COPY

IN THE UNITED STATES DISTRICT COURT

FOR THE EASTERN DISTRICT OF TEXAS

BEAUMONT DIVISION

CECIL SCOTT, ET AL]

v.] No. B-84-1103-CA

MONSANTO COMPANY]

VOLUME 1

VIDEOTAPE DEPOSITION

WILLIAM RICHARD JR

April 16, 1987

1300 Post Oak Boulevard

Houston, Texas

Jerry Kelley, Court Reporter

Nell McCallum & Associates Inc.

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LAWYER'S NOTES

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Volume 1 of the Videotape Deposition of William Richard Jr., taken on April 16, 1987, at 1300 Post Oak Boulevard, Houston, Texas, between the hours of 9 a.m. and 5:30 p.m. before Jerry Kelley, CSR No. 2004 and Notary Public in and for the State of Texas.

VIDEO OPERATOR: This deposition is being taken in Cause No. B-84-1103-CA and is filed in the United States District Court for the Eastern District of Texas, Beaumont Division. The style of the case is Cecil Scott, et al, versus Monsanto Company. For identification purposes, the video technician is Johnna Coalson of the firm Executive Services, and the certified court reporter present today is Jerry Kelley of the firm Nell McCallum & Associates. Today's date is April 16th and the time is approximately 9:15 a.m. We are here today to take the oral and video deposition of the witness Mr. William R. Richard Jr. We are located at 1300 Post Oak Boulevard, Houston, Texas. At this time will counsel please state their appearances for the record?

MR. LACEY: David Lacey representing the plaintiffs.

MR. SHOEBOTHAM: Jonathan Shoebotham with Woodard Hall & Primm representing defendant Monsanto Company.

VIDEO OPERATOR: Would the court reporter please swear in the witness.

WILLIAM RICHARD JR.,

being duly sworn, testified as follows:

EXAMINATION BY

MR. LACEY:

Q Will you state your full name for the record, please?

A William Ralph Richard, Jr.

Q And where do you live, Mr. Richard?

A I live at 729 Delchester Lane, Kirkwood, Missouri.

Q Are you currently employed?

A I'm self-employed.

Q And how are you self-employed?

A I have my own consulting company, one-man company, Delos Incorporated.

Q The name?

A Delos, D e l o s, Incorporated.

Q How long have you had that business?

A From December '85.

Q Tell me a little bit about your educational background.

A I have an AB degree from Amherst College, class of '43; I have a master's in chemistry from the University of Michigan in '47; and a Ph.D. from the University of Michigan in organic chemistry in '51.

Q Was the AB degree in chemistry?

A Yes.

Q And following your bachelor's degree were you in the armed service?

A No. I worked for Monsanto Company in Springfield, Massachusetts.

Q When was your first employment with Monsanto?

A January '43.

Q And that was after you actually acquired your degree?

A That's right.

Q And did you remain in the employment of Monsanto while you worked on your master's degree? Or

did you take a leave?

A I had a one-year leave of absence from '46 through part of '47, and then I resigned from Monsanto.

Q In 1947?

A Right.

Q And that was after you acquired your master's degree in chemistry?

A I'm not sure. But it was concerned with I had to stay in graduate school, I wanted to get a Ph.D., so I resigned. They wanted me to come back after a year.

Q I see.

After getting your master's degree, did you continue on in graduate school to get your Ph.D.?

A Right. Exactly.

Q And during the time from the time you started your master's degree until you completed your Ph.D., were you a full-time student?

A I was a full-time grad student.

Q Right. Did Monsanto pay for any part of that education?

A No, they did not.

Q Did you have any teaching responsibilities or fellowships, assistantships while you were in graduate school?

A I was a teaching fellow for two years at the university, and I was a Du Pont fellow for about the last two years.

Q Okay.

After you obtained your Ph.D., where did you go to work?

A I returned to Monsanto Company at the Dayton laboratories, Dayton, Ohio.

Q Okay. And from 1951 until what year did you remain in Monsanto's employment?

A I actually started in the fall of 1950, a few months before the degree was formally granted, and I remained in Monsanto's employ until December 1985.

Q The time that you left to form your own consulting business?

A I retired from Monsanto, right.

Q That was a retirement in '85?

A Retirement.

Q Let me ask you a little bit about your work assignments with Monsanto. From 1943 until you started your master's degree what were you assigned to do?

A I was in the plastics division. I worked on safety glass, on butyral, the safety glass group, I worked for Schawinigan Resins Corporation and on polyvinyl chloride.

Q What was the name of the company, Schawinigan?

A Schawinigan.

Q Was that a subsidiary of Monsanto?

A It was a 50/50 subsidiary of Monsanto.

Q Were you actually located in a Monsanto facility while you were doing that work or were you assigned to some other location?

A It was an adjoining plant. It abutted the Monsanto facility and was owned 50/50. There were gates and a separate corporation. But I was assigned there for roughly a year.

Q During that time were you paid by Monsanto or by the joint venture?

A By Schawinigan Resins.

Q When you came back to Monsanto in 1950 you went to a different location?

A Correct.

Q And that was in Dayton, Ohio?

A Dayton, Ohio.

Q And what was located in Dayton, Ohio?

A It was the facility of the central research department.

Q And what sort of things were assigned to the central research department?

A Initial exploratory research, some physical chemistry.

Q What sort of things are involved in initial exploratory research?

A In the whole facility or that I was connected with?

Q What I'm really trying to find out is generally what do you mean by the terminology initial exploratory research, not a particular job that you did or somebody else did, but what's involved in that work?

A Well, something that the company was not already making, was not manufacturing, and that they possibly could or would want to in the future manufacture.

Q Would this be brand-new chemicals that nobody else made or would it be chemicals that others were already making?

A Both.

Q Okay.

A Both.

Q In terms of chemicals that others were already making, I take it that not every chemical company produces every chemical that can be made. Is that correct?

A That's correct.

Q And is it also correct that a particular company may have to develop its own process for making a particular chemical in order to be able to make it?

A That's true.

Q And why is that?

A The process required may be different, it may be superior in terms of economics, might be superior in terms of quality, starting raw materials might be different.

Q Are there ever any restrictions that would keep one chemical company from simply copying what another chemical company is doing to make exactly the same thing in exactly the same way?

A Yes. The patent system in the United States --

Q So chemicals --

A -- may forbid it.

Q I'm sorry. So chemicals can be or chemical processes can be patented?

A Yes, chemical products could be patented.

Q Or products. And if that happens, then let's just say that chemical company A has a patent on a particular process for a particular product, company B could not make that same product by that same process without getting permission from company A. Is that

correct?

A Presently that would be correct.

Q Okay.

And if I understand what you are saying, the research that was being done at this Dayton, Ohio, central research department would involve both looking at ways to make chemicals that other companies were already making and also developing chemicals that nobody was making at that time.

A It could be that way.

Q Do you know if it was that way?

A I can't be precise.

Q Okay.

How long did you stay at the Dayton central research department?

A I stayed from 1950 through 1961.

Q Okay. And during that --

A Through part of 1961.

Q During that period of time, what different titles did you hold there?

A I was a research chemist, I was a group leader, and I was a section leader.

Q And can you tell me the chemicals that you worked on while you were located at that facility?

A I can tell you some of them.

Q If you would, do that, please.

A I worked on polyvinyl chloride, I worked on polyethylene high pressure process, I worked on ethylene copolymers, I worked on low pressure polyethylene, crystalline polystyrene. Those are the principal products I worked on.

Q Okay.

What happened in 1961 with regard to your work assignments for Monsanto?

A The facility was given over to government research -- contract research, not exclusively government, but contract research dealing with outside customers. And part of the personnel were transferred to the Monsanto facility in St. Louis. A new research center was built there.

Q The personnel that stayed in Dayton, did they remain Monsanto employees?

A Yes.

Q And additional Monsanto employees were transferred to the St. Louis research facility?

A That's correct.

Q Did that research facility have a particular name?

A They called it the research center in St. Louis.

Q Was that, after it was constructed, the main research center for all Monsanto?

A It became one of the research centers for Monsanto, yes.

Q Let me try to understand a little bit about Monsanto Company itself. Is Monsanto a United States company?

A Incorporated in the State of Delaware.

Q Okay. I guess what I was really asking you is whether its business all takes place in the United States.

A It does not. It takes place outside of the United States as well as inside.

Q Is there a headquarters location for Monsanto somewhere?

A Yes; St. Louis, Missouri.

Q Okay. In terms of operations that do take place in the United States, what states was Monsanto operating in in the 1960s and 1970s?

A I can't nominate all the states. You would have to get it from Monsanto Company.

Q Okay. Well, can you give me the names of states in which you are aware that Monsanto had facilities?

A Massachusetts -- you're talking about

manufacturing facilities now?

Q Well, let's start with that. Manufacturing facilities, yes.

A I can't give you all the sales offices.

Q Okay.

A Manufacturing facilities, I can give you some. Massachusetts --

Q Where? If you know.

A Everett outside Boston.

Q Okay.

A Springfield, Massachusetts.

Q Okay.

A New Jersey, Trenton, Camden --

Q Is that Trenton and Camden, are those two different facilities?

A That's two different facilities.

Q Okay.

A Jersey. Florida was Pensacola. Alabama was Anniston. Missouri, they had two or three facilities in and around St. Louis. Illinois was Sauget. Iowa, Muscatine. Facility in Huntsville later on. I'm not sure of the timing.

Q Is that Iowa?

A Huntsville, Alabama.

Q Alabama.

A Yeah.

Q Okay.

A Decatur, Alabama. Let's see. Columbia, Tennessee. Nitro, West Virginia.

Q I'm sorry. The town?

A Nitro, West Virginia.

Q Nitro?

A Nitro, West Virginia. Soda Springs, Idaho. Small facility in Seattle, Washington. Long Beach, California. Texas, Texas City and Alvin. That's the majority that I can think of.

Q Okay. Looks like we've got maybe 20 or more different manufacturing locations spread throughout the United States. Is that correct?

A That's correct.

Q Did all of these plants make the same chemicals?

A Did they all make the same chemicals? Sometimes, yes, but usually not.

Q Okay. So we might have one of these plants, say the one in Soda Springs, Idaho, might make two or three chemicals that Monsanto sold and the one in Seattle, Washington, might make two or three different chemicals that Monsanto sold?

A That's possible. But we also had some

duplication in terms of two manufacturing facilities for the same product.

Q Okay.

Let me just understand as best I can about any manufacturing facilities outside the United States.

A I'm less familiar with the manufacturing facilities outside the United States.

Q Are you aware of any of them at all?

A Yes.

Q If you would --

A There were two in England.

Q Okay.

A One is Ruabon, in North Wales, and another one was in Newport in South Wales. We also had a facility in Antwerp, Brussels. We have operated in Spain; operated a small plant, safety glass plant, in France. Operated a fiber plant in Israel for a short time.

Q Fiber?

A Fiber. Operated in South America, Brazil.

Q Those are all you can recall at this point?

A Without a lot of effort to go through more. There may be more.

Q Okay.

A There are more.

Q Okay. Well, that's fine. I just wanted to get a general idea. You are the first Monsanto employee or ex-employee we've deposed in the case, so you get the benefit of helping us understand a little bit about Monsanto and how they operated.

Let me ask very briefly about the organization of Monsanto as a company or companies. You mentioned that one time you were assigned to a joint venture they were in. Can you explain to me generally how Monsanto was organized from a corporate standpoint?

MR. SHOEBOTHAM: At what particular point in time, Mr. Lacey?

MR. LACEY: If the arrangement changes, then I would like to try to understand that.

A This is a difficult question.

MR. LACEY:

Q Okay.

A Very difficult question. I'm not a corporate man in that sense. I might be able to give you some general answers, but not specifics.

Q It would help me if you could give me any general information. As I say, you're the first person from Monsanto that we have deposed in the case, so --

A I think that you should specify the time. The corporation setups continually changed with regard

to whether they had divisions or companies. The arrangement was changed whether it was a geographic organization or whether it was organized on product lines or on process lines. Monsanto kept growing, adding. So this is a very complex subject.

Q Well, let me try first to say -- let's pick the year 1970, or thereabouts, and try to understand as best you can explain for us how the company was organized in and about 1970.

A I can tell you more about where I was in the organization.

Q Okay. Well, that will be helpful.

A And maybe slightly preceding that. I was assigned in 1963 and up through '70 to the organic division.

Q Organic means --

A Organic division, which made -- which was -- made principally organic chemicals.

Q And when we talk about organic chemicals, we're talking about chemicals that have carbon in their molecular structure?

A That's correct.

Q Okay.

A There may have been exceptions, but in general they had organic chemistry as their main base of

operation.

Q Okay.

A This does not mean that the rest of the company -- the rest of the company could also deal in organic chemicals. So there was a -- you would have had to define exactly what products the organic division made.

Q But in terms of just a general understanding, when we use the term organic, talking about organic chemistry, organic chemicals, we're normally talking about chemicals that have carbon in their structure?

A That's right.

Q Okay.

A But so do plastics. So we were talking about probably molecular weights under 500.

Q Okay. And the organic division was the organic division of Monsanto?

A The organic division of Monsanto Company.

Q And where was the organic division of Monsanto Company located, if it was located in any particular spot?

A Their principal operations were in St. Louis area and the Queeny plant was the -- one of the larger plants. And they also operated, I think, at that time, the Krummrich plant, or a good many products in the

Krummrich plant. Also had some operations at Anniston, Alabama.

Q So the three plants that you recall that basically were part of or had production for the organic division were the Queeny plant, the Krummrich plant and the Anniston plant?

A Yeah. Also Delaware River, which is one I didn't mention before.

Q And where was the Queeny plant located?

A Queeny plant is located in St. Louis on South Second Street.

Q That's on the Missouri side of the river?

A On the Missouri side.

Q And where is the Krummrich plant located?

A In Sauget, Illinois.

Q And how close is that to St. Louis?

A It's across the river in Illinois.

Q Okay. Is it generally directly across from St. Louis?

A Roughly.

Q What would be the physical distance as the crow would fly between the Queeny plant and the Krummrich plant?

A I don't know the distance, but a mile, half a mile.

Q Okay. It's at least far enough to be across the river?

A The river is fairly wide and it's not right on the riverfront, so --

Q Okay. And the Anniston plant was located in Alabama?

A Correct.

Q And the Delaware River plant was located in Delaware?

A No. It was in New Jersey on the Delaware River.

Q Okay.

Now, would each of these plants make more than one particular chemical?

A In general, yes. These plants all would make more than one --

Q Okay.

A -- chemical.

Q Now, we'll talk about these plants in a little bit, but let me go ahead and understand. What other divisions of Monsanto Company were there in the period from 1963 or so to 1970?

A I can answer in general terms.

Q Fine.

A They had the inorganic division which largely

made inorganic chemicals.

Q Which would be chemicals that don't have carbon in them. Correct?

A In general.

Q Okay.

A Not specifically. But in general they were based on phosphorus and phosphate products; inorganic phosphates. They had a textile operation.

Q Were there specific plants that were generally inorganic chemical plants?

A Well, it varied. And I'm not sure of the dates. Sometimes they're arranged geographically, in which case the organic division would have certain products that were made in different plants. Sometimes they're arranged by division, and division had certain responsibilities, and guest operations. So it's very complicated. You would have to go back and chart it year by year. And I don't have that in my head.

Q Okay.

Well, let me go on. You mentioned there was a phosphate division?

A Well, I said inorganic division that made principally phosphorus and phosphate --

Q Okay. That was one and the same?

A Exactly.

Q Okay. What other divisions were there?

A There was a plastics division and there was a textiles division or company.

Q Okay. Any other divisions that you can think of?

A Well, they had packaging, bottles and plastic materials.

Q Okay.

A Blown ware. I don't know whether they called it Fabricated Products at that time or not, but at one time it had the title Fabricated Products. They had an international division. If I think of more, I'll come back to it.

Q That's fine.

A These were around '70.

Q Now, you indicated that there were changes over time. If we go from 1970 to 1976, for example, were there changes in that period from what you've described as existing up to 1970?

A Yes. As far as I was concerned, the organic and the inorganic divisions were combined.

Q Sometime in the early Seventies?

A In the early Seventies. And they called that the Monsanto Industrial Company.

Q Monsanto Industrial Company?

A Industrial Company, right.

Q Okay. What happened to the other various divisions in that reorganization?

A I'm not familiar enough to give you the right information.

Q Okay.

When you left the company in 1985 was it still organized in the same way it was reorganized in the early 1970s?

A The answer is, I was -- as far as I was concerned, I was back in the Monsanto Industrial Company, having been in the Monsanto Chemical Intermediates Company in the intervening years.

Q Okay.

A So there was an organizational change, but I was back with the industrial company.

Q What was the difference between the organization up to 1970 that had the organics division and the inorganics division and the post-1970 combination of the organic and inorganic divisions into the industrial company?

A Would you repeat that, please?

Q Yes. What was the change that took place between the way the company was structured from having the organic division and the inorganic divisions as they

existed before 1970 and the combined divisions in the industrial company as they existed after about 1970?

A Well, one change is that their product groups might be slightly different. Paper group was assigned to the plastics division, for example. Again, the specifics, I would have to go back to an organization chart and go through in detail. But that would be typical. In general, they had the same products, but there were certain products which had been assigned to probably another division. Or another company at that time.

Q Okay. Did this basically change the reporting lines and things like that more than the actual individual work assignments of a person like yourself when reorganizations took place?

A It depended. If you had the same product group and the same business, the organizational changes were minimal. If you were reassigned to a different product group, of course, then the reporting relationships would change.

Q When the organic division and the inorganic divisions were combined and assigned to the industrial company, did the Queeny plant, the Krummrich plant, the Anniston plant and the Delaware River plant stay with that same group?

A The majority did. There might be a minor exception. But the majority went with the industrial company.

Q Do you know what the exception would be, if there were one?

A I don't know for sure whether Camden or Delaware River -- I think they stayed with the industrial company, but --

Q You mentioned at some point in time between the 1970s and when you retired you apparently were away from the industrial company and then came back to it. Is that correct?

