

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

THE UNITED STATES OF AMERICA,)
)
 Plaintiff,)
)
 vs.) No. 78 C 1004
)
OUTBOARD MARINE CORPORATION)
AND MONSANTO COMPANY,)
)
 Defendants.)

The deposition of ROBERT E. KELLER,
called by the Plaintiff, the United States of America,
for examination pursuant to notice and pursuant to
the Rules of Civil Procedure for the taking of depo-
sitions, taken before Thea L. Urban, a Notary Public
in and for the County of Cook, State of Illinois, and
a Certified Shorthand Reporter of said State, at the
offices of Kirkland & Ellis, 200 East Randolph Drive,
Chicago, Illinois 60601, on the 28th day of May, A.D.
1981, commencing at 9:30 o'clock a.m.

PRESENT:

MR. JAMES T. HYNES,
(Deputy Chief, Civil Division
United States Attorney's Office
219 South Dearborn Street, Room 1486
Chicago, Illinois 60604),

appeared on behalf of the
United States of America;

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PRESENT: (Continued)

MS. ROSEANN OLIVER,
(Phelan, Pope & John, Ltd.
30 North LaSalle Street
Chicago, Illinois 60602),

and

MS. JOANNA NEW,
(Martin, Craig, Chester & Sonnenschein
115 South LaSalle Street
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appeared on behalf of Outboard
Marine Corporation;

MR. BRUCE A. FEATHERSTONE,
MR. ROBERT E. SHAPIRO,
(Kirkland & Ellis
200 East Randolph Drive
Chicago, Illinois 60601),

appeared on behalf of Monsanto Company.

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I N D E X

<u>WITNESS:</u>	<u>Direct</u>	<u>Cross</u>	<u>Redirect</u>	<u>Recross</u>
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E X H I B I T S

Keller-OMC Deposition
Exhibit

Marked for ID

No. 1	192
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(Witness sworn.)

R O B E R T E. K E L L E R,

called as a witness herein, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. HYNES:

Q Would you please state your name and spell your last name for the record.

A My name is Robert Keller, K-e-l-l-e-r.

Q Where are you employed currently, Mr. Keller?

A Monsanto Company, St. Louis.

Q What is your current address?

A Home address or company address?

Q Home address.

A It is 10142 Glenfield, G-l-e-n-f-i-e-l-d, Terrace, St. Louis, Missouri 63126.

Q Would you please state what your educational background is, starting with college, where you got your degree, what year, what your concentrations were.

A I have a B.S. Degree in Chemistry, an M.S. Degree in Chemistry and a Ph.D. Degree in Chemistry, all from the University of Iowa.

Q What were the approximate dates of each of those degrees?

A The B.S. Degree was in 1947, the M.S. Degree in 1949 and the Ph.D. in 1951.

Q In either your Master's in Chemistry or your Ph.D., were there any specializations that you took?

A My major for the Master's and Ph.D. Degrees was Analytical Chemistry. My minor was Physical Chemistry.

Q Would you just briefly explain what analytical chemistry is and physical chemistry?

A Primarily analytical chemistry involves the identification and measurement of different chemical species, such as organic and inorganic types of materials in all types of products.

Q And physical would be?

A Physical chemistry is study of primarily what is known as physical properties of chemicals and related materials.

Q Have you taken any more formal education past your Ph.D. level?

A No, I have not.

Q Have you published any articles or been co-author of any articles in the field of chemistry?

A Yes.

Q Could you briefly state what they were. If you have a litany of 50 articles, I do not expect you to go through them, but as best you can.

A I published rather extensively earlier in my career and these publications appeared primarily in analytical technical journals in the United States.

Q What was the general subject matter of these articles?

A Directed towards determination of organic-type materials in a variety of matrices products.

Q You say earlier on in your career. Would you put a date on that?

A That would be a time frame of the first 15 years.

Q Somewhere between '51 and '65, somewhere in that area?

A Correct.

Q These were documented in analytical or technical journals and these are published to the community as a whole rather than an internal publication?

A That's right. These are well recognized technical journals, such as the Analytical Chemical Journal, which is a journal out of the American Chemistry

Association published in the United States.

Q Are you currently a member of any professional or honorary societies?

A Yes.

Q Which are those?

A American Chemical Society.

Q Any others?

A Society of Applied Spectroscopy, Sigma Psi, which is a technical professional society.

Those are the principal ones.

Q Are there any technical qualifications to become a member in any of these three societies you mentioned?

A A degree, college degree or certain period of demonstrated proficiency without a degree.

Q Have you been an officer in any of these societies at any point?

A Yes.

Q Which ones, and as best you recall, the office you held and the dates.

A The principal office would be the Society of Analysts, which is part of the American Chemical Society. This is the St. Louis section and I held three offices, the last one being Chairman of this group.

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Q Do you recall about what date that was, the time period when you were Chairman?

MR. FEATHERSTONE: Approximation is fine.

BY THE WITNESS:

A 15 years ago.

BY MR. HYNES:

Q When did you join Monsanto?

A 1952.

Q Shortly after you received your Ph.D.?

A Correction to the record. Do you want me to go ahead and --

MR. FEATHERSTONE: The pending question, Doctor, is when you joined Monsanto.

BY THE WITNESS:

A I joined Monsanto in 1954.

BY MR. HYNES:

Q Prior to joining Monsanto, could you briefly trace your work history as to where you worked and what your duties were?

A I was a research chemist at Smith, Klein & French Laboratories in Philadelphia in the Research Department.

Q What was the period of your employment there?

A Approximately two years.

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Q Would that be approximately from when you received your Ph.D. Degree until you joined Monsanto?

A Yes.

MR. FEATHERSTONE: Wait until Mr. Hynes completes his question before you respond.

BY MR. HYNES:

Q Prior to working at Smith, Klein & French, did you have any other employment prior to that in the field of chemistry?

A Yes.

Q Where was that and when was that?

A That was an Assistant Professorship at the University of Iowa in the Chemistry Department.

Q What were the dates of the professorship?

MR. FEATHERSTONE: As professor?

MR. HYNES: As professor.

BY THE WITNESS:

A 1950.

BY MR. HYNES:

Q Prior to that, do you recall any other employment in the field of chemistry?

A Only graduate assistantship in school chemistry.

Q Would you just briefly explain the work you did at Smith, Klein & French in Philadelphia, what the

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Research Department did, what your duties were?

A The duties there, I was a member of the Analytical Department in the Research Department. My work was directly toward development of new methods for analysis of pharmaceutical-type products.

Q Would you give me an example of what you mean by method of analysis for pharmaceutical-type products?

A An example would be interest in determining the rate at which time disintegrating capsules would dissolve or if a method was needed to determine how fast active components of these capsules dissolved, for this, a method specifically for these components was needed; for this purpose, then you develop in that case an instrumental type method for developing this.

(Brief interruption.)

BY MR. HYNES:

Q Would I be correct in stating it was a method of determining certain physical properties, a method to analyze the physical properties of these pharmaceuticals?

A Yes, more directly the chemical composition rather than physical properties.

Q And your time at Smith, Klein & French was spent in the Analytical Department of the Research

Department, is that correct?

A Correct.

Q Am I correct then in 1954 you joined Monsanto from Smith, Klein?

A Correct.

Q What was your first position with Monsanto and where was it located?

A Senior Research Chemist in the Organic Chemicals Division of Monsanto, located in St. Louis.

Q What were your duties as a senior research chemist?

A My duties involved development of analytical procedures needed by the Organic Chemicals Division.

Q What were the types of analytical procedures needed by it that you worked?

A This covered a variety of chemical instrumental techniques directed toward certain specific organic products, intermediates and starting materials.

MR. HYNES: Could you read that answer.

(Answer read.)

BY MR. HYNES:

Q I am just trying to get it clear in my own mind.

These chemical and instrumental techniques,

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these were used to measure various reactions, properties, things of that nature within the chemical products themselves?

A Yes. It was used to aid chemists who were developing new products and new processes to follow the presence or absence of these various materials in that work.

Q Would I be correct in saying that if you are dealing with a new chemical or an experimental chemical, for want of a better word, it would be to follow the reactions of the chemical to see that it does do what it is anticipated on doing?

A Yes.

Q How long were you working as a senior research chemist in the Organic Chemicals Division in St. Louis?

A Approximately two years.

Q Were your duties substantially the same during that period of time?

A Yes.

Q What was your next position with Monsanto?

A Project Leader in the same department.

Q Did your duties change when you became a project leader?

A Only in scope in type of projects, all directed

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toward analytical work.

Q What do you mean by your duties changed only in scope and type of products?

A It was still analytical chemistry and involved support help by another person or two as a project leader.

Q In other words, you had a couple of people assisting you, you were doing the same basic analytical work you had?

A With additional responsibilities.

MR. FEATHERSTONE: Wait until Mr. Hynes complete his question, Doctor, before you respond.

BY MR. HYNES:

Q You just had a couple of people assisting you on it?

A Yes.

Q How long were you a project leader?

A Approximately two years.

Q What was your next position?

A Group Leader.

Q How did your duties change then as a group leader from project leader?

A Again, this consisted of expanded duties in the analytical area with increased emphasis on certain

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instrumental techniques.

Q Would you explain what this increased emphasis was on certain instrumental techniques?

A This was a period in which new instrumental developments were coming from commercial manufacturers such as infrared spectroscopy and I was involved with application and use of techniques of this type.

Q The infrared spectroscopy I assume is one of the types of instruments you were working on at the time?

A Yes.

Q Would you just briefly explain how you would go about taking the infrared spectroscopy, as an example, what your duties or involvement would be in analyzing this new piece of equipment, how you would apply it to the work at Monsanto?

