors. You have certain publications by various
18 people showing that's what's happening.

19 Q Okay. What publications are you referring to?

20 A McDonald's paper.

21 Q What is McDonald's paper?

22 A It's on the health effect of tremolite.

23 MR. BARON: Let me have the reporter mark these.

24 We can do them seriatim to the other ones. This would be

1 18 and 19.

2 (Documents referred to above marked Plaintiffs'
3 Exhibits 18 and 19 for identification.)

4 Q Dr. Yang, I'm going to hand you a document that, for the
5 record here, is dated December 13, 1972. It shows a
6 received stamp dated December 15, 1972, on the
7 Construction Products Division. It's a memo to H. C.
8 Duecker, D-u-e-c-k-e-r, from Julie Yang,--

9 A Yes.

10 Q --"Subject: Comments on the Report"--I think this word
11 should be "Carcinogenic," should it not?"--Screening of
12 Vermiculite."

13 (Witness examined document.)

14 A Oh, yes.

15 Q It's misspelled there, is it not?

16 A Yes.

17 Q Is this a report that you yourself wrote, and is that your
18 signature on that report, PX-18?

19 A Yes.

20 Q Do you recall writing this?

21 A Yes, I did.

22 Q Now, so that everybody can follow along with me, the
23 subject of the report were your comments on the report of
24 carcinogenic screening of vermiculite by Huntington

1 Research Center in Huntington, England?

2 A Yes.

3 Q What was that?

4 A That's a report when I first went to Grace, they showed it
5 to me because they said, "You have some minerology
6 background," and it's a test done on South African
7 vermiculite. They're animal studies done on South African
8 vermiculite at Huntington Research Center in England.

9 Q All right. Now, the report is not attached here, but you
10 talk about photomicrographs of the thin-tissue sections of
11 the animals suffering from mesothelioma.

12 A Yes.

13 Q Can you describe what that report found generally?

14 MR. KUTNER: Objection.

15 A If you have the report,--we can produce the report, if you
16 want to. Then we will have their conclusion on what has
17 been done.

18 MR. BARON: All right. Well, we have a large
19 number of requests for production that you all have
20 answered that you would produce here in Boston, and we'll
21 get to that.

22 MR. KUTNER: Let me just state, the agreement was
23 that apparently your sister would review documents
24 yesterday.

1 MR. BARON: No.

2 MR. KUTNER: And the arrangement was that they
3 would be available, and she never contacted us to make any
4 other arrangements. She failed to appear.

5 MR. BARON: Well, we read your answers to our
6 requests for production to be that you said that you would
7 produce them at the proper time, that such records will be
8 produced.

9 MR. KUTNER: And an agreement was reached that that
10 would be the proper time.

11 MR. BARON: No, no. An agreement was reached that
12 records might be reviewed, and we understand from visiting
13 with other counsel that you have about 120 boxes of
14 records. That's not what I'm referring to. I'm referring
15 to our request for production where you have specifically
16 stated that certain documents that we listed would be
17 produced by W. R. Grace. But we'll get into that later.

18 Q Now, what generally was the report of the Huntington
19 Research Center

20 MR. KUTNER: Objection.

21 Q Give us a summation of it.

22 MR. KUTNER: Objection.

23 A The summation of the Huntington report is it says that
24 South African vermiculite has no ill health effect on the

1 animals.

2 Q All right. What about the animals that developed
3 mesothelioma

4 MR. KUTNER: Objection.

5 A I don't remember.

6 Q Okay, you don't remember. So that the animals that
7 developed mesothelioma from exposure to vermiculite had no
8 ill health effects?

9 MR. KUTNER: Objection.

10 A You'll have to ask a medical doctor's opinion, because I
11 can't answer that.

12 Q I see. But weren't you asked to study that?

13 A It doesn't matter. I can give them my chemical opinion,
14 but that doesn't mean I know the medical opinion.

15 Q In other words, you were the person given charge of
16 determining whether this medical study was valid, but you
17 have no expertise in that area. Would that be a fair
18 summation?

19 MR. KUTNER: Objection.

20 A I think they gave the medical expert to look at that
21 report before they give it to me.

22 Q Who was the medical expert?

23 A I don't know.

24 Q So you don't know what became of that?

1 A No, I don't.

2 Q Now, I'll show you PX-19, which is a memo dated
3 December 19, 1972, "Subject: Commercial Products
4 Containing Asbestos," from Julie Yang to H. C. Duecker,
5 and ask you again if that's a memo that you wrote, and is
6 that your signature?

7 (Witness examined document.)

8 A Yes, that's what I wrote.

9 Q Okay, take a look at it for a moment, and I'll ask you
10 some questions.

11 (Witness examined document.)

12 A Fine.

13 Q What you've done here is stated as follows: "The
14 following is an attempt to tabulate the commercial
15 products containing asbestos. If you have any further
16 information, please let us know, and it will be added to
17 this list," and then there's a list of products that
18 contain asbestos. What was the purpose of the exercise?

19 A I was asked by Dr. Duecker to give him a very general
20 scope of what materials, what product on the market has
21 asbestos in it.

22 Q Why would he ask you to do that?

23 MR. KUTNER: Objection.

24 A I don't know. He asked me, so I gave it to him.

1 Q All right. Did you know at that time that W. R. Grace was
2 involved with products that contained asbestos?

3 A I don't.

4 Q You didn't know at that time?

5 A No.

6 Q Do you know now whether they ever sold asbestos products?

7 A Yes, I do.

8 Q What product did they sell?

9 A Mono-Kote 3 and some of the acoustic materials.

10 Q When did you find that out?

11 A It's after I changed the responsibilities.

12 Q Okay. But at this time, in December of 1972, you did not
13 know that Grace was involved in the manufacture of
14 asbestos products?

15 A No, I don't. No.

16 Q Did you have any earthly idea why he would have wanted
17 this?

18 MR. KUTNER: Objection.

19 A I have no idea. You'll have to ask Dr. Duecker.

20 Q So you went out and did a project, and you had no idea why
21 you did it?

22 MR. KUTNER: Objection. You're asking her to
23 analyze what somebody else intended when he wrote this
24 memo.

1 A I don't.

2 Q You have no idea?

3 A No.

4 Q

5 MS. DEAN: I don't want to interrupt, but I'd like
6 for the exhibits to be attached to the transcript.

7 MR. BARON: They will be.

8 Let's mark this one as the next number, and then
9 these two.

10 (Documents referred to above marked Plaintiffs'
11 Exhibits 20 through 22 for identification.)

12 Q Again, back to PX-18, so I can be sure I understand what
13 we're talking about, in PX-18, which is your comments on
14 the carcinogenic screening of vermiculite, you were aware,
15 were you not, that mesothelioma had been found in animals?

16 MR. KUTNER: Objection. I believe that's a
17 mischaracterization.

18 MR. BARON: That's why I asked her.

19 A Let me read that thing again.

20 (Witness examined document.)

21 A Because it's very muddled, I don't understand that very
22 clearly. So that's what I said. I think you need more
23 study or give it to somebody with more expertise in that
24 area.