A That is correct.

Q What reorganization or restructuring caused that to happen?

A The larger volume products which were made in plastics division, textiles division and the industrial division -- and I'm talking about the chemicals, not the end products, but the intermediates that provided the end products, if were reasonably large volume or mainly process intermediate oriented, were put into the Monsanto Chemical Intermediates Company.

Q About when did that happen?

A Roughly about '79, early '79. Maybe late '78, something like that.

Q And you were then assigned from the industrial company to the intermediates company?

A That's correct.

Q And what products were you working with in '78 and '79 that were large volume that resulted in that reassignment?

A I had the responsibility for process chemicals for the industrial company prior to the reorganization.

Q And can you explain what you mean by that?

A Process chemicals meant the larger volume things that the organic division had previously made. Maleic anhydride was one product, chlorobenzene family, nitro-chlorobenzene family, sulfuric acid and caustic.

Q Any others?

A I was trying to think. I think that's -- those are the main -- they were the main products that we had, worked on.

Q What brought you from the intermediates back to the industrial?

A The intermediates company was disbanded.

Q Okay.

Prior to about 1963, because that's when we started talking about the various divisions, were there other organizational forms that existed before '63 that

we haven't discussed?

A I'm sure there were. I was --

Q Do you recall --

A I was mainly involved in the central research department and the research and engineering division, and really didn't play much of a part in the total organization at that time.

Q Okay.

Let me go back, then, and let's talk about the assignment that you had to the St. Louis research center in 1961. I take it this was the research center at the headquarters of all of Monsanto. Correct?

A Yes.

Q And was it their largest research facility?

A It was one of the largest. I don't know whether absolute -- we had pretty large facilities in research triangle, in Pensacola, we had a large research facility at Springfield. So it was probably the largest, but there were other research installations which were close.

Q How was the work divided between the various research facilities?

A How was it divided? Most of the plastics were done still at Springfield, with a small group at St. Louis. Most of the organic research was done either

on South Second Street or at the research center. Most of the inorganic research was done at the St. Louis facility. So there was no simple assignment.

The ag company, agricultural company, I left that out before. The agricultural company had a large facility at the research center. Textiles, in general, was done at Pensacola and also at the research triangle. Some at Decatur, Alabama, too. It's not an easy pattern.

Q Okay. Something like the corporate organization, a little bit hard to understand?

A Well, you had to stay with it and you had to know specifically the time interval that was involved.

Q Did your assignment to the central research facility at St. Louis in 1961 involve specific products or specific chemicals that you were going to be working with?

A I had the assignment to see if we could make new materials for the building construction industry.

Q Can you give me some examples of the types of things you were working on?

A Yes. We called part of the main part of the program, we called it heavy duty plastics or engineering plastic materials.

Q What sort of things were those being targeted

for in use?

A We wanted high modulus materials with good impact and fire resistance that would compete in the fabricated area for -- with other materials.

Q Can you give me an example of an end use of something like that? That's what I was trying to get at.

A Yes. One of the products which came out of this was Vydyne. And it was a Vydyne composite material. We were aiming at things like bathtubs and automobile parts.

Q Okay. How long did you have that specific assignment at the central research facility?

A Roughly two years.

Q And what was your next assignment?

A I went to the organic division in '63.

Q Okay. Were you still in the central research facility when you were with the organic division?

A No. I initially went to South Second Street, where the organic division research was done at that time. And later we moved -- we moved some of the people back to the research center and continued operations at South Second Street as well.

Q But then organic research was done under the auspices of the organic division as opposed to under the

auspices of the central research. Is that correct?

A That is correct. Or the central research was sometimes called the research and engineering division.

Q What -- I guess maybe that then -- it was its own separate division?

A Research and engineering division was, yes. Without any manufacturing facilities, though.

Q Was it a staff-type function?

A It was more a staff, because it lacked manufacturing facilities.

Q Were there other divisions or companies or groups that also were basically staff function groups as opposed to manufacturing groups?

A A whole -- yes, sure.

Q Can you tell me about those other aspects of the company that you recall which had staff-type functions and were not a part of any particular division?

A Finance and accounting; medical; distribution. At least, distribution had it both ways a small staff and each division, of course, had its own -- or each company its own distribution as well. The same thing is true of accounting. Law department. Patent department was often split, had both attorneys assigned to central and to the divisions. Engineering

continually changed. Sometimes it was division entirely, sometimes it was central with people assigned to the division problems.

Q When these staff -- what are they, divisions or --

A They call them -- earlier divisions; they called them companies later.

Q What's the difference between a division and a company?

A I suppose that the division was in the earlier days of Monsanto when they were smaller entities in terms of people and dollars. And later on they began to call them companies.

Q Was there any difference that you could tell other than the size of them?

A I can't answer that question.

Q Well, what I was asking was whether you were able to tell any difference other than the size.

A I think that was the principal difference.

Q Okay. Now --

A There may have been some legal reasons, I don't know.

Q Okay.

In terms of these divisions or companies, for example, the organic and when it combined with the

inorganic to create the industrial, they had a reporting chain that went on up to the top person at Monsanto. Is that correct?

A That's correct.

Q Did -- Was there also a reporting chain for these various staff groups that went on up to the top person at Monsanto?

A Sure. They eventually reported to the president.

Q Okay. And the question I guess I have is whether they reported directly to the president of the company instead of reporting to somebody in one of these particular divisions. For example, the law department didn't report to anybody in the organic division, did they?

A They might have had a dotted-line responsibility. But I'm sure that the direct formal would be straight up -- would be straight up the line.

Q When we talk about a dotted-line responsibility, we're saying they would help out these people in these other divisions when they needed help?

A Right. And they were partly responsible for that organization, making sure they, you know, did the right function and could help them.

Q Let me just see if I can understand it. For

example, if we have this finance and accounting division, that's basically a staff function. There may be some individuals in there who specifically are there to assist the organic division, there may be some other people who are specifically there to assist the plastic division and so on and so forth. Is that what you are suggesting?

A I would rather not say anything about the financial division. I was never really connected with it. So my knowledge -- detailed knowledge is not there.

Q Okay. Were there any of these divisions that performed staff functions that you ever worked with?

A Would you repeat the question, please?

Q Yes. Were there any of these divisions that performed staff functions, like finance and accounting, medical, distribution, law, patent, engineering, central research, that you worked with --

A I'm not sure that they were called divisions.

Q Okay. Well, what would the proper title be?

A I don't know. But not divisions. Maybe just a staff -- maybe just was called accounting or finance.

Q Okay.

A But they were not normally given the title of division.

Q Okay. Well, let me rephrase it. I don't

want to try to make it into something it's not, but were there any of these staff groups -- is that a good word to use?

A I think that's a good word.

Q Are there any of these staff groups, like finance and accounting, medical, distribution, law, patent, engineering and central research, that you worked with after you were assigned to a specific division, for example, the organic division?

A The answer is yes.

Q Which one did you -- or ones did you have direct dealings with?

A Patents, medical, sometimes legal, rarely accounting, but maybe once in a while.

Q And from that --

A Engineering. You left that out, but --

Q I thought I had listed engineering. I apologize.

A Well, in your last, I think, question --

Q Okay.

A But certainly we had a lot of interaction with the engineering staff or --

Q Now my question is whether or not you were able to determine from those groups that you did interact with whether there were specific people in

those groups that were assigned to assist, for example, the organic division that you were working in and others who were assigned to different divisions within that staff group.

A Depended on the size of the staff group and the situation involved. Sometimes they were targeted, we'll say, to work with a particular division, sometimes they were targeted to work for a particular product. I think they had some flexibility within that -- their own organizations, depending upon the work loads, importance of it.

Q And the difference between being targeted for a division or a product is that sometimes products switch divisions in reorganizations?

A Sometimes they did. Sometimes the work load would change and assignments would be remade, reassigned.

Q Let me go back now to your assignment to the organic division in 1963 and working on organic research at South Second Street. What sort of function did you have when you were assigned to the organic division in 1963?

A I was assigned as the manager of fluids, functional fluids.

Q Functional fluids?

A Right.

Q What are functional fluids?

A These were liquid materials, or fluids, which provided an application which did a particular function. For example, it might be dielectric fluids or it might be hydraulic fluids or it might be heat transfer fluids. These were typical application areas. It might be lubricants. High temperature jet lubricants was one of the areas.

Q Was there any common bond between all of these different functional fluids? Or was each one independent from the other?

A Common bond was that they were -- were fluids and had -- usually had mechanical or electrical applications closely connected with them.

Q Was there any chemical similarity between the materials that created these various functional fluids or were there all sorts of different chemicals that could create these functional fluids?

A We had a variety of families of products that we -- that we used. Some were in more than one application, others were not.

Q Can you give me the families of chemicals that you were involved with as the manager of functional fluids?

A Yes. Polyphenyl ethers and polyphenyl thioethers were involved in high temperature jet lubricants.

Phosphate esters were involved in fire resistant hydraulic fluids for the aviation industry.

Chlorinated biphenyls were involved in the electrical industry. They were involved with fire resistant hydraulic fluids. I say electrical industry. I think I ought to split it down into capacitors and transformers.

Chlorinated biphenyls were involved initially in heat transfer applications, fire resistant heat transfer products. It had various hydrocarbons that were also heat transfer. HB 40 hydrogenated terphenyls were involved with heat transfer.

Those were the principal that we worked with at the time. We did a lot of new synthetic work on phosphinates and phosphonates seeking fire resistant products. Worked on brominated derivatives.

Q With regard to the different families you've given me, and I think you've given me about four families here that I've noted, which one was the largest -- made up the largest portion of the actual product of the functional fluid portion of the organic division?

A I think in terms of volume I think chlorinated biphenyls were the largest volume. In terms of dollars, I'm not sure about that. We also worked with esters; not just phosphate esters, we worked with carboxylic esters as well.

Q What's the difference between when you say the largest volume but you're not sure about the dollars? What do you mean by that?

A Well, the price of the chlorinated biphenyls was lower than the price of most of the other products. The polyphenyl ethers were extremely difficult to make and volume was low, but the dollar volume was reasonably high.

Q Is there any relationship between the dollar volume of what you sell and whether it's good or bad for the company?

A No. I think that probably the importance of the application was -- was paramount. The polyphenyl ethers, for example, were used in particular aircraft, military aircraft. So it would depend a lot on the application.

Q I guess my question -- I didn't phrase it very well -- was: Simply because a particular product line had more gross dollar sales would not necessarily mean it's the most profitable line for the company,

would it?

A No, it would not. But also it might not be the most important product either.

Q Right. I mean if you had -- if you produced, hypothetically, ten pounds of some particular material that you sold for a million dollars a pound --

A Or that was important to the United States.

Q Certainly. All of those factors have to be taken into account in evaluating the chemical. Correct?

A That's correct.

Q Do you know, of these various families, which group was -- had the largest margin of profit in it?

A I don't recall.

Q Was that something that you were privy to at any point in time?

A It really was not my -- I didn't set prices and didn't have much to do with the pricing or with the accounting part of it.

Q I understand. I'm just asking whether you knew at some point in time.

A I'd say the profit margin probably was highest in polyphenyl ethers, but the volume was small. We also dealt with silicate esters. That's another family of products.

Q Do you think the highest profit margin was in

this stuff that you sold to the Government or the Air Force or whatever the --

A I'm not certain.

Q Okay. What was the next highest profit margin, as you recall?

A I think that you should seek somebody in a better position to remember what these profit margins were. They obviously changed with time. And it was not my responsibility.

Q Well, let me ask, then, just if you can direct me that way. And again you get the privilege of being the first Monsanto employee or former employee I've deposed. What way should I go to try to find somebody? Who would be more privy to that than you?

A Well, I would think the business manager, business director. He was responsible for the profits of that kind of organization.

Q And who was that?

A A man named Riney Wobus was the first that I worked for.

Q Who else?

A Joe Cresce.

Q Who else?

A Ascosta San Anagnostopolis.

Q Can you spell that?

A A n a g n o s t o p o l i s. That's close, anyway.

Q Okay. Who else?

A Howard Bergen.

Q Who else?

A That's about it.

Q Okay. And these people were the business people responsible for functional fluids?

A Yes. Up through '76 or so. '74, 5, somewhere, I bowed out.

Q Okay.

Now let me ask what sort of work the research group was doing with regard to functional fluids in the 1960s.

A We did synthesis work on base stocks and additives; and we did application work to determine the -- at least the initial functions of the -- of the product for the intended use; and then we possibly worked with the technical staffs of the engineering staffs of the intended market user.

Q Let me go back and try to understand each one of those things you've told me. First, when you talk about synthesis work on base stocks and the like, what are you talking about there, if you can give me an example to explain that?

A Well, we were always trying to make better fire resistant fluids, we'll say, for hydraulics. And we were trying to increase the temperature range of, say, the aircraft hydraulic fluids and maintain properties. So we looked at a lot of phosphorus chemistry other than phosphate esters, phospinates and phosphonates, and we would synthesis compounds, run their physical properties, run initial screening tests on corrosion and oxidation, and then scale up maybe in a pilot plan if it looked feasible, and then run things like pump tests or lubricant tests or bearing tests or whatever the application was, fire tests.

Q And did this primarily involve extensions of existing products to try to improve existing products?

A Sometimes yes, sometimes no. One of the projects we worked very hard on were tractant fluids. These were for new kinds of transmissions for automobiles, where you want high -- eliminate gears and have rolling elements only. So you've got -- when shifting, you've got a continual smooth shift. We worked on bi -- dielectric machining fluids for General Motors.

Q Explain what you mean by application work.

A Well, for the intended use. If we were trying to make a hydraulic fluid for fire -- fire

resistant hydraulic fluid for aircraft, we would have machines that would simulate part of the aircraft functions -- part of the aircraft functions. Then we would take our information and go to Boeing or to Douglas or whatever and find out whether they were interested and talk with them. And if they were interested, they would begin testing in a more sophisticated manner.

Q Would this involve attempting to find a way to have a product that Monsanto might have be applied in a way it had not previously been applied and therefore make it marketable to potential customers?

A Yes. If that were possible. Sometimes that was not possible.

VIDEO OPERATOR: We're off the record.

[Recess]

VIDEO OPERATOR: We're now back on the record.

MR. LACEY:

Q Are there occasions where Monsanto would be producing a particular chemical and they would have more of it produced, because of production requirements or the way the process operated, than they were able to sell?

A Would you repeat that, please?

Q Yes. Were there occasions where Monsanto would be producing a particular chemical and because of the way the process was structured or other factors you couldn't reduce the production to the level of sales and you would have to try to find new applications in order to be able to sell the entirety of the production?

A In general, no.

Q Okay.

A You could always cut production.

Q Were there occasions where plant capacity was such that the requirements for current sales did not involve operating at or near plant capacity?

A Yes.

Q And in those cases would Monsanto attempt to, if possible, find a way to increase the market so the plant could be run more nearly at capacity?

A The fluids business, it's not that easy. You have to have -- your customers and your applications and so forth are pretty well set, so you just can't go out and move more -- more fluid to somebody easily. It's not like selling methanol, where you can sell it around the world, cut the price and move it. It's not -- the fluids business is much more of a specialty operation, not geared to all-out production.

Q Well, I guess my question was: If I put a

new plant on line that made a particular component of fluid, and with my current demand I was only operating at 60 percent of that capacity, would it be a charge that might be laid to your group to try to find new applications for that remaining capacity, to develop the markets?

A That was not the normal kind of assignment nor a specific assignment. We geared production to what we thought we could sell. We had excess capacity and that was normal. And there was no way to quickly turn anything like that around.

Q Well, what sort of application work, then, would you do that would develop markets, if any?

A Well, I mentioned the new applications. For example, we tried to go after -- we were in the high temperature jet lubricant business, and mainly in government particular operations we tried to expand the jet engine lubricant business to the commercial airlines. And we did a lot of work in formulations, testing, working with Pratt & Whitney and GE. So we would try to expand our lubricant business. We used different chemistry. But we were knowledgeable of the area and therefore we wanted to expand the market. Our market.

Q With regard to the function of working with

the technical staff of market users, I believe you indicated that was one of the things that was part of what your group did.

A Yes.

Q Can you explain to me generally what's involved there?

A Well, a user has control over the product line, product -- particular product. If it's used in -- we'll say in dielectrics, the capacitor manufacturer really calls the shots. If it's a transformer, the same thing is true. General Electric and Westinghouse are calling the applications shots as far as they were concerned, and we were just supplying a component part. So their engineering staffs and their management, they're the key to whether a product is used or not and in what volume.

The same thing is true in aviation. It doesn't matter whether it's a jet engine lubricant or -- the end user is in control. You have to meet his specifications, you have to meet his requirements. The same thing is true in fire resistant hydraulic fluids. The aircraft manufacturer specifies what he wants. All you do is the preliminary testing, enough to get him interested, but he has to qualify the fluid, he has to test for flight -- flight test it. This is true, I

think, of almost all the applications. The end user, the pump manufacturer, whatever, has got control.

Q What my question is, though, is: What work did you do with the technical staff of your customers?

A Well, we would present our information to their engineering staff and they would tell us, "Yes, we're interested and we'll go forward," or "No, the test results don't look good enough, and go back and if you want to continue the operation you have to convince us of some other property or improve some property or improve some function or add some function or subtract some function."

Q Do I understand from what you're telling me, then, in the specialty fluids business, it takes more than just a salesman making a sales call to make the sale, it takes technical people like you assisting to make the sale?

A In a preliminary sense, yes. No question about it. Then the sale comes later. You may be working two, three, five years ahead of the actual sale. Maybe even more.

Q And after you have made a sale, and by that I mean let's take an aircraft manufacturer, for example, who you go and explain the potential fluid that you have for his use and after having heard your presentation he

says yes, he's interested, and his technical people look at it and do their testing and you actually start supplying that fluid, is there still a continuing role for technical people with regard to that customer and that fluid?

A Yes. Try to stay in contact to see whether the actual results were -- were consistent with the test results. So you're trying to monitor at least -- sometimes you can monitor, sometimes you can't. But you try to listen to his staff and find out whether -- whether there are problems with the product or not.