A Yes. The infrared spectroscopy is a tool powerful for determining organic types of chemicals. It has a capability for showing structural functional groups in these chemicals.

This makes it a technique that has considerable specificity and it also is a technique that is easily quantified in terms of measuring how much is present. It is also a rapid technique.

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Q What would your work involve with this instrument at the time when you first got it at Monsanto and you first started working with it as a group leader?

A This involved applying this to the development of products and processes involving many types of organic materials --

MR. FEATHERSTONE: Was it essentially fitting in a new piece of equipment into the techniques that you had been using or developed?

BY THE WITNESS:

A Yes, one of several as an example.

BY MR. HYNES:

Q We are just dealing with the IR spectroscopy as the types of studies you had.

Would the other instrumental techniques go through the same processes as you explained for the IR?

A Yes.

Q Would you have occasion to modify the basic technique, the basic instrument that you got that was developed by some other company and modified it to the uses of Monsanto that you would want to put it to?

MR. FEATHERSTONE: Are you talking about technique or instrument? You have both in your question.

MR. HYNES: He was talking instrumental techniques.
Let us use that.

BY MR. HYNES:

Q Would you on occasion modify the instrumental technique that was developed by some other country for use at Monsanto?

MR. FEATHERSTONE: Some other country?

MR. HYNES: Did I say country, excuse me, company.

MR. FEATHERSTONE: You are to read company instead of country in your question.

BY THE WITNESS:

A Yes.

BY MR. HYNES:

Q As a group leader, how long were you in that position?

A Approximately seven years.

Q Were your duties throughout this time substantially the same?

A Yes.

Q In this period of time, were you or the people within your group involved in developing your own instrumental techniques other than modifying basic techniques, which instrumental techniques you had acquired from other companies?

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A Not my immediate group.

Q There were other groups within Monsanto that might have done that?

A Yes.

Q Would you have been involved with those other groups in any way other than just receiving information from them about the techniques that they were developing?

A No.

Q Is there anything else concerning your duties as a group leader in this seven years that were what you consider significant duties which you have not mentioned?

A No.

Q I take it that you had a number of people working for you as a group leader?

A Yes, a small group.

Q Would there be project leaders working for you, is that a usual chain of command from project leader to group leader?

A Yes.

Q All of this was still within the Organic Chemicals Division at St. Louis?

A Yes.

Q What was your next position after group leader

with Monsanto?

A Senior Research Group Leader.

Q About when did you start in that position, what year?

A It is whatever these years add up to that I have given you.

Q Somewhere around 1965?

A All right, 1965.

Q '64 or '66, that's fine.

What were your duties as a senior research group leader?

A Expanded duties covering analytical chemistry and method development primarily.

Q Expanded duties covering analytical chemistry and what was the other?

A Method development.

Q In general, were these expanded duties?

A Again, this involved additional instrumental techniques.

Q Is that what method development is, instrumental techniques, is that correct?

A Yes.

Q I just want to get this straight.

Were there other group leaders who had

certain types of instrumental techniques to determine in their jurisdiction when you were a group leader that now as a senior research group leader these various group leaders and instrumentation methods that they had basically reported to you and you were involved in all of them?

A There were certain instrumental techniques that were used for analytical problems in our groups.

Q Am I correct that as senior research group leader, you then became involved in more instrumental techniques and methods than you had been before as a group leader?

A Yes.

Q Anything additional in the duties, your expanded duties that we have not discussed as senior research group leader?

A No.

Q How long were you in that position?

A Approximately five years.

Q If my math is right, somewhere around 1970 was when you moved into your next position with Monsanto?

A Correct.

Q What was that?

A Section Manager of the Analytical and Physical

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Chemistry and Instrument Development Section.

Q Could you explain what your duties were as section manager?

A These were primarily administrative duties involving management of these groups related to direction of the groups' resources, including facilities, equipment, budgets, personnel problems.

Q As section manager, were you at that time directly involved with any of the research materials of the instrument development or analytical techniques?

A The groups themselves have responsibility through the head of the group for the technical work carried out. They would take on projects which would come from our divisions. We were a support unit for our Organic Chemicals Division and which at that time was a division of corporate Monsanto.

We were in a support role where we accepted work upon request from clients. These were the business groups of the Organic Chemicals Division.

MR. FEATHERSTONE: I think the question was, Doctor, whether you were directly involved in any of the technical work done by the people under you.

BY THE WITNESS:

A In an administrative role.

BY MR. HYNES:

Q In other words, would it be correct in saying you were to assign these various tasks to these different groups, follow up to make sure they were completed in a timely fashion and within budget?

A Assignment of some of the tasks. Many of the tasks came directly to the group leaders of these groups, were reported out by these group leaders and I would see the work after it had been reported out. I would receive a copy of the work concurrent with the client.

Q Talking about the client, who do you mean by the client?

A The client would be our business groups of the Organic Chemicals Division.

Q All within the Monsanto Company?

A Correct.

Q How long were you section manager of these sections?

A Approximately one year.

Q This also was in St. Louis?

A Yes.

Q What was your next position at Monsanto?

A Manager, Applied Sciences.

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Q That was also in St. Louis, is that correct?

A Yes.

Q What were your duties as Manager of Applied Sciences?

A Administrative responsibility for five principal groups which were an organic analytical group, inorganic analytical and radiochemistry group, physical chemistry group, instrumental development group and applied math and computer sciences group.

Q I have six groups. You said five, did I mess something up here?

I have the organic analytical group, inorganic analytical group, radiochemistry group, physical chemistry group, instrumental development group and applied math and computer sciences group.

A The inorganic chemical and radiochemistry is one group.

Q Thank you.

In terms of your administrative responsibilities for these five groups, would those be similar types of duties as you had as a section manager: Direction of resources and facilities, things of that nature?

A Yes, yes.

Q Of these five groups that you mentioned you had administrative responsibility over, was the physical chemistry group the one that you were section manager of previously?

A No, it was the analytical related groups.

Q The organic analytical and the inorganic?

A Yes.

Q Would you briefly explain what the function of the physical chemistry group was at the time that group was reporting to you?

A Their efforts were directed toward determining physical properties of a variety of chemicals including chemical products, with emphasis on stabilities of these products for design of processes, safe design.

Q What does stability mean in a chemical?

A Thermal stability, how stable materials would be under various temperatures.

MR. FEATHERSTONE: I take it, Mr. Hynes, when you ask that question, you mean in the context of that group?

MR. HYNES: Of the physical chemistry group, yes.

MR. FEATHERSTONE: Process development, okay.

BY THE WITNESS:

A Yes.

BY MR. HYNES:

Q Anything else concerning the physical chemistry group that you can recall?

A No.

Q What are the functions and responsibilities of the instrumental development group?

A This group directed their efforts toward development of custom instruments for on-line process monitoring and special devices for research and development applications.

Q Would this work have been similar to the work you were doing as a senior group leader in the applied chemistry and method development?

A No.

Q How was the instrument development group here different than the instrumental techniques work that you were involved in in the Organic Chemicals Division?

A The instrument development group deals in producing a piece of equipment, hardware for certain measurements of which one might be analytical-type measurements or physical chemistry measurements. The difference in this group is through an end product which is usually an instrument. The other group that you are comparing this to had an end product of technical

information.

MR. FEATHERSTONE: A technique for using a product that was supplied by somebody else.

MR. HYNES: I don't understand what you said.

MR. FEATHERSTONE: My understanding of his testimony is that earlier on in his area, he was involved in development of technical techniques used on the market and purchased by Monsanto.

THE WITNESS: Yes.

MR. FEATHERSTONE: And the difference between that function and the function he had under him as manager of applied sciences is that he was developing techniques to develop equipment supplied by someone else.

THE WITNESS: Commercial.

MR. FEATHERSTONE: Where the group under him was developing custom instruments.

MR. HYNES: For use at Monsanto?

THE WITNESS: In-house use.

BY MR. HYNES:

Q And the other group which reported to the applied math and computer sciences group, will you explain their function, what their duties were?

A This group used statistics, experimental

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design math modeling techniques to help researchers in carrying out work directed towards new products and processes.

It also involved use of computer systems needed for a variety of activities between the research and development department.

Q Would I be correct in assuming that the computer sciences work done by this group was aimed basically toward research rather than an accounting program and things of that nature?

A Essentially that was the application.

Q Do you recall any other duties or responsibilities that you had as manager of applied sciences other than what we just discussed?

A No.

Q How long were you in that position?

A To the present date.

Q Am I correct in assuming then that from the time you started working with Monsanto, from 1954 to the present, you have been working in the St. Louis office the whole time?

A Correct.

Q Has the corporate structure of Monsanto changed from the time you were section manager in 1970

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to the present time that would involve your position as either section manager or manager of applied sciences?

A Yes. Your question is did the corporate structure change?

Q Yes.

A Yes, it did.

Q I want to find out when it did change so I know when you were section manager or manager of applied sciences.

A In the early '70s, the Organic Chemicals Division and Inorganic Division of Corporate Monsanto were combined into Monsanto Industrial Chemicals Company. As part of that combination of the applied sciences area which I had out of the Organic Chemicals Division was retained and served the new company.

Q And that became the --

A Applied Sciences.

Q The Organic Chemicals Division and the Inorganic Chemicals Division were no longer a part of the Monsanto corporate structure?

MR. FEATHERSTONE: Became independent companies.
BY MR. HYNES:

Q Became independent companies and what was the name of --

A Monsanto Industrial Chemicals Company, an operating unit of Monsanto Company.

