IN THE UNITED STATES DISTRICT COURT

FOR THE EASTERN DISTRICT OF TEXAS

BEAUMONT DIVISION

CLARENCE BOREL

VS.

FIREBOARD PAPER PRODUCTS CORPORATION, ET AL

CIVIL ACTION NO. 6449.

DEPOSITION OF DR. WILLIAM CLARK COOPER.

(ORIGINAL).

FILED
U. S. DISTRICT COURT
EASTERN DISTRICT OF TEXAS
SEP 20 1971
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ODESSA J. SMITH
SHORTHAND COURT REPORTER
BEAUMONT, TEXAS

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CLARENCE BOREL	X	
VS.	X	
FIBREBOARD PAPER PRODUCTS	X	CIVIL ACTION NO. 6449
CORPORATION, ET AL	X	

* * * * * * *

DEPOSITION AND ANSWERS OF DR. WILLIAM CLARK COOPER, who resides in El Cerrito, California, witness for defendants, taken on the 31st day of August, 1971, before me, Odessa J. Smith, Court Reporter and/or Notary Public in and for the County of Jefferson, in the State of Texas, at the offices of Weller, Wheelus, Green & Brocato at Beaumont, Texas, beginning at 10:00 o'clock A.M., of said day, in accordance with the accompanying notice. And the said Dr. William Clark Cooper, the witness named in said notice, personally appeared before me to depose in said suit pending in the District Court ofthe United States for the Eastern District of Texas, Beaumont Division, wherein Thelma Borel, et al, are plaintiffs, and Fibreboard Paper Products Corporation, et al, are defendants; and that I was then and there attended by Ward Stephenson of the law firm of Stephenson and Thompson, Orange, Texas, Attorneys for Plaintiffs, and by the following named attorneys for the defendants, to-wit: Mr. Geo. A. Weller,

ODESSA J. SMITH
Shorthand Court Reporter
Beaumont, Texas

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of the law firm of Weller, Wheelus, Breen & Brocato, for Fibreboard Paper Products Corporation; Charles S. Pipkin, of the law firm of Strong, Pipkin, Nelson, Parker & Powers, for Combustion Engineering, Inc.; Ben L. Reynolds, of the law firm of Royston, Rayzor & Cook, 1 Shell Plaza, Houston, Texas 77002, and Frank A. Bean of the law firm of Manning & Bean, Houston, Texas, for Eagle-Picher Industries, Inc.; Gordon R. Pate, and John Tucker of the law firm of Orgain, Bell & Tucker, for Johns-Manville Products Corporation; George Duncan of the law firm of Wells, Duncan, Beard, Greenberg & Hunt, for Pittsburgh Corning Corporation; Steve Rienstra of the law firm of Rienstra, Rienstra & Dowell, for Owens Corning Fiberglas Corporation; W. N. Arnold, Jr., of the law firm of Fulbright, Crooker & Jaworski, Bank of the Southwest Building, Houston, Texas 77002, for Philip Carey Corporation and Armstrong Cork Company; Gerald P. Coley, of the law firm of Vinson, Elkins, Searls & Smith, First City National Bank Bldg., Houston,Texas 77002, for Unarco Industries, Inc.; Robert E. Barnes of the law firm of Barnes & Barnes, for Ruberoid Company, a Division of GAF Corporation; James W. Mehaffy, Sr., of the law firm of Mehaffy, Weber, Keith & Gonsoulin, for Standard Asbestos Manufacturing and Insulating Company; and it was stipulated by said attorneys that all objections should be made at the time of the taking of the deposition, and that the reading of the

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deposition by the witness and signing of same by him being waived; and that the said deposition, or any part thereof, may be used on the trial of this cause with the same force and effect as if the witness were present in court and testifying in person; and the said Dr. William Clark Cooper, being by me first carefully examined, cautioned and sworn to tell the truth, the whole truth and nothing but the truth, touching his knowledge of the matters and things in controversy in said cause, deposes and says as follows, to-wit:

* * * * * * *

ODESSA J. SMITH
Shorthand Court Reporter
Beaumont, Texas

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DR. WILLIAM CLARK COOPER, having been first duly sworn, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. WELLER:

Q. What is your name, please?

A. William Clark Cooper.

Q. What is your profession?

A. I am a physician.

Q. Where do you presently reside?

A. I reside at El Cerrito, California, near Berkeley, California.

Q. Where are you licensed to practice medicine?

A. In the State of California.

Q. Is your license to practice duly recorded with the proper authorities there to permit you to practice?

A. It is.

Q. Doctor, will you give us your educational background and also the history of your medical training?

A. I graduated from high school in San Antonio, Texas, in 1928. I went to pre-medical school and medical school at the University of Virginia at Charlottesville, where I graduated in 1934, with an MD. I had my internship and residency training in medicine at the University Hospital in Cleveland, Ohio, in 1937. I went to the University of Cincinnati where I did research in

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nutrition and vitamin research. From 1937 until 1940 I was in the Medical Department of the U. S. Army, and also doing research at Walter Reed Hospital in Washington, D. C. In 1940 I joined the Public Health Service and was a member of the Public Health Service from 1940 until 1963. During that time I served approximately eight years at the National Institute of Health working in malaria and continuing clinical work in internal medicine. I got my Specialty Boards in internal medicine in 1948, and in 1950 I was transferred by the Public Health Service to San Francisco where I was deputy chief of the Medical Service at the Public Health Service Hospital. At that time I became particularly interested in pulmonary diseases and was assigned to the pulmonary disease service of the Pulmonary Disease Ward in the hospital. In 1952 I was transferred to Cincinnati, Ohio, and made chief of the Public Health Service Occupational Disease Laboratory, and I was chief of this laboratory from 1952 until 1957. During those five years I was particularly interested in studies of pulmonary diseases and carried out studies of lung diseases and diatomaceous earth, and carried out studies on uranium miners, hard rock miners, and silicosis, and organized some of the studies on coal miners.

Q. All right.

A. Then I -- in 1957 until 1958, I spent a year at Harvard where I received a degree of Master of Public Health

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(MPH), with emphasis on industrial hygiene. After that I was assigned to Washington, D.C., where I was in the headquarters of the United States Public Health Service, Division of Public Health, and in 1962 I was made chief of that division, and was chief of that division until I retired in 1963. In 1962 I took examination for and was certified by the American Board for Preventive Medicine and Occupational Medicine.

Q. That was in 1962?

A. 1962.

Q. All right, now would you tell us since your retirement from the Public Health Service -- first, what status did you occupy in the Public Health Service in Washington when you retired?

A. I was Chief of the Division of Occupational Health.

Q. And how long had you been chief of that division?

A. I was chief of that for a year and a half. I had been Deputy Chief for a previous period.

Q. All right, I think the term Chief of the Division of Occupational Health speaks for itself, but for the benefit of the jury tell us what that involves.

A. It involves the responsibility of all Public Health Service and services in the PO diseases. We had a budget

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which we thought was quite inadequate, but it was in the neighborhood of four to five to six million dollars, and we had a staff that ranged from one hundred to two hundred people all the time I was there.

Q. Doctor, what is the National Institute of Health?

A. The National Institute of Health is a group of research institutes mainly located at Bethesda, Maryland, which have been the research branch in medical sciences of the Public Health Services, the combined research, and it has been the major vehicle through which medical research has been carried out in the United States since World War II.

Q. All right, and this is a Government supported agency?

A. Yes.

Q. Since your retirement from the Public Health Service in 1963, would you tell us the sphere of your activity since that time?

A. When I left the Public Health Service I was appointed to the faculty of the University of California at Berkeley in the School of Public Health. My first appointment was as research professor, and I subsequently had my title changed to professor of Occupational Health, and my work has involved teaching graduate students in the field of Occupational and Environmental Health, and supervising and carrying out research in occupational

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health with particular emphasis on lung diseases, and with particular emphasis on asbestos and asbestos effects.

Q. All right, have you had any -- occupied any outside consulting positions since your retirement from the Public Health Service?

A. I have been a number of times a consultant to the Public Health Service, and I am a consultant to the Atomic Energy Commission in connection with medical problems in the western states, and I am a member of the National Research Council's Committee on biological effects of air pollutants, and in the last year have served as the chairman of the panel on asbestos and the effects of asbestos of the National Council.

Q. All right, have you since -- prior to 1963 did you make any studies in regard to the effects of the use of asbestos and occupational diseases and so forth?

A. I did not personally carry them out but I was involved in some of the discussions within the Public Health Service relating to the question of whether or not the Public Health Service should look and reinvestigate its position with regard to asbestos. This was in the period of 1961, 1962. There was confusion within the Public Health Service of whether or not it would be -- we had been correct in all of our assumptions with regard to asbestos up to that time.

Q. All right, now what month did you retire in 1963?

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A. September, 1963.

Q. All right, after September, 1963, did you participate in any research projects concerning asbestos or asbestos dust in relation to any particular phase of that industry?

A. I did not begin work in asbestos until sometime in 1964. I am not certain of the date. My first year I got to the University, I spent working on pesticides and some of the problems of organic results of pesticides, and I continued to be interested in insulating workers, and it was in part due to my acquaintance with Dr. Selikoff, and also the fact that I had become aware during that period that insulating workers did have problems. In 1964, I felt it would be important to find out whether or not insulating workers on the west coast who dealt with somewhat different products than other parts of the world had the same problems that were being reported about that time by Dr. Selikoff, so in 1964 we began studies of insulating workers in the San Francisco area.

Q. All right. Now describe to us what studies that you did, and if you had any associates you might designate them with reference to asbestos insulation workers on the west coast.

A. On the west coast we had access to the records of the International Association of Heat and Frost Insulators and Asbestos Workers of America, otherwise known as the Asbestos Workers Union, which is the insulation workers union, and we

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conducted studies which essentially fell into two major areas. One was to determine the causes of death in insulation workers and compare them with the general population and, in other words, to study the effects on their health, and, secondly, to study the working environment of the insulating workers to see if we could define where their maximum exposures were occurring and make recommendations to prevent them. The first part of the study we also looked for asbestosis, that is the fibrous body changes in the lung that have long been known to result in asbestosis, and we also looked to see if there was an increase in lung cancer.

Q. Doctor, did you engage in any field tests to determine the dust conditions or dust counts which involved insulation workers?

A. We very definitely did do this because we felt that one of the things the group in New York had not paid attention to had been dust concentration, so we did make measurements of dust concentration on the jobs.

Q. All right, now prior to the time of your -- and I am going to ask you about that study, did you make a field study, a study out in the field that involved the conditions surrounding the asbestos workers?

A. That's the only way we could do.

Q. Surrounding the asbestos workers?

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A. Absolutely. We went into shops where asbestos insulating materials were being prefabricated, and we also went on actual jobsites and measured the dust concentration during the various states of the various types of work that an insulator did. We tried to estimate the amount of time he spent working with asbestos-containing materials as compared to other materials, and the amount of time he spent in the dusty parts of his job as compared to the non-dusty part. We also tried to develop recommendations as to how the dustier portions of this work could be eliminated or remedied.

Q. For whom did you make this research?

A. This was financed by the Public Health Service.

Q. Financed by the Public Health Service. All right, in the trade is there something known as threshold limit values?

A. Threshold limit values is a term that is used in the field of industrial hygiene which -- and every year a list of so-called TLV'S or threshold limit values is published by an organization known as the American Conference of Governmental Industrial Hygienists -- the American Conference of Governmental Industrial Hygienists.

Q. Now explain to us what the American Conference of Governmental Industrial Hygienists, who it is composed of.

A. I will use the term ACGIA from now on.

Q. All right.

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A. The ACGIA was formed immediately after World War II, around 1944 or 1945 as an organization of individuals who were officially responsible in some capacity for industrial hygiene. These people from the State Health Department, sometimes the State Labor Department, from the U. S. Public Health Service, and the U. S. Department of Labor and to a limited extent people from universities. This was a group which was a quasi-official, I mean it had no official status, but the Government people were very active in it and they did a number of -- had a number of functions relating to training and standards of people in the field of industrial hygiene and this function of establishing and making recommendations for what was a safe guideline or a work place was just one of their functions, and they had a committee, a standing committee I should say,which made annually recommendations which were then submitted to the entire membership in their annual meeting, and they would even debate and discuss and approve an annual list. This was intended as a guideline, it was not a regulation but it was a guideline to industry and other people who were trying to supervise industry as to what would be a safe limit. Now you might want to ask me what the definition of official limit value is.

Q. I do want you to tell the court and jury what threshold limit values are generally, and also tell us what it means insofar as asbestos dust is concerned.

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A. I will paraphrase slightly here, but the definition of threshold limit value was the average concentration of a substance to which it was believed that nearly all workers would be exposed eight hours a day, five days a week, for a working lifetime without harm, and it was a time-weighted average. By that I mean if a man worked two hours at a high level, then that could be balanced off by his working two hours below this, so that, roughly speaking, it was an average based upon combining all of his exposure. It was not a ceiling above which it could never go.

Q. All right, I want to show you here, and we will just call it Exhibit No. 1 to Dr. Cooper's definition, marked Threshold Limit Values for 1961. Are you familiar with this publication, sir?

A. I am. In fact, I was a member of the committee at the time this was published.

Q. All right, now is that the threshold limit values for air-borne contaminants that was recommended and published by the Committee in 1961?

A. It is.

Q. Doctor, what threshold limit values were published and recommended for asbestos?

A. The recommended limit then was five million particles per cubic foot.

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Q. All right, had that recommended value or threshold limit values for asbestos been recommended for a number of years prior to 1961?

A. 1961, it slipped my mind when it was actually first recommended. I would have to refresh my memory.

BY MR. STEPHENSON: 1947.

A. It was very early.

Q. Now referring to your study in San Francisco of the asbestos construction workers or the workers involved in applying asbestos in insulating materials, what did you find in your studies in regard to the dust count or the threshold limit values of asbestos dust in this research project?

A. We studied the dust concentration, using the method recommended here, which I have to stress is five million particles of all kinds of dust, not just asbestos fibers. We studied air concentrations using this method, and we also studied air concentrations using methods that had not been available when these things were developed which we actually studied fiber counts in the same air at the same time, and we found that the -- I have actual figures here that I could quote, but in our conclusions were that the average insulation workers or non-insulation workers were receiving average concentration at or below. Then if one applied the approved methods of averaging out their concentrations, we found that they had occasional peak

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concentration that exceeded these levels, and we -- but we were, I might say, surprised to some extent that the concentrations did not exceed it. I have the actual figures here.