Q And if there are problems, do you try to rectify any problems that are partly caused at your end?

A If we're involved and we think we can do it or if we're involved directly we would try to correct it or change it if we had to.

Q To what extent did that job of working with the technical staff of market users get you and your people -- let me stop right there. You had people working under you?

A Yes.

Q Tell me generally about the number of people who -- and I'll say technical people. I don't mean secretaries, necessarily, but people who had science degrees who worked for you in this period from 1963 to

1970.

A The order of 20 people.

Q Technical people?

A Technical people.

Q And were those people broken down by specific assignments to particular things, like certain people assigned to the chlorinated biphenyls, others assigned to the phosphate esters and the like?

A Usually we had a combination of synthesis people, synthesis capability tied in with an application person or persons so that -- and sometimes in the intermediate there would be a formulation person. So we had synthesis, formulation, applications. And they would be geared to specific uses.

Q Would any of those people or yourself ever go to a customer's facility in connection with working with the technical staff of the customer?

A Yes. They would go.

Q Which people? Would it be the application people who would be basically going to a customer's facility?

A Yes, more frequently. But sometimes the synthesis person would also go, too.

Q And would you personally ever go to a customer's facility?

A Occasionally. I think I went less than my people, but I occasionally would go.

Q Okay. And when you or your people would be going to a customer's facility, would they normally be going to a laboratory or would they be going to a manufacturing plant where the chemical was used or what sort of place would they typically be going to?

A I think most of the people that we dealt with had a laboratory in connection with a manufacturing facility. But oftentimes we would talk with the engineering or engineering staffs. And that might just be a conference; we might not get out into the manufacturing facility; we might not get out into the laboratory.

Q That depended on the particular circumstances?

A Depended on the customer and what he wanted to do.

Q Did you have specific people who had some supervisory responsibility over other people on this 20-person staff who worked under you? Or was everybody reporting directly to you?

A No, we had group leaders.

Q Who were your group leaders?

A Varied with time, of course. We had group

leaders and in some cases we had scientists and we had -- in one case we had a senior scientist and distinguished scientist. The group leaders in the Seventies were John Herber, Lou Stark, Dave Miller. The scientists, Clint Thompson and Dr. Munch, Dr. Thompson. These are all doctors.

Q Ph.D.s?

A Ph.D. doctors, right.

Q How were the groups that these group leaders were over broken down?

A Well, Stark in general had fire resistant hydraulics, industrial.

Dave Miller had heat transfer and aviation hydraulics. These are not absolutes, but in general.

Herber normally had synthesis work, a lot in the hydraulic area.

Thompson had, oh, new chemicals, new stuff that we wanted to do. Aromatics in general. He also had tractant fluids when we brought him from central research.

Q Who had dielectrics?

A Munch had application work on dielectrics.

Q So there wasn't a group leader for dielectrics?

A Well, he was acting as group leader, but he

really was a distinguished -- was a scientist, senior scientist and I think ultimately a distinguished scientist.

Q Is that a title of a position within Monsanto?

A In Monsanto there are two ladders you can go up in the research area: You can go up an administrative ladder, so-called, where you become a research chemist and group leader, maybe a section leader, if they have such a thing, research manager, research director, and so forth.

Q That's the ladder you took?

A That's the ladder I took. The other was scientist -- research chemist first, of course, and then science, science fellow, and there were two or three grades of science fellows.

Q And I take it you are indicating to me Dr. Munch reached one of the higher grades in his line.

A Yes, in the science area. But they could function in terms of what they did in terms of they did application work and science work. They didn't necessarily do all exploratory work, in other words.

Q And did you reach relatively high up the ladder choice that you took?

A Relatively high. I normally had a boss who

was either -- if I was a research manager, I had a research director as boss. If I were a director, I normally had a general manager of research.

Q Who was a Ph.D. scientist?

A Yeah. Ph.D. engineer or chemist, yes. Usually.

Q Who worked with Dr. Munch on dielectrics and applications for them?

A Well, Munch had two technicians that were working for him.

Q And who were they?

A Ray Cox was one and he had a woman I don't remember her name right now.

Q Were they also scientists?

A No, they were technicians. They would have maybe a year or two degree, something like that, or maybe 10 or 15 years of practical laboratory work.

Q So in the dielectric area specifically, Dr. Munch was the only degreed scientist assigned to that area?

A That's correct. He also had, of course, and could call on -- when he needed, he could call on synthesis people, he could call on analytical people, he could call on engineers if he needed.

Q Now, was Dr. Munch in your specific group of

functional fluids when you came there in 1963?

A No, he was not.

Q Was there anybody fulfilling his role that he later took when you came there in 1963?

A There were no -- we did no specific application work in dielectrics in 1963. We did work with manufacturing on things like quality control and TSD groups, manufacturing groups did work on the process itself. But we did no application work when I first came there.

Q When did Dr. Munch get assigned to your group and start working with dielectrics?

A I don't have the exact date. We would have to look it up for you.

Q Can you give me an approximation?

A I don't have the date.

Q Okay. Well, that's fine. Was it by 1970 that he was there?

A Yes.

Q Now, in the reorganization that took place in about 1970, did that change your role as the manager of functional fluids over these various things that you've previously told me about?

A I had additional duties. I had the paper group, paper chemicals group, as well as the functional

fluids group.

Q But you kept all the functional fluids. Correct?

A Yes. And there were some added responsibilities. We -- they added encapsulin solvents to my -- I don't know the exact date, but it was in the early Seventies.

Q What were those?

A This is carbonless carbon paper.

Q It's where you press down hard and you get three copies?

A Right. We provided the solvent for that system, which was originally Aroclor. It was originally assigned to the plasticizer group, then it was reassigned to the fluids group.

Q Was there any reason for that reassignment that makes sense?

A Yes. We wanted to -- we did not want to furnish Aroclor anymore to that use, and we wanted to reach a replacement product as quickly as possible.

Q And therefore it was assigned to your group?

A That's right.

Q Anything else that was added that you can recall in that reorganization?

A Those are the principal changes.

Q Okay.

And after that 1970 or thereabouts reorganization, how long did you remain over this functional fluids plus paper group --

A Excuse me, but I think it was actually done before the reorganization, not coincidental.

Q Okay.

A At least as far as the encapsulin solvents.

Q Okay.

Well, after these additional duties were added, however they came about --

A Yeah.

Q -- how long did you remain as the manager of the functional fluid group that you first picked up in 1963?

A Approximately '74, I think. Sometime in '74. The exact date I don't remember.

Q And from the time that Dr. Munch joined your group, whenever that may have been, until the time that you ceased to have those responsibilities, was Dr. Munch always with your group?

A Yes.

Q And was he always the person responsible for the dielectrics?

A Well, research responsibility I think needs

to be qualified. He was responsible for the research application work in an administrative sense, reporting to me, but we did -- neither one of us had sole responsible for dielectric fluids as far as Monsanto goes.

Q But within your group --

A Within the research department, yes.

Q Okay.

Now, who replaced you in 1974?

A Well, the exact date I'm not sure of, but Marvin Gibbs.

Q And did Dr. Munch stay with that group at least when Marvin Gibbs first replaced you?

A I think so. I'm not sure. Munch retired, and I'm not sure of the exact date. But I think he did stay for a while.

Q And in 1974 what duty did you get reassigned to?

A I was -- I had process chemicals and paper chemicals for a time.

Q And was that in any way related to the additional duties that had been assigned to you somewhere around 1970 for the paper groups and the carbonless paper?

A Carbonless paper stayed with the fluids

group.

Q Okay. Did those other functions, any of the paper functions, go with you when you were reassigned?

A Well, for a while, for about two years, I had paper and process together.

Q Okay. And then --

A I think it was still within the MIC organization. And, I don't know, '76 to '77, somewhere along there, the chemical intermediates group was formed.

Q And that took the process chemicals and --

A Took the process chemicals. And I left paper chemicals.

Q All right. And you never came back to the functional fluid area after 1974 or thereabouts?

A When I returned to the industrial company, I had partial responsibility for the fluids group.

Q Okay. When was that?

A I came back in -- it was reorganized, I think, in '83.

Q When you say you had partial responsibility, what do you mean?

A I had the application work on fluids. The research department was organized in a different way at that time. There were three research directors.

Dr. Hill had exploratory research and certain growth functions.

I had process development, new stuff, and applications.

And Marvin Gibbs had the manufacturing process research.

Q And before all those had been basically combined under you from 1963 to 1974?

A All those functions? Just the fluids is all I had in --

Q Yes, but --

A -- in that time.

Q But the exploration as it related to fluids, the applications and the manufacturing process.

A Well, there was one addition. I supported research in the central research department on exploratory work on fluids in that '63 to '74 period.

Q When you say you supported it --

A Yeah.

Q -- what do you mean?

A Provided budget money.

Q But the actual work was primarily done by people in the central labs?

A Right.

Q Okay. Did they report to you in any way or

did the budget money just disappear from your budget?

A We kept track of the -- of the products and the process and -- but the administration was in the central research department.

Q And this last position that you held, from 1983, pertained on up to your retirement?

A No. We had another reorganization partway through there, from '83 to '85. The research department was organized or reorganized, and I had specialty products.

Q And what were specialty products?

A What came back as process chemicals in general, what came back as functional fluids. I had methanol in Texas City, acetic acid in Texas City.

Q Is that where you were when you retired?

A That's where I was when I retired.

Q Okay. What age were you at your retirement?

A Sixty-three.

Q Was that a normal retirement age for somebody in your --

A Well, 65 is the normal. Probably 18 months early.

Q Was that part of some special program that Monsanto was having?

A It was an incentive-for-retirement program.

Q So you got your regular retirement plus something else to retire?

A Yes.

Q Let me go back now and try to understand a little bit better some of the things that went on in the group that you managed from 1963 forward as relates specifically to the matters that are involved in the lawsuit we're here on. Have you had a chance to visit with Mr. Shoebotham, Monsanto's lawyer, or other Monsanto lawyers about this lawsuit?

A Yes.

Q Are you aware of what chemicals are involved at issue in the lawsuit?

A I think maybe you should inform me.

Q Well, we're talking about what I refer to as PCBs. And other chemicals that may arise out of that. But do you know what I mean when I say PCBs?

A Polychlorinated biphenyl? Is that your --

Q Yes.

A Okay.

Q Let me just ask so we can be clear. Is a polychlorinated biphenyl the same thing as a chlorinated biphenyl that you previously referred to?

A Chlorinated biphenyl might be the same or it might be monochlorobiphenyl.

Q Okay.

A We dealt with that product at times.

Q Let's see if we can sort some of these things out so we can have some similar terminology. First, in the term "chlorinated biphenyl" what is a phenyl?

A Usually refers to a part of a six-membered ring with five hydrogens connected with it. It's not really an entity, it's just a convenient organic component of a molecule.

Q Okay. And when we use the term "bi" there are two of them?

A Yes. Two joined together in that sense.

Q I've seen sometimes the term "diphenyl" as opposed to "biphenyl." Is diphenyl another way of saying the same thing chemically as a biphenyl?

A Yeah. I think diphenyl is probably more correct, but both are used.

Q So when we talk about a chlorinated biphenyl or a chlorinated diphenyl, we're talking about the same type of general chemical structure?

A We are.

Q Then, if I understand correctly, you indicated that not all chlorinated biphenyls or chlorinated diphenyls are polychlorinated. Correct?

A Correct.

Q And when we say poly, we mean more than one?

A More than one.

Q So that if we had a diphenyl molecule that had only one chlorine atom as a part of the molecule, we would have monochlorobiphenyl?

A That would be a convenient way of -- correct way of putting it, I think.

Q Is there any other way we should put it besides that, or another way of saying it?

A Other than the code designation.

Q Okay. Where we give a specific location for that chlorine molecule --

A Yeah, that could be. Or product name, for example.

Q Okay. What was the Monsanto product name for monochlorobiphenyl?

A It was monochlorobiphenyl, but MCS numbers were also used at times.

Q Okay.

A Monsanto chemical sample. And a numerical designation.

Q Was there more than one MCS number for a monochlorobiphenyl?

A There could have been. The MCS numbers were used for new chemicals, for new formulations. So they

were specific to that particular formulation or that particular batch, that particular product, trial product.

Q Now, if we have polychlorinated biphenyl or polychlorinated diphenyl, we're then talking about one of these diphenyl molecules that has more than one chlorine atom attached to it. Is that correct?

A Correct.

Q We have here a blackboard that has on it some paper. And I'd like, if I could, to get you to draw for us the way scientists draw in a schematic fashion what a biphenyl looks like. Can you do that for us?

A I'll attempt to.

Q Let me hand you a marker. Is there some color that is appropriately --

A Black is fine.

Q Black is fine?

A There are different ways. [Marking]

Q Now, you've drawn -- let me see if I can count. Those are pentagons, I guess, with a circle in the middle.

A Hexagons.

Q Hexagons. They're six-sided?

A Six.

Q Okay. And what's represented at each one of

those points in that -- in each of those two hexagons?

A Usually refers to carbon hydrogen plus another two bonds or valences or electrons, four electrons, that are free to move, free to bond.

Q Let me get you to stand over. The video person tells us they can't see with you immediately in front of the drawing. Could I get you to stand to the right of that where they can see what you've drawn for us? Good.

In order to increase my understanding, I'm going to hand you, I guess, a red marker here. Could you just put a C at each point where there is a carbon atom in that diphenyl or biphenyl structure?

A [Marking]

Q So the diphenyl or biphenyl has a total of, looks like, if I count correctly, 12 carbon atoms in the molecule?

A Right.

Q Now, what in the biphenyl exists in addition to the carbon molecules that we've shown, simply one hydrogen atom attached to each one of those carbons?

A Yes, as far as other elements go, yes.

Q So if we were looking at the chemical nomenclature for this we would have a C 12 H -- what would that be?

A Be 10.

Q H 10. And why are there not 12 hydrogens to go with the 12 carbons?

A You've got --

Q You may want to demonstrate to show me what you are talking about.

A Maybe I was wrong. We've got [marking] like so.

Q So we do have 10 hydrogens. And at one place where the rings come together there's no hydrogens between those carbons?

A Right.

Q And that's where they bond together?

A They bond together.

Q If we had one of those rings by itself, what would that be known as?

A Benzene.

Q Okay.

A But that's not a phenyl group.

Q When you put two of them together they become phenyls?

A No. A phenyl group does not exist in normal conditions by itself.

Q Well, if we have -- let me ask you to draw -- why don't you just put up above what you've drawn right

there "diphenyl" or "biphenyl," whichever the appropriate nomenclature is.

VIDEO OPERATOR: Excuse me. Before we go on, I need to take a short pause.

MR. LACEY: Fine.

[Recess]

VIDEO OPERATOR: Okay. We're ready to go back on.

THE WITNESS: [Marking]

MR. LACEY:

Q Now let me ask you to draw over on the right-hand side of the chart there, up at the top, just across from the biphenyl or diphenyl, what a benzene molecule looks like.

A [Marking] Done this way or this way. [Marking] Not the same molecule, though.

Q Well, can you explain the difference to me between those two different benzene molecules that you have drawn?

A This is a benzene molecule. That's a biphenyl molecule.

Q Oh, I see. There are two different ways of drawing a benzene molecule chemically?

A Yeah, two early models of how a structure might look.

Q But those are both actually the same chemical?

A Yeah. I've just drawn a circle to indicate the electrons are free to move here as a more classical, older method of sharing the aromatic content or structure.

Q Could I get you to use the red pen and mark where the carbon molecules are in those benzene molecules?

A [Marking]

Q Now, let me ask you, if I am going to try to make diphenyl, do I start with benzene and turn it into diphenyl?

A That's one way.

Q And what I need to do to accomplish that is to get two of the hydrogen molecules that are attached to two adjoining benzene rings to go away and join the two rings together at that point. Is that correct?

A Two of the hydrogen atoms.

Q Two hydrogen atoms go away?

A Right.

Q And instead of those two carbons being bonded to hydrogen, they're bonded to each other?

A Right.

Q And once I've done that I have a diphenyl or

biphenyl molecule?

A Correct.

Q In essence, if I can take benzene and replace two hydrogens with a carbon bond where they were, I have diphenyl. Correct?

A That's one way of making it.

Q Okay.

Now let's talk about a chlorinated diphenyl. What makes a diphenyl a chlorinated diphenyl?

A Add chlorine to the aromatic structure.

Q And when you talk about an aromatic structure, what do you mean?

A I mean you replace the hydrogen with chlorine without adding any more chlorines to that particular bond or leaving the hydrogen out.

Q Let me ask this. When you say an aromatic structure, what's an aromatic structure?

A Indicated -- that's an aromatic structure with the number of hydrogens and the structure with either the electrons shown here as the three double bonds or this as spread the three double bonds out in that circle.

Q So benzene is an aromatic structure?

A Benzene is considered an aromatic.

Q And diphenyl is also an aromatic structure?

A Right.

Q And so to make -- Let me ask you to draw, if you could, just below the diphenyl that you have drawn, a monochlorodiphenyl. And I think that there are different types, in terms of molecular number or in terms of number, but just draw any one of them for us so we can see what it looks like.

A [Marking] I have to take one hydrogen off here, but the chlorine could be anywhere on one of those rings.

Q Let me ask you to just draw one by picking a particular spot for the chlorine, wherever you might choose to put it, so we can see how it would be drawn.

A All right. Let's put it here. [Marking]

Q Okay.

And let me ask you to take the red pen and show where the carbon atoms show up in that molecule that you've drawn.

A [Marking]

Q And let me hand you a blue pen and ask you to mark where the chlorine atom is in that molecule that you've drawn.

A In the numbered position?

Q Wherever you choose to put it, yes, numbered position.

A All right. Chlorine here?

Q If that's where you've put it, that's fine.

A I've put it in the pair position.

Q Okay. Now, let me just get you to label above what you've drawn there that that's a -- if I'm correct -- a monochlorodiphenyl.

A [Marking] This is out of there.

Q Do you need to mark that out or something to make it clear?