Q And you still retained your position as manager of applied sciences but it was then part of Monsanto Industrial Chemicals Company at that point?

A Correct.

Q Did your duties change in any way after the formation of the Monsanto Industrial Chemicals Company?

MR. FEATHERSTONE: I may be wrong in this, but I thought you took the job of manager of applied sciences at the time of this reorganization.

THE WITNESS: No, I was manager of applied sciences as part of the Organic Chemicals Division shortly before the reorganization of Corporate Monsanto.

MR. FEATHERSTONE: Then Mr. Hynes' question is as a result of that reorganization that you described, did your duties change from how you described them earlier as manager of applied sciences.

BY THE WITNESS:

A No, with this addition, qualification: They were extended duties covering more clients.

BY MR. HYNES:

Q Again, these clients are within the Monsanto corporate structure?

A Operating divisions within the new company.

Q Would I be correct in assuming that any product or chemical which would come under the Organic Chemicals Division of Monsanto or under the Monsanto Industrial Chemicals Company, being manager of applied sciences, would all of these products or chemicals or experimental products go into your applied sciences department for some sort of work -- let me strike that.

MR. FEATHERSTONE: I think they worked on a project basis.

BY MR. HYNES:

Q You worked on a project basis, I understand, but would one of the clients or operating divisions or product groups within Monsanto, if they had or were working with something that would be considered an organic chemical, if they had need of the use of services of your applied sciences department, would it always go to you or would there be some other branch of Monsanto that they would send their work to?

A It would not always come to us. It could go to a variety of support facilities.

Q What were these or what are these other support facilities?

A A typical example --

MR. FEATHERSTONE: What are they?

BY MR. HYNES:

Q Let us get back in '71, '72, '73, just prior to the formation of Monsanto Industrial Chemicals Company.

What were these other support facilities that an organic chemical or product which would be under a broad category of organic chemicals, where would these other facilities be?

A There was one other principal facility of this type called Physical Sciences Center located in St. Louis.

Q What was the best you recall, again we are talking just before the Monsanto Industrial Chemicals Company was formed, what was the function of this Physical Sciences Center? What was their work, essentially?

A They provided additional support services directed toward routine analytical service and special sophisticated instrumental services for operating units of the company who required support of this type.

Q What were these routine analytical services which this service performed, just in general?

MR. FEATHERSTONE: And taking into account the

fact that he did not work there.

BY MR. HYNES:

Q No, all these things are as much as you know. If you don't know, say you don't know.

A They provided recognized standard method analyses, well-published analyses, chemical and instrumental in the category of routine analyses, those considered not too difficult and straightforward.

Q The routine here, would this routine then be routine types of tests, not necessarily a routine test on every product, the routine is the type of technique used?

A Yes.

Q Rather than the routine and this is the pattern all products go through, it has to go through this Center for this particular test, is that correct?

A Yes, yes. I would like to add to that.

Q Yes.

A This facility, it also was prepared to do method development work for operating units which needed it.

Q Did they ever? You say they were prepared to do it. Did they ever do it?

MR. FEATHERSTONE: I think that question is going

to go beyond his knowledge, did they ever do it.

MR. HYNES: I just want to find out.

BY MR. HYNES:

Q You said they were prepared to do it. That means they had the --

MR. FEATHERSTONE: Capability.

MR. HYNES: The capability to do it.

BY MR. HYNES:

Q I just want to know if to your knowledge they ever got involved in that.

A I'm aware that yes, they have.

Q And are you aware of the types of work that they did in that area?

A Yes.

Q Would you briefly explain what types of work they did in that area?

A They were a corporate support service facility with a wide spectrum of techniques and on instrument situations where Corporate Monsanto would have only one instrument and they were considered the center of expertise for operating units which may, for whatever reason, not have their own support facility.

Our company, Monsanto Industrial Chemicals Company, had their own support facility;

namely, Applied Sciences. For this reason, much of the work on special determinations, analytical work was carried on within our company rather than send it to the corporate support facility.

Q You also mentioned as to the Physical Sciences Center that they did some special sophisticated support services for new divisions of the company, is that what you are talking about?

A Yes.

Q Were there any other organizations in your divisions within the company which did analytical work similar to the Applied Sciences, other than the Physical Sciences Center?

A Yes.

Q What other facilities were there or the names of facilities, if you know?

A There were plant laboratories which had their own analytical laboratories.

Q In general what type of applied sciences work would these plant laboratories do, as best you recall?

A They applied analytical methods for monitoring the manufacture, production of products.

Q Am I correct in assuming that a plant manager's main function is just -- I don't know if quality control

would be the right word, but monitor the processes in the plant, the chemicals that are coming out are within the standards of whatever the process or product is that is being manufactured. Would that be the basic function?

A The plant manager or the plant analytical group?

Q Did I say plant manager?

Would I be correct in assuming that these plant laboratories' main function would be almost of a quality control type of function, making sure the products, the chemicals that came through the production line met the various specifications that were set for them?

A Yes.

Q Do you know of any other basic functions that they perform, these plant laboratories?

A No.

Q Any other facilities within the Monsanto Company that you can recall were involved in applied sciences-type area?

A Yes.

Q What were these others?

A Monsanto Research Corporation.

Q Was the Monsanto Research Corporation in existence prior to the formation of Monsanto Industrial Chemicals Company?

A Yes.

Q Is it still in existence today, the best of your knowledge?

A In a different organizational version.

Q The best of your knowledge, was that different corporate version, did that transformation occur when Monsanto Industrial Chemicals Company was formed?

A I don't recall the time when that occurred.

Q Prior to that change in the structure, what was the function, what type of work did the Monsanto Research Corporation do?

MR. FEATHERSTONE: Change, are we talking about from Organic?

MR. HYNES: No, the change in Monsanto Research Corporation. He said their function changed to some extent and prior to that change what were the functions.

BY THE WITNESS:

A They directed their efforts toward Government contracts.

BY MR. HYNES:

Q Do you have any general knowledge of the type

of Government contracts they did and into what area?

A No.

Q Do you know if they had any other major functions other than working on Government contracts?

A No.

Q You say the corporate structure of Monsanto Research Corporation changed to some extent. Do you recall when that change occurred and I am not trying to pin you down to a specific date, just the best of your recollection.

A In the later '70s.

Q And do you know at this point, the change in their function, what the change in that function was in that corporation?

MR. FEATHERSTONE: How is that relevant to this lawsuit?

MR. HYNES: I don't know. I want to find out what the corporate structure was.

MR. FEATHERSTONE: How much longer are we going to do that?

MR. HYNES: There is only the research group after the Monsanto Research Corporation.

MR. FEATHERSTONE: You can answer the question, but you are way beyond the time period of your lawsuit.

MR. HYNES: I know. That is why I want to ask the question. That is why I asked the question of any changes that he can recall.

MR. FEATHERSTONE: He doesn't work for the company.

MR. HYNES: I asked if he recalls.

MR. FEATHERSTONE: He may never have known, but go ahead, Doctor.

BY THE WITNESS:

A The only thing I recall was that they re-directed their efforts to the environmental thrust that the Corporate Monsanto started in the late 1970s.

BY MR. HYNES:

Q I am not sure what you mean by environmental thrust.

Let me put it this way: What do you mean by environmental thrust?

MR. FEATHERSTONE: Monsanto Research Corporation, whatever form it had, did more environmental work in the late 1970s.

BY THE WITNESS:

A That's right.

BY MR. HYNES:

Q What type of environmental work?

MR. FEATHERSTONE: Very generally, Doctor.

BY THE WITNESS:

A They were looking for situations where they might be of help to Monsanto or possibly others for projects of interest dealing with the environment.

BY MR. HYNES:

Q And that was sometime in the late '70s, they changed?

A Yes, somewhere in that area.

Q Any other branches out of Monsanto which did Applied Sciences work that we haven't discussed that you can recall?

A My only concluding comment on that is certain other operating units of Monsanto were of a support unit, such as ours, Applied Sciences.

Q But their work, am I correct, certainly wouldn't be as extensive, their equipment, facilities, as yours would be?

A Correct.

Q Am I correct that you have been either in the old corporate structure or the new corporate structure, been within the general auspices of the corporate division of either Monsanto or Monsanto Industrial Chemicals Corporation?

A Yes.

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Q Could you just briefly explain how the products, the chemicals are broken down within organic and inorganic chemicals, within the Monsanto corporate structure?

MR. FEATHERSTONE: I think he wants to know the chemical distinction.

BY MR. HYNES:

Q I want to know the chemical distinction, very basic.

MR. FEATHERSTONE: Carbon.

BY MR. HYNES:

Q Carbon as I understand it, but that is the distinction within Monsanto?

A That is the basic distinction.

Q Any other distinctions that you know of?

A No, that is the basic distinction.

Q Any chemical or chemical product involving carbon would be in the Organic Chemicals Division?

MR. FEATHERSTONE: As far as you know, Doctor.

BY THE WITNESS:

A To the best of my knowledge.

BY MR. HYNES:

Q Am I also correct that up to the point where you were manager of applied sciences in 1971, most of

your work was in the area of analytical chemistry and analytical techniques?

A Correct.

Q Other than expanding into some other areas as manager of applied sciences, is the analytical chemistry, the analytical techniques, are they still within your function as manager of applied sciences?

A Correct.

Q To the best of your knowledge, when was the first time you became involved with any analytical work with polychlorinated biphenyls, PCBs, while at Monsanto?

A Early 1967.

Q I am correct prior to that you really didn't have any involvement with anything dealing with PCBs, is that correct, within Monsanto?

A Applied sciences is a support unit serving the functional products unit, business unit, which had PCB products.