Q. Doctor, you and your associate, I believe, wrote a report or published a report in this regard, did you not, about your research?

A. Yes, we have the report.

Q. Is that by Cooper --

A. Balzer and Cooper.

Q. Balzer and Cooper, and when was that published?

A. Oh, it happens that that particular one, I am not sure --

Q. Was it published after 1964?

A. Oh, yes, it was published something like 1968.

Q. 1968?

A. Yes, 1968.

Q. All right, in 1968. Now prior to your study had there been a study of asbestos insulation workers in shipyards?

A. There had been a study published by a group at Harvard by Fleischer and two other co-authors, and Professor Drinker, who, in 1946, had studied some naval shipyards in New England and had measured dust concentrations.

Q. All right, now without going into the details of that report, based upon your examination, did dust concentrations

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in shipyards involve a heavier concentration than the average asbestos worker who would be applying new asbestos products?

A. I think that the conditions in shipyards, particularly in refinishing ships, probably provided the heaviest exposure.

MR. STEPHENSON: I would object to that because it has not been shown he has any experience in industrial dust in shipyards and in shipbuilding.

Q. All right, according to the Fleischer-Drinker report of that research project, did you make any conclusion -- what did they report as to the dust counts found by them in naval shipyards?

A. Their general conclusions were they were not excessively high, but there were places where dust control was necessary.

Q. Did they indicate that the dust counts found by them were below the five million particles per cubic foot of air?

A. They were not using techniques that were strictly comparable to these but by a number of other studies which tied their time and place together, I think one can safely say that the conclusion was on the average theirs were not higher. Now I would have to make some conclusions based on more recent studies in shipyards by Farris, using the same instruments which Professor

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Drinker did. This sounds fairly complicated, but you cannot go from one instrument to another instrument in industrial hygiene and say that the count I get with this is the same as that because they have different sampling characteristics.

Q. All right, I will ask you, Doctor, if Fleischer and Drinker did not publish the results of their report that it was reasonably safe for asbestos workers to work in shipyards without any problem?

A. I will answer yes. Their report was of a nature which was interpreted as minimizing the importance of this type of exposure.

Q. Later wasn't there another research project in naval shipyards by 1964 which reached the same results?

A. Mr. Marr carried out studies of the Long Beach Naval Shipyard. He too came to the conclusion that the dust concentrations as they were -- that he found, were not excessively high except for some limited exposure, and also he came to the conclusion that using these rules they were not excessively high, but he did not -- he contained within his report his warning that maybe we were not either measuring the right thing or that our rules were not correct because he did also say that they received some lung cancer, and this was in 1964.

Q. All right, didn't Dr. Marr, based on his report or his research, state that the threshold limit values for dust

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asbestos workers in naval shipyards was below the five million particles per cubic foot?

A. I will have to consult his paper to see exactly what he said, because I have not refreshed my memory on it but his paper did indicate that if we applied this threshold limit value and accepted it as being okay, then the naval shipyard workers on the average were not being exposed above the TLV. That's the conclusion one would get from it but by 1964 we were becoming concerned ourselves whether or not we were correct in our threshold limit value.

Q. All right, Doctor, let me ask you this, as far as the publication of articles up to 1964, wasn't it correct that the recommended threshold limit value for asbestos dust in asbestos workers was five million particles of dust per cubic foot of air?

A. That's right, the answer is yes.

Q. And wasn't it found after this or at least not prior to 1964, that articles were beginning to be published raising some question about the validity of this threshold limit value?

MR. STPHENSON: I object to that as leading.

Q. You can answer the question. I will reframe it.

A. Yes.

Q. In 1964 were there any publications that made any

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recommendation in regard to the change of the threshold limit value of five million particles per cubic foot of air in relation to asbestos dust?

A. I know of none.

Q. All right, now are you familiar with the publications of Dr. Selikoff?

A. I think I have read most of them.

Q. Do you know Dr. Selikoff personally?

A. Quite well.

Q. When did Dr. Selikoff begin publications of articles in regard to asbestos and the potential hazards of asbestos dust?

A. I am not certain I know the first published ones. The first ones that came to my attention were in 1963 and 1964.

Q. Now, Doctor, were you interested in this from a scientific standpoint?

A. I was interested from a scientific and also an administrative and an official standpoint too because I had to make recommendations in regard to the Public Health Service and the Federal Government's attitude on it.

Q. All right, now so you had access generally to all of the scientific publications in this field, didn't you?

A. I tried to.

MR. STEPHENSON: I object to him leading.

Q. Did you have access to all the scientific and

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official publications in regard to occupational health?

A. We tried our best to do it. We tried to have access to them.

Q. All right, so in your position as Assistant Director of the Public Health of the United States --

A. Assistant Chief and the Chief of the Division of Occupational Health.

Q. All right, Chief of Occupational Health, is it a correct statement that there were no publications prior to 1963 which were in general circulation that would have given any notice that an industrial worker working with asbestos insulation in construction could not work safely where the dust count was within limits of five million particles per cubic foot?

A. As your question has finally been phrased I would have to say that we would have put them in a fairly low order of risk. We were in a period of developing knowledge, of increasing knowledge, in a very complicated field of relationships, so to reconstruct the order of general knowledge or any specific knowledge at any particular time requires consideration of the facts that when we are dealing with asbestos we are dealing with a number of different minerals, and there was even more controversy then, as there is now, as to whether or not these different types acted quite differently in the human body.

Q. You mean the different types of asbestos?

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A. Yes, sir. Asbestos is not a single substance. There are many different minerals that come under the generic term of asbestos, and there are three types of major industrial importance. Secondly, we are talking about a number of different kinds of effects. We are talking about the disease asbestosis which is a fibrosis of the lungs which can lead to respiratory failure, and this had been recognized as being a problem of the asbestos worker. It had been known since about 1900 and had been widely known since about 1924 or 1925, and it was toward the prevention of this effect that this threshold limit value that I have mentioned had been directed. The threshold limit value had been arrived at out of studies of asbestos textile workers, and the harmful effect that it was aimed at preventing was fibrosis of the lungs, and during the period from 19 -- it was only in 1947 that there had been any reports the textile workers carry a lung cancer risk. When I was working in the Public Health Service in 1953 to 1960 this for the textile workers and miners was a very debatable point, and it was during the period 1960, 1961, 1962 and 1963 that studies began which were finally published in 1963 and 1964 showing that insulation workers did have an increase, of course, of lung cancer. All this is saying when you separate these effects, the different kinds of asbestos and different trades, you have to realize this was a changing and a developing situation.

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Q. Doctor, is there a difference between a textile worker in a mill and the conditions under which he was working and the dust conditions under which he was working, and the dust conditions under which the asbestos insulation worker was working?

A. I think we all agree on that. All people working in the field would feel that these were different.

Q. All right, what difference was there back prior to 1947, with reference to the textile mills working with asbestos products?

A. Well, the difference is many. They can relate to the type of asbestos, the concentration of asbestos, and the constant exposure as compared to rare exposure, and the amounts of other substances which may be inhaled at the same time, so that the textile worker is on the average exposed to a more constant concentration of fibers of the same type, but there are many variations.

Q. Doctor, did they at that time come up with the recommendation that if a factory maintained a threshold limit of five million particles or less in these factories, that it was a reasonably safe limit?

A. Yes. The answer is yes. If dust control was reduced to the concentration of five million particles or less the evidence in the textile industry was that the problems were

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greatly reduced or eliminated.

Q. All right, when, in your opinion -- well, first, based on the reported studies and based on your own study, I will ask you if the conditions under which the average industrial insulation worker performed his work were such that the threshold limit values were below the five million particles per cubic foot --

A. By the definition of threshold limit value, that's the average. The insulation worker continued to have high peaks, and we still do not really know the relative importance of those surges and peaks, so that his exposure was of a different kind. That's all we can say. So using the best knowledge, as to knowledge, it would be all right, but I think it would be improper to say that it was all right, because events have shown that it wasn't all right.

Q. Doctor, I'm taking you now back to 1961, assuming what was known in 1961 in relation to the asbestos insulation worker who worked in the field, I will ask you if the dust counts were maintained or if the conditions under which he worked and experiment showed that the threshold limit value of dust was below five million particles of air per cubic foot, that it was reasonably safe for the industrial worker to work with products that could have contained some asbestos?

MR. STEPHENSON: That's a multiple question. It is more than one

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question in one.

Q. Go ahead, you can answer it.

A. I am trying to recall where to break into that.

Q. Doctor, assuming the knowledge that was generally available in 1961, and assuming that the experiments done in the field of industrial insulation worker showed that the threshold limit values were below five million particles per cubic foot of air, was it reasonably safe, based upon your knowledge at that time for these workers to participate in work with products containing some asbestos?

MR. STEPHENSON: I object to that because it is an improper assumption, and the doctor has already stated that the workers in the field had high surges of concentration which exceeded five million particles per cubic foot.

Q. Go ahead, Doctor, you can answer the question.

A. I will answer that by saying if an industrial hygienist had been given the type of dust counts that were being experienced by the insulation worker and had the knowledge that the materials he was working with contained twelve to fifteen percent asbestos, I would have felt that he was in a low order of risk compared with many other people exposed to asbestos. In other words, it would not have been regarded as a dangerous level of exposure. Again I say this was a defect of knowledge at that time.

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Q. This lack of knowledge was general in the industry, wasn't it?

A. I think in this connection the British who had set up elaborate asbestos regulations which did control asbestos in the textile industry did not set up regulations covering uses such as we are talking about here until well up into the 1960's. In other words, the asbestos regulations had greatly reduced exposures and disease and the asbestos textile industry had not been translated into the insulation workers, and in fact, in 1963, two doctors, Leathart and Sanderson, reported on the situation in Great Britain and showed that insulation workers were beginning to be a major asbestos problem in Great Britain because they had not been covered by these regulations alone, which I think reflects again a lack of attention and a lack of knowledge as to this being a problem.

Q. Doctor, did the threshold limit value recommended by the American Conference of Governmental Industrial Hygienists remain at five million particles per cubic foor of air until the year 1970?

A. In 1968 a recommended change was made to two million particles if they counted all the dust, or twelve fibers per cubic centimeter if you used another method which depended upon collecting air samples from a so-called membrane filter.

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Q. Doctor, that was recommended but didn't the recommendation for this remain in effect for two years?

A. It was a tentative level for two years.

Q. All right, I show you Exhibit 2, Threshold Limit Values of Air-Borne Contaminants for 1968, Recommended and Intended Values. Doctor, are you familiar with that publication?

A. I am.

Q. Then was 1968 the first recommended change in the threshold limit value for asbestos, of dust containing some asbestos?

A. Yes, it was so far as I know.

Q. All right, and actually --

A. As I say, the answer to that is yes.

Q. All right, then up until that recommendation, the recommendation was five million particles per cubic foot of air?

A. Total dust.

Q. Total dust, all right. Now were the people who were connected with this American Association of Industrial Hygienists, did they represent the people in the United States who were concerned with the problem of occupational health?

A. It included the people who were officially concerned, and it had -- it solicited information from all people and made these recommendations available rather widely for comment prior to their publication.

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Q. Now did the Department of Public Health publish these recommended values, threshold limit values?

A. Not the Department of Public Health. These were published by the American Conference of Industrial Hygiene. They were used by the Public Health Service when they were asked for recommendations as to guidelines. There were no official Public Health regulations relating to industrial concentrations.

Q. But if a manufacturer of asbestos products had consulted the Public Health Service of the United States and asked what their recommendation was on dust counts, they would have received this material?

A. They would have received this material, and the Department of Labor would be given it. In fact the Department of Labor included it in the publication for Government supply contracts.

Q. All right, so these standards were recognized in the industry throughout the United States?

A. Yes, correct.

Q. Likewise, they have been recognized in England?

A. They have been widely copied and used all over the world. The English know of our special concern in the textile industry about this same period, 1967 and 1968, and they were developing some regulations of its own.

Q. All right, Doctor, then if a manufacturer of

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products containing some asbestos, twelve to fifteen percent of asbestos, had made inquiry, would he have found that the recommended values -- dust count values up to 1967 was five million particles per cubic foot of air?

MR. STEPHENSON: I object. It doesn't identify a beginning date.

Q. Well, from 1947 to 1955, when the Drinker report was made, I think that you have referred to it?

A. The answer is yes.

Q. All right. Now based upon the state of the generally accepted medical knowledge up until we will say 1962, was it recognized that a worker who worked under conditions where the threshold limit value were under five million particles per cubic foot of air was reasonably -- working in a reasonably safe industry?

A. It would depend a little bit upon one's understanding of the variable of human response of the uncertainty of threshold limit values as a guide. If one is sophisticated in the value, one would be less likely to rely upon any number as an indicator of safety. Therefore, as an individual, as a doctor and as scientifically interested in the field might be a different response than a person who was officially responsible as an inspector or one who was carrying this as an official function. One place is a break point between safety and non-

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safety, and at one point there is a midline. I don't want to give an answer I can't live with.

Q. Doctor, I am not asking you this from a strictly scientific standpoint, but from the standpoint of the generally accepted knowledge that was published at that time, was it generally accepted that if an asbestos construction worker was working in an area where the threshold limit values were below five million particles per cubic foot that it was reasonably safe?

A. Most people would have said that it was safe. Certainly, so far as asbestos is concerned, and any other thing, is very debatable.

Q. All right, asbestos disease per se had long been recognized as an occupational disease hazard, has it?

A. Yes.

Q. And it is covered by a number of our compensation laws. Now up until 1964, did we see very many cases of asbestosis, even in asbestos construction workers?

A. It depends on what you mean by many. When you consider the numbers of people employed, I think that up until 1964 we were seeing asbestosis in -- they were being reported, and considering the fact that the number of workers was not a huge crew, it was significant, but this was generally -- they were not -- the number of individuals becoming disabled did not

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seem to compare with the numbers that earlier had been employed by the textile industry, that's all I can say.