A Uh-huh. [Marking]

Q Now, would it be possible for that particular chlorine atom to be replaced in lieu of any one of the hydrogen atoms that had been attached to the diphenyl that was not chlorinated?

A Now, would you repeat that, please, Mr. Lacey?

Q Yes. Would it be possible, in making a monochlorodiphenyl, to have the single chlorine molecule that replaces a hydrogen atom in any one of the positions that a hydrogen atom was attached to the diphenyl?

A It's possible. But you would have to work hard at it. It would go preferentially in probably the 2-4 position.

Q Can you explain for us how scientists number

these different positions? And maybe --

A You're beginning to stretch my organic chemistry.

Q Well, I certainly don't want to do that, but --

A Okay. [Marking]

Q Is that last one No. 12?

A 12. I guess it would be 12.

Q And so the --

A These are blocked out, essentially.

Q Right. The chlorine -- I'm sorry. The carbon atoms then are numbered by way of their location. And when you start -- when you talk about a particular position, the chlorine atom is likely to go to, you use that number to identify it?

A That's one way, sure. Right.

Q And that's what you've drawn for us here?

A Yes, in the simple biphenyl case.

Q And what number position is that that is a likely position for a monochlorodiphenyl?

A I've drawn it in the 4 position. The 2 position is also possible.

Q And in the 2 position it would be in the upper left-hand spot on the right-hand section of the molecule. Is that correct?

A Well, it depends on how you number it, but here -- by our numbering here. But it could also be in either one.

Q I see. So there would be one, two, three -- six likely places for it to be?

A Most likely. But you're gonna get a whole -- you're gonna get not a hundred percent.

Q Fine.

A You'll even get some in a 3 position.

Q Okay. In an odd position, so to speak?

A Yeah, yeah. You have a preference, but you don't have an absolute guiding factor.

Q Okay. And if I understand correctly, there would actually be ten different possible monochlorodiphenyl molecules.

A No.

Q Why is that not true?

A Well, you have symmetry.

Q In other words, if I flipped it over there are really only --

A Yeah. I don't know whether you've got three or whatever it is, but --

Q Okay. I've noticed occasionally some people number these things with 1 through 6 and 1 through 6 prime.

A That's possible.

Q If one has a nomenclature like that, would you then have six possible spots where you don't flip it over in terms of looking at its location?

A You still, I think, only have a limited number of isomers.

Q Okay.

A They're all -- they're all symmetry, not really different, even though they look like it on the page.

Q Okay.

Now, in order to make our monochlorodiphenyl into a polychlorinated diphenyl, what we would need to do is remove one or more of the remaining hydrogen atoms and replace it with a chlorine atom. Is that correct?

A That's correct.

Q And can you make a polychlorinated diphenyl that replaces every one of the hydrogen atoms with a chlorine atom?

A It's a very difficult job. I wouldn't say it's impossible, but it's very difficult.

Q Just like some of the locations for the monochloro with the location of the chlorine atom is not a likely thing to do. Is that correct?

A Yeah. And you would get what chemists would

normally call steric hindrance. You would get so many chlorines on there another one can't get in.

Q Okay.

Now, in terms of the theoretical range of possible numbers of chlorine atoms that could be attached to a diphenyl, and their varying locations, how many different theoretical possibilities are there?

A I don't remember. But there are a number.

Q Okay. And I take it that if one is actually in production chlorinating a diphenyl what you'll actually produce will not be all of the theoretical possibilities in any substantial amounts. Is that correct?

A I'd have to remember the number of isomers and so forth, which I don't remember. But it would be a percentage of that, which might be something like maybe 50 percent.

Q I've seen a number in excess of 200 for the potential different isomers and congeners of chlorinated biphenyl. Does that sound familiar to you?

A I don't really remember the exact number.

Q Okay.

Can you tell us what an isomer is when a chemist uses that term?

A It would be the same empirical structure,

carbon hydrogen chlorine in this case, but the position of the chlorine and of the hydrogens would be different, would be distinguishable.

Q Let me see if I understand what you mean. I want to look at the monochlorodiphenyl molecule that you have drawn for us. On the monochlorodiphenyl molecule that you have drawn for us, you've shown the chlorine atom in the No. 4 position. Correct?

A Right.

Q If that chlorine atom had instead been in the No. 2 position, would that be an isomer of what you have drawn?

A Yes, I would call it an isomer of monochlorobiphenyl.

Q How does a scientist give a shorthand rendition of the chemical content of that monochlorodiphenyl molecule you have?

A They would probably put 4 chlorobiphenyl.

Q And that would indicate the specific location of the chlorine atom on the biphenyl?

A Right.

Q And if we had moved the chlorine atom to the No. 2 position, would it then be called 2 chlorobiphenyl?

A Yes.

Q And that would be an isomer of 4 chlorobiphenyl?

A Right.

Q What is a congener when a chemist uses that term?

A I'm not familiar with that term.

Q I see.

When I have two chlorine atoms attached to my diphenyl, is that a polychlorinated diphenyl?

A By our definition, yes.

Q When you say "our definition," is that a Monsanto definition?

A You and I have agreed this morning that we would call two poly. Some people might go to three and agree on that, but --

Q Well, is there any general agreement within the chemical industry about what constitutes a polychlorinated biphenyl?

A I think the general agreement would be more than one.

Q Okay. So if we have as many as two chlorines, up to ten, all of those would be polychlorinated biphenyls?

A Right.

Q Now, let me ask about additional changes that

may occur in structures that have some similarity. Are you familiar with dibenzofuran?

A Just slightly.

Q Could you draw us the structure for a dibenzofuran? In the same structure you've drawn us the structure, for example, for a diphenyl.

A [Marking]

Q And can I get you to take the red marker and show where the carbon atoms are in that?

A [Marking]

Q I see there two lines, one coming from each side of the diphenyl going down to a zero. What does that symbolize?

A The zero is an oxygen atom.

Q Let me get you to use this green marker to color in the oxygen atom for us.

A [Marking]

Q Now, is it possible with a furan, or actually I guess the term -- what is the term that chemists use dibenzofuran or furan?

A This molecule would be dibenzofuran. Furan is another -- another kind of molecule. Another molecule.

Q Let me get you to label that dibenzofuran so we'll know what that is.

A [Marking]

Q The di in that name stands for two?

A Yes.

Q The benzo, does that stand for the benzene -- the two benzene rings?

A Yes.

Q And what makes it a furan?

A Well, furan is a five-ring with an oxygen. So this is the furan part of the molecule here.

Q I see.

A Furan itself is just that separate without all the other parts.

Q In order to make a diphenyl into a dibenzofuran, two of the hydrogen molecules are replaced by a single oxygen. Is that correct?

A If you're talking about just the replacement structure, that's possibly correct. If you're talking about the actual mechanism, it may or may not be correct.

Q Okay. But in terms of what physically happens looking at the structure --

A Looking at the structure, I agree.

Q Okay.

There are also dibenzodioxins, are there not?

A Yes.

Q Can you draw us a dibenzodioxin?

A [Marking]

Q Can I get you to go ahead and use the red marker to mark in the carbon atoms and then the green marker to mark in the oxygen atoms?

A [Marking]

Q It appears from what you've drawn in order to -- and let me get you to label that, too, while you're up, so we'll know that is a dibenzodioxin that you have drawn there.

A [Marking] I'm not sure of the spelling. What is it? i-n?

Q I'm not sure I know.

A I never dealt with these compounds.

Q i-n, I think, but I'm not sure.

A i-n? Or a-n?

Q If we use i-n, we'll all play like that's the correct spelling.

A Okay.

VIDEO OPERATOR: Give me a few seconds.

[Recess]

VIDEO OPERATOR: We're now back on the record.

MR. LACEY:

Q Looking at the diagram you've drawn of the

dibenzodioxin, it differs from the dibenzofuran by having replaced the hydrogen atoms on both sides of the bond between the two benzene rings with oxygen atoms. Is that correct?

A By our diagram, yes.

Q Okay. And the diagram you've drawn is the diagram that chemists usually draw to demonstrate that molecule, is it not?

A Yes. Within my knowledge.

Q Now, is it possible to replace the remaining hydrogen atoms on the dibenzofuran molecule with chlorine molecules?

A I have no direct experience with this. But from a standpoint of if you want to talk about paper chemistry, it should replace.

Q Okay. Have you ever heard of chlorinated dibenzofurans?

A I've heard of chlorinated dibenzofurans.

Q And have you heard of polychlorinated dibenzofurans?

A I have heard of polychlorinated dibenzofurans.

Q And you've heard of them as existing in the world of chemicals that are created. Is that correct?

A In rare instances.

Q I see.

Is it possible to -- Well, even before I ask that, in understanding the nomenclature for the dibenzodioxin, the di stands for the two benzene rings. Is that correct?

A Yes. You're getting a little bit out of my field, though, because we never did any real work with -- at least in a synthesis area -- with the dibenzofuran or dibenzodioxin.

Q I'm just trying to understand the nomenclature right now.

A Well, okay. I'm not familiar with all the nomenclature with regard to that.

Q I see. So you don't know whether the dibenzo portion of the name refers to the two benzene rings?

A Well, I'm sure it does. When you start to number that ring, I'm not sure how that numbering goes.

Q I don't intend to start asking you how to number the ring. I was just going to try to establish, if we can, that the dibenzodioxin -- the dibenzo refers to the two benzene rings. Correct?

A Yes, that seems correct.

Q And the dioxin portion refers to the fact that on either side an oxygen atom has replaced two hydrogens. Is that correct?

A That's right.

Q And the reason the oxygen can replace two hydrogens is because it has the ability to bond to two different atoms at the same time. Is that correct?

A Right.

Q The reason hydrogen only bonds in one place is because it can only bond to one other atom at a time?

A Correct.

Q And the reason chlorine only exists in one place is because it can only bond to one other atom at a time. Is that correct?

A Would you repeat that statement? Because it might not be quite clear.

Q Yes. Can chlorine bond to more than one other atom at the same time?

A Normally not.

Q Okay.

Now, do you know whether or not the hydrogen -- well, in fact, strike that.

There are attached to the dibenzodioxin, in the places that it's not bonded together, hydrogen atoms, are there not?

A Yes.

Q Would you draw those up there for us, please?

A I'm not certain why you're --

Q You need to draw them, I think, in black is what we've been using.

A In black? All right.

Q I have another black marker if that one is giving up the ghost.

A [Marking] I assume it would be that way. I'm not familiar with dibenzodioxin chemistry.

Q Okay.

A That would appear to be correct.

Q All right.

Do you keep up with the literature in the chemical field?

A Since my retirement, only in I'd say a partial way.

Q Do you receive any of the monthly publications that are put out in the scientific area?

A I read Chemical Engineering News, I read more general stuff, Scientific American, Discovery, magazines such as this.

Q In all the reading -- you've done that for several years?

A Well, since my retirement.

Q You didn't read those before you retired?

A Yes, I read them before.

Q Did you have your own personal subscription

to those?

A Yes.

Q With all the interest that has come about in recent years about dioxins, do you recall seeing any articles on dioxins in those publications?

A I've seen articles on dioxins, mainly analytical. Or photochemistry.

Q And you read those?

A I let's say maybe read the abstracts.

Q Okay.

Are you aware of whether or not chlorine atoms can replace any or all of the hydrogen atoms in dibenzodioxin?

A The answer is yes. Papers have been out on this subject.

Q All right.

Now let me shift gears just a little bit and ask about your familiarity with the actual manufacturing processes used by Monsanto to make chlorinated, be it mono or polychlorinated diphenyl. Are you familiar with those processes?

A Yes.

Q Okay. Was it a responsibility of your group, the functional fluids group, at any time from 1963 through 1974 to assist the actual manufacturing

operations in their work of producing chlorinated diphenyl?

A We did not do any synthetic work on the process. The technical service staffs at both Anniston and at Krummrich were involved. But the research department did not do any synthesis work on chlorinated biphenyl as such. Or if we did, it was very limited.

Q What do you mean by synthesis work?

A Well, where we would be involved in direct chlorination or isomer preparations.

Q What sort of assistance did you give to the manufacturing operations?

A We would monitor, read the TSD reports, read the manufacturing reports and make sure that we thought the safety rules and the manufacturing operations were sound. But we did not do, you know, hands-on chemical research during that period, or very little.

Q What is a TSD report?

A Technical service department in the manufacturing. They would be engineers assigned to the plant to improve the process.

Q And those people were actually located at the manufacturing plants?

A That's normally correct, yes.

Q And did they report to the managers of the

plant or did they report to the research group in St. Louis or to whom did they report?

A In general, in the early days that we're talking about, earlier days, they reported to manufacturing. After that period, later in that period, they did report for a short time to the research department. But in the Eighties.

Q But not to your group?

A For a short period I had the clean TSD group that was reorganized and put back into manufacturing.

Q Let's talk --

A I had a small chemical group as part of the manufacturing operation at Krummrich, but it was not called TSD at that time. It was a TSD group. We had a small, chemical-oriented group at Krummrich.

Q Let's talk about the plants that produced chlorinated diphenyl or chlorinated biphenyl, whichever name we use. In fact, maybe the easiest thing now is to talk about PCBs and just use that term. Is that agreeable with you?

A It's agreeable with me.

Q Okay. What plants produced PCBs for Monsanto?

A The plant at Anniston, Alabama, and the plant at Sauget, Krummrich, are the two U. S. plants, United

States plants.

Q I have seen references to a plant in St. Louis and maybe the Queeny plant indicating that at some point in time they had something to do with PCBs.

A They ran a blending operation. A blending operation.

Q They didn't actually produce the PCBs, they just mixed them together?

A They blended them into hydraulic fluids or sometimes we would blend stabilizers into the aroclors.

COURT REPORTER: Into the --

THE WITNESS: Aroclors. Or we've agreed PCBs.

MR. LACEY:

Q Well, let me get that cleared up. A word that Monsanto used to describe PCBs as a trade name was Aroclor, was it not?

A Yes.

Q In fact, could I get you just up there to write the word "Aroclor" on our tablet so we'll know what we're talking about?

A [Marking]

Q That's A r o c l o r?

A Right.

Q And that's the same thing as a PCB. Correct?

A Yeah, by our definition.

Q Okay. Well, is that how Monsanto would use it, too? I mean I don't want --

A Well, during all this time I think that Monsanto would use the terms "chlorinated biphenyl" or Aroclor or Pyranol or Inerteen. These were trade names by Westinghouse and GE. PCBs were -- came in much later.

Q Okay. Well, maybe I should just get you to write up there for us -- you've already written Aroclor. Write all the other names that Monsanto used to designate products containing PCBs.

A Okay. Monsanto used Aroclor, chlorinated biphenyl. [Marking] Now, when we were making other products, these are other people's trade names. I'm not sure I've got the spelling right on that one. Interteen, Pyranol. I think this is a Westinghouse, GE. But there were many others around the world that had different trade names associated with that.

Q Okay. So one product --

A There were many other manufacturers and trade names around the world that were associated with chlorinated biphenyl. Bayer in Germany, Kanakafuchee (phonetically) in Japan, Italy had manufacture, France had manufacture.

Q Am I correct in understanding that the same chemical that Monsanto would call Aroclor you are saying Westinghouse would call Inerteen?

A That was their name for it, yes.

Q And so if we had a jar of it sitting on my coffee table here today in front of you, it would be called by you as Monsanto Aroclor, and if we had someone from Westinghouse they would call that same thing Inerteen, and someone from GE would call it Pyranol?

A They might do that, right.

Q Okay.

Now, you mentioned that there were other people around the world who manufactured PCBs. Is that correct?

A That's right.

Q Who else manufactured PCBs in the United States?

A Monsanto was the sole manufacturer of polychlorinated biphenyl during the time we're talking about.

Q Was there any period of time in the United States when anybody other than Monsanto manufactured PCBs?

A I don't know. On a limited basis there might have been others.

Q Are you aware of anyone?

A I think standard chlorine might have at one time. I'm not sure about that. I think Dow probably made some inadvertently possibly.

Q But not to sell?

A I can't -- I can't operate that -- I can't tell you that operation. But not to sell very much of it, anyway.

Q Okay.

Why, to the extent you know, did nobody else besides Monsanto make any appreciable quantities of PCBs in the United States?

A I think the investment was considerable in terms of when you look at the biphenyl, the quality of the biphenyl that was required, capital investment that went into making biphenyl, and the purity and price of the final product. In other words, it was not profitable for somebody else to go in.

Q You mentioned to me earlier that sometimes chemicals are patented. Do you know whether or not Aroclor or PCBs were a patented chemical?

A Monsanto had not a patent. I think the patents -- application patents were issued to -- to General Electric. And, of course, then other electrical manufacturers had various combinations of

polychlorinated biphenyl and various stabilizers and various end-use patents.

Q So if I'm understanding what you are telling me correctly, there was no patent restriction that would keep any other manufacturers from making PCBs?

A That's largely correct, yes.

Q And nobody else chose to enter the field significantly for whatever reason?

A Well, for the reasons I think I've enumerated. The capital cost and the profitability were not -- not there.

Q Are you telling me that PCBs were a relatively unprofitable chemical for Monsanto?

A Well, profitability is relative. But in order to enter the manufacture, you had to invest capital in biphenyl or get biphenyl of a high purity. And that was difficult to do. You could always make that investment if you wanted to. I think people chose not to.

Q Well, I guess my question was whether you're telling me that the profit margin on the manufacture of biphenyl was such that it would not be attractive to anyone else to enter the market.

A It's not the profit margin. It would be the profit margin and the volume and what they could sell it

for that would be important. They would have to calculate that. And I'm sure they did.

Q Do chemical companies, in making decisions about what products to manufacture and how many places to manufacture them and by what process, take into account all those factors to arrive at a decision?

A If they are astute in the economic area, they -- they will do so.

Q And whether or not a particular chemical company chooses to manufacture a particular chemical will depend upon the economics of that process, if they're astute?

A I confined it to their economic consideration. There may be other considerations. They might want to make it for reasons of protection for another product; they might be asked by a particular customer to make it; there are many other reasons why you would make a chemical.