As a practice, whenever any work was needed, work would come into one of our groups and would be in turn reported back directly by this group.

To the best of my knowledge we had very little work of this type prior to 1967.

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Q Do you recall specifically if you did any type of analytical work on PCBs prior to early 1967?

A No.

Q What was your first recollection, you said early 1967 you became involved with something to do with PCBs. Could you explain what your initial involvement was?

A This is related to the reported work of Widmark and Jensen regarding the findings of PCB types of material in Sweden and reported by their publication in the New Scientists, I believe, in late 1966.

Q How did you first learn of this article by Widmark and Jensen?

A Through out clients, that is, Applied Sciences' client, Medical Department and business unit.

Q Do you recall who informed you about it or who brought this article to your attention?

A This would have been a member of the Medical Department and manager of research and development for the business unit.

Q Who was manager of the research and development for the business unit?

A Bill Richard.

Q What was that business unit?

A Functional Fluids.

Q Who is the Medical Department --

A Elmer Wheeler.

Q How did they bring this to your attention?

Did they call you into a meeting, basically how did this occur?

A It was oral communication.

Q As best as you recall, what was said and by whom?

A It related to excerpt letters of Widmark and Jensen's publication with respect to looking at this from the view of how did we feel about it in terms of what they were finding and the amounts found.

Q What did you feel about it in terms of the amount found or what was found? Can you explain what was meant by how you feel about it?

A This was a first time to our knowledge that PCBs had been reported. This was a surprise to me as it was to many others, I'm sure.

MR. FEATHERSTONE: I don't know whether he asked for an assessment from an analytical standpoint.

BY THE WITNESS:

A Correct.

BY MR. HYNES:

Q How did you feel about it in terms of accuracy of the report, the techniques used or how did you feel generally about PCBs being found in Sweden, that is what I'm trying to find out.

A We had, the business unit had responsibility for finding of PCBs and what impact they would have. They asked us from an analytical position how did we assess that publication, that report, on an analytical basis.

Q What was your response to that? How did you assess it from an analytical point of view?

A We felt the publication appeared technically sound, but we had reservations about what was reported.

Q You said the publication appeared to be technically sound. What do you mean by technically sound?

A Well, we were impressed with a new technique they were reporting and using; namely, gas chromatography combined with mass spectrometry.

Since this was the first time that an application of this new technique had been used, we were in a position of having to learn a good deal about this technique and since we didn't have a good technical

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base to make that judgment, we felt we needed more information.

Q You also said that you had reservations on what was reported?

A Yes.

Q What were your reservations?

A One key reservation was whether there might be contamination of Aroclor-type products, for example, in the laboratories and local laboratories of Widmark and Jensen which could provide false findings when looking at environmental materials.

We also had some concern that this was not, this work, this publication did not appear in a leading scientific journal and we also felt concerned that this was one single report of a single group of researchers. And we were uncomfortable with that.

We felt we had to develop further information across those lines I have just covered.

Q Your concern was that it was a report of one group because scientifically you need to verify through other groups, conclusions, findings on more than one scientific group to be more comfortable with it?

A That's right.

Q You also said you were concerned that the

publication did not appear in a leading scientific journal. What is the significance of that, in your mind?

A Well, we didn't know why they wouldn't be reporting that in a journal that would have more extensive coverage. It seemed like an important finding, if correct, and it is just a reservation that we had.

Q Did you at this point that we were just discussing, did anyone assign to you a particular task or assign you to get involved in this problem at that time?

A Yes.

Q Who assigned you and what was the task you were assigned or requested to do?

A The task at that time was to do what was necessary to assess this problem further from an analytical view.

Q It sounds like a very general direction, was that what it was, in fact?

A Yes.

Q How did you go about assessing this from an analytical view?

A Out of our clients, Medical Department and the business group, it was decided that there should be a visit made to Sweden for the purpose of more directly

determining the points that I mentioned and of my personally talking with these people about their work.

Q About when was this determination made for a visit to be made to these authors?

A This would have been developing in late 1968, early 1969.

Q You stated earlier that you first learned about this finding sometime early in 1967 and the determination was made in late '68, early '69 to visit them to learn about these, get more information about the techniques?

A Correct, yes.

Q Were you involved in any analytical work relating to the findings in this article and that year and a half period prior to the decision being made to visit the authors?

A Yes.

Q What was your involvement?

A The key involvement from our end was to get ourselves established in gas chromatography/mass spectrometry techniques and to accomplish that we had to acquire a system of this type.

MR. FEATHERSTONE: This type?

BY THE WITNESS:

A (Continuing.) Being a gas chromatograph combined with a mass spectrometer.

We for this purpose proceeded with plans to purchase in early 1967 a mass spectrometer/gas chromatograph system. None were commercially available in this country at that time.

We bought our system which was made in Germany in 1967 and this arrived at the end of the year and was physically moved into our Applied Sciences laboratories at that time.

MR. FEATHERSTONE: End of the year, 1967?

THE WITNESS: End of year 1967.

BY MR. HYNES:

Q Prior to receiving the equipment at the end of the year 1967, were you or anyone in your group involved in any type of analytical work involving the direct findings of Widmark and Jensen?

MR. FEATHERSTONE: You mean without the equipment?

MR. HYNES: No, other type of analytical work.

MR. FEATHERSTONE: Just so we are clear, when you say analytical work, you are not saying analyzing samples; work in the analytical group?

MR. HYNES: Right, work in the analytical group.

BY THE WITNESS:

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A Our main thrust was to get the equipment which was the tool needed to do work of this type.

BY MR. HYNES:

Q So basically your answer is --

A No.

Q -- is no?

A No.

Q Is the reason being you didn't have the equipment to do any analytical work?

A Correct.

MR. FEATHERSTONE: On PCBs?

MR. HYNES: That is what we are talking about.

MR. FEATHERSTONE: Sometimes we talk, spend an hour and ten minutes on things and I want to be sure it is related to PCBs and I am just checking to make sure.

BY MR. HYNES:

Q Prior to Monsanto acquiring this equipment, a gas chromatograph coupled with a mass spectrometer, what techniques did Monsanto have available to it, and I am not talking about the findings in the Widmark and Jensen study.

A Yes.

Q But in work within your group, within Applied

Sciences, what analytical techniques were available to you to analyze any of your products containing PCBs?

A Gas chromatography.

Q How long was that equipment, that technique available to Monsanto prior to 1967?

A Early 1960s.

Q What types of analysis would a gas chromatograph allow you to do with regard to PCBs or products containing PCBs?

MR. FEATHERSTONE: I think you have two different questions. Are you on PCBs or PCB products?

I am not sure that you are referring in analyses to samples of products you know the formulation of.

MR. HYNES: Let me do it two ways.

BY MR. HYNES:

Q The analytical work that your group would do utilizing the gas chromatographs, what was the capacity for analyzing this technology in dealing with products containing PCBs?

A This technique, gas chromatography, had capability for making some separations of a component in PCB mixtures. It did not have a capability for identifying the chemical structure of these components.

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Q You said there was some capability of analyzing separation of components of PCB mixtures. What would a PCB mixture be? Would it be the chemical polychlorinated biphenyl mixed with other chemicals to come up with an end product, is that the type of mixture you are talking about?

A No, I am talking about a mixture of the isomers in PCB mixtures.

Q In other words --

A Chlorinated biphenyl materials.

Q The amount of chlorination where the chlorination would be on the --

MR. FEATHERSTONE: Finish your thought, on the biphenyl ring?

BY MR. HYNES:

Q On the biphenyl ring, yes.

A Yes.

Q Could you identify the chemical PCB using a gas chromatograph?

A No.

Q You said it did not have the capacity for identifying the chemical structures of a component, the gas chromatograph technology?

A Yes, I think I said capability, possibly.

Q Did not have the capability of identifying the chemical structure of a component?

A Correct.

Q That would be a component of the product that you would be analyzing?

MR. FEATHERSTONE: He used the phrase these components which related to the component in PCB mixtures, which I take it are the isomers.

THE WITNESS: Isomers.

MR. HYNES: I'm sorry, the isomers, all right.

THE WITNESS: Yes.

BY MR. HYNES:

Q Am I correct in the capacity of the gas chromatograph in terms of your division, your groups' analyzing of products which contain PCBs, you would not be able to identify chemically using that technique that PCBs were in that product?

A Correct.

Q Am I correct in assuming that in doing such analyses, you would know there were PCBs in there because of the fact it is a product which contains PCBs and you would analyze that knowing PCBs are there, but not being able to detect them with a gas chromatograph, is that correct?

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MR. FEATHERSTONE: Are you as confused as I am, or can you answer that?

THE WITNESS: I can answer.

MR. FEATHERSTONE: Okay.

BY THE WITNESS:

A The technique could be used if you had a known mixture in the laboratory and nothing had happened to change the isomeric ratios. It could not be used if that mixture was taken out somewhere and used where changes could occur in the isomeric ratio and brought back into the laboratory and one would attempt to analyze and measure.

At that point, you could not identify PCBs.

MR. FEATHERSTONE: Are you saying if you had a pure PCB product and knew it was PCB and put it in a gas chromatograph, you could tell it had PCBs in it?

THE WITNESS: Where you had physically personally contained that and know it did not change, you could then say these are PCB chromatograph factions and that is the only way that could be done, even though that is not identification of PCBs.

BY MR. HYNES:

Q Are you saying of known components in the

product, you have now identified all the components you can, this component here must be PCBs, is that kind of a simplified way of putting it, because you know PCBs are there, you would assume it would be in this range of the chromatograph tape printout?

A Printout.