Q. All right.

A. When you say were we seeing any significant numbers, it would be unfair to say we were not because we were. It was becoming apparent in the early 1960's.

Q. All right, now, Doctor, up to, we will say 1962, was there any general knowledge that had been disseminated or published to the effect that the person using asbestos or who had been subject to asbestos dust could develop mesothelioma?

A. The answer is that in -- although there had been isolated case reports, I mean one case here and two cases there, from Europe and England, it was not until 1960 when a group of people in South Africa reported a series of mesothelioma cases that appeared to be associated with, with either working with or living near areas where crocidolite asbestos exposure occurred had the tumor which had hitherto before this been regarded as very rare.

Q. All right, was this in connection with a mine in that town?

A. It was a mining area, and many people were living on roads upon which this material had been used to build roads, and there was much of it in the soil in the area, but many had worked and handled or in processing of it, I have the paper

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here, but the essence of it was it called attention to a rare tumor which occurred in large numbers in an area where crocidolite asbestos was found.

Q. All right, crocidolite is blue asbestos, is it not?

A. Yes, sir, it is.

Q. Is there some opinion that crocidolite asbestos is more harmful than chrysotile or amocite?

A. Originally this was believed to be -- originally that was postulated that these cases in some way were especially related to crocidolite, and that one could not or should not translate those results in other forms of asbestos. It was found, however, that in other areas of South Africa, which also produced crocidolite, they did not find as high a number. It has also been found subsequently that there was some excess of these in places when workers had no crocidolite exposure, but this was the kind of knowledge that was developed in the period between 1960 and 1963 and 1964, so that, therefore, the first revelations I would say that we might be dealing with a problem of mesothelioma was lured by the uncertainty as to whether or not this was not a unique effect of crocidolite, and crocidolite is one used in insulating materials, so that the answer in 1962 was that the mesothelioma was a matter of concern and one that required careful study as it related to another type of asbestos exposure, and it

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was out of these studies this crocidolite was incidentally reported.

Q. All right, Doctor, you are talking that the scientists became concerned about that?

A. About that.

Q. Along in 1962, 1963 and 1964?

A. That is correct.

Q. And it was in that period that Dr. Selikoff began his studies in regard to asbestos construction workers?

A. Yes, he was beginning to accumulate enough data about 1963 and 1964 to be able to reach certain conclusions.

Q. All right, did Dr. Selikoff write his publications about 1964?

A. Yes, sir, he gave a report, I don't think it was widely circulated in 1963 at some meeting, but 1964 was his key publication.

Q. All right, Doctor, does talc cause conditions very similar to asbestosis?

A. To answer that question one has to define what one means by talc.

Q. All right.

A. I hate to be -- because talc in the sense of a mineral, pure talc, there is no evidence that it can or does produce changes like asbestosis, however, much commercial talc occurs in types which contain tremolite, which is

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form of asbestos, so while we are talking about talc in a commercial sense we may be talking about asbestos in a mineral sense, and these people exposed to that kind of talc, as in the talc mines of the type in New York State, developed lung changes which looked very much like asbestosis, you might classify pleural plaques. There is no indication that I know of that they have an increased exposure of talc is a very confusing subject, and it is one on which we are in a state of knowledge right now that might induce questions like this ten years from now that have been asked earlier.

Q. I see. All right, but talc powder or talc products are suspected as causing lung changes?

A. As causing lung changes but it would be absolutely wrong to combine all talcs or all sources of talc. You have to be discriminating on what you are talking about.

Q. Isn't there a threshold of talcs the same as for asbestos and other products?

A. Yes, there is, but I would have to refresh my memory on it.

MR. STEPHENSON: I object to that as immaterial. There is no talc involved in the cases before the court.

Q. Now, Dr. Cooper, based upon your knowledge and experience and knowledge in this field and based on all of the medical knowledge up to 1962, the published medical knowledge of

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1962 and 1963, can you reasonably be certain that the manufacturer of asbestos products containing twelve to fifteen percent of asbestos, insulation products, could not reasonably anticipate that the use of the product could cause serious bodily harm to an asbestos construction worker?

MR. STEPHENSON: Read the question, please. (Question read by the Reporter).

A. I think it is truthful to say that he had been led to believe by what appeared to be the low level of exposure and the low level of concentration that it probably would not produce serious effects.

MR. DUNCAN: By he, who are you talking about?

A. The manufacturer. I at that time was in a position of being an individual who was trying to look for sources of trouble, and that I was concerned with things -- that's why I became interested in it, the things we might not be handling with sufficient care, so if you ask me at that time I would say we better look into this even though the evidence doesn't show it. That's why I became interested in it, and that's why I think you have to translate this into the different avenues of responsibility and comparing, and if you had asked me at that time, I would say that we better look into this. In fact, I was helping -- Dr. Selikoff came to the Public Health Service to get me to help him with his studies, and I endorsed those studies in 1961

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and 1962, which indicated that I was not satisfied.

Q. Referring to the same question to you, relating this to the manufacturer of the products containing some asbestos, could he, based upon the medical knowledge and the knowledge available, could he reasonably anticipate that the use of his product was reasonably safe?

A. I think the answer to that is he was not getting the information and he had no basis really for concern.

Q. All right, now you say the same --

A. I can only speak for my particular field. I think there are different levels of knowledge and sophistication in this as in everything else.

Q. Could we say this was true up to 1964?

A. Changes were occurring rapidly then.

Q. In 1964?

A. Changes were beginning to develop on that before 1964 and 1965. I think that it was -- we could say that we had not been -- that some of our assumptions were not correct.

Q. Doctor, when you made your experiment or research in San Francisco, and I believe you said it was in 1966?

A. Yes, we began in the latter part of 1964 and we continued. Our first report on our actual medical findings was not given until 1968 in the meeting at Bethesda.

A. I see. So you were still not fully satisfied

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when you continued your research in this particular field of the asbestos worker under the conditions under which he was working, were you?

A. I was not satisfied that there were no differences in the east coast and the west coast. By 1964 I felt Dr. Selikoff's figures were pretty solid, and I felt the insulation workers were suffering a special risk.

Q. All right, assuming that an individual began working as an insulator in the year 1936, and that he continued to work until 1969, a span of thirty-five years, and that he worked in the shipyards in his early days, and assume further that there has been a diagnosis in 1969 of asbestosis, 1969 or 1970, of asbestosis or mesothelioma or both in this individual, could you -- is there any way to tell when or which exposure over that period of thirty-five years that products containing asbestos caused or produced his condition of asbestosis or the condition of mesothelioma?

A. There is no way to tell absolutely. One can express -- make certain statements as a probability.

Q. All right, now, Doctor, assume that he had excesses, that he worked in shipyards and the shipyards generally during the war there were excessive exposures to asbestos dust, could you tell us how long it would take for asbestosis to develop or how long it would take -- well, I will say for

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asbestosis to develop first?

A. All right, a diagnosable asbestosis itself, asbestosis that you can detect by X-ray or by examination or impaired pulmonary function rarely occurs at the levels of exposure we see in insulating workers in less than fifteen to twenty years after the starting of exposure, and we see many who have been in the trade thirty and forty years who don't show it, so with regard to the asbestosis, it is a fibrosis of the lungs, a period of fifteen, twenty, twenty-five or thirty years is a normal length of time from the effective exposure to the appearance of the disease. That's all.

Q. All right, Doctor, if this individual had been removed from all exposures for the last ten years and he subsequently developed asbestosis would it have made any difference in the final results of his case?

MR. STEPHENSON: I object to that hypothesis. It is not based on any facts.

Q. Go ahead, Doctor, and answer it.

A. I would say asbestosis does progress after exposure is stopped.

Q. It does not progress?

A. It does progress.

Q. All right, it does progress. All right, so based upon your knowledge and experience and the research, if a man

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had been exposed to excessive asbestos dust twenty-five or thirty or thirty-five years ago, would you say what the most probable cause of his condition of asbestosis was?

A. I would have to answer that it is composition both of the intensity of exposure and the duration of the exposure, and particularly the length of time from the exposure to the present that determines one's decision as to probability and that is -- by that I am saying that a heavy exposure twenty-five years ago would be much more likely to be associated with an effect you can see today than a heavy exposure five years ago.

Q. All right.

A. So that it is a very interesting common factor -- one of the most interesting factors in regard to the asbestos effect is the long delay between exposure and apparent effect.

Q. All right, Doctor, assume that a man has been diagnosed in 1969 or 1970 as having mesothelioma, that he has worked in the asbestos construction insulation industry for some thirty-five years, beginning his career in a shipyard, what length of time does medical science recognize that it takes to develop the disease of mesothelioma or the condition of mesothelioma?

A. The common finding in all the cases of mesothelioma as to relate to asbestos to the time when the first contact with asbestos until the diagnosis of tumor or

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definitely tumor is very long. In a series that Dr. Selikoff reported in 1969, he had twenty-two cases of mesothelioma and the average length of time from first exposure to diagnosis or death was thirty-four-point-eight years. He had one case who had started work after 1930 in that series of twenty-two. Dr. Newhouse in England studied fifty-one cases and found that time ranged from sixteen to fifty-five years or an average of thirty-seven and a half years. Dr. Vodner, in the original series, reported some fifty-two over there and found the length of time first contact to development of diagnosis of the tumor was from twenty to forty years. McDaniel, in twenty-one cases in Canada, reported sixteen to fifty years, so that this is a fairly consistent finding of a very long interval. Therefore, one would have to regard it highly probable that exposure associated with the development of mesothelioma in an asbestos worker would not likely be those of recent years but much more likely to be those of fifteen, twenty and thirty years ago.

Q. All right, now, Doctor, is every case -- does every exposure to asbestos dust, no matter how minimal, produce asbestosis?

A. Not asbestosis that can be diagnosed or can be detected.

Q. All right, then if a person is diagnosed as having asbestosis in 1969 or 1970 after working thirty-five years as an asbestos insulation worker, could you as a man who has studied

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long in this field as a physician and researcher, is there any way that you can tell which exposure and which product caused or produced his condition of asbestosis?

A. I know I can't and I don't think anyone can.

Q. Is there any way that you as a physician and researcher could tell which exposure over a span of thirty-five years caused or produced mesothelioma, if it did?

A. My answer would be the same. I know I can't, and I don't think anyone can.

Q. Now, Doctor, if a man had been working in the industry, asbestos insulation industry, for some thirty-five years, the early part of his career being work in shipyards during the war, what would be the most probable cause of his condition of asbestosis which is finally diagnosed in 1969 or 1970?

A. I would place those early exposures high on my list of probable causes. I would not rule out some of the immediate later exposures and add them to it. As I approach the present I would tend to give them less and less significance, so it is a relative answer.

Q. Doctor, in all reasonable probability the exposures over the last ten years would not have caused the condition that ultimately developed, would it?

A. I would think that I would regard them as not

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being of much importance, if any at all.

Q. I see. Would that go both as to asbestosis and mesothelioma?

A. It would apply more to the mesothelioma than the asbestosis, but it would apply to some extent to the asbestosis too. By that I mean -- I could expand on this with your permission, that I think it is highly probable that if he had quit work as an insulator entirely and become a farmer in 1960 that he might have developed, he very likely would have developed this mesothelioma. For example, in Dr. Selikoff's series, he found a man who had quit work fifteen years before. In his series that he reported several years ago, he had three out of ten cases that he reported were no longer insulators, and one of them had stopped three years before he developed his mesothelioma, and two of them had stopped fifteen years before they developed mesothelioma, and this is the kind -- this kind of evidence turns up repeatedly.

Q. Doctor, in the diagnosis of mesothelioma, is there cancer too that will metastasize and affect the same organs that mesothelioma will affect?

A. The answer is the metastatic particularly from the pancreas and in women the ovary and other organs will be spread out over the surface and become indistinguishable from

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mesothelioma. Now I am not a patholigist so I am reporting my general knowledge of this.

Q. Doctor, if you are going to rule metastasized cancer or cancer that has been produced at some other source, how would you do that?

A. You do it by careful examination of all the other likely sources, which is by inspection and by complete autopsy, and in which you look to see if it is the primary location, and you can draw some conclusions by the type of cells you find in the spreading tumor.

Q. Doctor, if you do not do an autopsy or rule out a primary cancer from another source, which has spread to the area where this would be mesothelioma of the chest and pleura, could you state with any degree of medical certainty that this was mesothelioma as opposed to metasthasized cancer which had spread?

A. Strictly speaking, the criteria of mesothelioma requires that you rule out the primary source. Consequently, if you have not had a complete autopsy you do not meet that criteria and it could not be stated with certainty that it is a mesothelioma. However, if there are mesothelioma tumors as it were, which by their cell characteristics and so forth, and particularly there is a variety of cells in them in which one can say probably mesothelioma, and if one has examined and ruled

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out primary sites elsewhere, but it is a very difficult diagnosis to make.

Q. Have you had any experience in the diagnosis with the use of slides --

A. This is something I have not published but I have done this personally. I have found what appears to be thirty or forty mesotheliomas diagnosed in northern California over the last four or five years. Cases that I found by going back and searching death certificates, so I prepared to write a report on these trying to show how they related to asbestos plants and asbestos exposures. I turned the slides over on the first twenty-five or thirty of these to a pathologist who is a member of a review panel that has been set up unofficially to review cases like this in the United States under the auspices of the International Union Against Cancer. I sent slides on the first thirty or so and he ruled out half of them, so I have abandoned my project because I did not have time to establish the diagnosis on these. Now this is not an uncommon experience and it reflects differences of opinion between pathologists as to their criteria. There are those who say we are too strict in our criteria and others say we are not strict enough, and I am (a) not prepared to judge between these, and (b) I think it is going to take time to separate this out. There are other methods of diagnosis such as tissue culture and other

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approaches. All I am using this is an illustration of the fact that the diagnosis is a difficult one.

Q. All right, then based upon your personal experience --

A. And upon other reports or literature, Dr. Levin and Bell, which he reported thirty-three cases in Pennsylvania indicating something like half of his cases were ruled out by a review pathologist, and I have that paper for direct reference here, but he finally decided to analyze all of these together and not to throw out the ones that the pathologist threw out, and that complete paper analyzes the whole group.