Q Well, let me ask this. Is it generally true that chemical companies don't make chemicals -- particular chemicals unless they can be sold profitably?

A Well, I've indicated there are some cases where if you want to protect a downstream product or make a downstream product you might well want to make the intermediate for that and you might not make a

profit on that intermediate, or it would be a very low profit.

Q But the overall profitability of the entire process is there. Correct?

A Somewhere along the line you've got to have enough profit to make the chemical and stay in business.

Q Okay. And I suppose Monsanto was a financially-astute chemical company.

A Sometimes.

Q By the way, Monsanto is not an oil company in the sense of producing oil or gas or exploring for it or anything like that. Is that correct?

A Well, I think they've sold their assets now, but they bought Lion Oil. And I don't know the year. So we did have an oil exploratory program, a small one, and we did operate wells. We even operated a refinery for a little bit.

Q Okay. That was something that Monsanto acquired after it started working as a chemical company?

A Yes.

Q And subsequently disposed of?

A Well, the Lion Oil operation was integrated largely into the agricultural company. They made ammonia, made ammonium nitrate, and they did -- I think they disposed of the refinery early. But we did operate

oil wells and explored for a number of years after that.

Q But Monsanto is no longer doing that. Correct?

A I think they sold -- it was up for sale. I'm not sure whether they sold it or not.

Q As a chemical company, Monsanto does use oil as a feedstock for some of its processes, does it not?

A It did at that time. They're less dependent. They sold, as you said, Texas City; they sold part of Alvin. So they're a lot less in that business than they were.

Q Okay.

What other feedstocks, general sources of chemicals, does Monsanto use besides oil?

A Salt, sulfur, phosphate rock. Gosh, I don't know. A host of small things. But those are the principal elements on which it's built.

[Recess]

VIDEO OPERATOR: We're now back on the record.

MR. LACEY:

Q Dr. Richard, does Monsanto take these very basic chemicals and from that manufacture most of the feedstock products for its more complex chemicals?

A They do this in certain areas, yes, certain

lines of products.

Q Well, let me go --

A Like styrene and acetic acid and methanol. Natural gas is another product, I guess it's oil-related. Benzene we use. Benzene we use.

Q Where do you get benzene?

A We usually buy it, although we've also got it from Alvin, from our own operations there.

Q Was the Alvin plant the one known as the Chocolate Bayou plant?

A Chocolate Bayou.

Q Let me ask specifically now about the manufacture of PCBs. What chemical or chemicals did Monsanto start with in its process of manufacturing PCBs?

A We started with benzene.

Q And from whom would you get benzene?

A I don't know specifically. But Exxon and our own operations. But I don't know whether it was exclusively from one or the other. We also probably bought on occasion from other sources. But you would have to go to purchasing for that.

Q When you get benzene, is that a liquid?

A Normally, yes.

Q Okay. And is the first step in manufacturing

a PCB from benzene to create diphenyl?

A Correct.

Q Let me get you to use the blue marker up there to just draw an arrow showing that the first step is to go from benzene to diphenyl in the process of manufacturing PCBs. At least as far as Monsanto's steps of manufacture are concerned. You might use the blue one. I hope it's got more ink than that black one seems to.

A The black one? Okay. [Marking] Sorry about that. I think the problem is --

Q We've left them uncapped?

A I think so. [Marking]

Q Okay. So you've now drawn the first step that is taken by Monsanto.

A Was taken by Monsanto.

Q Was taken.

A Was taken.

Q I'm sorry. Okay. Monsanto is no longer manufacturing PCBs. Is that correct?

A Right.

Q When did they stop?

A I'm not sure about that. '77, I think.

Q And what was the reason that Monsanto stopped manufacturing PCBs?

A I think the electrical industry found replacements for the products.

Q Was there anything that moved them toward that step in the 1970s?

A Sure. I'm sure there was.

Q Do you know what it was?

A It would be environmental concerns.

Q Anything else?

A Government potential action. But Monsanto moved earlier than that. Earlier than regulations.

Q What regulations are you talking about?

A I think that polychlorinated biphenyls were considered an environmental industrial compound that did not belong in the environment; therefore, it was used as an example in TSCA legislation or pending legislation.

Q What is TSCA legislation?

A It was the foundation for the EPA agency.

Q Is TSCA an acronym that stands for something?

A I'm not sure what that stands for.

Q Okay.

Now, so Monsanto has ceased manufacture. But when it was manufactured, the first step would be to take some of the benzene that we've shown on our piece of paper here and convert it to diphenyl and simple hydrogen gas. Correct?

A That's the simplest part of the operation, yes.

Q Okay.

Now, what was the second step taken by Monsanto to convert benzene into PCBs?

A Distillation of biphenyl.

Q And what was involved in the distillation of the biphenyl?

A Separation from terphenyl.

Q What is terphenyl?

A Three phenyl groups put together.

Q So that would be three benzene rings connected together?

A Yeah. Right.

Q And where did that come from?

A It came from the pyrolysis of benzene to biphenyl.

Q What is pyrolysis?

A Heating in the absence of oxygen or air or anything else. You pass benzene through a hot tube.

Q And in the process you make diphenyl, which is what you're trying to make?

A We also tried to make terphenyl, too.

Q I see.

Now, are there any things beyond terphenyls?

A Yes; quadriphenyls.

Q Quadriphenyls? Those are four benzene rings together?

A Yes.

Q Anything beyond that?

A Yes. Some small amounts. Tar.

Q Tar?

A We called it montar.

Q What was montar?

A Mixture of quadriphenyls probably higher -- and higher aromatics.

Q Was that something that you were trying to make in this process of converting benzene into diphenyl?

A No. They came along with the process.

Q That's pretty common, isn't it, for chemical processes to generate some waste materials that you're not really trying to create but they just are part of the process?

A True.

Q Now, you would then try to get rid of everything but the diphenyl after you had made benzene into diphenyl by purification. Is that correct?

A Well, no, we saved the other products as well.

Q Okay. Well, you were separating --
A Separated them.
Q Separating them, then?
A Right.
Q And when you got the terphenyls and the montars separated from the diphenyl, what you had left was pure diphenyl?
A Almost pure, yes.
Q Would there be any benzene left in that diphenyl?
A If there were, there would be very, very small amounts parts per million.
Q Would there also be some terphenyls and even quadriphenyls left in that diphenyl after purification?
A Yeah, very small amounts possibly.
Q It's almost impossible in a large-scale chemical process to entirely eliminate impurities, isn't it?
A Yes, true.
Q So, after you had gotten the diphenyl as pure as you practically could, what was the next step in the production of PCBs?
A Chlorination.
Q And that would mean adding what, chlorine gas to the diphenyl?

A To the diphenyl, yeah, diphenyl.
Q And how was that process done?
A In continuous chlorination vessels series.
Q Gas was just injected into the material?
A Right. With stirring cooling.
Q With what?
A Stirring and cooling. Cooling.
Q And would you have one batch that made a specific monochlorodiphenyl and another batch that made a specific bichlorodiphenyl and another one that made a specific trichlorobiphenyl?
A No. You come out with a mixture.
Q You can't make just monochlor --
A Well, mono you can -- you have a better chance of making mono than any other one. But you go to di and poly and you get mixtures of isomers and you get mixtures of various chlorination products. Various degrees of chlorination.
Q Why is it that you have that problem of getting different mixtures?
A Well, it's a statistical operation. And you make one and you can get two and three and up to four and five.
Q When you have gone through that continuous chlorination process, you then come out, as I understand

it, with a mixture of PCBs. Is that correct?

A That's correct.

Q Are there any impurities that are generated in that process?

A There's HCL.

Q That's hydrogen chloride gas?

A Hydrogen chloride gas.

Q Anything else?

A Those are the principal -- that's the principal impurity.

Q Any other impurities that are generated?

A We looked. I think that we're talking about impurities that contain oxygen. If we're looking for that, we did not find any dioxins in our product analytically. And these methods were developed late. We looked for any dibenzofurans and found parts per million late in 'Seventy -- late in the Seventies -- I shouldn't say late in the Seventies, but late in the Sixties, early in the Seventies.

Q So you did have some dibenzofurans as impurities in the manufacture of PCBs?

A Parts per million possibly.

Q Well, when you measured it, you found it. Not possibly. You actually found it, didn't you?

A I think we did. It was not -- you would have

to ask the analytical people what the exact parts per million were, but very low.

Q Which analytical people did that work?

A Applied sciences -- in general, applied sciences were working under Dr. Keller.

Q Dr. Keller?

A Dr. Keller.

Q And what group was he with?

A He was with the -- either the organic division early or the industrial company as it got reorganized. He also was in the research department, had a separate organization.

Q After PCBs were produced with this measurable dibenzofuran contamination, was it possible to purify the PCBs in order to remove all the dibenzofurans?

A All -- it was not impossible -- it was not possible to remove all the products in a practical manner when you're down to parts per million in the first place.

Q When the analytical tests that you referred to were conducted, were they conducted on current production of PCBs or on PCBs that had been produced many years earlier?

A You would have to ask Keller about what samples were actually produced -- were actually

analyzed.

Q I see.

Do you know whether or not the analytical method used made it possible to positively confirm the absence of any dioxin in the PCBs?

A Within the detection limits available at that time, I think he could -- he could document what the level of detection was.

Q Explain what you mean by level of detection.

A Well, what's the sensitivity of the analytical method in terms of reaching the level that you're talking about in terms of accuracy.

Q Can you explain that in laymen's terms, so to speak?

A Well, the separation and detection depend on isolation techniques, first. And isolation techniques are -- are imprecise. You do the best you can by things like absorption and extraction and manipulation. And then you have instrumentation that is hopefully specific to the compound you're talking about, but often is not. So you're depending upon the isolation techniques first, and then the sensitivity of the next analytical method, and maybe you combine a third analytical method to try to identify the particular compound you've got. So it's a pretty complicated procedure to get a part per million

or a part per billion kind of analytical method. It takes a lot of instrumentation, takes a lot of technique.

Q What you are saying is, there is some margin for error in all of that. Is that correct?

A That's the sense -- that margin of error is included in the term "sensitivity." So that what the analytical people try to do is say what is their margin of error by stating it.

Q And what that means is that if they have a margin of error at all there is some room for that chemical to have been there and not been detected. Correct?

A Well, if they don't detect it, they don't detect it, that's -- you have to stop there.

Q But that does not rule out the possibility that the chemical is there but below the margin of error. Is that correct?

A In terms of sensitivity, yes. When you get down to it, you could talk about levels of detection times 10 to the minus 20th or something like that, and we're not able to reach those levels at the present time. So it's impossible to answer your question other than in a theoretical way.

Q Well, my -- my real question is that it is

possible, if you have any given level of detection, whether it's parts per 10,000 or parts per 100,000 or parts per million or parts per ten million or hundred million or billion, whatever it may be, to say that "We didn't find that and here's our level of detection" simply says that: It's not there, as best we can tell, at that level. It does not mean it's not there at a lower level. Isn't that correct?

A It says only that it's not there within the limit of our detectability.

Q That's right.

A You don't know whether it's there or not.

Q Exactly. And so the measurements that were made by Dr. Keller and his group do not rule out the possibility of dibenzodioxin as a contaminant in PCBs manufactured by Monsanto, do they?

A They don't rule it in, either.

Q That's right. We just don't know. Isn't that correct?

MR. SHOEBOTHAM: I have to object to that question. That's not what Dr. Richard has testified to. Dr. Richard has clearly told you about the use of these scientific methods to detectable levels, and you are twisting around what he is saying and asking a misleading question. And I object to it on that basis.

MR. LACEY:

Q What I want is a simple layman's answer to the question. When you say you can't rule it in or you can't rule it out, what that means is you don't know. Isn't that right?

A I repeat that we ran the tests, we repeated the tests, determined a level of sensitivity, and that's what will be reported.

Q When you say you can't rule it in and you can't rule it out, don't you mean you don't know?

MR. SHOEBOTHAM: Objection.

A That's not true.

MR. LACEY:

Q What do you mean, then, when you say you can't rule out the presence of dioxin as a contaminant in PCBs produced by Monsanto?

A I repeat that we analyzed for dioxin. And when the sensitivity of the test and the level of the test is reported, dioxin is not present.

Q Okay. And why, then, does that not rule out the presence of dioxin as a contaminant in the PCBs?

A Because it was not detected.

Q Okay.

Now, why is it that dibenzofurans are created when one is attempting to convert diphenyl into PCBs?

A Why is it that they're created?

Q Yes.

A Some traces of oxygen might be present in the dehydration, dehydrogenation of the benzene.

Q And what that says is when I take hydrogen -- dehydrogenation of the benzene simply says I'm going to strip the hydrogen atoms away. Correct?

A Right.

Q And the reason I'm stripping it away is so hopefully chlorine atoms will bond back where those hydrogen atoms were. Correct?

A No.

Q Why am I stripping the hydrogen away?

A So that carbon can bond.

Q Oh, I see. This is in the process of making benzene into diphenyl?

A Right.

Q So you think that the oxygen and the creation of the dibenzofuran may be created in the step of converting of benzene to diphenyl rather than the step of converting diphenyl into PCBs?

A It might and it might not. I don't know the answer. But it's possible.

Q Okay. Is it also possible it may be created in the step of converting diphenyl into PCBs?

A That's also possible.

Q And that would also be because as we replace hydrogens -- atoms with chlorine atoms, if there's oxygen present, they may step in and be bonded instead?

A Right.

Q Now, the process by which -- strike that.

Dibenzofuran is a biphenyl in which two hydrogen atoms have been replaced with a single oxygen. Is that correct?

A In the biphenyl molecule.

Q Yes.

A Right.

Q And dibenzodioxin is a diphenyl molecule in which four hydrogen atoms have been replaced with two oxygens. Isn't that correct?

A It's really not a biphenyl molecule. I've made a mistake in the structure here. But there's no -- there's no bond. When I drew this, there should be no bond here, and this should be a six-member ring.

Q With two oxygens --

A It would be two oxygens on each phenyl ring. So there would be four -- four hydrogens involved.

Q Why don't we get you to draw right below the dibenzodioxin you've previously drawn what you now think is a correct dibenzodioxin.

A Yeah. I said earlier that I was unfamiliar with this chemistry.

Q Why don't we get you to draw it -- let me give you a new black marker so we can kind of keep the consistency of this thing. That one won't work.

A Maybe if we close it up for a bit.

Let's see if I can get it right. You gentlemen can help me a little here. [Marking] I think that's closer.

Q Okay. Let me get you to use the red pen, if you can, to put in the carbons --

A Is that correct in your --

Q You're the -- you're the chemist, Dr. Richard.

A Not on dioxins.

Q Is there enough green left to kind of take those oxygens and make them green so we can see them a little bit better?

A [Marking]

Q Maybe we can close all those things up here and tried to keep them -- preserve them there for the rest of the day.

Now, how did you determine that you had made a mistake in drawing the --

A I started thinking that this structure was

crazy, and I talked to Jon, and we decided we should correct it.

Q By "Jon," you are talking about Mr. Shoebotham?

A Yes.

Q Monsanto's lawyer?

A Monsanto's lawyer.

Q He helped you figure out that you had drawn the dioxin wrong?

A No. I -- I was thinking about it, and it just looked cockeyed up here to me.

Q Okay.

A Too many bonds, two big rings, impossible situation.

Q Well, let me ask you, now that you have redrawn the dioxin and we've got the one there on the bottom that's drawn with Mr. Shoebotham's assistance -- would that be a fair statement?

A I think it was my correction.

Q After talking with Mr. Shoebotham?

A Well, after thinking about it and saying the structure looks crazy.

Q Who said, "The structure looks crazy"?

A I did. I was drawing dibenzofurans and thought I could just extrapolate from this to this, and

you really can't.

Q Well, let's -- let's go back and look at the difference between dibenzofuran and dibenzodioxin. What you have when you have the dibenzofuran, which has been created with two hydrogens replaced with a single oxygen -- is that correct? -- plus the remaining phenyl bond. Correct?

A Yes, you have to split it or do something, yeah.

Q And when you get to dibenzodioxin, an oxygen atom steps in place of the straight carbon-to-carbon bond and you then have the two rings -- the two benzene rings bonded together through two oxygen atoms. Correct?

A Yes.

Q Now, under what circumstances or what physical conditions do you create dibenzofurans from benzene?

A I don't know that this has been done.

Q Well, I thought you --

A I'm not an expert on dioxin. But as far as I know, it is not done this way.

Q I thought you just previously told me --

MR. SHOEBOTHAM: I think there was a miscommunication. The question went to dibenzofurans,

not to dibenzodioxins.

THE WITNESS: Oh, excuse me. I thought you were talking about dibenzodioxins.

MR. SHOEBOTHAM: Why don't you repeat the question.

MR. LACEY: Let me ask again.

Q Under what conditions do you create dibenzofuran from benzene?

A I don't know that you do create dibenzofuran from benzene. It may be possible to do so in small amounts.

Q Well, I thought you told me that part of the contamination of dibenzofuran that is found in Monsanto's PCBs arose from the creation of dibenzofurans while you were making diphenyl from benzene.

A I said that was possible.

Q I see.

A I said it was possible.

Q I see. Well, is it fair to say --

A I don't know -- I don't know that for a fact.

Q Is it fair to say that the creation of dibenzofuran that was a contaminant in Monsanto's PCBs must come either during the stage of converting benzene into diphenyl or the stage of chlorinating the diphenyl?

A Right.

Q Okay. And is it also fair to say that in each of those stages there must be some oxygen present in order to create a dibenzofuran?

A Oxygen, yes; some form.

Q By definition?

A By definition.

Q And also is it fair to say that in each of those stages there is some heating present?

A Some heating present? It wouldn't react at room temperature?

Q Yes.

A Possible.

Q Well --

A More than likely, I guess.

Q I'm sorry. Isn't there heating present in converting benzene into diphenyl in the way Monsanto did it?

A Yes. We said we did a pyrolysis reaction.

Q Right. That involves heating, does it not?

A Yes.

Q Okay. Isn't there also heating involved in chlorinating the diphenyl?