1 Q So you were convinced that somebody needed to look into
2 this--

3 A Right.

4 Q --to see if vermiculite was really causing problems?

5 MR. KUTNER: Objection.

6 Q Right?

7 A Correct.

8 Q To your knowledge, was that ever done?

9 A Yes.

10 Q By whom?

11 A By Dr. Smith of Farley-Dickinson Laboratory.

12 Q When was that done?

13 A '73, '74, in that time.

14 Q Is he an M.D. or a Ph.D.?

15 A He is an M.D..

16 Q And what did he do?

17 A He injected vermiculite with tremolite in the hamsters and
18 did an animal study.

19 Q And what was his conclusion?

20 A His conclusion, you'll have to read the report. I didn't
21 know the exact conclusions. It's a lot of medical terms
22 in it.

23 Q Did you understand it was safe or hazardous?

24 MR. KUTNER: Objection.

1 A Well, tremolite is hazardous, according to his conclusion.

2 Q All right. Do you have a copy of Dr. Smith's report?

3 A We may have it in the file. I don't know whether I have
4 one personally or not.

5 MR. BARON: Well, I would hereby request a copy of
6 Dr. Smith's report.

7 MS. MacKENNA: Fine.

8 MR. KUTNER: We acknowledge your request, and we
9 will respond accordingly.

10 MR. BARON: Okay.

11 Q Now, I have in front of me a document entitled "PX-20,"
12 which is a memo dated June 26, 1973, to H. C. Duecker from
13 J. C. Yang, "Subject: The possible occurrence of asbestos
14 in Mono-Kote." Are you the author of this document?

15 (Witness examined document.)

16 A Yes.

17 Q Okay. Now, first, would it be fair to say that we are
18 talking about MK-4 or -5, one of the products that did not
19 have added asbestos fibers?

20 A I would like to look at this experiment first.

21 Q Go right ahead.

22 (Witness examined document.)

23 A In this report, it didn't state which Mono-Kote it is. It
24 just shows you how much I know about Mono-Kote. But I

1 would assume it is--

2 MR. KUTNER: Well, don't assume. I want you to
3 answer it only if you know.

4 THE WITNESS: I don't.

5 Q All right. Would it be fair to say you're not an expert
6 on Mono-Kote?

7 MR. KUTNER: Objection.

8 Q Is that true?

9 MR. KUTNER: Objection.

10 A I'm an expert on analysis of Mono-Kote, but I'm not an
11 expert in developing Mono-Kote product or their research
12 and development.

13 Q All right. Have you ever done any work with a product
14 called MK-3, Mono-Kote 3?

15 A I have anything done with it?

16 Q Have you ever done any research projects or analysis of
17 MK-3?

18 A I have done a lot of analysis on the material that's
19 already been applied as Mono-Kote 3, but not as virgin
20 Mono-Kote 3 from the bag.

21 Q So you have never taken a piece of Mono-Kote 3 from the
22 bag before it was mixed and done any research on that
23 product, is that right?

24 A Yes.

1 Q Okay. So the only research you have done on MK-3 is on
2 material that was already in place and has been removed?

3 A Correct.

4 Q Have you ever done research on the atmosphere around the
5 installation of MK-3?

6 MR. KUTNER: Objection.

7 A Since I wasn't at Grace at that time, so whatever they
8 did, the air analysis is not--I don't know anything about
9 at all.

10 Q Okay. Well, then, so I can be sure I understand your
11 areas of expertise, or at least the things that you've
12 done work on, the only work you've done with MK-3 is on
13 material that has been removed that was previously
14 installed?

15 A Correct.

16 Q Okay. Now, in this document right here, you did some work
17 to determine tremolite contamination of vermiculite?

18 A I was asked to interface with Arthur D. Little to carry
19 out the analytical work.

20 Q Okay. Are you a minerologist?

21 A No, I'm a chemist by training.

22 Q All right. Minerology, is that an area that you profess
23 some expertise in?

24 A Yes.

1 Q And did you feel comfortable doing an analysis of the
2 vermiculite to determine how much tremolite or asbestos
3 was in it?

4 A Do I feel comfortable?

5 Q Yes.

6 A What do you mean by that?

7 Q In other words, this project that is the subject of this
8 memo describes the possible occurrence of asbestos in
9 Mono-Kote; and after reading it, it would appear that
10 somebody asked you to review the nature of
11 asbestos/tremolite contamination of vermiculite. Did you
12 feel that that was within your area of expertise to
13 accomplish?

14 MR. KUTNER: Objection.

15 A Yes.

16 Q And your report indicates that the vermiculite was in fact
17 contaminated with asbestos.

18 MR. KUTNER: Objection.

19 A Yes, that's based on the analysis made by the Arthur D.
20 Little Company.

21 Q Did you do any of the work or are you merely repeating
22 back what Arthur D. Little found?

23 A I am repeating the Arthur D. Little work. I had done
24 nothing at that time.

1 Q Okay. And I take it you have a copy of Arthur Little's
2 report?

3 A Yes, I do.

4 MR. BARON: Again, we'd make a request for you to
5 produce that.

6 Q Now, the next one is PX-21, and it is a memo to
7 H. A. Brown, dated July 26, 1973, "Subject: Asbestos in
8 Vermiculite and Mono-Kote," referencing your earlier memo.
9 This is signed by Mr. Duecker. Have you seen this
10 document before?

11 (Witness examined document.)

12 A I probably did, because I remember Dr. Duecker discussed
13 this with me, but I didn't remember whether I saw that
14 exactly or not.

15 Q Okay. The last paragraph says: "In conclusion, it is our
16 opinion that Libby and Enoree"--E-n-o-r-e-e--"Mono-Kote
17 may contain trace amounts of fibrous tremolite at
18 concentrations less than the limit of detection using the
19 X-ray diffraction technique. Enoree Mono-Kote may also
20 contain platy tremolite. The average content of the total
21 tremolite in Mono-Kote is about .2 to .5 percent." But it
22 says that "Individual samples may give higher values, but
23 an entire bag of Mono-Kote probably never contains more
24 than .2 to .5 percent total tremolite."

1 Was that the end of the investigation?

2 MR. KUTNER: Objection.

3 A I don't remember exactly what happened to it.

4 Q What is platy tremolite?

5 A Actually, it's massive. It's not platy.

6 Q Okay. We heard testimony a little earlier from a

7 Mr. Cintani. Do you know him, James Cintani?

8 A Yes.

9 Q He said that Mono-Kote 3, which contained asbestos, did
10 not contain fibrous material. Do you know what he was
11 talking about?

12 MR. KUTNER: Objection.

13 A What's this?

14 MR. KUTNER: I believe that you're
15 mischaracterizing the testimony.

16 Q Chrysotile asbestos is always, in its commercial form,
17 fibrous, is it not?

18 A Chrysotile asbestos in commercial form, it is fibrous.

19 Q I'm going to show you PX-22, which is a memo to
20 Mr. O. F. Stewart at Enoree, South Carolina, dated
21 August 31, 1973, from Julie C. Yang, "Subject: Treomlite
22 Determination in South Carolina Vermiculite Ores." Is
23 that a document that you authored?