Q So that is how you would identify them?

A Yes.

Q Doing it from a layman's point of view and I am trying to make sure in my own mind of what you are saying --

A Yes, but I want to emphasize to you, you cannot identify PCBs just by gas chromatography.

Q Is there any way to identify them through infrared spectroscopy?

A Could you explain by "them"?

Q PCBs, I am sorry. Could you identify PCBs that would be in a product using infrared spectroscopy?

MS. OLIVER: What time period are we talking about?

MR. HYNES: The time period in the 1960s, let us say.

BY THE WITNESS:

A I will have to answer that this way:

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Infrared would show certain structural features common to the isomers. It would not tell you which isomeric components or classes would be possible.

BY MR. HYNES:

Q Am I correct that if someone is utilizing an infrared spectroscopy technique, you will get a printout or a tape of the peaks from, for want of a better word, in this findings and then to identify whatever that chemical is or that component is, you have to go to a catalog and compare it to similar peaks to say this is Chemical A, this is Chemical B, is that correct?

A That is correct, but infrared doesn't have the capability of handling mixtures of related components and giving you that much information about what is in that mixture.

It can handle single chemical entities and tell you, give you an idea of what is present, but the only absolute method of doing this is by mass spectrometry and this is because you get more information out as to the chemical structure needed to answer that question.

Q Did Monsanto maintain a catalog of infrared fingerprints, so to speak, of the various chemicals

it produced?

A We would have infrared reference spectra for certain peaks of interest. We normally would draw upon commercially available spectra of this type.

Q To the best of your knowledge, between, say, 1960 and 1972, was there a commercially available reference for polychlorinated biphenyls available for infrared spectroscopy?

A Not to my knowledge.

Q Was one available at Monsanto, did you have one in your own reference library, to the best of your knowledge?

A Not that I remember.

Q Were there any other techniques available to your Applied Sciences group for analyzing products containing PCBs other than the gas chromatograph?

MR. FEATHERSTONE: Analyzing for what, PCBs?

BY MR. HYNES:

Q Analyzing their presence in products, in your products?

A At what period of time?

Q Prior to your receiving the gas chromatograph or mass spectrometer in late 1967?

A The other principal technique related to

infrared and it is called ultraviolet absorption.

Q Is that a-b or a-d?

A A-b.

MR. FEATHERSTONE: Could I have Mr. Hynes' second to the last question read?

(Record read as requested.)

MR. FEATHERSTONE: I take it your question was qualified to the extent the witness qualified his answer to the extent he couldn't identify PCB as PCB, just with a gas chromatograph.

MR. HYNES: Right.

BY MR. HYNES:

Q Were there any other techniques available at that point of time other than a gas chromatograph? You said ultraviolet absorption, is that correct?

A Correct.

Q Could you explain how that technique works?

A It is based on varying wave lengths of ultraviolet light being passed through a solution of the sample and due to chemical characteristics of the material in solution, certain wave lengths of this light will be absorbed and it gives you a characteristic spectrum, drawn curve.

Q Would you explain how accurate this technique

would be in terms of identifying PCBs in a product?

A Very inaccurate. It would have little capability of showing any differences between the many isomers in the PCB mixtures. It most likely would give you a single broad peak with all the isomers up to 209 or the total number appearing somewhere in this one peak and it would be of no value for PCB isomers in mixtures.

Q I am not sure I understand that. You say there would be a large peak and within that peak could be upwards of 200 isomers in that entire peak that would be able to be identified as PCBs, but you wouldn't know which isomers, how chlorinated it was, am I correct in that?

A You could not identify PCBs from that curve.

Q To the best of your knowledge, what else could that curve be to a chemist that is familiar with the technique? What other types of chemicals could it be?

A That curve would be representing primarily the aeromatic biphenyl nucleus of all the isomers, the biphenyl ring part.

Q Are you saying then that that large peak would be able to be identified as being or containing

a biphenyl ring but that is about as far as you could go?

A That's as far as you could go.

MR. FEATHERSTONE: Again, the knowledge that when you put it through the ultraviolet absorption technique, you knew the product had PCBs in it, that is your assumption?

THE WITNESS: Yes.

BY MR. HYNES:

Q If you don't know there were PCBs in the product or the chemical, would you still get the same peak on the graph or the readout?

You would still be able to identify it as containing a biphenyl ring, but that is as far as you could go, is that right?

A Correction on biphenyl ring. You are all right in your use of it. I would like to add to that.

This curve, this technique is so non-specific that a benzene ring or biphenyl ring in many different types of compounds, organic chemicals, will give you a peak almost superimposable and for this reason if you had pesticides of similar structures, PCBs, other organic types of ring structures in an unknown mixture, you would be totally unable to show

what the components were or what the mixture was or anything about it.

MR. FEATHERSTONE: Is that because the printout of the different chemicals would look the same?

THE WITNESS: Yes.

BY THE WITNESS:

Q It is a very nonspecific technique and would only be useful if you had total control over a PCB mixture. You would put that in an instrument, you would get one curve and you knew nothing could happen to that and you wanted to check it some way to show that a certain amount passed through, whatever, and that came out --

MR. HYNES: I am not sure you changed your answer. Would this peak be able to be identified by someone as a chemical containing a biphenyl ring, but that is as far as you could go?

THE WITNESS: No.

MR. FEATHERSTONE: I don't know whether he did change his answer, but you could not identify it.

BY MR. HYNES:

Q So if you didn't know what they had, my question using the ultraviolet absorption method, you would get a peak but you wouldn't even know if it was

containing a benzene ring or biphenyl ring?

A Correct.

Q Would a chemist, not knowing what was in this chemical being analyzed, getting this peak, is there any chemical group that he would be able to identify that peak as being?

A No.

MR. FEATHERSTONE: When you get to a convenient point.

MR. HYNES: I want to ask one more question.

MR. FEATHERSTONE: Sure.

BY MR. HYNES:

Q This is prior to when you received the machine in the late 1967 period, using the gas chromatograph technique, working with a chemical or chemical product, you didn't know the components, would you be able to use that to identify a biphenyl ring product?

MR. FEATHERSTONE: Could I have the question read back?

(Question read.)

MR. FEATHERSTONE: In other words, an unknown sample?

MR. HYNES: Right.

BY THE WITNESS:

A I believe you addressed your question just to the gas chromatograph technique?

BY MR. HYNES:

Q Right, prior to receiving the mass spectrometer.

A No.

Q Would you be able to identify an unknown chemical or chemical product as containing a chlorinated hydrocarbon using the gas chromatograph technique?

A No.

Q And using the ultraviolet absorption technique, would you be able to identify an unknown chemical as being a chlorinated hydrocarbon?

A No.

Q Am I correct that you are saying that unless you knew there was PCB in the product or the chemical you were analyzing, you would not be able to identify it using the gas chromatograph?

A Right.

Q And all of this we are talking about is prior to your receiving the new equipment in 1967?

A Right.

MR. HYNES: Do you want to take a couple of minutes?

MR. FEATHERSTONE: Sure.

(Brief recess had.)

BY MR. HYNES:

Q You mentioned prior to late 1967, the gas chromatography technique, the ultraviolet absorption technique. Were there any other techniques available to you to measure and analyze PCBs?

A No.

Q Maybe I am being a little dense, I certainly admit to that in the field of chemistry, but using the gas chromatograph, are you saying that unless you know PCBs are present in the mixture that you are analyzing, you would not be able to identify the peak on the printout as PCBs, is that correct?

A Correct.

Q And if you were analyzing a mixture which you did not know the components and PCBs were in that mixture, you would not be able to identify PCBs as being in that mixture, is that correct?

A By chromatography, that is correct, yes.

Q And the PCBs would come out as some peak in the gas chromatograph printout, is that correct?

A Yes.

Q Would you be able to identify generally the

chemical group that that peak would be in, a chlorinated hydrocarbon or something like that using gas chromatography prior to 1967?

A No.

Q What would you be able to identify that chemical as being in general chemical terms?

A Not to overemphasize, but the chromatographic separation technique cannot identify it by analogy to a reference material which had been put through the same instrument, can be some evidence that a peak that is coming out at a certain so-called retention time is the same as your reference material. But since it doesn't have capability of showing structure of whatever is in that peak, you cannot conclusively say that that's that component or mixture of components coming out in that peak because it doesn't have capability to show structure.

Q If you have a reference library --

A Of chromatographics?

Q Of chromatographics, then this unknown peak, if you had a fingerprint, so to speak, a reference library, would you be able to identify it as PCBs?

A No. You would be able to show that it has, whatever the unknown is, has components that separate

out at the same point in this curve coming out of a chromatographic column as to your material of interest, but many components can come out at that same point which differ in structure. For that reason, you cannot know for sure that what you have got is the component you think you have and in an unknown situation --

Q Again, in the unknown situation, you have put a chemical into the gas chromatograph. The peaks come out and in your analysis, using a reference library, you identify each of the peaks. You get to a particular peak and am I correct that you reach a peak where there is no definitive similar peak or identical peak and your reference library, would you be able to identify similar types of chemicals which would come out at this retention time?

MR. FEATHERSTONE: May I have the question back?

MR. HYNES: Let me rephrase it.

BY MR. HYNES:

Q What I am getting at is you are saying a certain chemical will come out at a particular retention time.

A Yes.

Q Using the gas chromatograph, am I correct in understanding you that there may be several different

chemicals that will come out at the same retention time?

A Correct.

Q Then my next question is how do you identify the particular, or are you able to identify the particular chemicals that come out at this same retention time?

A Not without a mass spectrometer.