Q. Then based upon your experience it is easy for someone who is not thoroughly experienced in the diagnosis or interpretation of mesothelioma to diagnose another type of metastasized cancer as mesothelioma?

A. My answer to that, that pathologists can differ in their own criteria and in their knowledge and experience in applying the criteria.

Q. All right, sir. Doctor, as of 1961, on the basis of general knowledge,generally accepted and published medical knowledge, that was available to an industrial hygienist, would he have regarded the work of an industrial insulation worker applying asbestos products which contained twelve to fifteen percent asbestos as being particularly hazardous?

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A. He would have regarded it as something that required some attention to dust control, but he would have regarded it as a highly hazardous operation if he thought about it at all. Generally it was a level of -- any reason for having it called to your attention, I mean we have many, many things, people working in stockyards that just don't come to your attention. There has been nothing published in the whole area of problems and things that need to be taken care of that is not regarded as one that is in high order of hazard.

Q. All right, Doctor, as of 1961 on the basis that was generally available, would there have been writings by industrial hygienists and the people in that field that an industrial insulation worker engaged in the application of products which contained twelve to fifteen percent asbestos was likely to produce serious physical consequences?

A. No, because we were thinking then largely of asbestosis. We didn't think the concentration then was such that they would be likely to produce asbestosis, and we hadn't really begun to connect asbestos with lung cancer, and certainly not with mesothelioma, so we would have been thinking about it in terms of asbestosis.

Q. Doctor, this is the question that I asked you before, in 1961 was it reasonably foreseeable by a manufacturer of insulation products containing approximately twelve to

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fifteen percent asbestos to foresee that insulation workers such as Mr. Borel and these others, Mr. Potter, Mr. McDaniel and Mr. Crawford, would have contracted asbestosis as a result of working in the asbestos construction industry with the product, relating this solely to 1961 or prior thereto?

A. Let me --

MR. STEPHENSON: Let me object, Doctor, please.

A. I am sorry.

MR. STEPHENSON: I would like to object because this does not set out the standard to which the manufacturer is held and that being the standard of the expert in the field.

Q. Go ahead, sir.

A. I would have to say that as of 1961 it was not foreseeable and I have to say this because I was associated with the Government job at the time, and I frankly say we did not foresee it.

Q. That's all at this time.

CROSS EXAMINATION

BY MR. STEPHENSON:

Q. Doctor, my name is Ward Stephenson. I am an attorney representing Mrs. Borel in an asbestosis case against several manufacturers of asbestos insulating products. I will ask you some questions as Mr. Weller has done, and if you don't understand my questions just tell me and I will try to make them more

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clear. Do you know generally about the case and the nature of it?

A. Generally, yes, sir.

Q. Have you been involved in other cases involving asbestosis or asbestos use?

A. Yes.

Q. All right, would you please tell me about them so I can know what they are?

A. Now when you refer to involved, do you mean legally or medically?

Q. Well, as a witness, medically perhaps, or any way.

A. Because I have been involved medically in a fairly large number because I am a medical adviser to the Western States Conference of Asbestos Workers and Associated Insulation Contractors of the Western States, as their medical adviser in regard to health problems, and I have a general relationship and supervision of physical examinations that are carried out on asbestos workers in Spokane, Seattle, San Francisco and Anchorage, Alaska, and a number of places, so I am involved to that extent, and I from time to time give my opinions as to cause and effect relationship in specific cases to people that ask me for it.

Q. All right.

A. So that in that way I am medically involved. I

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have at least once in the past year reviewed a case for a company, for a manufacturer of asbestos products, and given my opinion as to what I thought some appropriate questions might be in developing evidence of the case.

Q. Was that Fibreboard Paper Products Corporation?

A. I assume that it is all right for me --

MR. WELLER: You can identify the company, whoever it was.

A. It was Johns-Manville Corporation.

Q. Do you know a manufacturer called Fibreboard Paper Products Corporation, commonly referred to as Fabco?

A. I am aware of them.

Q. Are you aware also of a company called Combustion Engineering Corporation?

A. I know nothing about them.

Q. Johns-Manville Products Corporation?

A. I am aware of them, having worked with them in study of a number of problems ever since about 1954.

Q. Owens Corning Fiberglas Corporation?

A. I have worked with them in connection with fiberglas products.

Q. And Eagle-Picher Industries Corporation?

A. I know them for the fact they operate out of Ohio, and I have given them advice.

Q. Pittsburg Corning Corporation?

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A. Pittsburg Corning Corporation, I know them because they are one of the biggest producers of fiberglas and also manufacture asbestos products, and I have had occasion to talk to their medical director and other members of their staff from time to time.

Q. Unarco Industries Corporation?

A. I know nothing about them.

Q. Philip Carey Corporation?

A. Only that they are involved in the supply of some products we have studied on the west coast.

Q. Ruberoid Corporation?

A. I don't know about them.

Q. Armstrong Cork Corporation?

A. I have talked to some of their representatives in connection with the use of asbestos products.

Q. Would it be your opinion that the companies which I have just read out to you represent the majority of the asbestos insulating manufacturers in America?

A. I am not in position to answer that.

Q. Doctor, would you give me some background, please, on what a medical researcher does, what do you do in medical or scientific research?

A. It indicates everything from the study of an interior enzyme system of a single cell when it is separated

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from a person, and it is hard to even realize you are dealing with people all the way. It is studies of a group of people, the study of causes of diseases in a large group of people in an attempt to try to find out the more causative factor in disease.

Q. Would it be proper for a medical or scientific researcher to review medical and scientific articles previously written by others in order to form a basis perhaps for a beginning point, or to get more knowledge of the particular subject under inquiry?

A. Certainly.

Q. For example, I would suppose that when you were going to investigate asbestos and its effects upon the human body, you reviewed all the articles of a medical or scientific nature which you could find on the subject?

A. That's the usual starting point.

Q. And that's acceptable and proper for researchers to do?

A. Yes.

Q. May I say it probably would be not correct if you did not review all the medical and scientific literature available to you?

A. I would say that for most persons. Occasionally some one who has an eccentric idea says he does not want to be

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influenced by what other people think but that's an uncommon take-off point.

Q. Can you tell me in your best judgment how many articles of a scientific or medical nature had been written about asbestos and its effects upon the human body by the year 1945?

A. Oh, it would certainly be over one hundred.

Q. Now let's go back say to the year 1930, how many articles would be in your opinion the amount under scientific or medical studies?

A. If you counted all the languages in the world it would be fifty plus or minus. In fact, I have not attempted such a count. I know it would be considerable if you count every case report and every summary and every review.

Q. Was it also proper and appropriate for a researcher to read medical and scientific articles written by authors or writers of other countries such as Italian, German, French and so on?

A. The answer is yes. It would depend upon the problem and the apparent relevance of the experience to yourself, but the answer to this would have to be yes, because it is customary.

Q. I have just a list of articles which I was able to turn up concerning asbestos. Most of those of early

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time have been marked with a pencil mark or a pen mark on the side. Would you mind just glancing at that for a moment, please?

A. Uh-huh.

Q. Well, thank you, I don't want to take you unarmed by any of this. In 1930, in your opinion, was there ample medical and scientific literature available to cause anyone -- to put anyone on notice who might inquire about the dangerous nature of asbestos dust?

MR. WELLER: I object to that. It calls for an opinion and a conclusion, and would invade the province of the jury, and there being no proper predicate laid for the answer.

Q. You may answer it, please, Doctor.

A. By 1930, as I believe I said earlier this morning, in my other testimony, the fact that asbestos could cause mesothelioma, the asbestos was, I would say, generally accepted.

Q. Doctor, when you attended medical school during the 1930's was the disease asbestosis taught to the students or were you taught about asbestosis at that time?

A. It was mentioned. It was not given much prominence but it was given to us as one of the dust diseases of the lungs.

Q. All right, one of the mesotheliomas?

A. One of the mesotheliomas.

Q. So can we say in the 1930's that medical schools were teaching their students about the disease asbestosis?

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A. Yes, no argument about that.

Q. You mentioned that you had made some studies of asbestosis in California, I am interested to find out how your studies were conducted and the general system of sampling various workers and so on, what did you do?

A. We obtained a list of everyone who had been a member of Local 16 of the Asbestos Workers Union at any time, I believe it was January 1, 1946 -- from January 1, 1946, through 1965, and we then attempted to find as many of those people, whether they were still working or not, and to determine the causes of the deaths of those who had died, and compared the numbers of deaths and causes of death with those that would have been expected from men of the same age in California from the general population. This was phase 1, and secondly, we set up the facilities for physical examination of these men and examined several hundred of them in our clinic, and, thirdly, we reviewed the X-ray films that had been taken by the union's health and welfare fund, which is a management labor managed fund which has been taking X-rays since 1958 of asbestos workers with the objective in finding whether they had developed asbestosis, and we reviewed those films and classified them all by a standardized method. That was a part of our studies and the occasion of it as related to the study of men. Now the study on the working environment involved making arrangements

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with the major contractors to go on jobsites and put dust samples to be worn on the lapels of selective workers and measure the dust concentration as they carried out their various jobs. We also took samples by our industrial hygienist reading from the X-rays, and those samples were then collected and counted to permit us to get dust concentrations and to get counts by the worker of fibers per cc, and that is in broadest outline a summary of what we did.

Q. Thank you, that's helpful.

Q. What was your beginning date they did it for the workers or where did they go back to start?

A. It was January 1, 1946.

Q. All right, sir, January 1, 1946, through 1965?

A. 1965, but this included men in 1946 who possibly had been there for ten, fifteen or twenty years before, and, in fact, I have a breakdown somewhere in my report here of the dates that these people actually began work in the study, but it is not in this report.

Q. All right, did you come to any conclusion about the percentage of asbestos insulation workers who had abnormal lung findings?

A. We found of the total population, and again these figures will not stick in my mind, I will have to look here, we found of the total population whose films we reviewed which

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was three hundred eighty-six men, we found X-ray changes in twenty-four percent. Now if we move back into those who had entered the trade early, the percentages were much higher, and so they come down to those who had entered the trade ten years before.

Q. Are you familiar with Dr. Selikoff's figures and percentages that he made of the asbestos workers who had been in the trade as long as thirty years?

A. I have read his report and I think it was nearly all of them.

Q. Nearly ninety-four percent, is that about right?

A. Yes, sir. All workers who had been in it over thirty years would have been seventy percent perhaps. Now these kind of differences are -- do not necessarily reflect differences in the population, although they might. It does reflect differences in what you call significant change, and by the time you get to the dividing point there can be differences of opinion.

Q. Your research indicated, in any event, the asbestos worker had a much higher count of abnormal lung findings than an average person?

A. There is no question about that.

Q. All right, and the name of the disease asbestosis comes from the word asbestos, I am sure?

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A. Yes.

Q. Do you recall in your studies when the disease asbestosis was first written about?

A. The first published description was in 1900 by Cook -- no, by Montague Murray, who described a case at the Charing Cross Hospital in London, and this is the first report. This was a very obscure sort of publication, and it was actually a governmental report, and it was really not until about 1924 when Cook reported on a series of cases that asbestos came to reach the consciousness of people as being a serious industrial problem. There were isolated reports but these were obscure or single cases, and so that the 1924 articles were the ones that really began to establish it as important and from them the British Inspector of Factories, Dr. Merriweather, conducted studies which began in quantitative terms.

Q. Are you familiar with the fact that England enacted legislation concerning asbestos?

A. About 1931.

Q. Could we say that in the 1920's and in the 1930's that there were literally dozens of articles written about the disease asbestosis?

A. There was a period of intense interest in it. In fact, there were more written then than written in a comparable period ten years later. It was recognized and it was thought

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that methods for its control were being developed and could be applied, and in a sense interest in it tapered off.

Q. You remember Arobolt's work on this in 1906?

A. Yes, this was my example of something that was not given wide circulation, as is not uncommon in medicine or research for isolated reports to precede definitive studies to establish a cause and effect.

Q. All right, sir, can you likewise say that in the 1930's there was not at that time any particular established standards or suggested minimum exposure that might or might not be harmful?

A. It was not -- the first serious attempts as to allowable concentration was contained in a report by Duson, I believe, in 1938, who did make a recommendation based on the three textile mills that he had studied, that the total dust concentration of five million corresponding to that which was recommended for silica dust on the basis of the studies would probably be effective in preventing asbestosis.

Q. Are you familiar with a work by H. E. Eyler and M. D. Gilmore on cases of asbestosis reported in the British Medical Journal in 1931?

A. I have seen the report but I can't say I am familiar with it.

Q. Is the British Medical Journal a widely read and

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published medical periodical?

A. Yes, it is an outstanding medical periodical.

Q. Are you familiar with a work by F. E. Tylelott and J. E. Dunn written in 1931 --

A. Here again I have scanned this article but I am not saying I am familiar with it. It didn't have anything particularly new or different than other reports of the same time.

Q. Are you familiar with the work by Dr. B. Gordon on pulmonary asbestosis, Pennsylvania Medical Journal, 1932, in June of that year?

A. This again I have only scanned it. It didn't have anything different from other things appearing at the same time. I might say that the literature on asbestos is a stack about this high, and there are many, many reports, but out of every ten articles there may be one that really makes a contribution.

Q. You have indicated a stack about two feet high?

A. Yes.

Q. Dr. J. Donley wrote an article on pulmonary asbestosis in the American Journal of Public Health --

A. I have read that.

Q. M. J. Stewart and N. Tattersol and Dr. Haddow

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wrote a work in 1932 about asbestos bodies in the sputum of asbestos workers.

A. Yes, I am familiar with that because Stewart was making some contribution on asbestos bodies, and I was very interested in following his work, and he was the first one to emphasize the importance of these fibers in the sputum in being an aid in diagnosing.

Q. Doctor, what is the periodical Tubercel,is that an abbreviation for tuberculosis?

A. Tubercel,is that a name of a publication?

Q. Yes, sir, that's the name of a publication, and I don't know whether it is still being published or not.

A. This publication was very popular back thirty or forty years ago as a place for publishing articles on unusual lung diseases, or usual lung diseases, excuse me.

Q. I didn't mean to interrupt you, are you familiar with an article by Dr. W. B. Wood in Tubercel in July of 1929, on asbestosis?