24 (Witness examined document.)

1 A Yes.

2 Q Is that your signature?

3 A Yes.

4 Q Now, Dr. Yang, you have been listed as a witness in the
5 case of Max G. Williams versus W. R. Grace, and it states
6 that "Dr. Yang will testify regarding the chemical
7 composition of Mono-Kote, and she will further testify
8 regarding the testing of Mono-Kote."

9 First of all, were you aware that you had been
10 listed as a witness?

11 A Yes.

12 Q Have you discussed your testimony in the Max Williams case
13 with anyone?

14 A Max Williams case? I don't--

15 Q The one in Omaha, Nebraska, that you've been listed on.

16 A No.

17 Q Okay. Did you intend to testify regarding the chemical
18 composition of Mono-Kote 3?

19 MR. KUTNER: Objection.

20 A Raw material or finished product?

21 Q Let's talk about raw material as it is being installed.

22 A I cannot testify that, because I'm not here at--I was not
23 at Grace at that time.

24 Q But you're not going to testify based on studies of

1 others, is that right?

2 MR. KUTNER: Objection.

3 A What do you mean, "study of others"?

4 Q In other words, you're not planning to say, "Oh, I read a
5 study about MK-3 that was done before I got here, and
6 here's how I interpret it."

7 MR. KUTNER: Objection.

8 Q Are you planning to do that?

9 MR. KUTNER: Objection.

10 A I don't understand the question that well. I'm sorry.

11 Q Let me be sure that we're on the same track. In this
12 particular case, Mr. Williams's case, I'm talking about,
13 at this point, there will be testimony that Mr. Williams
14 worked around the installation of MK-3.

15 MR. KUTNER: Objection.

16 Q There will be testimony that he worked around the
17 installation of MK-3 and was exposed to asbestos emanating
18 from MK-3 as it was being installed. Do you expect to
19 give any testimony pertaining to the installation of MK-3?

20 MR. KUTNER: Objection.

21 A No.

22 Q Okay. Now, it says that you will further testify
23 regarding the testing of Mono-Kote. Do you expect to give
24 testimony pertaining to the testing of MK-3 at any point?

1 A If you get the MK-3 product, I would analyze. Or I look
2 at other people's analysis, can make comments on it.

3 Q All right. Have you yourself tested MK-3 product?

4 A What do you mean by that?

5 Q Product in place.

6 A Product in place?

7 Q Right.

8 A Taken down for sample analysis?

9 Q Yes.

10 A Yes.

11 Q And what types of analysis have you made on the MK-3
12 product that's been taken down from a job site and
13 analyzed?

14 A Litigation cases--

15 Q Okay.

16 A --and other cases which our product manager asked me to
17 do.

18 Q So the work that you have done has been exclusively
19 centered around defending W. R. Grace in product-liability
20 cases?

21 A No.

22 MR. KUTNER: Objection.

23 Q What else has there been?

24 A Well, if a customer is interested in whether he has

1 asbestos or whether he has Mono-Kote 3 on the ceiling or
2 as a fireproofing material, they ask Grace either as a
3 favor or they are thinking about removal, they ask us to
4 do it. Not necessarily in litigation cases.

5 Q Okay. In other words, if a prior customer comes in and
6 wants to know what it is they've got on the I beams, you
7 make an analysis?

8 A Maybe.

9 Q When did you begin to make analyses on MK-3?

10 A Probably in the '70s.

11 Q Late '70s?

12 A I don't recall the exact year.

13 Q Okay. Was the first time that you did it for litigation
14 purposes?

15 A No.

16 Q What was the first time that you did it?

17 A I don't remember, but it's in the documents.

18 Q All right. Dr. Yang, have you done chemical-composition
19 analysis of MK-3?

20 A As a product, finished product.

21 Q Yes.

22 A Yes.

23 Q Have you been able to determine what is the average
24 concentration of asbestos fiber in MK-3?

1 MR. KUTNER: Objection.

2 A Yes.

3 Q And what is that?

4 A It's between 11 to about 13 percent, in that range.

5 Q All right. So the material that has been taken down from
6 wherever it was installed and analyzed by you, that is,
7 MK-3, generally contains somewhere between 11 and 13
8 percent asbestos by weight?

9 A By weight.

10 MR. KUTNER: Objection.

11 A But I have to make--the classified answer is: When the
12 material is being analyzed, they have the right ingredient
13 as Mono-Kote 3. They may have--the weight percentage
14 resembles Mono-Kote 3, but I don't know if it's really
15 Mono-Kote 3 or not.

16 Q Because it doesn't have a label on it?

17 A Not only that. I understand there are other companies
18 making similar material with similar composition at that
19 time.

20 Q So you really, there's no way to know whether it's really
21 MK-3, because they were all fairly generic; would that be
22 a fair statement?

23 MR. KUTNER: Objection.

24 A That, I don't know. But I know there are materials

1 available that are like that.

2 Q Now, the 11 to 13 percent is by weight?

3 A By weight.

4 Q What about by volume?

5 A It's difficult to judge by volume. Depends on the
6 application methods.

7 Q Okay. What have you found in terms of a range by volume?

8 MR. KUTNER: Objection.

9 A We always do it by weight.

10 Q You've never done it by volume?

11 A I don't do it by volume.

12 Q It would be much higher by volume because of the
13 inherently light weight of asbestos fibers, would it not?

14 MR. KUTNER: Objection.

15 Q Isn't that true?

16 A No.

17 Q Would it be smaller by volume?

18 A I don't know, because you have to go through a lot of
19 series of compilations on density of different materials
20 to be present and the way they have been applied. If you
21 sprayed it on, you will have a lot of high pressure and
22 low pressure; you will end up with a very different
23 density of the material.

24 Q Okay. Well, Dr. Yang, I recently took the deposition of

1 the plant manager of the W. R. Grace facility in North
2 Little Rock, who was the individual--his job initially was
3 making Mono-Kote 3, and he said that he used about
4 25 percent asbestos by volume in the manufacture of MK-3.
5 Do you know whether that's in the ball park or not in the
6 ball park?

7 MR. KUTNER: Objection.

8 A I have no idea what he's talking about, because I don't
9 know the volume percent.

10 Q So have you ever seen the formula for how MK-3 is made?

11 A I saw the mixing record from some plants, but that's in
12 weight percent.

13 Q So you've only seen it by weight; you've never seen it by
14 volume?

15 A Grace formula is by weight percent.

16 Q Now, what else have you determined from your analysis of
17 MK-3 other than the percentage by weight of asbestos
18 fiber?

19 A We study every component present in the Mono-Kote 3. We
20 break it down all in weight percentage.

21 Q Other than doing an analysis of the composition of MK-3,
22 have you done other analyses of MK-3?

23 A Other--

24 Q Let me make it clearer. You've told us that you have done

1 analyses of the material by weight of MK-3.

2 A Yes.

3 Q Have you done any other analysis of MK-3?

4 A Such as what?

5 Q Such as anything other than determining its chemical
6 composition by weight.

7 A I don't think so.

8 Q Have you determined the movement of asbestos fibers within
9 the material that is called MK-3 that has been taken off,
10 the migration of the material?