Q Is there any corporate relation of the number of chemicals which come out at a particular retention time in terms of chemical groups, and just for an example, say chlorinated hydrocarbons or chemical groups containing biphenyl rings, could they all come out at a particular retention time so you are able to identify a particular chemical group that this unknown chemical is in?

A To my knowledge, that would be extremely difficult, if not impossible. I will expand on that with just one additional sentence.

Q All right, fine.

A Where a component comes out from a chromatograph is dependent upon the chromatographic conditions the researcher used. Sometimes these conditions are designed to separate closely related chemical species. Other times they may be directed towards separating components

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over a wider range.

With the mixtures we are talking about, PCBs, I think it would be impossible to identify on that basis.

Q . Would someone be able to identify the difference between DDT and PCBs in using that technique at that time?

A You would still have a built-in risk of other related materials being present that you are blind to in the chromatographic technique that you are calling, whatever.

Q I am not sure I understand your answer. Are you saying DDT and PCBs are so closely related chemically --

MR. FEATHERSTONE: Do you mean in their printout?

BY MR. HYNES:

Q (Continuing.) In the printout, right, that it would be difficult to separate the two in a chromatographic printout?

A Yes, that's true, and even if they were separated, it would be difficult to still come in with a separated peaks and know that was the only component in that peak.

Q Are you saying you would be able to identify

the DDT but you wouldn't know what the other chemical is that is mixed in with it?

A No, you still cannot identify with any chromatographic technique, you cannot identify. The only way I know of to identify is to go to a mass spectrometer.

MR. FEATHERSTONE: I think what he is saying is even if you could separate the two, you are not sure that you have gotten rid of three, four, five and six; they may be coming in in the same peak.

BY THE WITNESS:

A Right. You are always blind to what is in that peak, gas chromatographic peak. You never know from the chromatograph chemically speaking what may be in that peak if you are basing it only on the peaks that you are observing.

BY MR. HYNES:

Q But if you knew the component, you had control over the components going into the gas chromatograph, then you would be able to separate the various components by their peaks, is that correct?

A That is correct.

Q But you would have to have total control over the components, the chemicals going into it?

A Correct.

Q Prior to getting the mass spectrometer, would you have the capability of measuring a hydraulic fluid manufactured by Monsanto, Pydraul? I assume you are familiar with the Pydraul products generally?

A Yes.

Q Would you be able to separate the chemical components of a Pydraul fluid and be able to identify the percentage of PCBs that were in that fluid or the molecular weight of the PCBs within that fluid?

A Using a gas chromatograph?

Q Using a gas chromatograph.

A You would not be able to identify the PCB components in Pydraul fluids.

Q Would you be able to identify that the PCBs were in there?

A No, and I want to requalify: Identify means in materials, chemical structure.

Q By chemical structure, you mean the number of isomers, how chlorinated it is?

A The weight of the chlorination, correct.

Q But you would be able to identify that chemical generally as PCBs, but not be able to break it down as to which isomers it is?

A No.

Q You stated that Monsanto received its gas chromatograph with a mass spectrometer late in the year 1967.

About what time did your group begin using, and I don't mean just for PCBs, begin using this technology?

A I can best answer this with a brief indication of what was required for us to set up and to do this work.

The first action was to physically get the equipment brought in.

We purchased a mass spectrometer from a company in Europe and a gas chromatograph and a so-called separator to hook these two instruments together.

MR. FEATHERSTONE: Which two?

THE WITNESS: The gas chromatograph and the mass spectrometer.

BY THE WITNESS:

A (Continuing.) You have to have something more than just a tube that you connect to this one, the mass spectrometer and connect it to the gas chromatograph.

To make these two work together requires

a very sophisticated, what they call an interface unit, a separator, so you can run components off the gas chromatograph and go into the mass spectrometer system and get these two systems compatible so that you could do that work.

So our program after several months, when the factory engineer got us on stream with the equipment installed, checked out, we then devoted our efforts to getting our own people trained and skilled in how to do this work. This was the first mass spectroscopy work we had done and we approved this with people who are competent and fairly rapid learners and chose to bring them up to speed.

So the next six months was required to do just that, for them to develop enough volume to be able to use this equipment with proficiency. Also in this period, we had to develop separation techniques required for work-up of many varieties of materials and samples and this had to be done before we could even put in a sample into this mass spectrometer.

This took a number of months. And concurrent with this, we had to develop enough information on how to read what this mass spectrometer is presenting as information, not only to learn how to use it, but to

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interpret results. Normally we are talking mass spectrometists who do nothing but this type of work. This is the way we were coming up and getting on top of this and we put appreciable effort in this direction to get ourselves up to speed for PCB work, projects of that type.

We also, of course, had clients with our projects who were entitled to some time on this system, and we were taking care of these along the way.

MR. FEATHERSTONE: During 1968?

THE WITNESS: This is during 1968 ending and into 1969.

BY MR. HYNES:

Q About when did you feel you had the expertise and the capacity to begin doing analysis work using this equipment?

A We were developing continuous expertise, but in early 1969, we were coming on quite well and being able to apply this to a certain number of projects and get results out of that we were comfortable with.

Q The best you recall, when did you begin to do any analytical work using this equipment with PCBs?

MR. FEATHERSTONE: You mean apart from developing

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the methodology he has testified to?

MR. HYNES: Right.

BY THE WITNESS:

A Applications were being started in 1969 of different types. Again, a great deal of effort in this period was directed to getting ourselves competent in being able to handle a variety of matrices, many different types of materials.

BY MR. HYNES:

Q You said you began sometime in 1969 performing some of these projects dealing with PCBs. Do you specifically recall any that you were involved in using this technology?

A As we moved through this period, we especially were directing efforts where needed with certain clients' support projects, internal plant projects, certain monitoring projects of that type.

Q Is that in the area of PCBs?

A Yes.

Q Generally what type of work was it with your client and client groups that involved PCBs?

MR. FEATHERSTONE: He has already told you generally what types of products.

MR. HYNES: I am talking specifically on PCBs,

the general type of work he was doing with the mass spectrometer at the time with the general client groups.

BY THE WITNESS:

A Well, a source, a good example would be sewer effluent work and, for example, with Outboard Marine for Johnson Motors.

BY MR. HYNES:

Q Specific analysis of a product or a chemical sent to you for analysis, that is basically what it was?

A Yes, effluent-type materials, streams.

Q These would be at the request of the particular product group in the company, Functional Fluids or some of the others?

A Yes. We operate as a client-related support unit and this work comes in through the business unit or the Medical Department on a job basis.

Q You also said that you did some monitoring work. Generally what type of work was involved in monitoring tasks?

A I had mentioned we were concerned, involved with our plants and manufacturing sites and a certain amount of work of this type was carried out.

A Was this monitoring the processes inside the plant or outside the plant, or was there any difference?

A Most of this work in this area came in directly to our group, one of our groups handling this and they handled these directly and reported directly. Much of the time I would not even be involved or see the results out of this, so I am really hard put to answer this for you.

Q I was trying to say you know generally you had some work but you don't know specifically what it was?

A Correct, because the groups themselves handled this type of work, reported it out and I didn't monitor all these jobs. We had hundreds of jobs come through our unit and I had no way to monitor those.

Q Any other category of work involving PCBs you recall doing other than the monitoring that came in from the groups and the client groups?

A We were concerned methodwise in use of this technique, the gas chromatography/mass spectrometry technique on studies of other types other than environmental materials, for example.

I will give you an example --

Q I meant relating to PCBs.

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A I meant PCBs. I will give you an example.

At a little later point, we were interested in biodegradation work and this involved development of necessary methodology, and for this we drew upon the GC/mass spectrometry technique which really made this work possible, so we had a number of projects of this type going.

Q And those types of projects weren't specific tasks requested by different product line groups like Functional Fluids or something? This would be separate from that?

A Yes.

MR. FEATHERSTONE: Wait a minute.

BY MR. HYNES:

Q In terms of assignment of these tasks, would it be different in the types of assignments you would get from a plasticizer group or Functional Fluids, is that correct?

A The answer I gave was we were responding to the business unit and Medical Department in setting up biodegradation technique and skill.

Q So it came from one of your client groups, but it was somewhat out of the ordinary type of requests from them?

A Yes.

Q All of this work or these types of tasks began sometime in 1969?

A Yes, and on into 1970.

Q While your department was acquiring the expertise to use this new equipment, was there any other involvement that you know of, your group, with PCBs at all other than a general task coming from a group? Would you consider a routine type of work involving a PCB-bearing product, were you involved in any other analytical-type work dealing with PCBs?

A Yes.

Q What was that?

A We at one point during this period of '60-70 were concerned with solubility testing of PCB materials.

Q Did you use the GC/MS for solubility testing?

A Yes.

Q What I am asking, and it probably wasn't clear, I am now talking about any analytical work drawing on that new technology, any other type of work that your group did involving PCB which was not routine.

MR. FEATHERSTONE: Would your question be including literature, talking to people, that type of thing?

BY MR. HYNES:

Q Any involvement of your group involved in PCBs at that time.

MR. FEATHERSTONE: I think you switched the question. You keep saying analytical work drawing on that new technology and through the instruments. What is it?

MR. HYNES: All right.

BY MR. HYNES:

Q Were you involved in any work or any task relating to PCBs other than utilization of this technology between when you received the machine and, say, 1970?

A In the early stages, I was involved in a trip to Europe with Elmer Wheeler to assess findings by Widmark and Jensen.

Q Anything else you recall?

A No.

Q Am I correct then that your main involvement with PCBs in the time period when you received the gas chromatograph with the mass spectrometer was involved in the analytical techniques, familiarization with the equipment and improvements on the equipment, analyses of that type using that equipment and this trip to Europe with Mr. Wheeler. That is the broad

category of your involvement in this, is that correct?