A Yes. But at a much lower temperature.

Q But in both of those processes there is the application of heat to either the benzene or to the

diphenyl. Correct?

A Right.

Q And whether the dibenzofuran contamination in Monsanto's PCBs is created in the step of going from benzene to diphenyl or in the step from diphenyl to PCBs, in either one of those steps there must be oxygen and there is heat applied. Correct?

A Yes. In small amounts.

Q In fact, if there were more oxygen contamination, it's likely that there would be a larger amount of dibenzofuran created, isn't there?

A If that's the mechanism for the creation.

Q Well, if either one of those is the mechanism.

A If that's the mechanism, then your conclusion is correct.

Q Well, are you telling me that you think that Monsanto's initial feedstock of benzene contained dibenzofurans in it?

A I don't know the answer to that question.

Q Was there anybody at Monsanto who did check for that to ensure that the feedstock was clean when you got it?

A There may -- well, there are records. I don't -- I'm not familiar with the records on benzene

purity.

Q Would there be records --

A There would be records.

Q On each shipment of benzene that was received?

A On -- well, it would be between the supplier and Monsanto to either furnish specifications or analytical work. And I'm not sure how that was set up. They might have to guarantee specifications.

Q Well, let me -- let me just ask a question hypothetically so I can understand how Monsanto worked. And I guess to do that, from whom -- give me the name of a company that might have been a supplier of benzene to Monsanto.

A Exxon.

Q Okay.

A One supplier.

Q Okay. That's fine. If Monsanto says to Exxon, "I want benzene that's 100 percent pure, you guarantee that to me," and Exxon says, "I'll guarantee you benzene that's 100 percent pure," if nobody ever checks the benzene, nobody is ever going to know whether or not they met the specification. Correct?

A Correct.

Q Okay.

Now, my question is whether or not Monsanto actually checked each quantity of benzene it received from its suppliers to ensure that it in fact met the purity specifications.

A Let's say they would check it. But whether they checked every batch or they sampled the storage tank I can't tell you.

Q Okay. So then you are telling me it is possible that the dibenzofuran contamination could have been present in the benzene as it came in?

A Possibly, but unlikely.

Q Okay. So you think it's more likely that Monsanto created the dibenzofuran contamination itself?

A Yes. When we're talking about -- now, we're talking about one or a few parts per million. So you talk about a contamination. But we're talking at that level.

Q Well, let me ask you a little bit about that for a moment. You mentioned that processes -- for example, this analytical process was developed relatively late and was a very good process. Did the ability of Monsanto to make PCBs get better over time with technological improvements?

A There were not too many changes in that process.

Q I see. So basically the process was the same as it had always been?

A Basically the process was the same.

Q So the technologies initiated in what, the 1930s?

A Well, no. We're talking about the time frame from '63 through '70 when I was concerned with it. That's the only thing I can really speak for.

Q That's what I'm trying to ask about.

A Between that time limit the process was relatively unchanged or little changed. Some minor improvements, but no major changes.

Q Okay.

Now, how many samples -- how many different batches of PCBs were sampled by Dr. Keller and his group to attempt to determine the level of dibenzofuran and possible dibenzodioxin contamination?

A You would have had to ask him. I don't know.

Q Was that a routine sampling that was done on every batch?

A No, it was not a routine sample.

Q Okay. Now, let me then go back and ask my question about that. If, for example, in the process of making benzene diphenyl in a particular batch more oxygen was introduced into that process than in another

batch, there would be a greater likelihood of dibenzofuran contamination of that batch, would there not?

A It's possible.

Q The greater the amount of oxygen, the greater the amount of possible dibenzofuran contamination. Correct?

A Correct.

Q Similarly, if in the process of converting diphenyl into PCBs in one particular batch, for whatever reason, there was more oxygen present than in another batch there would be the greater likelihood of more dibenzofuran contamination. Correct?

A Correct.

Q One, and maybe the only, as far as you know, limiting factor on the amount of dibenzofuran contamination in the manufacture of PCB would be the amount of oxygen present. Correct?

A Yes.

Q And that could vary with the particular operation of the plant, could it not?

A It could within limits. But the chance of contamination with oxygen is very limited. Pains were taken to make sure that oxygen was not a contaminant.

Q And my point is that sometimes chemical

processes at a plant don't run like they're designed to. Isn't that correct?

A Within limits. You would have possibly unstable Aroclor or something like this that would be out of specification. So what you try to do is set your specifications and your detection limits to minimize that. Now, the process -- actually, the electrical properties of Aroclor were required to be extremely good. And in fact what happened was that the process was tested or the product was tested for electrical properties, for dielectric constants and for power factor and so forth, which almost automatically ensure that the level of contaminants, especially oxygen-containing contaminants, is always low. And so, therefore, through the electrical testing, which was done on every batch and every product that was shipped out, I think automatically would minimize the kind of scenario which you expressed earlier. And that was the final testing of the product before it was shipped by Monsanto.

Q What is the maximum concentration of dibenzofuran contamination in PCBs that could exist and still have the Aroclor meet the electrical testing specifications?

A I don't know the precise answer to that. The

detection -- the electrical properties, though, are more sensitive than most chemical methods, at least in this time frame we're talking about. So that the electrical testing is probably a more sensitive method for overall oxygen containing than anything else.

Q Well, my question is slightly different. Certainly there was a difference in electrical properties between various batches of Aroclor, was there not?

A Within limits. But the limits were very tight.

Q Well, what I'm trying to get at is, if you happen to have a batch of Aroclor that had absolutely no contamination of any sort whatsoever, it would be perfect and everybody would be happy with that. Right?

A Well, it wouldn't be perfect. They would be modestly happy with it.

Q Well, no, but I mean I'm just going to hypothesize we have a batch that has no contamination at all. That would be perfect and everybody would be happy with that, wouldn't they?

A No. They -- what they wanted was consistency rather than perfection.

Q I see. Okay. So, actually, there wasn't even a striving to reduce the contamination level to

zero, it was only to have a consistent level of contamination?

A Well, we ran absorption -- we had absorption and the electrical people themselves used absorption to ensure a low level of contamination of oxygen-containing impurities.

Q But my question --

A And this --

Q I'm sorry. Go ahead.

A And this almost ensures that there's a level above which you are not going to operate.

Q That's not my question to you. If I understand your previous answer correctly, it would not be desirable to have PCBs with no contamination; rather, it would be desirable to have a consistent level of contamination.

A A consistent low level of contamination.

Q Okay.

A Consistent low level.

Q So that --

A Extremely low level.

Q So that in electrical testing we can almost be assured that every batch of Aroclor would have had some dibenzofuran contamination in it. Correct?

A Below a certain level.

Q But present in every batch. Correct?

A I can't say whether it was present in every batch or not.

Q Well, if you had a batch that didn't have that level of consistent contamination, would it be tossed out?

MR. SHOEBOTHAM: Objection. The question has been asked and answered. He said you can't tell whether it would be in there or not in a particular batch.

MR. LACEY: That's not my question.

Q My question now is: If we had a batch of Aroclor that was inconsistent and the reason it was inconsistent was because it had no contamination, would it be rejected by your quality control people?

A I don't think we ever saw a batch that didn't have some impurities. But we're talking about ten to the minus six and below. And we're talking about electrical contamination probably that's lower or as low or lower than that.

Q Ten to the minus six is one part per million?

A Yeah.

Q Okay.

Now let me ask you about PCBs. Were all PCBs put to electrical applications?

A Were they all put to electrical -- no. The

answer was, they were used in other areas as well.

Q Did all of the PCBs have to meet the electrical specifications before they left Monsanto's plant?

A They were all produced in the same plant, probably went through all the same quality control tests. We didn't isolate nonelectrical and electrical at the manufacturing -- at the Aroclor plant itself.

Q You mean even Aroclor that didn't need to be refined to the level to meet the standards you've described for electrical purity was nevertheless refined to that level anyway?

A Yes, probably.

Q You say probably. Do you know?

A I don't know it was given special, special treatment in some cases. Whether that was always carried out I don't know. You would have to look at the records. But the main process was always the same.

Q The general process --

A General process was always the same.

Q I see.

Are you familiar with the numbering of the aroclors? I've seen numbers like 1242 and 1254 and 1260.

A Yes, in a general way, sure.

Q What does the numbering indicate?

A The numbering early indicated the level of chlorine. 1242 meant roughly 42 percent chlorine.

Q Okay. And 1254 meant --

A Roughly 54 percent chlorine.

Q And 1260 meant --

A Same thing.

Q Sixty percent chlorine?

A Right.

Q So the last two digits in that number indicated the approximate percent of chlorine?

A Approximate percent by weight of chlorine.

Q And what did the first two digits represent?

A I can't answer that question. 1200 series was just normal practice.

Q Was there an 1100 series?

A We made special batches of 1100, for example, that might be a different process or different -- slightly different step. But I can't remember what the 1100 series was. Very little was sold, if any.

Q What about 1300?

A I'm not familiar with any 1300 numbers except the MCS numbers possibly.

Q What about 10?

A 1016 you are talking about? Aroclor 1016?

Q The first two digits at 10.

A Well, the only -- only 10 number that I know is Aroclor 1016, which was an electrical grade which was taken from an MCS number 1016.

Q Okay. And what is an MCS number again?

A Monsanto chemical sample it stood for.

Q That's a test product?

A It's a test product.

Q And so if we have --

A If it has an MCS number on it, it's a test product.

Q If we have a product with an MCS number, that means it's not in regular production yet for commercial sale?

A That's right.

Q And if it's in production for commercial sale it's going to have Aroclor number?

A That would be normal. There would be a transition from one to other, but that would be the normal practice, right.

MR. LACEY: Let me ask the court reporter to mark the sheet that we've been discussing as an exhibit to your deposition, Dr. Richard.

[Exhibit 1 marked]

[Noon recess]

VIDEO OPERATOR: We're now back on the record.

MR. LACEY: Let's take care of a couple of matters of housekeeping before we get started back on the deposition. I understand that Dr. Richard will review his deposition and sign it. And we have the same agreement we've had before with regard to using a copy in the event we don't have the changes back a week before trial?

MR. SHOEBOTHAM: Correct. That's agreeable.

MR. LACEY: And we've agreed that we'll use the documents produced by Monsanto as exhibits and just refer to them by the last digits other than zero for purposes of identification for the depositions?

MR. SHOEBOTHAM: That will be fine.

MR. LACEY: Without attaching copies of the documents to the deposition transcript?

MR. SHOEBOTHAM: That is agreeable.

MR. LACEY: The next matter of housekeeping is, I want to offer what has been marked as Richard Deposition Exhibit No. 1.

Q I would like you to confirm, Dr. Richard, that what is marked now by the reporter as Richard Deposition Exhibit No. 1 are the drawings that you have previously made with regard to various chemicals that we

discussed, and names for chemical compounds.

A I do.

Q Okay.

Let me ask you, Dr. Richard, if you are aware of the circumstances under which -- I'm not talking about now in the manufacturing process, but following the manufacturing process, the circumstances under which PCBs might be transformed into furans.

A The only thing I've seen is in the literature in terms of photochemistry.

Q And what have you seen?

A Well, people were trying to make dibenzofuran by radiation of samples in the laboratory.

Q Do you mean exposing them to --

A UV light.

Q -- UV light?

A Yeah.

Q Do you know anything other than that?

A That's about it.

Q Do you know anything about the circumstances under which -- again, I'm not talking about the manufacturing process, but when you have PCBs they might be transformed into dibenzodioxins?

A It's very unlikely, I think. I'm not an expert in dioxin chemistry.

Q Okay.

In connection with your work or your section's work from time to time with the various plants that produce PCBs, did you ever have occasion to visit either the Krummrich plant or the plant in Anniston, Alabama?

A I was there on occasion.

Q Did you visit the portions of those plants where PCBs were manufactured?

A Yes.

Q Can you describe those sections of the plants for me?

A Not really. Tanks and vessels and control rooms. That's about it. I mean typical chemical equipment.

Q Okay.

A You would have to have a detailed flow sheet. I don't have that in my head.

Q Okay. Was there anything about the way in which the workers in those sections of those plants where PCBs were produced that were any different than the workers in other sections of those same plants or other Monsanto plants?

A You would have to ask manufacturing a question like that.

Q You didn't observe anything different?

A I'm not -- not that knowledgeable in detail of all the procedures and employment practices in the two plants.

Q What about the -- was it J. F. Quenby plant?

A Queeny?

Q Queeny.

A Queeny plant.

Q Did you ever visit that facility?

A Yes.

Q Did you visit the section where PCBs were blended?

A Yes.

Q Did you notice anything different about the work there versus any other sections of the plant?

A Well, the blending operation is much simpler. There were storage tanks and there were blend tanks and then lines to the various tank cars and so forth; some drumming lines. It was more of a packaging, drumming, mixing thing; no chemical reactions went on.

Q Did that take place at ordinary temperatures?

A Or slightly elevated possibly. But ordinarily you just mix at room temperature.

Q What were --

A They were fluids.

Q Okay. Is there something like a big mixer that whips it up?

A It would be a blend -- blend tank. Blend tanks.

Q Does it have something inside that mechanically aggitates it?

A Normally, right.

Q In doing any research -- and I'm talking about laboratory research now -- did your group actually handle PCBs?

A Yes. We had them in the laboratory.

Q What sort of things would you do with PCBs in the laboratory?

A We would possibly do some special testing, maybe we would build small capacitors, about like so big, impregnate them. We would try to measure the electrical properties on those capacitors, artificially age them. But we did -- this was all small-scale stuff compared to anything that Westinghouse or GE or the electrical people would do. We would make a few, age and measure the electrical properties. We also had apparatus to measure dielectric strength, power factor, dielectric constant. That's about it.

Q Did your -- I'm sorry.

A That's the normal -- would be the normal

thing. Analytical people, of course, would use it to develop the analytical methods.

Q I'm not sure I understand your answer there.

A The analytical people -- I was talking about the electrical laboratory. The analytical people would use Aroclor in terms of, you know, making the separations and proving what the analytical results were, using small quantities.

Q Okay.

A The biodegradation people, which was part of applied science, would be doing biological sludge -- activated sludge experiments. We analyzed tissues from test animals. We also blended on laboratory scale. And this would be as much as four or five gallons of certain hydraulic fluids.

Q Did all of these --

A Well, one other thing, I guess. We would occasionally test the thermal stability and heat transfer systems in the presence of metals for decomposition and degradation.

Q Were all these functions -- and by that I mean the electrical test, the analytical test, the thermal test, the tissue test, the biodegradation test, the blending, were all those things done by people who reported through you or to you?

A The applied science group did not report to me. This would be the analytical and the analytical work on tissues.

Q Okay. So the two things that didn't report to you were what you referred to as analytical and then the analysis --

A Analysis of tissue materials.

Q -- of tissue?

A Yeah.

Q The biodegradation, the blending --

A Okay. Biodegradation was in that analytical section, applied science section, too.

Q Who did that section report to?

A This was Dr. Keller. Then he reported, I think, to the director of research, who was Roos during this time. Bill Roos. Anagnostopolis, I guess, too, at one time.

Q What was Dr. Roos's position?

A He was the research director of MIC, Monsanto Industrial Company, during part of this period.

Q Was he a person who you reported to as well?

A Yes.

Q Was he your immediate superior at that time?

A In terms of the research department, yes.

Q Okay. And then there were other people who

reported to him in a different type of research capacity, which would include --

A Well, there were other groups, yes, that would report to him.

Q Dr. Keller's section was a parallel section to yours?

A It would supply analytical services to the entire MIC division at that time.

Q Okay. So your group, then, was involved in thermal testing, electrical testing and blending?

A And hydraulic testing, right.

Q Okay.

What sort of precautions were taken around your laboratory dealing with laboratory samples of PCBs?

A Depend on the application. In electrical, analytical, I think the main precautions were to make sure that samples were not contaminated. During the entire rest of the operation I think it was just good laboratory practice: Don't spill anything, use hoods if you need to. But I don't think there were any special rules or precautions in the Aroclor handling.

Q Did you have chemicals for which you had special precautions?

A Later there were things that were put under special conditions, like the chloroethers, I think,

something like that. Things that were considered highly toxic. There were special rooms, for example, created.

Q But PCBs were not handled that way?

A No.

Q Did you ever have occasion to give caution to anybody who worked for you about their handling of PCBs?

A Well, the only cautions we developed, I think, were if you wanted to measure electricals, you better keep it in brown bottles, make sure that there was no contamination, storage was special. Wanted to make sure we had clean laboratories. If there was a spill, make sure you clean it up. I think just safe, ordinary good lab practice.

Q What things come under the heading of good lab practice? Would you tell me what good lab practice is?

A Well, I'll try to. If there were vapors, heat tests and so forth, we tried to use hoods.

Q When you say a hood, what do you mean?

A Well, a ventilated hood would be in the laboratory. If we were doing oxidative testing or something like that, those were all done in hoods. Biodegradation I think was in general -- I better be careful. I'm not sure of this. That's about it. Keep engineering tests -- keep things tight.

Q Very general, I take it.

A Yeah. Make sure it's not leaking. We would do that anyway.

Q Let me see if I can get you to give me, as best you can recall, from 1963 until 1970 the other people who were at your level in the organizational chart, and I don't mean necessarily in line with you, but the other people who were in the organization chart that dealt with PCBs.

A The other people in an organization chart about at my level? Is that the question?

Q Yes. Maybe the thing to do, if we could turn-- that page there and find one of these markers that works, if you could just draw me an organizational chart as you recall it from roughly 1963 up to 1970 as it related to PCBs.

A I think I can verbalize what I know. In the '63 period aroclors were the main province and responsibility of the fluids group and of the plasticizer group. That one application. So the organization would be Richard and Martin Farrar was in charge of the plasticizer group, the research department. Early I reported and Martin reported to Anagnostopolis as research director, and I think later than that we both reported to Bill Roos, at least as one

of our -- as the research director. Okay. Now, there would normally be a manufacturing manager during those times.

Q Responsible for more than one plant?

A Responsible to the business group that controlled fluids or plasticizers. I have to be a little careful about timing here. But that was one type of organization.