11 MR. KUTNER: Objection.

12 A The migration?

13 Q Do you understand my question?

14 A Is that--you are talking about air sampling?

15 Q Yes. Have you done any of that work?

16 A As I told you, in Mono-Kote 3, because I think when I
17 joined Grace, I don't have anything to do with the air-
18 counting sample until several years later. So I would say
19 I have no knowledge on the air counting, air sampling, of
20 Mono-Kote 3.

21 Q All right. Well, would it be fair to say, then, that your
22 testimony pertaining to Mono-Kote 3 will be limited to its
23 chemical composition by weight?

24 MR. KUTNER: Objection.

1 A I would say if people are removing some material called
2 Mono-Kote 3, from Grace data, Grace record, it was
3 Mono-Kote 3. If they remove it, if they took air samples,
4 the counting, the counting of the fibers will be done, was
5 done, by my laboratory.

6 Q All right. So you are going to testify, then, on air
7 sampling for the removal of MK-3?

8 MR. KUTNER: Objection.

9 Q Do I understand that to be your testimony?

10 A We are doing it only mechanically on counting it, but we
11 gave the data to the CIH, and they do the final reports.

12 Q Okay.

13 A So I have nothing to do with the actual evaluation of the
14 final data.

15 Q Okay. And you do not intend to express any opinions at
16 this trial, do you, on the airborne concentrations of
17 asbestos from MK-3?

18 MR. KUTNER: Objection.

19 A Correct.

20 Q Again, I want to be specific here. Other than testifying
21 on the chemical composition of MK-3 by weight, do you know
22 of any other testimony that you will offer pertaining to
23 MK-3?

24 A I don't think so.

1 Q Okay. What about the nonasbestos Mono-Kote? Do you
2 expect to offer testimony on the nonasbestos-containing
3 Mono-Kote product?

4 MR. KUTNER: Objection.

5 A What do you mean, nonasbestos-containing Mono-Kote? Would
6 you specify what you are talking about?

7 Q All right. There has been testimony in this case--

8 MR. KUTNER: Can I just interrupt here to provide a
9 statement. To the extent that there have been discussions
10 with any of the Grace witnesses concerning expected
11 testimony, those discussions would have occurred with
12 their attorneys, and to the extent now that you're asking
13 about conversations that may have occurred with Grace
14 attorneys, certainly the witnesses are not going to
15 provide any information, and that has been the case with
16 Ms. Yang's prior testimony.

17 MR. BARON: Okay.

18 Q Have you ever testified in a trial before?

19 A Not in court.

20 Q Okay. Just by deposition?

21 A Yes.

22 Q Have each of those depositions been depositions where the
23 opposing lawyer such as myself has asked you questions?

24 A Yes.

1 Q Have you ever given testimony for use in trial by a Grace
2 lawyer?

3 A What do you mean by that?

4 Q In other words, have you ever had a W. R. Grace lawyer
5 question you as if you were in court for use in court?

6 A You mean following the deposition directly or in a
7 separate case?

8 MR. BARON: Let me ask you, Mr. Kutner: Has she
9 ever given an evidence deposition or are they all
10 discovery depositions?

11 MR. KUTNER: We don't distinguish, because they all
12 can be used in evidence.

13 MR. BARON: Certainly they can, but do you recall
14 any deposition she's given where the Grace lawyer has gone
15 through her testimony with her?

16 MR. KUTNER: I don't have any specific
17 recollection, but that's not to say that there isn't.

18 MR. BARON: All right.

19 Q Do you have any opinion as to whether MK-3 is hazardous to
20 the health of human beings?

21 MR. KUTNER: Objection.

22 A I don't form any health opinion, since I am not an M.D.

23 Q Has anybody ever told you or given you information that
24 would indicate that MK-3 was a product that was not

1 hazardous to human beings?

2 MR. KUTNER: Objection.

3 A You are asking a negative question. Would you repeat
4 that?

5 Q Okay. Have you ever been given any information by anyone
6 that MK-3 was not hazardous to human beings?

7 MR. KUTNER: Objection.

8 (There was discussion off the record.)

9 A I don't recall what I was told in such a long time I have
10 been with Grace.

11 Q All right. Do you have any knowledge as to whether MK-3
12 can cause lung problems in human beings?

13 MR. KUTNER: Objection.

14 A It must be; otherwise they don't change into a nonasbestos
15 product.

16 MR. KUTNER: I'll move to strike.

17 Q And do you understand that that's the reason they went to
18 a nonasbestos product?

19 A I don't.

20 MR. KUTNER: Objection.

21 Q Have you ever seen a package of MK-3?

22 A A package? What do you mean, "a package"?

23 Q Unused MK-3 that was still in a bag.

24 A No.

1 MR. BARON: You're free to go. Thank you.

2 (Deposition concluded at 12:30 p.m.)

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

C E R T I F I C A T E

COMMONWEALTH OF MASSACHUSETTS)
) ss.
COUNTY OF ESSEX)

I, Linda A. Johnson, Notary Public in and for the
Commonwealth of Massachusetts, do hereby certify:

That JULIE C. YANG, the witness whose deposition is hereinbefore set forth, was duly sworn by me and that the foregoing transcript is a true record of the testimony given by such witness, to the best of my knowledge, skill, and ability.

I further certify that I am not related to any of the parties in this matter by blood or marriage and that I am in no way interested in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand and
affixed my seal this 22d day of March, 1988.

Linda A. Johnson
LINDA A. JOHNSON
Notary Public

My commission expires:
May 9, 1991

Fig 3 in Environmental
air
CAMBRIDGE

RECEIVED

DEC 15 1972

(8781

TO: H. C. Duecker

DATE: Dec. 13, 1972

INJECTION PRODUCTS DIVISION
H. A. S.

FROM: Julie Yang

SUBJECT: Comments on the Report Carcinogen
Screening of Vermiculite by
Huntington Research Center
Huntington, England

CC: H. Brown
A. M. Rosenberg

The report has offered valuable information for environmental health hazard studies on the South African vermiculite. Unfortunately, it was presented solely from a medical point of view, and no information on the chemical compositions, geological formations with the associated minerals of the vermiculite or asbestos were given.

If we are interested in running a parallel study on our vermiculite, I would propose studying the following:

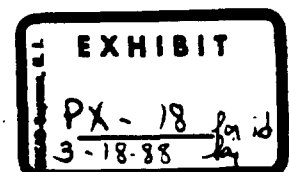
- 1) vermiculite from the Montana mine.
- 2) vermiculite from the South Carolina mine
- 3) a synthetic composite made of a pure vermiculite and a known amount of tremolite, preferably in two levels covering the range of the tremolite content in our mines.
- 4) chrysotile asbestos control.

The injection of a suspension of 25 mg material in 0.2 ml physiological saline solution is the UICC (Union International Contre le Cancer) standard test employed for animal study. In addition to all the descriptive histology and the macroscopic pathology studies of the testing animals.