A Correct.

Q When was your European trip, as best you recall? Approximately when did it take place?

A Late Spring, 1969.

Q In other words, you and Mr. Wheeler, is that correct?

A Yes.

Q I take it this is the trip that you had discussed previously to get more information on the techniques which they used in their reported study?

A Correct.

Q First of all, did you meet with Widmark and Jensen?

A We met with Widmark, not Jensen.

Q Any reason why you met with him and not Dr. Jensen?

A Dr. Jensen was out of the facility and out of the city at the time of our visit and was not available.

Q How long did you talk to Dr. Widmark: One day, two days; generally?

A One day.

Q The best of your recollection, what was discussed?

A We were especially interested in his GC/mass spectrometer system and we used that opportunity to learn everything we could about what they were doing with it, their techniques and et cetera.

We were interested in comparing that with our own system which was just coming on stream nicely at that point. We were interested in satisfying ourselves that we didn't have contamination in his laboratory or in transport of environmental materials through containers or whatever.

We also were very interested in his findings of PCBs in certain environmental materials.

Q In general, what else was discussed, those three categories pretty much?

A Those are the principal categories.

Q In comparing his techniques using the mass spectrometer and those which you were implementing at the plant, did you find any significant differences between the technique?

A No. We felt that they were competent in the techniques they had used and were using. We thought the equipment was adequate. We felt on something it was not as good as the system we had just installed.

Q You had a later model or something?

A Well, we felt our mass spectrometer had more capability of separating and identifying different species.

Q Were you able to determine if there was any contamination in the laboratory or transport of the materials which they analyzed?

A We concluded out of that visit their techniques were analytically acceptable in terms of avoiding contamination and we felt this was not a likely explanation.

Q In your discussions dealing with their findings, I take it those findings were the findings they published in late '66, I believe, is that it?

A Yes.

Q What was your discussion in terms of the findings in their report?

A Well, the key point that struck us out of this, looking at what they had determined as information which bothered us, was the higher chlorinated species, five chlorines on a biphenyl ring or higher being the more dominant species found in environmental materials they were looking at. And at that point, there wasn't a good explanation for this.

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Q Were you able to arrive at any conclusions in discussing with Dr. Widmark why the higher chlorinated species were dominant, what his opinion was on that?

A His opinion was that it was perhaps biodegradation or losses of that type of the lower chlorinated species below five chlorines.

Q Any other explanations or theories that anyone came up with there?

A That is the principal one that I can recall.

Q Why did you consider it significant that the higher chlorinated species appeared to be more dominant in his study, what significance did that have to you?

A We knew in Europe that European manufacturers were manufacturing PCB products which represented a series of isomers relative to containing lower chlorinated isomers below five and higher chlorinated isomers, many times in the same mixtures. And knowing this information, you would normally expect to find all components if the total product got into the environment and this was not being found.

It was only the higher chlorinated components that were dominant as residues and wildlife

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and materials of this type.

Q Am I correct that the product mix of the European manufacturers of PCB products had higher and lower chlorinated species and they were only finding higher, so you were trying to find some explanation why the lower were not being identified?

A Correct.

Q And that at that point, was it Dr. Widmark's explanation that it is perhaps a lower chlorinated species were biodegrading --

A Biodegrading.

Q Could you briefly describe what biodegradation is, what biodegrading is?

A That is a conversion of a chemical through microorganism or bacteria to a degradation product, normally carbon dioxide and water.

Q Am I correct it is just through the reaction of some bacteria or organism, it breaks the chemical down into its component parts?

A Parts which eventually go all the way to carbon dioxide and water. The bugs actually chew the chemicals, destroy them.

(Discussion off the record.)

BY MR. HYNES:

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Q Do you have a microscope?

A I think that is a fair question for Dr. Kimbrow.

Q Do you recall anything else being discussed at your meeting with Dr. Widmark and Dr. Wheeler?

A We discussed methodology very generally and he was kind enough to provide us with their latest techniques which we brought back with us.

Q In your discussions or prior to that, were you able to find out when his laboratory or the University acquired their gas chromatograph/mass spectrometer?

A It is my best recollection they acquired it approximately one year prior to their published report in '66. I will say, to the best of my knowledge, it would be in 1965.

Q Did they say how they acquired it? I don't mean go out and buy it, but how they received information that that technology, that equipment was now available for purchase?

A They, of course, being in Sweden maintained close contact with commercial instrument companies and especially in Sweden, and the instrument they had was commercially produced at that time by a Swedish

company and that is the reason they went ahead and bought that instrument.

Q Do you know if the best of your knowledge, was the information concerning the availability of this equipment made known to Monsanto at about the same time as it was made known to the University of Stockholm, I think it was?

MR. FEATHERSTONE: Wait a minute. How is he going to know when the University of Stockholm learned about this?

MR. HYNES: Let me put it another way.

BY MR. HYNES:

Q To the best of your knowledge, they acquired the equipment sometime in 1965, is that correct?

A Correct.

Q In that time period, do you know if Monsanto had knowledge that that equipment was available for sale?

MR. FEATHERSTONE: That time period being 1965?

MR. HYNES: Right.

BY THE WITNESS:

A I can't speak for all Monsanto on that.

BY MR. HYNES:

Q Did you know?

A I personally do not know it. Perhaps those responsible for instrumentation --

MR. FEATHERSTONE: You are not supposed to perhaps anything. Do you know, you didn't know it?
BY THE WITNESS:

A I personally do not.
BY MR. HYNES:

Q The best of your recollection, when did you first learn this technology was available?

A Through the Widmark-Jensen report.

Q At that time you were research group leader, I believe, in '65 through 1970, roughly, is that correct?

A If that is what the record states, it should be correct because I was a section manager --

MR. FEATHERSTONE: At the time of your trip to Europe.

BY THE WITNESS:

A At the time of the trip to Europe.

BY MR. HYNES:

Q Was part of your duties as a senior research group leader to keep apprised of new developments and technology in the field?

A As it relates to the needs of our company.

Q Do you know if there is any specific group whose function it was to keep abreast of the new technology, such as this GC/MS at that time?

A All of Monsanto Sciences are charged with this.

Q To the best of your knowledge in that time period, and we are talking about 1965, you don't know of anyone who did know that this technology was available?

A I know of no information on this.

Q And your first information was the Widmark-Jensen report, is that correct?

A Correct.

Q While you were in Europe with Mr. Wheeler at the time you visited Dr. Widmark, did you also visit any other facilities or people in Europe?

A We visited several locations in the United Kingdom and Scotland, one in Scotland.

Q Anywhere else?

A We also visited with the University of Utrecht, party by the name of Van Dender and Vos.

Q Anywhere else that you recall at that trip?

A Additionally, we visited Bayer.

Q B-a-y-e-r?

A Yes, and Prodelec, P-r-o-d-e-l-e-c, Company in France.

Q Bayer is in Germany?

A In Germany.

Q Bayer and Prodelec were chemical firms which manufactured products which contain PCBs?

A Correct.

Q Quickly run through each of those visits made in the United Kingdom and Scotland.

What was the purpose of the visits and who did you visit or what organizations?

A We visited --

MR. FEATHERSTONE: Which is the question, what is the purpose or which organizations?

BY MR. HYNES:

Q What was the purpose?

MR. FEATHERSTONE: May I make a suggestion?

MR. HYNES: Yes.

MR. FEATHERSTONE: You might ask what was the purpose for all of those groups that he mentioned.

BY MR. HYNES:

Q What was the purpose of all four of the groups?

A The purpose was to get available information obtained by others on PCBs and especially PCB-type

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materials in the environment.

MR. FEATHERSTONE: I take it including analytical type techniques that were used?

BY THE WITNESS:

A (Continuing.) And especially analytical techniques.

BY MR. HYNES:

Q Now we have purpose.

Who did you visit, either who or what groups did you visit in the United Kingdom or Scotland?

A We visited with a scientist by the name of Holden, H-o-l-d-e-n, at the Department of Fisheries. I can't give you more than that, a government department within Scotland.

Would you like the other names first?

Q Yes, right.

A That was the only one in Scotland.

Q In the U.K. who did you visit?

A In United Kingdom we visited with Richardson at Shell Research, a scientist by the name of Tatton, T-a-t-t-o-n, at the Laboratory of the Government Chemists, and I believe that was it.

Q As best you recall, what was discussed with Mr. Holden in Scotland?

A His role was directed towards pesticides work and analytical determinations and he had pursued somewhat further the identification of PCB interferences in pesticides and analytical work that they were carrying out.

The results of this visit with him added to what Widmark and Jensen had reported in that PCBs were being found in certain aquatic-type wildlife on the shores of Scotland.

Q Did you have any discussions with him as to his opinions, as to where the PCB interference was coming from, the PCBs were coming from?

MR. FEATHERSTONE: Do you mean how the PCBs were getting into these environmental samples?

MR. HYNES: The source of the PCBs.

MR. FEATHERSTONE: Because I can tell you what PCB interference was coming from, PCBs. All right, do you have the question?

BY THE WITNESS:

A I don't recall this discussion on source with him.

BY MR. HYNES:

Q Are you saying you just don't recall any discussion on source of PCBs?

A I can't recall there was any discussion on source.

Q What was the main purpose of this visit, the analytical detection techniques with Mr. Holden?

A That was the principal reason, to determine whether he had any other skills, modifications that would be helpful.

Q Any other other than analytical techniques, any other discussions with him relating to PCBs?

A No.