A. Here again the name is familiar and the articles are familiar, and they are in my bibliography, but I have, in fact, many of those in it, and I wouldn't be able to say.

Q. All right, sir, was Tubercel in the 1930's a widely distributed medical journal?

A. Not widely. It was within a closed circle of

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people that were particularly interested in tuberculosis and chest diseases. It was not such a journal as the American Medical Association, it was to a specialized audience.

Q. But to this specialized audience it was available to anyone who wanted it?

A. I assume so. I never saw it, it was a little bit before my time.

Q. Doctor, if I wanted to know what articles were available on asbestosis for medical investigative purposes, how would I go about in the library,or wherever, getting the information and data together so I might study it?

A. Well, if you didn't realize that you could get it from me or from Dr. Selikoff, and I think you could get a coverage of it from someone who has done this. You could write to the National Library of Medicine and you could have them send you some of the literature on this. This was not available fifteen or twenty years ago but now there is access to this kind of information, probably twenty years ago, or ten years ago, I don't know, but now, yes.

Q. Are these sources of information available to say companies like Fibreboard Paper Products as well as to medical researchers?

A. I assume so.

Q. Would the AMA, American Medical Association, like-

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wise be able to make inquiry of bibliographic data on asbestos?

A. To a limited extent. They do not at the present time attempt to maintain up-to-date bibliographies, they did in years past do this, but they could, they have groups or committees that could probably answer questions and send you selected sources and who in turn could lead you to other sources.

Q. The state of knowledge in the 1930's, let's say, in your opinion was asbestosis as a disease known about and recognized as a danger caused by inhaling asbestos dust?

A. Yes.

Q. And would you say that would have been rather common knowledge known in the 1930's?

A. Yes, I would say that. The answer to that would be yes.

Q. Doctor, in the 1930's if a company manufacturing asbestos products had a desire to do so, could a company have gotten dust samples, was there equipment available at that time?

A. To a limited extent. They were in the process of being developed right in that period.

Q. Would you say in the 1940's the art of dust sampling had been --

A. Yes, sir, I would say by then and other types of apparatus in Great Britain and South Africa and this country.

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Each country had their own methods of collecting dust.

Q. I believe in 1941 Great Britain enacted legislation about the sampling of dust at that time?

A. Yes, sir, that is right. I have not reviewed the fine print but I am not sure -- I know they did not set a fixed rule.

Q. All right, sir, in the 1930's was it known or recognized medically and scientifically that any certain percentage of asbestos dust in the air would be dangerous as opposed to a lesser being safe?

A. You mean the percentage?

Q. Well, any concentration.

A. I think I said earlier, based upon the studies of dust concentration taken in textile mills that five million total particles concentration, five million per cubic foot or less, you can probably be safe.

Q. All right, sir.

A. This was developed late in the 1930's.

Q. All right, sir, in relation to dust samples or tests, has it been your experience that asbestos insulation workers experienced high peaks of exposure to great quantities of asbestos dust?

MR. WELLER: I object to that because it is highly speculative and would have no reference to any particular defendant in this

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case.

Q. You may answer.

MR. WELLER: And the answer would be highly speculative.

A. Well, dust samples did show there were certain operations involved in the trade of the insulator in which there were very high brief concentrations of dust.

Q. What would be the concentration of dust at these high levels, could you put it in particles per cubic feet?

A. For brief periods we had concentrations in marine construction that went as high as twenty-nine million, and in industrial work we had concentrations going as high as fourteen million. These were in turn with operations in certain sawing operations, and when it came to fiber concentrations, we also had these very brief high concentrations which, if you took into account the time this happened and averaged it out, it would still be below your so-called threshold limit value.

Q. All right, do you recall the examples mentioned in scientific and medical writings of housewives whose husbands worked around asbestos who contracted the disease of asbestosis through the handling of their husbands' clothing?

A. There have been such cases reported and I see no reason to doubt that this has occurred on the basis of cases I see reported.

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Q. All right, sir, likewise, have you read of cases that have been cited in medical and scientific writings of children who contracted asbestosis while using asbestos to make toys in kindergarten in school?

A. I do not know of any such reports, and I do not think there are such reports.

Q. All right, sir, now if a worker is exposed to heavy concentration of asbestos dust such as it would get in the nose and in the mouth and so on, I assume it would be reasonable to believe that he breathed some of the particles of dust and fibers in his lungs, would it not?

A. How is that again?

Q. If a worker is exposed to heavy concentration of asbestos dust such as it would get in the nose and in the mouth and so on, would it not be reasonable to assume that he breathed some of these particles or fibers into his lungs?

A. If one knew enough about the kind of dust that we are talking about, it is quite conceivable that there could be dust with the particles' size so large it could be deposited on the face and still not get any into the lungs. We would have to know the size of dust. There is not a direct relationship, you would have to know other things before you can answer that question yes.

Q. At the times when you found high concentrations of

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asbestos dust in the asbestos worker's work, was it reasonable to believe that he inhaled some of that dust and particles into his lungs?

A. Absolutely, yes.

Q. I don't mean to cut you off.

A. I want to make it brief but sometimes I tend to meander.

Q. If the asbestos particles entered the worker's lungs, would there be any medical method to get these particles out of the worker's lungs?

A. Not while he was alive, no.

Q. All right, can we say that asbestos by its very nature is difficult to burn, it has to be at extremely high temperatures?

A. Yes, it is difficult to burn.

Q. It would burn at temperatures far in excess of that that the human body could withstand?

A. Yes.

Q. And likewise, would there be any way to freeze the asbestos particles in a human being without of course killing the person?

A. Freezing them in the sense of keeping them from moving?

Q. Yes.

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A. I know of no method to do that.

Q. What I am driving at in perhaps a clumsy fashion --

A. I can't conceive of any.

Q. The asbestos fibers move, I understand, in the lungs, and the asbestos fibers move in the pleura and peritoneum and cause a fibrosis around the fiber, is that correct?

A. We know this much and we know they are associated with fibrosis, and whether one is dependent upon the other, we don't know.

Q. Can we say that because the asbestos fibers get in the human lungs they stay there, there is no way to get them out?

A. There is no way we can speed up or alter the course of their moving so far as I know.

Q. How many heavy exposures do workers have to experience to give a worker the disease of asbestosis?

A. There is no clear cut answer to that. I have no way of answering that question.

Q. Can we say it can be then perhaps as few as six exposures to asbestos dust?

A. I have no way of saying that.

Q. Can we say this is variable?

A. Yes, it is variable.

Q. Then you could not dispute or admit the fact

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that six exposures of heavy concentration of dust might cause it?

A. Here again I would be dealing with probabilities and if the total amount and total duration decreased my estimate of the probability would reach the point where I would say it is highly improbable or would be almost impossible, and when we talk about six, we might be talking about six lasting a second or six lasting a whole day, and so this is a question I can't answer.

Q. All right, Doctor, are you familiar with the procedure commonly used to mix asbestos cement in water in the mortar business?

A. Yes, I am in general familiar with it. My industrial hygienist has studied it and made dust concentrations during this operation.

Q. Would that be work that would cause high dust concentration?

A. There is a good deal of dust which if a man remains in doing this it can give him a significant exposure or I would say a fairly high exposure.

Q. All right, sir, are you familiar with the cutting of asbestos products so that they may be applied to pipe surfaces and other surfaces?

A. That's right, fabrication and cutting is a normal

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procedure.

Q. All right, sir, would this likewise be a source of high dust concentration?

MR. WELLER: I object to that because the conditions under which some cutting and fabricating is done has not been established. Many of them are done in shops which are protected by dust collectors or exhaust fans and so forth.

Q. Go ahead, please, Doctor.

A. It can produce dust, and to protect a worker in this situation it would be recognized and protection should be provided.

Q. So far as you know, in the 1930's or 1940's or the 1950's, did any of the manufacturers of asbestos insulating products ever warn the worker who would be cutting and mixing the cement and using their product of the dangerous nature?

A. I have no --

MR. WELLER: Just a minute, Doctor, I object to that question for the very reason that the manufacturer has no control over the working conditions of the asbestos worker, but that the responsibility for the working conditions is that of the asbestos worker's employer, therefore, such question would be highly speculative unless the doctor has specific knowledge with reference to each and every manufacturer. The question is too general.

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Q. Doctor, let me back up just a moment then, I assume that in your studies you made in the 1960's that you go into the field and observe workers engaged in their trade?

A. I went in personally on a supervisory basis with my industrial hygienist. My industrial hygienist went in and studied it in depth with Dr. Balzer.

Q. I am sure you had the benefit of his study?

A. I did.

Q. Did you find that the men doing the mixing of cement experienced high concentrations of asbestos dust at that time?

A. Some of them, yes.

Q. Did your investigation also reveal that the cutting of asbestos products preparatory to placing the products in their place also experienced high concentrations of asbestos dust?

A. Some did and many of them had protective -- had ventilation, and were wearing respirators. It was quite variable.

Q. I am speaking of the dust at the moment?

A. It was a source of dust.

Q. Well, high concentration of dust?

A. Yes, brief high concentration.

Q. All right, sir, I believe in your work now that

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you took an average so if a worker was exposed to heavy concentrations of dust for two hours and to light concentration of dust for two hours, then you balance this out to a medium?

A. We did this only in our interpretation of the results and tried to relate them to the threshold limit value, but our actual counts are the actual counts which we obtained during the period which might have been fifteen minutes or an hour of the sample, and we report the number that we get, and we have those records, but in an effort to interpret those we attempted to see how those would be averaged out.

Q. Could you tell me how you could make an interpretation based on average high and low periods of dust concentration when you don't know how long is required to give a worker a lung disease with a heavy concentration of the dust?

A. When I said we averaged them out because we were attempting to relate them to the existing regulations or guides to dust control. In fact, our conclusion there, you must remember this was 1967 and 1968, our conclusion was that this was an inappropriate way to attempt to gauge the men's exposure, and that special attention should be given to control these peaks, and that it was practically impossible to -- it was impossible to come to an exact figure of a minimum average exposure. It was very difficult to come even to an approximation of an average time but measuring the results of the man's time

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that he worked in one or the other, and assuming he worked in it practically all the time, we averaged it out. We said since we were seeing disease in these people here what we were seeing was due to high exposure in the past which we doubted was entirely true, but that it could be due to more modest exposure a long time ago by surges just like we are seeing now, and this was not until 1968 until this kind of recommendation came out, and it was not until last year that Dr. Selikoff and his group reported formally on his studies in New York and this was in 1970.

Q. In the inquiry Mr. Weller made of you about the average of the governmental industrial hygienist you mentioned five million particles per cubic foot.

A. Yes, sir, of total dust particles.

Q. Is this total asbestos dust particles?

A. Any kind of dust that came into the machine, the collecting device. This was total dust of all kinds.

Q. To refresh your memory do you recall it was the year 1947 when the ACGIH first came to the five million parts per cubic foot of total dust?

A. Right.

Q. At that time, in 1947, was there adequate sampling equipment available to manufacturers of insulating products to enable them to go in the field and take dust samples?

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A. Samples were available.

Q. In your reading or in your experience do you know in the1930's, 1940's, 1950's or 1960's of any manufacturer of insulating material that went into the field to see how much --

MR. WELLER: I object to this, this calls for a conclusion, and further because the manufacturers owed no duty to provide the working conditions for the employees of insulating contractors.

A. I don't know of any but that doesn't mean it was not done because I was not in position to know. In fact, being with the Government, I might not have had some ways to have had access to all of that.

Q. And you say in your experience you know of none who made dust counts during those years?

A. I know of none but I don't know of too much to be made of it because I did not know everything that was going on.

Q. You have mentioned Fleischer and Drinker's report on studies of shipyards, Doctor. I will ask you whether that is or is not considered to be an authoritative work?

A. Well, the senior authority of that report, Dr. Drinker, was one of the outstanding industrial hygienists in the country at the time.

Q. I don't mean to impugn him but what my question refers to is it recognized as an authoritative report because

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of the manner in which it was made?

A. It was the best we had at that time, and it was authoritative in that sense. In fact, there have been few reports since.

Q. All right, did Fleischer and Drinker take into consideration any asbestos workers at that time who had been exposed to asbestos dust over a period of years or was it just over a short span of years?

A. I would have to review the paper on that. My recollection would be that there had not been long periods such as we are talking about now. They were mainly people who had been in a shorter time than twenty or thirty or forty years.

Q. Doctor, so we might have it in the record, I think it is in here in one form or another, but pardon me if I re-ask, do I understand that there is a connection between the time of the exposure to asbestos dust and the time of the first manifestation of the disease, the lung disease?

A. Yes, there is a relationship. It is conflicting by the intensity of the exposure plus individual variables.

Q. Surely, one individual may be more susceptible to mesothelioma than another, I assume is what you say?

A. Yes, sir.

Q. This being the case, for example, is a worker working in the industry let's say for one year, and then left

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the industry and went to farming, I believe you mentioned that type of parable yourself.

A. Yes, sir.

Q. Would you expect there would be several years go by before he would have abnormal lung findings?

A. If he had any at all it might be ten, it might be twenty or it might be thirty years, if he had any at all.

Q. Now, Doctor, do I understand that a person does not have to necessarily be exposed to asbestos dust for ten, twenty or thirty years for the asbestos exposure to show up?

A. That's the description of what has been observed.

Q. Am I correct in understanding that asbestos fibers in the lungs are not themselves subject to X-ray, that is, to be shown byX-ray?

A. No, they don't show up on X-ray.

Q. All right, sir.

A. I assume you could possibly get a large enough glob of them, but that doesn't happen. They are not what you see in looking at an X-ray of the lungs.

Q. What would be the usual first observation in X-ray you would have if there were asbestos particles in the lungs?

A. The reaction to asbestos can vary from individual to individual. The first manifestation may be an increase in markings in the lower lobes of the lungs and maybe a thickening

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of the pleura. There may be mesothelioma developing thirty years afterwards with nothing you can see on the X-ray. It may be a lung cancer with nothing you can see elsewhere in the lung, so the first manifestation can take any one of a number of forms.

Q. So as I understand it that would be then some resultant medical harm or harm to the body that would first be seen and not the asbestos fibers themselves?

A. Not the asbestos fibers or even the X-ray changes. The X-ray changes even if you see them, they may not be connected with anything the man knows about.