I would think that a few photomicrographs of the thin tissue sections of the animals suffering from mesothelioma and the ones injected with vermiculite for comparison will be more illustrative to laymen.

JCY:jmh

Julie C. Yang
J. C. Yang



CAMBRIDGE

RECEIVED

68753

DEC 20 1972

TO: H. C. Duecker

DATE: Dec. 19, 1972

FROM: Julie Yang

SUBJECT: Commercial Products Containing
Asbestos

CC: A. M. Rosenberg
T. P. Feit
J. L. Wright
B. R. Williams
H. A. Brown

The following is an attempt to tabulate the commercial products containing asbestos. If you have any further information, please let us know and it will be added to this list.

A. Mineral Products without Commercial Asbestos

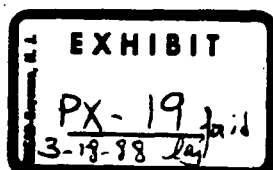
1. Dusting powder (talc)
2. Mold releasing agent (talc)

B. Composite Materials containing Commercial Asbestos

1. Brake lining - automobile and railroad
2. Roofing shingles
3. High temperature gaskets - with metal, impregnated in rubber like material
4. Ropes, tapes, gloves, suits, curtains and fabrics
5. Insulation Material - rigid blocks, hot pipe covers, tapes
6. Acoustical materials
7. Floor tile - vinyl asbestos and asbestos asphalt tiles
8. Asbestos cement products - pipes, boards, extruded forms, laboratory bench tops, sinks

Julie C. Yang
J. C. Yang

JCY:jmh



CAMBRIDGE

TO: H. C. Duecker

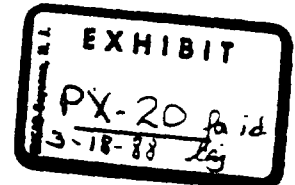
DATE: June 26, 1973

FROM: J. C. Yang ✓

SUBJECT: The possible occurrence of
asbestos in Monokote

CC: H. A. Brown
T. P. Feit
A. M. Rosenberg
B. R. Williams
J. L. Wright

FILE: 500 Asb. Detn.



Expanded Vermiculite samples and Monokote products from various mining locations and plants have been analyzed since Dec. 1972, by quantitative X-ray diffraction method (developed by Arthur D. Little, Inc.). This is supplemented by optical microscopy (dispersion staining techniques developed by Arthur D. Little, Inc.), transmission electron microscopy (rub-out method, developed by Johns-Manville, but used ourselves at WRO) and scanning electron microscopy with X-ray fluorescence analysis attachments (Arthur D. Little, Inc.).

Based on the experimental results collected up to date, tentative conclusions and comments are summarized as follows:

1. Vermiculite contains a small amount of asbestos in the range of 0.5%. The only asbestos species detected is tremolite; it can be either in platy or fibrous morphology. The analyses are presented in Table 1.
2. Sampling technique for the analysis is extremely important - all the analytical techniques mentioned above require very small specimens. Because of the heterogeneous nature of mineral species present, difference in density and form, segregation tends to occur. Representative analysis of a trace mineral in this material can be achieved only by collecting a large number of samples, perhaps 10 or more randomly and average the findings. Repetitious sampling (in Tables 1 and 2) show the variations in the determinations.
3. Monokote product contains approximately a maximum of 39% expanded vermiculite, 56-60% gypsum and a minor amount (4%) of organic materials. The only asbestos containing ingredient is vermiculite. Since the tremolite content of the expanded vermiculite is about 0.5%, Monokote products will have less than 0.2% tremolite by computation. Laboratory analysis shown in Table 2 confirms the computed results.

4. We are continuously improving the techniques for these analyses such as to determine the ratio of platy form vs. fibrous form of tremolite, to distinguish the fibrous tremolite vs. other fibrous-like minerals such as hornblende and contaminants which may lead to more accurate resolutions and identifications. In addition, we are trying to determine the number of samples required to give a statistically reliable analysis.

Julie C. Yang
Julie C. Yang

JCY:web

Table 1 - Analysis of Expanded Vermiculite

No.	Identification No.	Description of Samples		(%) Tremolite Content Analyzed By:	
		Location of Ore	Locations of Expanding	ADL	JM
1	22203-2	South Carolina	Trenton	0.30	-
2	22203-9	Montana	East Hampton	0.80	0
3	22203-10	Montana	Denver	0.65	-
4	22203-11	South Carolina	Little Rock	<0.2, 0.45	-
5	22203-12	South Carolina	Enoree	<0.2	0
Average:				ADL 0.43	JM 0
				Total 0.33	

Table 2 - Analysis of Monokote Products

No.	Identification No.	Description of Samples		Tremolite Content Analyzed By:	
		Location of Ore	Location of Monokote	ADL	JM
11	22203-9	Montana	Denver	0	-
12	22203-10	Montana	Los Angeles	0	-
13	22203-11	Montana	Waukegan	0	-
14	22203-12	Montana	Oregon	0	-
15	22203-1	Montana	East Hampton	0.3	0
16	22203-2	Montana	Denver	<0.2	-
17	22203-3	South Carolina	Little Rock	0.2, <0.2	-

Average - Total: 0.2

Research file
(see also Asbestos file)

CAMBRIDGE

RECEIVED

JUL 31 1973

CONSTRUCTED BY SUBJECTS DIVISION
H. A. C.

TO: H. A. Brown

DATE:

02815456 1973

FROM: H. C. Duecker

SUBJECT:

Asbestos in
Vermiculite and MONO-KOTE
Ref: Yang's 6/26/73 memo,
Brown's 7/10/73 memo

CC: R. M. Vining

Normally, the analyses of tremolite in MONO-KOTE and vermiculite are given only by ore sources. Yang's memo of June 26, 1973 was a compilation of data to be submitted to the EPA with the intention of showing that MONO-KOTE contained no more than trace quantities of tremolite. To be accurate, all analyses had to be considered. The picture regarding the relative tremolite contents of Enoree and Libby vermiculite is not clear to us at this time and the data were purposely presented as they were in view of the following facts:

1. Using our x-ray diffraction technique, tremolite has thus far been detected only in MONO-KOTE made with Enoree vermiculite. No tremolite has been detected in any analysis of MONO-KOTE made with Libby vermiculite. (Correction: 1 sample with tremolite)
2. Microscopic examination of the Enoree MONO-KOTE samples which contain tremolite shows that at least some of this tremolite is present in the fiber form.
3. We have not yet developed a technique for determining the ratio of platy to fibrous tremolite within a sample of MONO-KOTE or vermiculite, and therefore cannot make further statements in scientific confidence.

It is our opinion that:

- a. The platy tremolite of the Enoree deposit is higher than the platy content of the Libby deposit.
- b. Platy tremolite is more difficult to separate from platy vermiculite (in the milling process) than is fibrous tremolite.
- c. The platy tremolite has some tendency to fragment upon expansion, giving some tremolite falling within the fibrous definition. However, we believe that the majority of the tremolite remains in the platy form.