There would also be a plant manufacturing manager or possibly director -- usually a manager, plant manager -- who would be responsible for all the products in his plant. There would be a marketing director and a marketing manager.

Q One report to the other or --

A The manager would report to the director. And the marketing manager would have responsibility for usually a large application area such as dielectrics or hydraulics or hydraulics and heat transfer.

Q And the director would be over all of those?

A Yes. The marketing director of the fluids group would have responsibility over all those. The same thing would be true for the plasticizers.

There would be patent counsel who would be responsible for the fluids group, or be assigned to it, so that you knew who to contact in the patent

department.

The medical department. In the case of polychlorinated biphenyls, I think Mr. Wheeler was our main contact, although we met with Dr. Kelly on occasions.

Q Who?

A Dr. Kelly. Emmett Kelly.

Q Who?

A Dr. Emmett Kelly.

Q Was he higher than Mr. Wheeler?

A Yes. He was Mr. Wheeler's boss.

Q So your direct contact was Mr. Wheeler, who --

A Normally, yes, who then would report to Kelly.

Q What was Mr. Wheeler's first name, if you recall?

A Elmer.

Q Okay.

And what was Mr. Kelly's title?

A I don't know specifically, but something like medical director of Monsanto or --

Q So he --

A -- close to that.

Q -- would be the head of that department,

then?

A He was the head of the medical department. He would normally have a boss above him who was less than the president.

Q Okay. Do you have any idea what area his boss would be in?

A Emmett retired in '76. So I don't know whether it was -- possibly Mr. Throdahl.

Q I guess I was asking more what area. I mean the medical department doesn't fit in any particular chemical --

A Well, it was a corporate staff and would eventually report to the president.

Q Okay.

A But I think he always had somebody in between him and the president.

Q And that's what I'm trying to get to. What would that person be responsible for besides the medical department? Would he have other staff --

A He would have usually some other duties.

Q Okay.

A They kept shifting that. You would have to look at the chart by year.

Q Does that give us the organizational layout as best you can recall?

A Yeah, up through the time we were talking about, I think, from '63 to early -- the organization shifted a little bit, but not -- not drastically.

Q Now, if I were going to get people in the same level of responsibility, would I be correct that the research director would be on the same level of responsibility as the marketing director? Are they roughly coequals in terms of their place in the organization?

A Yeah. If you have a director and a director, I think they tried to make it somewhat the same level. Whether that was in fact, it's not really pertinent. There's one slight difference and that is that the philosophy changed part way through that. From early it was research department under Anagnostopolis, who was an entity under itself. And later on business groups became one of the main focal points for the research managers. In other words, I had, really, two bosses, I had the business director of the fluids group and I had the research director. So --

Q You had two --

A -- there was a little bit of philosophy, yes.

Q Is the business director the same thing as the marketing director?

A No. The marketing director would report to

the business director.

Q Okay. So we've got the business director.

Now, if we look at a marketing manager, would he be equivalent -- roughly equivalent to you as a -- in your managerial position?

A Yeah, I'm sure in the salary range probably. He might have less scope in terms of narrower scope but then have a particular product line, whereas in the research department you may have five or six product lines.

Q What about the position of a person like Mr. Wheeler in the medical department? How does he fit into the structure in terms of equals and superiors?

A He would be dealing largely with me and/or possibly a group leader in a special situation.

Q So he's maybe a little bit below the level of manager in this --

A We didn't go on that close a protocol. If he was needed in a particular area, he would work with the most knowledgeable people and persons.

Q Okay.

Do you recall who the business director was during this period?

A I gave you, I think, four names that were either directly responsible or partly responsible for

the business in a business sense. That was Wobus --

Q Okay.

A And Cresce. They were kind of dotted-line responsibilities, had a little bit less authority; and then Anagnostopolis and Bergen had more responsibility. So they came later.

Q Now, am I to understand that Anagnostopolis and Bergen would be in the category of business directors?

A Yes, they were, for the fluids group.

Q Okay. And --

A Anagnostopolis, you see, went from research director to business director.

Q Okay.

A Fluids group.

Q And Wobus and Cresce had a similar title but before there was quite as much authority in that job?

A There was a little less authority that they had, but they were still kind of drawing overall business together.

Q Who was the marketing director of fluids during that time?

A There were different ones. Tom Gossage was one. I think George Buchanan was early. He left the company. I've forgotten who took his place. Maybe

Gossage took his place. There might be one other in there.

Q How did the plant managers and the manufacturing managers fit into this scheme?

A Well, the manager of manufacturing for fluids reported to the business director and tried to keep track of all the fluids business. And, of course, then the plant manager, his overall job was to manufacture and see that the plant was running. So these two would coordinate operations. Manufacturing operations.

Q Was the manufacturing manager responsible for distribution and that sort of thing?

A I think only indirectly. I think the plants had more distribution authority and probably took more orders from marketing.

Q And with regard to specific fluids, would that come from the marketing manager of that particular fluid?

A Well, the orders would come in to marketing and then these would be transferred to manufacturing. And I don't know all the steps. And then first the distribution would be the plant's responsibility and then back to marketing if anything was going wrong. Any customer complaints would come back to marketing and/or manufacturing in some cases.

Q Who were the marketing managers during this period of time as related to particular products?

A Well, Paul Denivious (phonetically) was manager of marketing for dielectrics for many years during -- earlier and during this period we're talking about.

Q Okay.

A Dick Davis had hydraulics and some Thermonol responsibility, I think, heat transfer responsibility. There were others in there. Stan, I can't remember his last name, had heat transfer for a while. I don't know who had the aviation. Let's see. Frank Langenfeld had the aviation hydraulics for many years. And he was followed, I think, by Cumming Peyton. Cumming became Langenfeld's boss or was his boss.

Q That --

A There may be a few others, but if you get that far you've got them.

Q Who were the manufacturing managers who reported to the business directors of the business group?

A Jim Savage, I think, was the main one during this product, but there -- during this time interval, but there are one or two others that -- one gentleman has died. I've forgotten his name. He was -- during

the -- when Anagnostopolis was director, this man was manufacturing rep. I've forgotten his name.

Q What about the plant managers during this period of time?

A You would have to -- we would have to go back to the organization charts. There were a number.

Q And the patent counsel?

A Jack Mauer during a lot of this. Again, there are changes here that would have to be documented.

Q Now let's go from 1970 on until you left this area. Can you give me some idea of the structure and then the people who occupied the positions?

A It's about the same. I think that from -- I think I've tried to cover from '63 through '72, 3, somewhere along in there. And I had responsibility for paper what, '74, '75, somewhere in there, in addition to the fluids group.

Q Did the fluids group remain relatively constant during that period?

A The research department was -- people working in the fluids group was fairly constant during that time.

Q What about the rest of --

A We added people, but I don't think very many left the group.

Q What about the rest of these positions, positions like marketing director, the marketing managers --

A We would have to go back and document that information year by year and position by position.

Q Do you think there's some way to document that within the company?

A I would think there would be.

Q I have heard the name Pappageorge, I think it is. I didn't hear you mention him. Does he fit into this thing anywhere?

A Yes. Pappageorge was plant manager at Anniston in the late Sixties. In 1970 or thereabouts Pappageorge joined the fluids group and became -- I don't know his exact title, but the environmental manager or director, maybe director, to coordinate environmental issues pertaining to the aroclors and to, I think, probably fluids in general. But mainly aroclors.

Q Was that a new position or did he succeed somebody?

A It was a new position.

Q Do you know why that position was created?

A Yes. A concern that polychlorinated biphenyls were being detected in the environment and

shouldn't be. And to make sure that Monsanto acted responsibly.

Q Did you have any involvement at all in those sorts of issues?

A I had involvement in those issues before -- particularly before Mr. Pappageorge came. And partial involvement after he came.

Q Tell me about what your involvement in those issues was before Pappageorge took on his role as director or manager of environmental matters.

A Okay. Well, the polychlorinated biphenyl issue I think first came to my attention in somewhere around late '66, maybe '67, through reports from David Wood, who was a marketing man in England.

Q Was he marketing any particular thing in England?

A I think he had some responsibilities in the dielectric area. Whether he had others -- he may have had other responsibilities as well. Maybe fluids in general.

Q Okay.

A And he was hearing and reading reports from Sweden that Widmark and Jensen had thought they had identified polychlorinated biphenyl in environmental DDT samples.

Q Did you or someone else with Monsanto undertake to determine whether or not in fact their work did document PCBs in the environment?

A Yes, we did.

Q And what did you determine?

A Well, I think the first thing we did was we -- one of the first things we did was to go to Europe. And Keller, Wheeler and I went to Stockholm --

Q Okay. So you and Mr. or Dr. Keller --

A Yes. And Mr. Wheeler.

Q -- and Dr. Wheeler --

A No. Mr. Wheeler, it is.

Q Mr. Wheeler?

A Mr. Wheeler.

Q Dr. --

A Went to Stockholm and visited Widmark and tried to talk to Jensen. We couldn't either find Jensen or Jensen wouldn't talk to us.

Q What was the --

A And the other things we did were to begin to monitor the literature. And Wheeler and Keller visited a number of laboratories in the U. S. and around -- well, in England, Scotland that were monitoring environmental chlorinated hydrocarbons. And the next thing that we did was we said we should begin to check

out the reports and determine whether the reports were valid and at what levels and so forth. So Keller began to gather analytical equipment and an analytical team that could begin to positively identify Aroclor along with the DDT.

Q Let me stop you right there for just a second. Dr. Keller had certain responsibilities for technical areas that you did not and vice versa with regard to functional fluids. Correct?

A Yes. Keller was the manager of applied science --

Q Right.

A -- who did not all the analytical work, but analytical work and development that was -- not all that was done in organic, but a great deal of what was done in the organic division other than myself.

Q Between the two of you, you basically comprised the managers for almost all the technical work done with regard to dielectrics and other functional fluids containing PCBs. Is that correct?

A We covered the vast majority other than the plasticizer applications which I mentioned earlier.

Q Who was responsible for the plasticizer technical matters at this time?

A Early it was Farrar. Just when it was

transferred I'm not quite sure. Martin Farrar, though, had the initial responsibility.

Q And you're not sure whether he still did at the time you and Dr. Keller went to Sweden?

A I think we were before that. I think it was transferred after that.

Q Okay.

Now, what was Mr. Wheeler's particular specialty?

A Industrial hygiene.

Q And what is industrial hygiene?

A I think he better define it. There are definitions, but I don't have them in front of me.

Q Why did you understand he went on this trip with you and Dr. Keller?

A Well, he was representing both the medical department and industrial hygiene was the closest to the discipline that we needed for environmental at that time.

Q I'm not sure I really understand your answer.

A Well, all -- medical always did all our toxicity testing, all our issuances of what the toxicity or safety handling and so forth. So it was natural function that we should include a representative of that department in trying to find out what the issues were.

Q Did you determine from your visit to Sweden that there were health issues involved?

A No. We couldn't tell health issue or not. I think Widmark was an analytical chemist basically.

Q You mentioned that when you got back you began to monitor the literature. Do you know whether or not anybody with Monsanto ever monitored literature about products Monsanto produced prior to that time?

A The -- sure. The answer is yes. Marketing would monitor, medical would monitor, research would monitor. And certainly the three were responsible for trying to keep track of what was happening around the world.

Q So it was the intention, then, of the company that somebody in the company monitor technical literature that would relate to the chemicals it was producing?

A That's right. And the library had -- usually had a profile on research chemists, managers, group leaders, on what they should be monitoring in terms of what publications they should be reading. And you wouldn't get the whole publication, but you would get the title page, index pages of these journals, magazines and so forth.

Q So that, for example, to the extent you had a

responsibility to monitor certain aspects of the literature, you would receive the title page from the appropriate journals each month and review it and decide which articles you wanted to have a copy of?

A Yes, you tried to. You couldn't do a perfect job.

Q Certainly.

A It was easy at first, but it eventually became a large matter. And, of course, that's when I think Pappageorge really took over part of the responsibilities.

Q But prior to that you and somebody in the medical department and somebody in the marketing department each would have your areas of responsibility?

A We would try to monitor what was happening to our products in the environment. We were also in contact with government agencies. We were in contact with places like Woods Hall, Scripps Institute, Wisconsin Alumni Research Foundation. And we would ferret out people who were doing analytical and environmental work in the areas of small -- detecting small concentrations.

Q Now, had that been a responsibility you had had ever since you became a manager in 1963?

A Yes. It was an implied responsibility to

know as much about the product of the competition, our customers, as we could. I don't think it had been an issue. We didn't -- we really didn't think that Aroclor was an environmental hazard. At least, I was certain that we were not aware of even a potential problem until the Jensen situation.

Q Let me phrase my question slightly more broadly. There have been publications that relate to different aspects of what seems to be matters the company covers for long periods of time. For instance, I take it the medical department has been present at Monsanto for a long period of time.

A Right.

Q And from what you tell me apparently has had some level of responsibility with regard to certain aspects of things that relate to PCBs, like toxicity and the like.

A They did work early.

Q And was that --

A Before my time.

Q Yes. Was that department responsible for monitoring things that would relate to their work before the environmental issue came to the fore in 1966?

A Sure. They would try to keep track of hygiene issues or plant safety issues, sure.

Q Now, you mentioned earlier, I just want to make sure I understand correctly, you didn't just monitor the American literature, you also monitored foreign literature as well?

A We tried to. We had representatives in Japan, John Durland, who was available for information from there. Sweden, England. Tried to monitor the continent -- what was coming out of Holland.

Q So just about every place that you had a representative on behalf of Monsanto you would also be monitoring the technical literature in that locale?

A Well, if -- if we were sensitized to it. We didn't read everything. It's impossible. But people became sensitized to it and I think we began to do a pretty decent job of coverage.

Q What did you personally do with the things that you monitored?

A There was a committee, an informal committee, of Keller, Wheeler and myself. We tried to meet periodically, exchange information and plot a course of action that would make Monsanto responsible and responsive to the environmental or potential environmental problems.

Q Was this committee ever recognized in any formal way or just three guys trying to work on a

problem?

A No, I think we -- I think we had some sort of recognition. How formal it was I don't know. But certainly we reported the information to the business manager, the business director. I think we also were in contact with marketing people. As part of the monitoring of outside -- Scripps and institutes, we would talk to those people. We invited those people in to tell us what they knew.

VIDEO OPERATOR: Excuse me. I need to go off the record for a minute.

[Recess]

VIDEO OPERATOR: We're now back on the record.

MR. LACEY:

Q What sort of people did you have come in and advise you about their knowledge?

A We had people who were monitoring the environments of oceans, of air. We didn't know much about fish toxicity. I think medical asked a lot of questions about testing procedures in fish.

We had Mr. Riseborough come in and tell us what he had found. Dr. Riseborough probably.

We had WARF come in and tell us what they were doing in the Great Lakes.

Keller visited an environmental lab in Scotland doing monitoring work on chlorinated residues, fish and wildlife.

We consulted with people at University of Illinois in the environmental area, Metcalf.

We consulted with Mailer at Marquette, biological enzymes, which we really couldn't do much with. Talked with him.

I think these were some of the people that either Elmer talked with or I talked with, or Keller. Some combination.

Q When you say talked with, did you have a formal presentation made or was it just a phone call in some cases --

A No, no. These would be face-to-face contacts.

Q Okay.

What percentage of the people who were publishing in the field with regard to PCBs after 1970 did people at Monsanto contact directly?

A After 1970?

Q Uh-huh.

A I can't give you the time. I think we were doing this more in '68, '69. But Pappageorge would probably know a better record after '70, after he took

over.

Q After Pappageorge got involved, did your involvement in that type of concern about environmental matters and health effects go away and that became his area and not yours anymore, or did you stay interested in that area?

A My concern did not drop, but the amount of detailed work I did in that area slackened.

Q Were you involved in the decisions by Monsanto to limit the uses for which PCBs would be sold?

A I had some input to that. But the policy was really set down by John Mason and then carried up and down from there. He was Bergen's boss at the time, around 1970.

Q And if I understand correctly, at that point we're talking about somebody who is over the business director.

A Yeah. He's like an assistant general manager or whatever next to the head of the whatever it was, the MIC company at that time or organic division, I'm not sure which at that moment.

Q But he was at the level of --

A One above the business director.

Q So he would be responsible for more areas than --

A And had more say in the policy formulation.

Q And it's your understanding that it was Mr. Mason who was the person who we might call the architect of that approach?

A At least the gatherer and presenter and consolidation of thoughts of what recommendations should be made, should be done.

Q Do you know who made the initial recommendation for that?

A Well, I was involved in earlier -- some earlier recommendations.

Q Tell me about that.

A But I didn't certainly have a final say in anything.

Q Tell me about the early recommendations.

A Well, the early recommendations, after we decided that chlorinated biphenyls were really out there as part of the DDT residues or part of the chlorinated burden in the environment, was to cut back on production and try to confine the applications so that they would not get out in the environment. These were industrial products. They were never intended to be out in the environment. It wasn't like spraying orchards with DDT and things like that. So we wanted to confine it.

We also began to make substitute products

which were more biodegradable.

In the case of Aroclor, we introduced 1016 to the dielectric capacitor market.

In the case of Pydraul fluids, we formulated away from those containing chlorinated biphenyls.

In the case of heat transfer, we stopped the applications first in food and then finally the total use of fire resistant hyd -- fire resistant heat transfer fluids.

We promoted incineration, return of chlorinated biphenyls.

We promoted the idea of reclaim fluids so they would not be disposed of in a wrong manner.

We did all sorts of things with the distribution system. Pappageorge can tell you more about that.

We introduced more toxicity testing, long-term toxicity testing.

Q I guess my question was specifically what you did.

A Well, I was involved in all of this.

Q These were all your recommendations?

A Well, I was involved in most of them.

Q Okay.

A I did not make any one decision. But they

would be brought up by the informal committee, discussed and decide whether they're practical or not. Then it would -- it was -- really, it was -- that's what Mason did, he would take the recommendations of the business director and so forth and pull this all together.