Q Did you discuss any findings which he had made concerning identifying PCBs, and I think you said aquatic animals and birds?

A Yes, very generally discussed finding PCB-type material along with pesticides, again, wildlife, aquatic life, wildlife on the shores of Scotland.

Q Do you recall any discussions concerning biodegradation with him?

A No, I don't.

Q Do you recall if there were any discussions or comments made concerning the types of PCBs that he had been finding in the higher or the lower chlorinated species?

A Only that he too was concerned with the higher

chlorinated, five chlorine and higher were dominating his residues in many of their findings.

Q So his findings, would it be correct, were similar to Widmark's?

A He was quite supportive to what Widmark had found.

Q Your discussions with Mr. Richardson of Shell Research, what were your discussions with him, what did they entail?

MR. FEATHERSTONE: Can we go off the record for a second?

MR. HYNES: Yes.

(Discussion off the record.)

(Question read.)

BY THE WITNESS:

A We discussed analytical technology for PCBs in the presence of pesticides. Their prime interest was analysis of materials for pesticides.

They were concerned with identifying the interferences which they had observed which had been earlier reported out by Widmark and Jensen and proceeded with that applied math spectrometry and also did confirm that in their pesticide chromatograms, there were PCBs, certain PCB-type materials.

BY MR. HYNES:

Q Again, this is basically a discussion on analytical techniques and the problems involved in that?

A Correct.

Q Any discussions dealing with the higher or lower chlorinated species and their findings?

A I don't recall that.

Q Do you have any recollection of any bio-degradation studies with them?

A No.

Q Mr. Tatton of the Laboratory of the Government Chemists --

A England has great names of their various departments.

Q What was generally discussed with Mr. Tatton?

A Primarily the same information that was discussed at Shell Research Laboratories, and the same conclusions in general came out of that.

We felt they weren't as far along in capability or technique as was Shell. Shell had a very capable facility and we didn't get that much more information out of that visit.

Q Did Mr. Tatton ask you for similar information

involving analytical techniques, that is, your experience in it and things of that nature?

A Only as a polite inquiry. We could see that he wasn't that interested in what we were doing in the States and I'm not sure he was that interested in what was being done in Sweden.

Q All right. You also visited the University of Utrecht. What were your discussions with the people there, what did they entail?

A We once again were interested in their technique which was, we found out, gas chromatography/ mass spectrometry. We were impressed with their skills and found that they had a mass spectrometer like the one we had and the principal user of that system for them had actually installed several of these German instruments like the one we had put in in the United States.

We also listened to their findings of PCBs along certain regions of the Rhine and in the Netherlands, again, associated with certain species of wildlife and the findings of residues therein and, again, emphasis on a higher chlorinated, five and above species of PCBs.

We also were interested in work that

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they discussed with us on dibenzyl furans in certain European manufactured products, and they indicated in a general way that they had observed some of the dibenzyl furans.

Q And their indication of the dibenzyl furans was they had found them in the work products of the European manufacturers?

A Yes, correct.

Q Were they able to determine how the dibenzyl furans got into the PCBs or did you have any discussions on that with them?

A No.

Q Did they theorize as to the amount of dibenzyl furans they had been finding in their work compared to the amount of PCBs they had been finding, I mean, a percentage or amount of dibenzyl furans in comparison to the PCB levels they were finding in their work product?

MR. FEATHERSTONE: As a matter of clarification, the discussion, as I understand the testimony, was about the finding of PCB residue in environmental samples. The second discussion on dibenzyl furans was the finding of dibenzyl furans in PCB products.

You have two particular products and --

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MR. HYNES: Then I am confused.

BY MR. HYNES:

Q Was the finding of dibenzyl furans in the products themselves that they were testing?

A Yes.

Q They didn't find them in any of their species of wildlife or whatever they were examining in the environment?

A Checking in the environment?

To my knowledge, they had not found them in the environmental materials.

Q Did they mention which manufacturers were finding the dibenzyl furans in their products?

MR. FEATHERSTONE: I am sorry, could I have that question read back?

(Question read.)

BY MR. HYNES:

Q Which products were they finding it in, did they identify the manufacturers?

A My best recollection is that one was a product called Clophen; C-l-o-p-h-e-n, I think it is.

Q That is the only one you recall?

A Yes.

Q Do you recall who manufactured it or what

it was used for?

A No.

MR. FEATHERSTONE: Was it manufactured by a Western European company?

THE WITNESS: Yes.

BY MR. HYNES:

Q Were they able to identify the quantity of dibenzyl furans in their product?

A They made an estimate of levels of dibenzyl furans present. I don't recall absolute figures, but it was very low amounts in terms of a few parts per million or less that they found.

Q Did you discuss any explanation of why the dibenzyl furans were found in their product?

MR. FEATHERSTONE: You already asked that. You asked whether there was any theorizing about how the dibenzyl furans got into the PCBs.

MR. HYNES: Yes.

MR. FEATHERSTONE: And the answer was he doesn't recall the discussion.

BY MR. HYNES:

Q Was the answer you didn't recall any discussion about how the dibenzyl furans got into the product?

A Correct.

Q Any other discussions with the people at the University of Utrecht that you recall?

A No.

Q The Bayer Company in Germany, do you recall what was discussed with the people at Bayer?

A Yes.

Q What was discussed?

A We primarily informed them of what we were doing and our concerns with PCBs and asked them if they were doing anything of a similar manner, especially on analytical work.

Our finding on this was they were not doing very much. They had no work going directed toward determining PCBs in the environment or more sophisticated analytical techniques, such as the GC/mass spectrometry technique.

MR. OLIVER: Could I have the answer read?

(Answer read.)

BY MR. HYNES:

Q In other words, they weren't doing a heck of a lot at the time?

A Right.

Q Did you have any other discussions with them

that you can recall?

A No.

Q Did you make any suggestions to them that maybe they should get going?

A Oh, yes. We encouraged them to do that and they said they would.

Q Why did you encourage them to get moving on improving their analytical techniques and the like?

A Because we were concerned about finding PCBs in the environment and being reported, and we felt it was a concern of anyone involved with that type of product.

Q Anything else you recall discussing with them?

A No.

Q Did you ever discuss the findings with the people at the University of Utrecht on the finding of dibenzyl furans in one of the products, the Clophen --

MR. FEATHERSTONE: May I have that question back, was it did he discuss it with the people at Bayer?

MR. HYNES: Yes.

BY THE WITNESS:

A I am pausing because I don't remember the sequence of our visits.

BY MR. HYNES:

Q You don't recall discussing it with Bayer?

A I don't recall.

Q Now, the other meeting you had with the people at Prodelec in France, is that correct?

A Yes.

Q Would you briefly describe what discussion you had with those people?

A Primarily discussion, we informed them of the finding of PCBs in the environment, what we were doing and asked if they were doing anything of a similar nature, and analytically they were not. They were much farther back in terms of skills to be able to go ahead and do this type of work compared to Bayer.

MR. FEATHERSTONE: Prodelec and Bayer are both PCB manufacturers?

THE WITNESS: Yes.

BY THE WITNESS:

A (Continuing.) So we came away from that visit, to my recollection, primarily informing them.

BY MR. HYNES:

Q Basically you were informing them of what was going on and the available techniques?

A And we learned very little from them.

Q Does that then cover the organizations or people you visited on the European trip?

A Yes.

Q In any of the discussions with any of these individuals or groups, do you recall any discussions on the source of PCBs or on controlling the sources of PCBs into the environment?

A Yes.

Q Do you recall which persons or groups you discussed that with?

MR. FEATHERSTONE: Which that? Your first question was compound, A or B?

BY MR. HYNES:

Q Do you recall which groups you discussed it with?

MR. FEATHERSTONE: If any.

MR. HYNES: Strike that.

BY MR. HYNES:

Q Do you recall who you discussed the sources of contamination of PCBs with?

A Yes.

Q Who did you discuss that with?

A Widmark.

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Q Any other group?

A That's the principal one that I can recall.

Q You just do not recall discussing with the others?

A Yes.

Q Do you recall what your discussions with Dr. Widmark were concerning the sources of PCBs?

A He was suggesting that perhaps this was coming from paint on ships in the waterways or some coastal areas. That was a principal source.

At one of these places, and I cannot recall where, other sources of contamination were discussed in a general way, but I cannot recall specifics for you. Perhaps Elmer Wheeler, who would be representing, would be our client, the Medical Department, would be able to respond at length because he would be the person responsible for bringing that type of information back, reporting it.

Q But you don't specifically recall what the discussions entailed other than --

A No.

Q -- other than Widmark saying it might be from the ships, ship paints?

A No, I don't.

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Q Do you recall yourself suggesting any sources of PCBs?

A No.

Q Do you recall any discussions concerning the control of the sources of PCBs with any of these groups or individuals?

A Yes.

Q Do you recall which groups that came up in discussion with?

A Again, that was Widmark.

Q Anyone else other than Widmark that you can recall?

A No.

Q Do you recall what the discussion was concerning the control of PCBs with Dr. Widmark?

A He recommended the usage in limited closed systems.

Q Did he expand on that in terms of why he felt that was a good suggestion or what he considered to be closed systems? Did he expand on that at all?

A Only that he felt this would minimize whatever pathways there might be for escape of PCBs into the environment.

Q Do you recall any other suggestions by him

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in terms of control of sources?

A No.

Q Do you recall either yourself or Mr. Wheeler discussing this or saying anything with regard to his suggestion?

A No.

MR. HYNES: Why don't we break for lunch now.

(At 12:45 o'clock p.m. a lunch recess was taken until 1:15 o'clock p.m., this same day.)