In conclusion, it is our opinion that Libby and Enoree MONO-KOTE may contain trace amounts of fibrous tremolite at concentrations less than the limit of detection using the x-ray diffraction technique. Enoree MONO-KOTE may also contain platy tremolite. The average content of the total tremolite in MONO-KOTE is about 0.2-0.5%. (Due to the inhomogeneity of the product and day to day variation, individual samples may give higher values, but an entire bag of MONO-KOTE probably never contains more than 0.2-0.5% total tremolite.)

Duecker

H. C. Duecker

HCD:mlr

EXHIBIT

PX-21 for
3-18-88

cc: Julie C. Yang
112 - Rem-27
HR
CAMBRIDGE

29526

TO: O. F. Stewart, Enoree, S.C. DATE: August 31, 1973

FROM: Julie C. Yang

SUBJECT: Tremolite Determination
in South Carolina Vermiculite Ores

CC: R. M. Vinning
H. A. Brown
T. Lyall
W. F. McCord
J. L. Wright
H. C. Duecker
A. M. Rosenberg

FILE: 150 - Asbestos Determination in Vermiculite Ores

TABLE OF CONTENTS:

Objective
Summary
Material Received
Experimental Work
Discussion of Results
Conclusion
Recommendations for Added Study
Appendix 1
Table 1
Figures 1 to 7

OBJECTIVE:

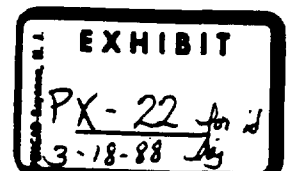
To determine the tremolite content in S.C. vermiculite ores at various locations.

SUMMARY:

Instrumental means were employed to determine the asbestos content in S.C. ores. The findings are listed as follows:

1. There are asbestiform fibers present in S.C. ores, but mostly very fine and small. All the identifiable fibers are hornblende, an aluminum-rich amphibole. So far no information has been published to indicate whether this material is detrimental to health or not, as of other types of amphiboles (tremolite, crocidolite and amosite) and chrysotile asbestos.

2. The only detectable difference between Allen and Waldrup type specimens from the same location (Pool #7) is that the Allen type has relatively higher talc and hornblende contents than the Waldrup sample.



MATERIALS RECEIVED:

The following samples were submitted from O. F. Stewart, Enoree, S.C. at R. M. Vinning's request for tremolite analysis:

<u>Sample No.</u>	<u>Deposit</u>	<u>Type</u>
22210-1	Poole #7	Allen
2	Poole #7	Waldrup
3	Allen	Allen
4	Poole #3	
5	Burns	Waldrup
6	Meadows	Waldrup
7	Yarborough	Waldrup
8	Lanford	Waldrup

EXPERIMENTAL WORK:Instrumental Methods Employed

X-Ray Diffraction

A rapid, non destructive method to identify crystalline materials such as mineral species

Scanning Electron Microscope (SEM)

To study the morphology of particules

Optical Microscopy

To identify individual particules by its optical properties

Electron Probe Analysis (EPA)

To analyze the elements present and the relative quantities of them

DISCUSSION OF RESULTS:

The instrumental analyses were done at Arthur D. Little, Inc. by Dr. E. Peters and his colleagues, the interpretations were made by J. C. Yang in collaboration with E. Peters.

1. X-Ray Diffraction Data

The ore samples as received showed an intense x-ray diffraction peak at 20-23.5°. The position employed for our previous quantitative measurement of tremolite in Monokote[®] and expanded vermiculite from Libby mine. Attempts were made to expand the vermiculite 1) chemically with conc. hydrogen peroxide and 2) thermally for 3 minutes at 1400°F, but in the expanded samples the unwanted peak at 23.5° persisted. It

was then decided to perform the x-ray diffraction analysis to provide identification and quantitative estimates of the mineral species present, and to examine the fibers in several samples by scanning electron microscope. If fibers were present, they would be identified by the optical properties and electron probe analysis for its elemental ratio.

The mineral species in the samples were analyzed and tabulated in Table 1.

All the samples were found to have x-ray diffraction peaks that correspond to hornblende or tremolite. Based upon the diffraction peak at 8.40 Å hornblende line, the quantity of hornblende in various samples were estimated and incorporated with other results in Table 1. The distinction between hornblende and tremolite, as well as whether they are in platy or fibrous form was then determined by SEM and EPA.

2. Scanning Electron Microscopic (SEM) Examination and Electron Probe Analysis (EPA)

A few representative photographs and profiles for the elements present are shown in Figs. 1 to 5.

Elements corresponding to various peak position are:

Mg	1.25	K	3.30	Ti	4.55
Al	1.47	Ca	3.70	Fe	6.40
Si	1.75	Ca	4.05	Fe	7.05

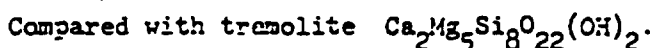
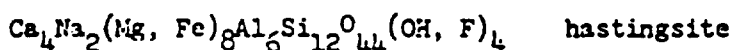
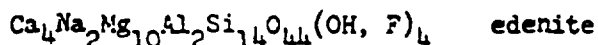
Several fibrous particles were observed in each sample by SEM. The chemical composition by the probe analysis showed that the elemental ratio of 5Mg-1Al-16Si-4Ca, whereas the tremolite standard from Libby yielded a relative ratio of 5Mg-20Si-1K-3Ca. It thus appeared the analyzed fibers were hornblende instead of tremolite as we suspected. Other non-fibrous particles showed the typical ratio of 2Mg-1Al-5Si (Vermiculite) with occasional replacement of some or all of the Mg by K (hydrobiotite).

3. Optical Examinations

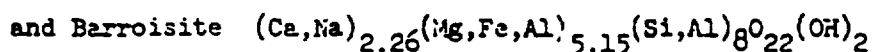
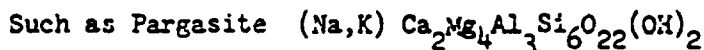
Two of the samples 22210-2, Poole #7 (Waldrup) and 22210-6, Meadows (Waldrup) were examined by optical microscope, utilizing the Montana tremolite sample as a standard. Observed fibers were found to have the refractive indices in the range of those of hornblende (measure $n_x = 1.623, 1.648$) which are considerably higher than the values for tremolite ($n_x = 1.599, 1.625$).

4. Chemistry of Hornblende

Hornblende series is a family in the amphibole asbestos group which shows a considerable variation in composition. The principle features of the composition are the presence of both Ca and Na or K, the former dominating, the Al is partially substituted for Mg and Si, and most of the members are deficient in silica. The composition of the series may be expressed by the two end members:



Fluorine commonly enters into the composition to replace OH in part, Mg by FeII, Al by FeIII, as do Ti and Mu for cations.



are the intermediate members.

These minerals are monoclinic in crystal structure, and have fiber-like appearance but usually very chunky (low aspect ratio). These are soft and easily pulverizable like clay minerals, and quite different from either the harsh Mg-amphibole, tremolite; Fe-amphibole, crocidolite and Fe-Mg amphibole, amosite or from the silky, flexible chrysotile asbestos fibers.

No known literature published to date has been found discussing the effect of hornblende to health.