Q. What are some of the recognized sicknesses caused by asbestos inhalation?

A. As we have said, mesothelioma and asbestosis which is a fibrosis of the lung, and changes in the X-ray and restriction of movements of the lung and the ability to move air in and out and ultimately it will affect the passage of blood through the heart and so called cor pulmonale, and that's asbestosis, and that's the one that has been known thirty, forty or fifty years, and second, is an increased risk in lung cancer which may be due to the asbestos, and, third, this again only within the last few years has generally been acknowledged as an associated disease which is mesothelioma and which occurs apparently much more often in people who have worked with asbestos than with people who do not. There are asbestos warts, that is,

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people get a little skin reaction, and that so far as I know has never been associated with skin cancer. It is in the established disease associated with asbestos.

Q. Did you mention pleural calcification?

A. I should have included that in my general description of asbestos, but it is so unique and special for asbestos and it can go along without much evidence of disease in the lung that it should be singled out for special mention, calcified tips on the diaphragm and on the pleura.

Q. Would you say that pleural calcification is typically attributable to asbestos?

A. It so strongly suggests asbestos that you almost have to rule out other causes.

Q. All right, sir, in this particular man's case, Mr. Borel, he died, but before his death the doctors removed a lung and the pathologist found asbestos particles in the lung. The disease was diagnosed as asbestosis. In addition he had pleural calcification. Section studies were made of various portions of the lung after it was removed from his body, would you feel that under circumstances that I have mentioned and such tests were undertaken, that there would be any medical question at all but what this man had the disease asbestosis?

MR. WELLER: This question assumes facts that are not in evidence. There has been no proper predicate, and further he asks this doctor

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to base his opinion upon hearsay testimony.

MR. REYNOLDS: And further, it is an invalid hypothetical question in that it does not include all the appropriate facts.

MR. WELLER: And let everybody adopt these objections, Odessa.

MR. COLEY: All the way through the deposition.

MR. WELLER: Yes, all the way through.

A. I would prefer not to answer this question. I would say I would be surprised not to find asbestos and asbestos particles in this man's lungs because we find them in everyone's lungs to a certain extent. We would have to get the quantity before it would have any meaning.

Q. Doctor, is it not true that asbestos is used in such quantities today that most people who have autopsies or lung section studies might even at this time have findings of asbestos particles in their lungs?

A. I will answer the last part of your question. I will say that most people do have, but I am not prepared to say it is due to the increased use of asbestos.

Q. Thank you for straightening that out. Doctor, are you familiar with studies that have been made out in California of the effect of asbestos coming from brake linings of automobiles where there is travelling on heavy concentrated roads?

A. I know that there are no conclusive -- we have no

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conclusive data as to brake linings to air-borne asbestos. In fact, our laboratory right now has a contract with the Air Resources Board of California to study asbestos fibers on the near freeways and to compare them with a natural background of asbestos that we see in many parts of California due to the presence of crocidolite asbestos from the serpentine type which is present in much of California. So the data on asbestos fibers, you asked me if I am familiar with it, I would say this is a very questionable source, and we don't know to what extent it is important.

Q. You are familiar with the studies that have been made in this field?

A. There have also been studies in static stations in laboratories by the Public Health Service and by the industry relating to it. This is a complicated little subject as to what happens to the asbestos fibers under heat, and a portion of them are converted to phosphorite, and whether ten percent goes into the brake lining or one percent or what, that becomes air-borne, we don't know the answer to that, nor does anybody.

Q. Are you still engaged in the study of asbestos and its effect upon the human body?

A. We are still acting as medical consultants to the contractors, and we are continuing to review the X-rays of asbestos insulating workers in the western states. I have a file

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of several thousand films, and we are also making recommendations as to improving dust control with the contractors, and we periodically review the statistics on this. We are also studying problems in the air of California cities, and in addition this likewise applies with reference to asbestos and many other fibers that occur in the air.

Q. Doctor, who sponsored your particular studies in 1965 or 1966?

A. The Division of Occupational Health of the United States Public Health Service.

Q. Doctor, do you know in your experience of any manufacturer of asbestos insulating products who in the1930's through 1960's tested their products in a controlled environment or otherwise to see how much dust was created by sawing their product, for example?

A. I know of none up until recently.

Q. I include the 1930's through the 1960's.

A. Yes, in the last two years we have tested some products.

Q. 1969 then?

A. 1969 and 1970, but part of this was an outgrowth of studies such as the ones we reported in 1968, and the ones that Selikoff and the others reported in the last two or three years and development of the atoms which has not yet been adopted

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as an official point of view that it is these peaks or surges that we need to control.

Q. All right, sir, do you know of any manufacturer of asbestos insulation in the 1930's to 1969 who tested their products -- their cement, let's say, to see how much dust was created in the mixing procedure?

A. I know of none, but I would not have had access to it if they had.

Q. Why wouldn't you have access to it?

A. If they carried out a test they might or might not let me know about it, I don't know. I would not have had access necessarily to it but I know they were testing brake lining, for example, and many of these things that were personally determined -- once these figures came up from our studies they didn't have to go back and do it again.

Q. In 1950's and 1940's and 1930's would it not have been of significant help in the study and effects of asbestos to determine whether or not anyone made any tests in the air --

MR. WELLER: I object to that question because it is argumentative and does not set any standard.

A. As I say, I don't know, I really can't say anything about it. I don't know anything about it. Whether or not tests were done, I simply don't know whether they were or not.

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Q. My question was, Doctor, would it have been helpful to have had the benefit of any studies had one been made to one engaged in research?

MR. WELLER: I have the same objection I made before.

A. I will answer that to say anything you know about something can be helpful.

Q. All right, Doctor, are you familiar enough with the application of asbestos insulating material to be able to say whether or not these products have to be cut, sawed and applied and mixed with water and so on in order to be applied?

MR. WELLER: I object to that. You are referring to all products and they haven't been identified to the manufacturer, and each manufacturer produces a separate and distinct product, and some of them don't produce any cement at all.

A. All I can say in our studies we did find products that did require this, so we know that some do.

Q. All right, in your opinion as an expert do you think it would be reasonable to assume that an asbestos insulation worker would have to cut, saw and scribe the insulating products in order to apply them?

A. Yes.

MR. WELLER: I object, it is argumentative, and, further, there are no rules and regulations by the unions and the employees themselves which prevent the employer from prefabricating these

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things and to prevent the manufacturer from prefabricating them.

Q. I think you already answered, Doctor. Now, Doctor, is there any way for a person to contract the disease asbestosis other than through the inhalation of asbestos dust and fiber?

A. I have answered that asbestosis is due to asbestos, and the only other way is to deliberately inject himself with asbestos which is unlikely.

Q. I agree it would be unlikely. Of course there is a parallel in the experimental animal.

A. Yes, by sticking a needle in the pleural cavity.

Q. Nothing else causes asbestosis other than asbestos?

A. Nothing, but still there are many kinds of asbestos.

Q. But all the results of asbestos is the same?

A. Yes, sir.

Q. Are you familiar with any breathing apparatus commercially in use by asbestos workers?

A. You mean respirator protection?

Q. Yes, sir, excuse me, Doctor?

A. The answer is yes.

Q. All right, I am going to show you a little paper type mask that has been marked as Plaintiff's Exhibit 4, and ask you if you can identify this.

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A. That looks like one of the M & M or some other companies' throwaway mask, which is a form which has been regarded by some as respiratory protection.

Q. Have you made any studies to help you learn whether or not this type mask prevents the inhalation of asbestos dust by one exposed?

A. I have not personally carried out studies, and I don't know of any even published studies on it. It is not an effective device.

Q. All right, sir, I show you another item which appears to be some type of breathing apparatus, plaintiff's Exhibit No. 5, and ask you if you can identify this.

A. Yes, this again is not my area of detailed expertise in the sense of technical differences between masks. I will have to consult guides as to choice of filters, and this is a recognized and acceptable form of respiratory protection if the proper filters are used.

Q. All right, sir, do you know whether this Exhibit 5 will prevent the inhalation of asbestos particles?

A. I cannot speak for this specific model and this particular type. It depends upon the type of filter, it depends upon its fitting, and it depends upon a number of things. I think this type with the proper filter would reduce it if those conditions were adhered to.

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Q. Do you know of any filter of any kind in common use that would prevent the inhalation of asbestos dust?

A. There are filters that would greatly reduce the inhalation and probably reduce the inhalation in an otherwise hazardous atmosphere to a point where it would be -- but when you open up the question of respiratory protection you are opening up something where neither the industry nor the worker nor the industrial hygienist really had completely satisfactory masks to carry, to be worn. Some of the work that an insulator has to perform, both in terms of resistance to breathing and abrasions of the skin due to pipe grease which he might be working with at the same time, and so that the matter of getting a satisfactory mask or respirator for the insulating worker has been a very difficult one. You asked me if that is right, and if everything is right it will reduce the dust exposure.

Q. It will reduce but not eliminate?

A. That's right, and the reason is that fibers do not behave in filters as round dust particles. You have to test a filter specifically for fibers. The Bureau of Mines until very recently has not considered asbestos as a different kind of dust in making ~~students~~ workers have masks.

Q. Do you know Dr. Selikoff's work in his attempt to develop masks?

A. No, but we have had some of their masks and some

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of our insulators have worn them. This is an attempt to get an inexpensive throwaway mask that will be effective in reducing asbestos dust.

Q. I think that's all, Doctor.

REDIRECT EXAMINATION

BY MR. WELLER:

Q. Doctor, are you familiar with Dr. Selikoff's testimony before the Congressional Committee on Environmental Control regarding --

A. Not in detail, I have scanned it but I am not familiar with it in any detail.

Q. Do you agree with Dr. Selikoff that the manufacturers of products containing some asbestos from twelve to fifteen percent would not be held responsible to the asbestos insulation industry for the conditions which were discovered to exist after 1964 in relation to the use of asbestos products?

A. I am not sure of the context of which you said, and I would have to answer it in terms of context. I would agree with the general statement, which was a different time and a different state than today.

Q. All right, now when Mr. Stephenson was asking you a question about your research project in 1964 of the union workers, asbestos workers, did your study begin in 1964?

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A. Well, as I can recall it was 1964 or either 1965 when we began our project, and we were funded for three years by the Public Health Service, and since then the work which we have provided service is funded by the industry and the Union Welfare Fund.

Q. All right, sir, now your study, I take it, related back to employees as early as January, 1946?

A. That's right, and it included exposures back to 1920 sometime, because some of that we picked up in 1946 had worked twenty years or more.

Q. All right, now, Doctor, Mr. Stephenson asked you about various literature and various studies and legislation in England, I will ask you if most of these studies did not concern themselves with the textile mills which were using pure asbestos in the manufacture of products?

A. The answer is a large proportion of the studies related to textile mills.

Q. All right, now based on your knowledge prior to -- that is, based on your research and knowledge prior to the legislation in England, was there an absence of dust control in the modern factory facility?

A. In the British --

Q. In the British textile industry?

A. The answer is yes.

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Q. Now in this country was there a standard established in textile manufacturing plants and plants that manufactured products containing some asbestos, that is, a dust standard or a threshold limit value of dust?

A. After the Congress study in 1938, then our advanced segments of industry began to adopt this. They were confronted by the realization that they were liable for compensation and also to a varying extent they were concerned about the Air Force so there was a gradual improvement in conditions.

Q. Now beginning after 1938 --

A. It probably didn't really begin until 1940.

Q. All right, beginning in 1940, was it recognized and considered in this country that as long as the dust count remained at five million particles per cubic foot of air that this was a reasonably safe operation for people engaged in the asbestos industry?

A. Yes, and this was part of the explanation for the decline in interest in the disease in the sense it was thought we had established the disease and we had found a way to prevent it and let's get on to the next problem.

Q. All right, Doctor, did you publish an article after your research in 1964 through 1968 in San Francisco?

A. I have an article that was presented and will

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appear in the proceedings of the Second International Conference on the biological effects of asbestos, which I ~~wrote~~ prepared in Dresden in April, 1968. This is the one to which I have been referring. I have published sections in other papers.

Q. What is the title of that?

A. It is the Evaluation and Control of Asbestos Exposures in the Industry and Trade, which most of the people are interested in in this country, including Dr. Selikoff.

Q. Let me ask you a little bit about that article, if this is not your statement: "It has been recognized for a number of years that insulating workers have an increased risk of asbestosis (Leathart and Sanderson, 1963; Marr, 1964; Selikoff, et al, 1965; Ahlman, 1966; Keane and Zavon, 1966; Ferris, 1967; Kleinfeld, et al, 1967; and others)", is it your position that these particular studies directed everybody's attention to the problem in the asbestos industry?

A. Yes, these were the conglomeration of studies that had begun a year or two earlier, but these were the reported findings of the studies.

Q. These were really the first reports --

A. In which insulation workers had been singled as a high risk.

Q. I see. Also, if you will refer to page 11 of your article, the last paragraph, and see if this was the

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conclusion that you reached from your study.

MR. STEPHENSON: I object, George, if you are not going to introduce the report, I don't have a copy of it and I can't follow your testimony, and I don't really know what he said in the report.

Q. I will give you a copy of it but I don't have it right now. Doctor, the last paragraph, is this your conclusion: "It is of interest that time-weighted averages were not unusually high and that current TLV recommendations in the United States for asbestos containing dust (5 million particles per cubic foot) would not have been exceeded, even for a man working 100% of his time with asbestos. The fact that most men work less than half of their time with this material would be an added safety factor. Figures 3 and 4"

A. Yes, I subscribed to that statement in the context of the entire article.

Q. In the context of the entire article?

A. Yes.

Q. But this was the result of the test which you made at that time?

A. Yes.

MR. STEPHENSON: I object to this as not being a correct statement, he said it was in the context of the entire article, and you are going to have to introduce the entire article to

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introduce any portion of it, if you are just referring to that one statement.

Q. Doctor, look at page 15 in regard to the dust levels, actually it is the second paragraph on the page starting with "Existing dust levels", and see if I read your conclusion correct: "Existing dust levels, whether measured by midget impinger or fiber counts from membrane filters, were not as high as had been anticipated. The time-weighted averages were within the present threshold limit value of 5 million particles per cubic foot, even for men working full time with asbestos. In reality, most men work less than half of this with such materials."