CONCLUSIONS:

1. All the S.C. ore samples analyzed are very similar in mineral compositions. All of them are rich in vermiculite and hydrobiotite with minor amounts of hornblende, talc and quartz.

2. All samples examined contain asbestiform fibers that have been identified as hornblende, an Al-rich amphibole, which are fiber-like under light and electron microscope. This material is, at this time, an unknown health hazard.

3. The difference of Allen & Waldrup type specimens from the same location is the relative talc and hornblende content. Allen type seems to be richer in both.

4. The SEM preparation procedure tends to emphasize the smallest size particles, so that the method is not quantitative. Of all these samples examined, 22210-2, Poole #7 (Waldrup) appeared to contain the largest fraction of fibers.

RECOMMENDATIONS FOR ADDED STUDY:

Since hornblende is a fibrous amphibole, the carcinogenic potential of this material has not yet been found in any literature, but it may be questioned in the future because of composition and structure closely associated with tremolite and other amphiboles. It is suggested to contact outside agencies to have an animal study made on the potential carcinogenic effects of hornblende, compared with tremolite and chrysotile fibers. Usually, the test will take one to two years, but by then we will know for sure whether this material exhibits any cancer-inducing potential.

Agencies and Institutions equipped to do this type of work:

1. Huntingdon Research Center
Huntingdon, England
- where the carcinogenic screening of vermiculite (S.A.) was done in 1970-1972.
2. Dr. Lewis J. Cralley
Occupational Health Program
National Center for Urban and Industrial Health
Public Health Service
1014 Broadway
Cincinnati, Ohio 45202
- previous contact, had studied amphiboles and chrysotile of various length, pure synthetic chrysotile and chrysotile with added Ni, Fe, Co, etc. in the structure.
3. Dr. Paul Gross M.D.
Industrial Hygiene Research Unit
Dept. of Occupational Health
Graduate School of Public Health
University of Pittsburgh
Pittsburgh, Pa. 15213
- previous contact, did similar studies as Dr. Cralley.

Julie C. Yang
Julie C. Yang

TABLE 1

0/32/13

29531

DETERMINATION OF MINERAL COMPONENTS PRESENT
IN SOUTH CAROLINA VERMICULITE ORE
(BY X-RAY DIFFRACTION METHOD)

<u>SAMPLE NO.</u>	<u>DESCRIPTION</u>	<u>VERMI- CULITE</u>	<u>HYDRO- BIOTITE</u>	<u>HORNBLLENDE TREMOLITE</u>	<u>TALC</u>	<u>QUARTZ</u>
22210-1	Poole #7 (Allen)	+++	+++	++ (10-20%)*	++	+
2	Poole #7 (Waldrup)	++	+++	+ (2-5%)	?	Trace
3	Allen (Allen)	+++	+++	+ (5-10%)	+++	-
4	Poole #3	+++	+++	+ (2-5%)	++	+
6	Meadows (Waldrup)	++	+++	++ (10-20%)	-	Trace

Legend:

+++	Major	(> 50%)
++	Intermediate	(10-40%)
+	Minor	(1-9%)
?	Doubtful	(< 1%)
-	None	

* The percentage of hornblende in the parenthesis was determined by the intensity of $2\theta = 8.40^\circ$.

8/31/73

Figure 1 SEM AND ELECTRON PROBE ANALYSIS OF SAMPLE 22210-1

29532

Poole #7, S.C. (Allen)



(1000 X)

2005E-12802INT											
US-1000000-28EV/CM											
1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81	82	83	84
85	86	87	88	89	90	91	92	93	94	95	96
97	98	99	100	101	102	103	104	105	106	107	108
109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132
133	134	135	136	137	138	139	140	141	142	143	144
145	146	147	148	149	150	151	152	153	154	155	156
157	158	159	160	161	162	163	164	165	166	167	168
169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192
193	194	195	196	197	198	199	200	201	202	203	204
205	206	207	208	209	210	211	212	213	214	215	216
217	218	219	220	221	222	223	224	225	226	227	228
229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252
253	254	255	256	257	258	259	260	261	262	263	264
265	266	267	268	269	270	271	272	273	274	275	276
277	278	279	280	281	282	283	284	285	286	287	288
289	290	291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310	311	312
313	314	315	316	317	318	319	320	321	322	323	324
325	326	327	328	329	330	331	332	333	334	335	336
337	338	339	340	341	342	343	344	345	346	347	348
349	350	351	352	353	354	355	356	357	358	359	360
361	362	363	364	365	366	367	368	369	370	371	372
373	374	375	376	377	378	379	380	381	382	383	384
385	386	387	388	389	390	391	392	393	394	395	396
397	398	399	400	401	402	403	404	405	406	407	408
409	410	411	412	413	414	415	416	417	418	419	420
421	422	423	424	425	426	427	428	429	430	431	432
433	434	435	436	437	438	439	440	441	442	443	444
445	446	447	448	449	450	451	452	453	454	455	456
457	458	459	460	461	462	463	464	465	466	467	468
469	470	471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490	491	492
493	494	495	496	497	498	499	500	501	502	503	504
505	506	507	508	509	510	511	512	513	514	515	516
517	518	519	520	521	522	523	524	525	526	527	528
529	530	531	532	533	534	535	536	537	538	539	540
541	542	543	544	545	546	547	548	549	550	551	552
553	554	555	556	557	558	559	560	561	562	563	564
565	566	567	568	569	570	571	572	573	574	575	576
577	578	579	580	581	582	583	584	585	586	587	588
589	590	591	592	593	594	595	596	597	598	599	600
601	602	603	604	605	606	607	608	609	610	611	612
613	614	615	616	617	618	619	620	621	622	623	624
625	626	627	628	629	630	631	632	633	634	635	636
637	638	639	640	641	642	643	644	645	646	647	648
649	650	651	652	653	654	655	656	657	658	659	660
661	662	663	664	665	666	667	668	669	670	671	672
673	674	675	676	677	678	679	680	681	682	683	684
685	686	687	688	689	690	691	692	693	694	695	696
697	698	699	700	701	702	703	704	705	706	707	708
709	710	711	712	713	714	715	716	717	718	719	720
721	722	723	724	725	726	727	728	729	730	731	732
733	734	735	736	737	738	739	740	741	742	743	744
745	746	747	748	749	750	751	752	753	754	755	756
757	758	759	760	761	762	763	764	765	766	767	768
769	770	771	772	773	774	775	776	777	778	779	780
781	782	783	784	785	786	787	788	789	790	791	792
793	794	795	796	797	798	799	800	801	802	803	804
805	806	807	808	809	810	811	812	813	814	815	816
817	818	819	820	821	822	823	824	825	826	827	828
829	830	831	832	833	834	835	836	837	838	839	840
841	842	843	844	845	846	847	848	849	850	851	852
853	854	855	856	857	858	859	860	861	862	863	864
865	866	867	868	869	870	871	872	873	874	875	876
877	878	879	880	881	882	883	884	885	886	887	888
889	890	891	892	893	894	895	896	897	898	899	900
901	902	903	904	905	906	907	908	909	910	911	912
913	914	915	916	917	918	919	920	921	922	923	924
925	926	927	928	929	930	931	932	933	934	935	936
937	938	939	940	941	942	943	944	945	946	947	948
949	950	951	952	953	954	955	956	957	958	959	960
961	962	963	964	965	966	967	968	969	970	971	972
973	974	975	976	977	978	979	980	981	982	983	984
985	986	987	988	989	990	991	992	993	994	995	996
997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008
1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020
1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032
1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044
1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056
1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068
1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080
1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092
1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104
1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116
1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128
1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140
1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152
1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164
1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176
1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188
1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200
1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212
1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224
1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236
1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248
1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260
1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272
1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284
1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296
1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308
1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320
1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332
1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344
1345	1346	1347	1348	1349	1350	1351	1352	1353	1354	1355	1356
1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368
1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380
1381	1382										