A. That's right.

Q. Now is that a correct statement of your conclusion?

A. That was my interpretation, my conclusion.

Q. Based upon the actual field experiment?

A. Yes.

Q. And beginning with the last paragraph on page 15: "In our opinion, in the absence of any evidence that work practices have changed sufficiently to blame present asbestosis on extreme conditions in the past and uncertainty as to levels necessary to reduce cancer rates, we think it is prudent that insulating workers not be permitted to work under any conditions that exceed 5 million particles per cubic foot

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by midget impingers and that industrial hygiene and personal protective equipment be geared toward these objectives."

A. This is essentially saying let's put a ceiling of five million particles per cubic foot average. In other words, let's cut off these peaks.

Q. On page 17, I will ask you if you didn't reach this conclusion based upon your field experiment and observation and test: "Dust concentrations were studied by midget impinger and membrane filter sampling. The former indicated time-weighted averages in nearly all work situations below the present threshold limit value of 5 million particles per cubic foot", is that a correct statement?

A. That is a correct statement.

Q. And that's what you found on your test and experiment. Now, Doctor, Mr. Stephenson asked you about the use of respirators, do these serve to reduce and cut down the exposure to the inhalation of asbestos dust if properly used?

A. A respirator of the type that is approved, if it is worn, it will greatly reduce the asbestos dust.

Q. All right, it will greatly reduce the dust?

A. Yes, and if it could be worn consistently it will probably prevent the development of asbestosis.

Q. So would it reduce the exposure to non-hazardous exposure to asbestos dust if it were properly used?

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A. I don't get that.

Q. Down to a non-hazardous level?

A. There are respirators that will do that. I can't speak in general terms for all respirators but there are respirators that are made that will do that.

Q. Do you know that the use of respirators and dust collectors have been recommended in the asbestos industry for a considerable period of time?

A. I don't know the extent to which they have been. I can't answer that in terms of my own knowledge.

Q. All right, Doctor, has the Bureau of Mines until recently recognized asbestos fibers as being anything but dust?

A. No, they have not singled them out for special consideration.

Q. All right, when did you start singling asbestos dust out?

A. Within the last five years.

Q. Within the last five years?

A. And I have been developing tests methods for testing for asbestos dust.

Q. Now with the use of dust collectors, suction fans and so on, will that reduce the exposure?

A. Very definitely it will.

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Q. In some instances these have been in use for a considerable period of time in industry, have they not?

A. Yes.

Q. Isn't the main recommendation today, so far as asbestos dust is concerned and the asbestos industry to reduce the exposure to dust by good housekeeping and by the use of suction equipment and exhaust equipment and the use of masks, respiratory masks?

A. Yes, sir, a combination of these devices. There are a variety of approaches, depending upon the situation.

Q. Now have there been some tests in the United States in regard to the general public that the average individual will show some particles of asbestos in his lungs?

A. Yes, it has been shown in a number of places since about 1962 or 1963 that asbestos bodies and asbestos fibers can be found in many lungs. Dr. Gross has found ninety-nine percent of the lungs he examined in Pittsburgh, and Dr. Selikoff says he finds fibers in practically every one, but these are generally in very small numbers in the general public.

Q. Doctor, in your opinion, based on your knowledge in this field is it each exposure to asbestos dust that will cause asbestosis?

A. Obviously not or we would all have what you call asbestosis.

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Q. Is it each exposure to asbestos dust that will cause mesothelioma?

A. Certainly not.

Q. Or chest cancer?

A. Certainly not. There is some relation between dosage and other factors.

Q. Actually your research will show that a lot of workers who have engaged in this field of endeavor over a long period of years have neither asbestosis nor mesothelioma?

A. Certainly.

Q. A good percentage?

A. Certainly.

Q. Now is there any way on earth that you could sit here today, and considering that there are eleven alleged manufacturers of products containing asbestos with which a man has alleged in which he worked beginning thirty-five years prior to 1970, and that in 1970 it is alleged that he had developed asbestosis and that he developed mesothelioma, now taking those facts, is there any way in the world that you can sit here and tell us with any reasonable degree of medical certainty when this man got an exposure which caused or produced his asbestosis?

A. The answer is no.

Q. Is there any way you can sit here and tell us with any degree of medical certainty which exposure or exposures

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has caused or produced the mesothelioma?

A. The answer is no.

Q. Doctor, isn't it entirely probable that the man could have worked with the product on some job where he had a minimal exposure to dust and that it caused no harm whatsoever to him?

A. In a relative sense or use of the word I would say no, there would certainly be some that had no detectability exactly in terms of total outcome but I wouldn't be able to distinguish those here.

Q. You wouldn't be able to distinguish those here?

A. No.

Q. So actually, if you were trying to pick out, out of the eleven products or eleven manufacturers and some instances where the product may have been used once a day and without reference to time, would it just be bold speculation to say which product did cause or did not cause any injury or damage?

A. It would be bold speculation.

Q. Doctor, does the mere finding of asbestos fibers in the lungs indicate that a man has disability?

A. No.

Q. Does it indicate that he has asbestosis?

A. No, not in itself, it does not.

Q. All right, Doctor, how old are you?

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A. I was born in 1912. Let's see, that would make me --

Q. Fifty-eight, wouldn't it?

A. Fifty-nine.

Q. Fifty-nine, depending on the month?

A. Fifty-nine.

Q. Fifty-nine, all right, and how long have you been licensed to practice medicine?

A. I graduated from medical school in 1934, and I was licensed immediately in Virginia in 1934, but since I was in Government service I did not take my formal state license board until I went to California in 1943.

Q. So, Doctor, you have been engaged in research --

A. I practiced medicine in the Public Health Service but being with the Government I did not have to have a formal state license.

Q. That's all.

RECROSS EXAMINATION

BY MR. STEPHENSON:

Q. Doctor, do you have any objection to your whole paper that Mr. Weller has been reading excerpts from being introduced in this case?

A. It may have had some editorial revisions and there may be two or three typographical errors in it, but other

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than that I have no quarrel.

Q. Would you care to look at Table No. 2 of your paper?

A. Yes.

Q. Do I understand this table to mean if a man entered the trade of an asbestos insulation worker between the years 1911 and 1915 that you found one hundred percent with definite changes consistent with asbestosis?

A. Only two and both of the two people are dead.

Q. Do I understand you report those entering the trade from 1916 to 1920 to have one hundred percent evidence of definite changes consistent with asbestosis?

A. All five of those that we took X-rays of.

Q. All right, sir, we can go on down with this, which I believe 1921 through 1925, there was sixty-seven percent and 1926 through 1930 there was sixty-two percent, and 1931 through 1935 there was forty-six percent and so on. Now Mr. Weller has taken portions of your paper to mean that asbestos workers in the field don't get more than five million particles per cubic foot exposure, that's not what your paper says, is it?

A. What the paper says, if you average out the exposures of an asbestos worker over a period of time they don't average out more than five million particles per cubic foot.

Q. All right, sir, now in regard to your paper you

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showed in light and heavy industrial work, prefabrication,an exposure range up to fourteen percent, is that correct -- fourteen parts, I am sorry.

A. We showed that we found some sample studies that went that high.

Q. And for marine construction and repair and fabrication you found samples up to 28.8 parts, million parts per cubic foot?

A. Yes.

Q. And in application, light and heavy industrial, you found up to 7.5 parts per million cubic foot?

A. Yes.

Q. And in marine construction and repair you found 5.9?

A. Correct.

Q. And in mixing you found in light and heavy industrial 9.8 and in marine construction you found 29.0?

A. Yes, I agree.

Q. Those are in your paper?

A. Yes.

Q. And this does not mean that these men were not exposed to more than five million parts?

A. At any time?

Q. Let's assume that at any time they were

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exposed to ten parts per cubic foot, then would it be your opinion at that time they would have gotten enough asbestos to give them symptoms of asbestosis?

A. No, I think that this is not a correct conclusion to draw from these types of figures. This type of figure meant that during the course of a surge. Sometimes they were down and sometimes they were high. If you assume you have a man that worked all the time in the high surges and he used that respirator protection and he didn't change his job to any one of these jobs, he might get an average in the order of fifteen or twenty, but that's not what we found was occurring. Industrial hygiene requires common sense applied to the things a man does, and when we apply our interpretation of an insulator worker over a period of months or years on the basis of this type of figure he would not have had an average of more than five million. We know they are getting momentarily higher, and when I say this, that's about fifteen minutes that there are surges which are higher. It was the nature of the industry that nobody kept doing these things constantly over a working lifetime.

Q. Do you remember my earlier examination where I asked you if you could tell me how many exposures of heavy concentration of asbestos that would be required to give one a case of asbestosis?

A. And I recall I said I don't think there is a

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magic number.

Q. All right, and you can't say how many times a man has to be exposed to fourteen parts per cubic foot to give him the disease?

A. I can't say it today, and I certainly could not have said it ten years ago.

Q. And you can't say it with reference to tearing out marine construction where he might be exposed to fourteen parts per cubic foot?

A. No, and I don't think it should happen.

Q. All right, you recognized in your paper, did you not, that a factory would have better control conditions than would exist in the field?

A. I think for a number of reasons control measures are both excellent to install and afford good supervision.

Q. Do you know any manufacturer of insulating products that I originally read off to you that has done anything to prevent the inhalation of asbestos dust in the field by those workers applying their product?

MR. WELLER: I object to that question because it calls for hearsay and speculation on the part of the witness and, further, it is not the duty of the manufacturer of the product containing asbestos to supervise and police the worker in the field where he is employed by an independent contractor.

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A. My answer to this is that I do know that some companies have at least assisted in and made contributions to the research efforts to reduce the exposure, but this has been within the last five to six years since this kind of information has become available.

Q. All right, but prior to this you know of none?

A. I know of none.

Q. Doctor, would you classify, so far as the human health is concerned, would you classify asbestos as a dangerous product?

A. I don't know that asbestos is a product, I believe it to be a mineral. It does not specify it as a product, especially manufactured by Eagle-Picher.

MR. WELLER: I object because it invades the province of the jury, and it hasn't been presented in the light -- it isn't related to any specific product manufactured by any specific manufacturer, and on behalf of Fibreboard, for example, our product contains a hard rind and so forth, and it contains twelve to fifteen percent asbestos, and the question is not related to the use of these products by experienced professional asbestos insulation workers who are employed by expert employers who are engaged in this field or who have developed this as a specialty, and, therefore, the question would not pose any test which would be applicable in this case.

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MR. COLEY: That goes for all of the defendants.

MR. WELLER: Yes.

MR. COLEY: And further, the word dangerous is not defined, nor has there been any predicate laid to show what we are talking about when we say dangerous.

A. I would not dare to answer it unless the word dangerous is defined. It is a term that could be applied to many things that we work with all the time, to which I prefer not to answer.

Q. You prefer not to answer?

A. Yes.

Q. Doctor, can we say that for at least fifty years it has been recognized that asbestos is a harmful -- causes harm to the human body?

A. If I don't have to narrow myself down to words, and I also have the responsibility to the insulating workers and to the contractors to whom I make recommendations, and I want the record to show that I believe strongly that asbestos, the inhalation of asbestos can be harmful, and that I feel it is a great responsibility for people that manufacture or sell or use asbestos to handle it with dispatch and to avoid exposures, and the record must show that I feel this very strongly.

Q. Thank you, Doctor.

A. Which is the context of what I have learned in my

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own experience in seeing insulation workers in the last five or six years.

Q. All right, sir, my question was, I think maybe he might have answered it in that, but if you don't mind my repeating it one more time, do you believe that it has been recognized for more than fifty years that asbestos can cause harm to the human body?

A. It has been recognized that it can cause asbestosis which is harm, and it was known for the last ten or fifteen years that this harm could be prevented if the exposures were kept down to a modest level. It was both recognized as harmful and also as being controllable.

Q. But you know of no controls that any manufacturers have suggested prior to 1969?

MR. DUNCAN: I object to the question.

MR. WELLER: It calls for speculation and conclusion, and invades the province of the jury.

Q. Do you, Doctor, know of any controls that were suggested by any manufacturers before 1960?

A. It depends again upon the time period.

Q. Before 1960 now?

A. Before 1960 I know of none. I have not made special inquiry and have not looked for them.

Q. But you know of none?

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A. The answer is I know of none.

Q. That's all.

FURTHER REDIRECT EXAMINATION

BY MR. WELLER:

Q. I have two questions. Doctor, before 1960 was it not recognized in industry and by the Public Health Service and by the unions that the threshold limit value for dust containing asbestos was five million particles per cubic foot of air?

A. That was the threshold limit value.

Q. All right, and as long as the threshold limit value was kept within those limits it was considered to be reasonably safe for workers, wasn't it?

A. The answer is yes to that.

Q. And all of the research that had been done, including your paper, up through 1968, showed that asbestos insulation workers on an average were not subjected to dust counts in excess to the five million particles per cubic foot of air?

A. They were not subjected to average exposure.

Q. All right, in your research on the Pacific coast with the contractors and the asbestos union, didn't you find that some of them used dust collecting equipment in their fabricating shops, and that some of them used respirators, some of the men?

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A. Some of them used them and some didn't. Some provided respirators and some of the respirators were worn and some of the respirators weren't worn.

Q. The mere fact in your report that you tested the dust counts and what you reported didn't mean --

MR. STEPHENSON: Object to your leading.

Q. Did it mean where dust collecting equipment was used and the men were wearing masks that they were subjected to these exposures?

A. Ventilation was in place and the effect of that ventilation would have been reflected in lowering these counts, but if a respirator was being handled well, and that's basically a poor substitute, it would not be reflected in this count, the man's actual exposure would have been less.

Q. Thank you, Doctor, that's all.

FURTHER RECROSS EXAMINATION

BY MR. STEPHENSON:

Q. Doctor, one other thing, if there was a recognized five million particles per cubic foot by the National Conference, can you tell me if there is any way that a manufacturer of an asbestos product would know that his product exceeded that particle?

A. He could only tell by such a study as presently made which he probably didn't, and the only other way would

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have been to have gone and done it because observation would not be enough, take the count.

Q. That's all.

(CLOSE OF THE DEPOSITION)

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Beaumont, Texas

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THE STATE OF TEXAS

COUNTY OF JEFFERSON

I, Odessa J. Smith, a Notary Public in and for Jefferson County, Texas, do hereby certify that the facts stated by me in the caption to the foregoing deposition are true; that the foregoing deposition of DR. WILLIAM CLARK COOPER, the witness, was, at the time named, taken down correctly in shorthand by me, both the questions propounded by the attorneys and the answers given by the witness, in accordance with the notice and stipulation aforesaid, and afterwards transcribed correctly on the typewriter, all to the best of my skill and ability, and the foregoing is a true and correct transcript of the testimony given by the witness at said time; said witness being by me first carefully examined, cautioned and sworn to tell the truth, the whole truth and nothing but the truth.

I FURTHER CERTIFY that I am neither attorney or counsel for, nor related to or employed by any of the parties to the action in which this deposition is taken, and further, that I am not a relative or employee of any counsel or employed by the parties hereto or financially interested in the action.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, this the 9th day of September, 1971.

Odessa J. Smith

ODESSA J. SMITH, NOTARY PUBLIC IN AND FOR JEFFERSON COUNTY, TEXAS

ODESSA J. SMITH
Shorthand Court Reporter
Beaumont, Texas

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Exhibit 6
Fibreboard Exh. 1
8-31-71
DJS

Threshold Limit Values For 1961

Adopted at the 23rd Annual Meeting of the American Conference of Governmental Industrial Hygienists, Detroit, Michigan, April 9-12, 1961.

2/7/69

THRESHOLD LIMIT VALUES FOR 1961

Adopted at the 23rd Annual Meeting of the American Conference of Governmental Industrial Hygienists Detroit, Michigan, April 9-12, 1961

Threshold limits should be used as guides in the control of health hazards and should not be regarded as fine lines between safe and dangerous concentrations. They represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect. The values listed refer to time-weighted average concentrations for a normal workday. The amount by which these figures may be exceeded for short periods without injury to health depends upon a number of factors such as the nature of the contaminant, whether very high concentrations even for short periods produce acute poisoning, whether the effects are cumulative, the frequency with which high concentrations occur, and the duration of such periods. All must be taken into consideration in arriving at a decision as to whether a hazardous situation exists. Special consideration should be given to the application of these values in assessing the health hazards which may be associated with exposure to combinations of two or more substances.

Threshold limits are based on the best available information from industrial experience, from experimental studies, and, when possible, from a combination of the two. These values are based on various criteria of toxic effects or on marked discomfort; thus, they should not be used as a common denominator of toxicity, nor should they be considered as the sole criterion in proving or disproving diagnosis of suspected occupational disease.

DEFENDANT'S EXHIBIT 19 Civ 5402

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These limits are intended for use in the field of industrial hygiene and should be employed by persons trained in this field. They are not intended for use, or for modification for use, in the evaluation or control of community air pollution or air pollution nuisances.

These values are reviewed annually by the Committee on Threshold Limits for changes, revisions, or additions as further information becomes available. The Committee welcomes the suggestion of substances to be added to the list and also comments, references, or reports of experience with these materials.

Mineral and Non-Metallic Inorganic Dusts

Substance	M.P.P.C.F.£
Silica	
Quartz	
High (above 50% free silica)	5
Medium (5 to 50% free silica)	20
Low (below 5% free silica)	50
Cristobalite (above 5%)	5
Amorphous	20
Silicates	
Asbestos	5
Mica	20
Portland Cement	50
Soapstone	20
Talc	20
Miscellaneous:	
Aluminum Oxide	50
Calcite	50
Dolomite	50
Limestone	50
Marble	50
Silicon Carbide	50
Other inert dusts	50

£ Millions of particles per cubic foot of air based on impinger samples counted by light-field techniques.

TENTATIVE VALUES

Substance	P.P.M.£	Approx. Mg. per Cu. M.£
Acetonitrile	40	70
Allyl glycidyl ether (AGE)	10	45
Boron oxide		15
tert. Butyl chromate (as CrO_3)		0.1
n-Butyl glycidyl ether (BGE)	50	270
Butyl mercaptan	10	35
Chloroacetaldehyde	1	3
Chlorobromomethane	200	1,050
DDVP (0,0-Dimethyl-2,2-Dichlorodivinyl phosphate)		1
Diglycidyl ether (DGE)	10	55

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DR. W. CLARK COOPER

exhibit 7

Fibreboard Exh 2
8-31-71
DS

Threshold Limit Values of Air-borne Contaminents For 1968

RECOMMENDED AND INTENDED VALUES

DEFENDANT'S EXHIBIT
#20
Civ 5402
PENSAD • Bayonne, N.J.



Adopted at the 30th Annual Meeting of the American Conference of Governmental Industrial Hygienists, St. Louis, Missouri, May 13, 1968.

2/7/69

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THRESHOLD LIMIT VALUES FOR 1968

The Threshold Limit Values refer to air-borne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect. Because of wide variation in individual susceptibility, exposure of an occasional individual at or even below the threshold limit may not prevent discomfort, aggravation of a pre-existing condition, or occupational illness.

Clinical tests are becoming available that permit detection of those individuals who will hyperreact upon exposure to certain industrial substances. Being predictive in character, they may be applied as screening tests in the preplacement job examination. Requests for further details of these tests should be directed to the Chairman of the Committee.

Threshold limits should be used as guides in the control of health hazards and should not be regarded as fine lines between safe and dangerous concentrations. Exceptions are the substances given in Appendix A and certain of the substances given a "C" listing. The values not given a "C" listing refer to time-weighted average concentrations for a conventional 7 or 8 hour workday.

Time-weighted average concentrations permit excursions above the limit, provided they are compensated by equivalent excursions below the limit during the work day. The degree of permissible excursion is pegged to the threshold limit value of the particular substance as given in table in Appendix C under "Test TLV Factor." Hence, it is not considered appropriate to interpret air concentration values as exceeding time-weighted average limits, if such values lie within the permissible excursions. (See section on Legislative Code.)

The amount by which these concentrations may be exceeded for short periods without injury to health depends upon a number of factors such as the nature of the contaminant, whether very high concentrations even for short periods produce acute poisoning, whether the effects are cumulative, the frequency with which high concentrations occur, and the duration of such periods. All must be taken into consideration in arriving at a decision as to whether a hazardous situation exists. Enlightened industrial hygiene practive inclines toward controlling exposures below the limit rather than maintenance at the limit.

Threshold limits are based on the best available information from industrial experience, from experimental human and animal studies, and when possible, from a combination of the three. The basis on which the values are established may differ from substance to substance; protection against impairment of health may be the guiding factor for some, whereas reasonable freedom from irritation, narcosis, nuisance or other forms of stress may dominate the basis for others. The Committee holds to the opinion that limits based on physical irritation should be considered no less binding than those based on

physical impairment; growing bodies of evidence indicate that physical irritation may promote and accelerate physical impairment.

These limits are intended for use in the field of industrial hygiene and should be interpreted and applied only by persons trained in this field. They are not intended for use, or for modification for use, (1) as a relative index of toxicity, by making a ratio of two limits, (2) in the evaluation or control of community air pollution or air pollution nuisances, (3) in estimating the toxic potential of continuous uninterrupted exposures, (4) as proof or disproof of an existing disease or physical condition, or (5) for adoption by countries whose working conditions differ from those in the United States of America and where substances and processes differ.

Documentation of Threshold Limit Values. A separate companion piece to the TLVs is issued by ACGIH under this title. This publication gives the pertinent scientific information and data with reference to literature sources that were used to base each limit. Each documentation also contains a statement defining the type of response against which the limit is safeguarding the worker. For a better understanding of the TLVs it is essential that the Documentation be consulted when the TLVs are being used.

Ceiling vs Time-Weighted Average Limits. Although the time-weighted average concentration provides the most satisfactory, practical way of monitoring air-borne agents for compliance with the limits, there are certain substances for which it is inappropriate. In the latter group are substances which are predominantly fast acting and whose threshold limit is more appropriately based on this particular response. Substances with this type of response are best controlled by a ceiling "C" limit that should not be exceeded. It is implicit in these definitions that the manner of sampling to determine compliance with the limits for each group must differ; a single brief sample, that is applicable to a "C" limit, is not appropriate to the time-weighted limit; here, a sufficient number of samples are needed to permit a time-weighted average concentration throughout a complete cycle of operations or throughout the work shift.

Whereas the ceiling limit places a definite boundary which concentrations should not be permitted to exceed, the time-weighted average limit requires an explicit limit to the excursions that are permissible above the listed values. The magnitude of these excursions may be pegged to the magnitude of the threshold limit by an appropriate factor shown in Appendix C. It should be noted that the same factors are used by the Committee in making a judgment whether to include or exclude a substance for a "C" listing.

"Skin" Notation. Listed substances followed by the designation "Skin" refer to the potential contribution to the over-all exposure by the cutaneous route including mucous membranes and eye, either by air-borne, or more particularly, by direct contact with the substance. Vehicles can alter skin absorption.

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This attention-calling designation is intended to suggest appropriate measures for the prevention of cutaneous absorption so that the threshold limit is not invalidated.

These values are reviewed annually by the Committee on Threshold Limits for revision or additions, as further information becomes available.

Mixtures. Special consideration should be given also to the application of these values in assessing the health hazards which may be associated with exposure to mixtures of two or more substances. A brief discussion of basic considerations involved in developing threshold limit values for mixtures, and methods for their development, amplified by specific examples are given in Appendix B.

"Inert" or Nuisance Particulates. A number of dusts or particulates that occur in the working environment ordinarily produce no specific effects upon prolonged inhalation. Some insoluble substances are classed as inert (e.g. iron and steel dusts, cement, silicon carbide, titanium dioxide, cellulose); others may be soluble (starch, soluble oils, calcium carbonate) but are of such a low order of activity that in concentrations ordinarily encountered do not cause physiologic impairment; still others may be rapidly eliminated or destroyed by the body (vegetable oils, glycerine, sucrose). In the case of the insoluble substances, there may be some accumulation in the respiratory passages. In the case of the soluble substances, this accumulation will ordinarily be temporary but may interfere to some extent with respiratory processes. Hence, it is desirable to control the concentrations of such particulates in the air breathed by any individual, in keeping with good industrial hygiene practice.

A threshold limit of 15mg/m^3, or 50 mppcf, whichever is less, is recommended for substances in these categories and for which no specific threshold limits have been assigned. This limit, for a normal work day, does not apply to brief exposures at higher concentrations. Neither does it apply to those substances which may cause physiologic impairment at lower concentrations but for which a threshold limit has not yet been adopted. Some "inert" particulates are given in Appendix D.

Simple Asphyxiants - "Inert" Gases or Vapors. A number of gases and vapors, when present in high concentrations in air, act primarily as simple asphyxiants without other significant physiologic effects. A TLV may not be recommended for each simple asphyxiant because the limiting factor is the available oxygen. The minimal oxygen content should be 18 percent by volume under normal atmospheric pressure (equivalent to a partial pressure, pO_2 of 135 mm Hg). Atmospheres deficient in O_2 do not provide adequate warning and most simple asphyxiants are ordorless. Several simple asphyxiants present an explosion hazard. Account should be taken of this factor in limiting the concentration of the asphyxiant.

Physical Factors. It is recognized that such physical factors as heat, ultraviolet and ionizing radiation, humidity, abnormal

pressure and the like may place added stress on the body so that the effects from exposure at a threshold limit may be altered. Most of these stresses act adversely to increase the toxic response of a substance. Although most threshold limits have built-in safety factors to guard against adverse effects of moderate deviations from normal environments, the safety factors of most substances are not of such a magnitude as to take care of gross deviations. For example, continuous work at temperatures above 90°F or over-time extending the work-week more than 50%, might be considered gross deviations. In such instances judgment must be exercised in the proper adjustments of the threshold limit values.

"Notice of Intent" At the beginning of each year, proposed actions of the Committee for the forthcoming year are issued in the form of a "Notice of Intent." This Notice provides not only an opportunity for comment, but solicits suggestions of substances to be added to the list. The suggestions should be accompanied by substantiating evidence.

As Legislative Code. The Conference does not consider the Threshold Limit Values appropriate matter for adoption in legislative codes and regulations and recommends against such use. If, however, the list is so used, the intent of the concepts contained in the Preface should be maintained and provisions should be made to keep the list current.

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MINERAL DUSTS

Substance	m.p.p.c.f. e)
SILICA	
Crystalline	
** Quartz, Threshold Limit calculated from the formula	$\frac{250\ f)}{\%SiO_2 + 5}$
** Cristobalite " " "	
Amorphous, including natural diatomaceous earth	20
Tremolite	5
SILICATES (less than 1% crystalline silica)	
** Asbestos	5
Mica	20
Soapstone	20
Talc	20
Portland Cement	50
GRAPHITE (natural)	15
"Inert" or Nuisance Particulates see Appendix D	50 (or 15 mg/m³ whichever is the smaller)

Conversion factors

mppcf x 35.3 = million particles per cubic meter
= particles per c.c.

e) Millions of particles per cubic foot of air, based on impinger samples counted by light-field technics.

f) The percentage of crystalline silica in the formula is the amount determined from air-borne samples, except in those instances in which other methods have been shown to be applicable.

** See Notice of Intended Changes

NOTICE OF INTENDED CHANGES (CONTINUED)

Substance	
+ Asbestos + Cristobalite	12 fibers/ml > 5μ in length j) , or 2 mppcf k) Use one-half the value calculated from the count or mass formulae for quartz.
+ Quartz	(1) TLV for respirable dust in mg/m³ : $\frac{10\ mg/m^3\ m)}{\%\ Respirable\ Quartz + 2}$ (2) "Total dust" respirable and nonrespirable: $\frac{30\ mg/m^3}{\%\ Quartz + 2}$
+ Tridymite	Use one-half the value calculated from formulae for quartz.

j) As determined by the membrane filter method at 430 X phase contrast magnification.

k) As counted by the standard impinger, light-field count technique.

m) Both concentration and per cent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:

Aerodynamic Diameter (μ) (unit density sphere)	% passing selector
≤2	90
2.5	75
3.5	50
5.0	25
10	0

+ 1968 Revision
++ 1968 Addition

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