Figure 2 SEM AND ELECTRON PROBE ANALYSIS OF SAMPLE 22210-2

2953

Poole #7, S.C. (Waldrup)



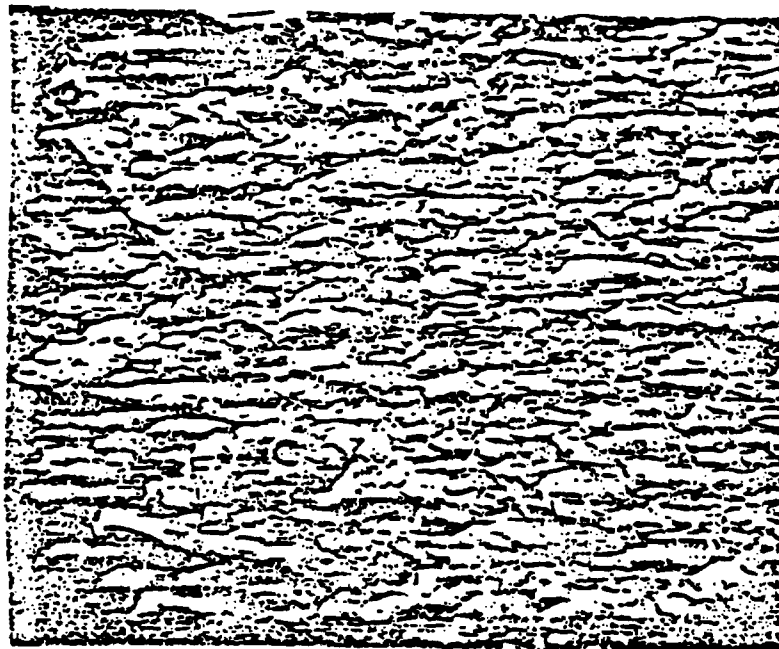
(1000 X)



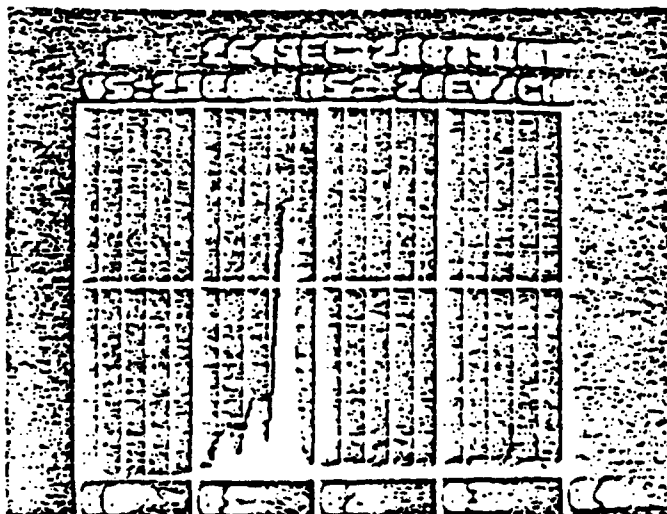
Figure 3 SEM AND ELECTRON PROBE ANALYSIS OF SAMPLE 22210-3

29534

Allen, S.C. (Allen)



(1000 X)



07/31/13

Figure 4 SEM AND ELECTRON PROBE ANALYSIS OF SAMPLE 22210-6

2953

Meadows, S.C.



(1000 X)

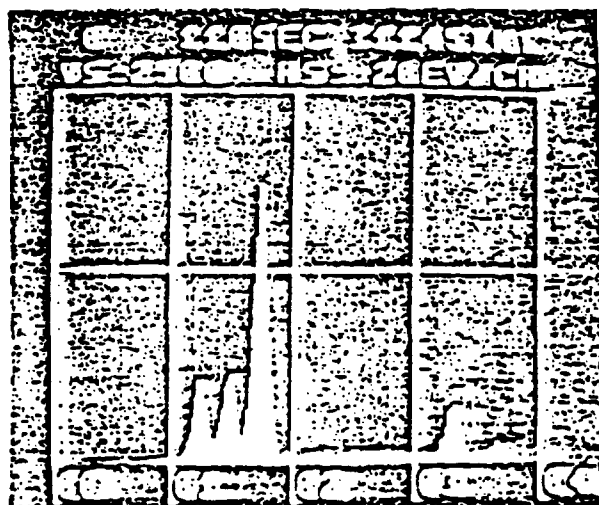
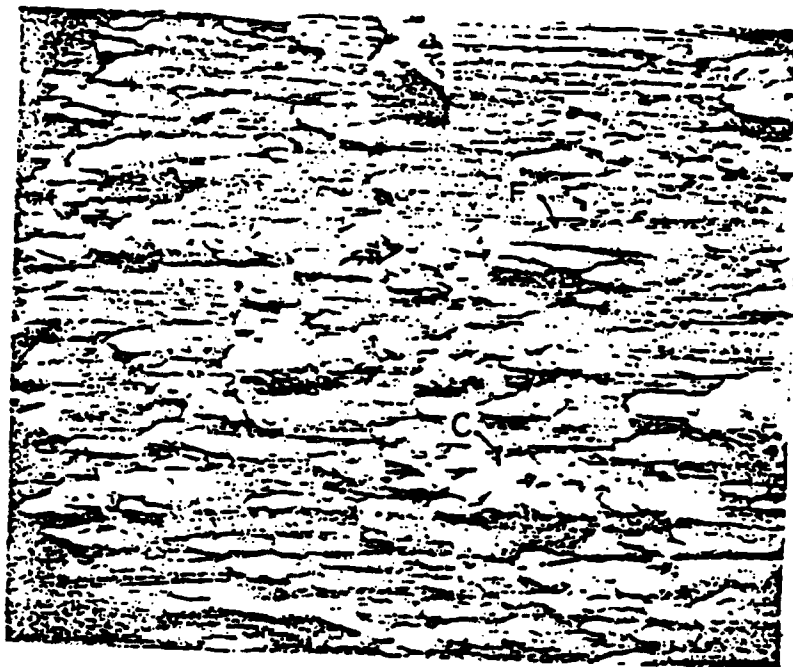


Figure 5 SEM AND ELECTRON PROBE ANALYSIS OF SAMPLE 22210-8

Lanford, S.C. (Waldrup)



(1000 X)