Q What I'm trying to find out about is what specific things you personally recommended in response to the problem, if anything.

A Well, Wheeler and I and Keller went to Industrial Biotest. I think it was medical's call that we should do more long-term testing. The research department agreed that we would do all the analytical testing on animal tissues and so forth, specimens which were sent back. The main reason was that we had the analytical capability and we wanted it under our thumb, so to speak, under our authority.

I made recommendations asking, really, questions in the area of hydraulics.

I didn't play much of a job in -- much of a part in the Thermonol situation. That was somebody else, maybe marketing, to cease the FDA.

I was involved in providing the FDA with samples, analytical samples.

It was my responsibility after the plasticizer group -- Monsanto had decided not to sell

Aroclor to carbonless carbon paper because we couldn't control or they couldn't control the distribution of it. So myself and my group leaders substituted -- got the substituted product, we synthesized it, got it accepted, built a plant. It took us about -- it's the shortest job I've ever had in terms of from time of responsibility to plant. I think we did it in less than a year.

I was responsible all for the reformulations away from Aroclor and hydraulic.

I think I was the first to recommend incineration, although I didn't approve the final expenditures. That was up the line.

Q Let me go back and go through the specific things you've indicated. With regard to the Industrial Biotest, let me first understand this analytical testing you mentioned. Now, what did that involve?

A We wanted to do tissue analysis for aroclors, chlorinated biphenyls.

Q And where were these tissue samples coming from?

A They were coming from Industrial Biotest.

Q How was the work between Industrial Biotest and Monsanto coordinated?

A Coordinated through the medical department.

Q Who did that?

A Elmer Wheeler was the main contact.

Q How was Industrial Biotest selected?

A The initial toxicity was done by Younger Laboratories in Cutes. And Industrial Biotest was one of the -- one of the companies that Monsanto used for long-term, lower-level feeding studies. Monsanto had used Industrial Biotest for other products.

Q Do you know what other products?

A Not specifically, no.

Q When you and Mr. Wheeler and Dr. Keller went to Industrial Biotest, who did you meet with?

A We met with Dr. Fancher and we met with Calandra, the head of it, briefly. But the protocols were, I think, really between Wheeler and Fancher.

Q When you talk about protocol, what do you mean?

A Well, this is an agreement to test the products in a certain way and certain animals for certain lengths of time.

Q So the decision about how to conduct the testing and how long to test it and what animals to use was one that Monsanto participated in?

A Yes.

Q Why did you go and participate in that

meeting?

A Well, the research department was going to play a part. We were going to foot part of the bill, maybe all of the bill. We were trying to learn as much as possible. I think those are the three major reasons.

Q When was it that this meeting took place?

A I don't know exactly. '68, somewhere along in there. '69 maybe.

Q Did you have any information after this initial meeting about what the result was in establishing the protocols, how the studies were to be done?

A Yes. I think we received copies. I'm not sure I went up there. But the analytical people -- I think Scott Tucker was -- who worked for Keller was probably the closest to the actual detailed work, analytical work, receiving samples, storing samples, doing the hard part of the physical correlations and reporting the results.

Q Was he also involved in actually conducting the test on the samples?

A Yes. The analytical part. Not the animal-feeding studies.

Q Well, can you explain the difference between the animal-feeding studies and the analytical studies?

A Yes. The animal studies and the feeding and so forth were done by Industrial Biotest. And then they would section the animals and -- chickens, rats, dogs. I'm not sure whether any other animals. But those three, anyway. And then they would freeze samples and send them to St. Louis. And our people would extract and measure the Aroclor and as much about the chlorine contents as we could at that time.

Q So that actually involved destruction of the tissue sample in the process of testing it?

A Well, I guess they probably -- yeah. Have to ask them.

Q That's --

A Extracting methods.

Q You're not aware of how they did that?

A Not in precise detail, no.

Q And that wasn't actually done in your department?

A It was done in Keller's department.

Q Right.

Were you involved in interpreting the results of the work done by Industrial Biotest?

A No. Other than the analytical. We looked pretty carefully at the analytical results. And we looked at the -- some of the studies were made such that

we would feed for a while and stop feeding and find out how fast the animal would eliminate and what isomers would be eliminated. We looked at that kind of information. The pathological stuff, the toxicity, the animal behavior, the weights and all that stuff were Industrial Biotest and were reported to the medical department.

Q Okay.

From the reviews that you made of the analytical testing of materials supplied by Industrial Biotest, what conclusions did you personally reach?

A I reached the conclusion that the -- in general, the higher chlorinated biphenyls, and I'm talking about 54 and 65 and 6, were retained longer and probably built faster than the lower chlorinated ones, the 2s and 3s and some of the 4s. And this seemed to be at least consistent with what was happening in the environment itself.

Q Did you reach any other conclusions besides that?

A I think that the other toxicity information, on chickens we were accused of eggshell thinning and things like that. I didn't see any evidence of that. The other interpretation was left to the medical department.

Q And you don't have any opinion about that one way or the other?

A No. We would listen -- try to listen to the medical department and listen to their interpretations. But we weren't really qualified to either argue or to know all the innuendos of the toxicity testing.

Q This business of providing the FDA with analytical samples, did that involve anything more than responding to letters by sending vials or whatever the container was of PCBs to them?

A I think recording the samples, make sure we had retained samples, try to meet their requirements in terms of what they wanted. I think we also visited the FDA laboratory. I was there at least once. Other people were down there trying to exchange information on test methods that they were developing and what we were developing.

Q With regard to the development of this substituted product for the carbonless carbon paper, had you made any efforts at all to change the formulation of the chemical used for that prior to the development of these problems in the late 1960s?

A I had not -- personally, right? I had no involvement. There were -- in the United States, Aroclor was selected by National Cash Register, the

inventor. In other areas -- I'm not sure of the timing, but Wiggins Teeth in England had used HB 40, an hydrogenated terphenyl. But there were different systems. They had different systems and different philosophies.

Q So that from the work that your group did you were essentially starting from scratch?

A No. When we took over, the plasticizer group had already begun work on a substitute. It was isopropyl biphenyl, and all-hydrocarbon fluid, which was not satisfactory as far as NCR went. So we had to invent a new class of compounds.

Q I guess I'm trying to find out, from the time somebody started on that project with Monsanto until it was completed, how much time elapsed.

A Well, from the time we got a satisfactory answer to NCR's problem, it was less than a year, I think.

Q Okay. So from start to finish we're talking less than one year?

A About a year for the satisfactory product.

Q Okay.

A How long the isopropyl biphenyl was a partial substitute I don't recall. Maybe six months to a year.

Q What about the reformulation of hydraulic

fluids away from Aroclor? How long did it take to get that problem resolved?

A It took about -- oh, about a year to get Aroclor out. We substituted chlorinated terphenyls first, and then we eventually went to a phosphate ester system. That took about another year.

Q So within two years you were to a substitute product that was satisfactory?

A Well, the second product probably was satisfactory in a way. But I think the environmental people were happier in not having any chlorinated hydrocarbons out there. That's not necessarily true, but certainly chlorinated aromatics, chlorinated naphthalenes are there, chlorinated paraffins are there still, chlorinated benzene is still there. But we were trying to anticipate and make the best product we could.

Q With regard to the recommendation for incineration, that was for the purpose of destroying PCBs?

A It was the purpose for destroying PCBs and providing our customers and our users with a way of disposal of material that they were -- had been contaminated or they couldn't use, yes.

Q That recommendation was adopted by Monsanto?

A Yes.

Q And Monsanto actually engaged in a program of destruction of PCBs for customers?

A They did.

Q Was there any charge for that service?

A That's a question for Pappageorge. I'm not quite sure what the answer was. I think maybe a nominal charge or something.

Q Did anybody in your group suggest that Monsanto immediately cease production of PCBs?

A Cease production?

Q Uh-huh.

A It might have been suggested. But it was never considered seriously. If you talk about a very short time interval, I'm sure that it was considered as a phase-out. It was considered as a phase-out. And in conjunction with our customers.

Q Who suggested that you immediately cease production of PCBs?

A I don't know specifically. But probably many people at one time or another suggested it.

Q Do you know who at Monsanto suggested it?

A I don't know specifically.

Q Do you know that that recommendation was in fact made, however, by people at Monsanto?

A I don't know there was ever any formal

recommendation such as that.

Q Well, whether it was formal or informal --

A It depends on the time interval.

Q Well, as I understand it, Monsanto said that it was going to cease production for uses like the ones you described, plasticizers and carbonless paper and things of that sort.

A Well, cease production is one thing. But cease to sell to that application, I think that's -- that's more correct. Cease production was another situation.

Q Well, do those things go hand in hand or --

A Not necessarily. You would cut production. But you would not necessarily cease production.

Q Well, why would you still be producing if you weren't selling for that application?

A Well, if you're selling Aroclor 1242 for dielectrics and you're selling it for NCR paper, carbonless carbon paper, you produce for electrical and you cut back production and you just don't sell to the user that you can't control -- or he can't control the environment.

Q So, actually, the program that Monsanto instituted was one that would limit sales and then have the production match the demand for those uses it had

not limited sales for?

A Yes. That's closer to the picture.

Q And one -- it is not true, then, that one can look and identify particular Aroclor production as being for this use and another type of Aroclor production being for another use? That's not the way it worked?

A That's not the way it worked.

Q Okay. In fact, was one plant dedicated to production of aroclors for one particular type of use and the other plant designated for production of aroclors for the other type of use?

A There were not a -- there was not a complete match, but they -- both Anniston and Krummrich both produced electrical grade. You would have to examine the detailed records point by point for just the other grades that were made and when and where.

Q Okay.

And as I understand what Monsanto did, it did not decide, at the time it stopped selling for the applications like the carbonless paper and the plasticizers and these other applications, that in two years or three years or five years it would stop selling for the applications like dielectric fluid. Isn't that correct?

A Would you repeat that, please?

Q Yes. As I understand it, when Monsanto made the decision to stop selling PCBs for applications like carbonless paper, plasticizers, heat transfer fluids and the like, they did not at the same time make the decision to stop selling PCBs for dielectric use at any point in time.

A The points did not coincide in time. The electrical use was continued because the Westinghouse and General Electric and the government said they didn't have substitute products and therefore Monsanto should continue until they at least got substitute products. So it was not -- in any of these cases it's not necessarily Monsanto's decision alone, it's Monsanto's decision plus the customer, all usually big companies, that would try to reach an agreement, yes, we will substitute, we will stop. But it's always a Monsanto customer relationship that is important, or sometimes a Monsanto-government agreement of what will be done.

Q Are you telling me that Monsanto didn't have the ability to stop PCB production on its own?

A Well, I don't know all the legal ramifications in contracts that would be involved. But in general we tried to be considerate of the customer, the economy, what the government wanted. Those three things.

Q Well, is it your testimony that Monsanto would sell PCBs for any application where there was not a substitute?

A You're getting into a policy decision and area that belongs to Mason when you get into the fine points.

Q Well, I'm trying to find out what your understanding as a person making recommendations and a part of this group --

A My recommendation was to limit the applications to closed systems. That's easy to say. You -- you try to minimize the exposure, you try to get all your customers to reach that point, and you find out that they can or can't, then you make a further decision.

Q Were you involved in any of those further decisions about --

A The detailed decisions at that time were probably made and came in more from marketing as to what customers were doing, and the business decision and the business director and John Mason, than the research department at that stage.

Q And the primary closed use or closed system that you sold for or that you would recommend selling for was the dielectric use, was it not?

A Yeah. And transformers in particular.

Q That's a dielectric use, is it not?

A Yes.

Q And the --

A We substituted Aroclor 1016 to minimize the environmental load in capacitors during the interim period.

Q The marketing person there who was directly responsible was Mr. Benignus?

A He was the manager. The still more responsible man would be the director of marketing and still more responsible would be Bergen and still more responsible would be Mason and still more responsible would be some combination of law and Pappageorge being -- having some input.

Q Can we go on up the chain till we get to the --

A I run out of -- I run out of -- at Mason I run out of any kind of knowledge.

Q But I mean we could, I guess, go on up the chain --

A Theoretically you could go to the president, I guess, or chairman of the board, I guess.

Q Okay.

A Or maybe the board of directors.

Q But in terms of being aware of how customers were actually using PCBs and their ability to have the closed system that you recommended, that was something that would come back to a person like Mr. Benignus, who had direct contact with the customers?

A He would be their prime contact. Pappageorge, too. I visited a couple of the big plants, tried to educate some of our customers what Monsanto was doing. We did not try to run their operations. We couldn't. We didn't know how to manufacture capacitors or manufacture transformers, run an automobile shop or whatever.

Q What customers did you visit?

A I visited General Electric at Hudson Falls; General Electric at Pitsfield, Mass; Westinghouse at Bloomington, but I didn't see all the plant. I think those are the principal places that I went on this kind of operation.

Q When you visited the GE plant at Hudson Falls, who did you meet with?

A Probably briefly with the plant manager. But I don't know the people that were in charge of manufacturing. Engineers that were involved in the manufacturing process. But I don't recall their names.

Q Did you go into the plant area itself?

A Yes.

Q What did you observe there?

A We observed them manufacturing capacitors, small and big capacitors.

Q And did the use seem to meet your definition of the closed system?

A It could have met the closed system.

Q Did it meet it?

A We measured effluents from that plant, which is what we were concerned with, and there were PCBs in the effluents at that time. What they did subsequently I'm not sure.

Q Do you recall about when it was that you went to the GE Hudson Falls plant?

A I don't recall specifically.

Q What about the Pitsfield, Massachusetts, plant?

A Same kind of visit, same time frame.

Q Same interest in the effluents of the plant?

A Yeah. Analytical methods. Make sure they had them.

Q What about the Westinghouse plant at Bloomington?

A I'm not certain of that. I was over there and I think we were more on 1016 than we were on plant

effluent.

Q I'm sorry.

A Aroclor 1016. I think we were talking Aroclor 16 rather than doing anything on plant effluents.

Q So you're not sure if when you visited the Westinghouse plant --

A I did not see the Westinghouse operation in detail.

Q So you don't know whether or not they were operating in a way that would meet your definition of a closed system?

A No, I don't.

Q Do you have any reason to have an opinion one way or the other?

A I don't have an opinion.

Q Do you know if anybody else visited the Westinghouse plant in Bloomington to determine whether or not the operation met the closed system --

A I don't know specifically.

Q Who was it who recommended that the sales contracts between Monsanto and people like GE and Westinghouse be modified to allow Monsanto to cease sales if the PCBs were not being handled in a way acceptable to Monsanto?

A That would be a business-legal-marketing decision.

Q Did you have any input on that?

A None.

Q Were you present at any meeting where recommendations like that were made?

A None. No.

Q Were you aware that that was done?

A Just only after the fact, I think.

Q When did you first become aware of that?

A I couldn't tell you.

Q Ten years ago or --

A I don't know.

Q Not within the last week or two?

A I haven't had anything to do with PCBs since 19, roughly, 74.

Q And you knew it back then?

A Yes.

Q Okay.

In terms of what you've previously indicated was the decision by Monsanto to continue to sell PCBs for certain uses like dielectric uses because there were no substitutes, did you have any problem reconciling that position with having a contractual clause that would provide for stopping sales anyway?

A I was not involved in that kind of decision, operation.

Q You never thought about that at all?

A I didn't -- didn't participate and just accepted what -- whatever was given back to us, that's all.

Q Okay. Without thinking it through in any way or wondering about it. Correct?

A It's up to the legal-marketing-business decision on that score.

Q With regard to the development of substitute fluids, was that a matter that was left to the customers to take care of?

A Would you rephrase the question, please?

Q Surely. When it came to developing substitute electrical dielectric fluids, was that a matter that the customers were to come up with or was Monsanto involved in doing that?

A Both sides.

Q In other words --

A Monsanto did and GE was also working.

Q When did Monsanto first develop a substitute fluid that could have been used in capacitors and transformers had PCBs not been available?

A We worked on 1016 -- okay? -- and that was

introduced. Non-PCB fluids, we worked on diphenyl sulfones, aromatic sulfones and hydrocarbon mixtures. These were introduced to the dielectric capacitor people. Some testing went on, some tested, some did not. And that's about the time when those -- I had been phased out when those things started to be taken to the marketplace, I was no longer part of the projects, so I don't know specifically what happened.

Q But that became available as an alternative at about the time you left functional fluids?

A '74, '75, '76, somewhere -- somewhere in there.

Q Okay.

A It probably was somewhat after I left that development wanted -- these were available.

Q Do you know whether anyone else besides Monsanto had succeeded in finding an acceptable substitute before that time?

A General Electric were working on phthalate esters, had been working on phthalate esters. I don't know the specifics.

Q Who would be aware within Monsanto of when substitutions started being made for PCBs in dielectric use?

A I don't know.

Q Were there any uses of PCBs developed by your group, new uses I mean, after you came to that group in 1963?

A I think the answer is, we thought of some but didn't go out with any.

Q Why not?

A I think we felt they were not satisfactory applications.

Q What do you mean by that?

A That they would really not do a job, not be unique. Not fulfill a unique purpose. We were after things that were unique to Monsanto and would fulfill a particular marketing need.

Q What was the interest in having products that were unique to Monsanto?

A Well, we wanted to support a specialty product group, make it a specialty product group so it would be small -- essentially small volume and have a unique use.

Q Is there some particular business reason for that?

A Well, some people like to go for large volume, and it just turns out the fluid business is in general smaller volume and it's better to have a unique place in the industry, marketplace. Have a lot of

research to be done, a lot of application work. If it's not unique, you can't support the application work usually.

Q Would you explain what you mean by that? If it's not unique you can't support the application work?

A Well, if the situation is -- you've got five or ten suppliers, it's unlikely -- and they're all equally divided in volume, it's unlikely that any one can do a very good job. Pricing gets so low that you can't put very many people on the project, maybe you can't even support a research person.

Q So with a unique application there's a pricing arrangement where you can support more researchers and the like?

A If the application is sufficiently in volume and you're fulfilling that need in a way it should be fulfilled, yes.

Q Was --

A It becomes an engineering value rather than a straight chemical value.

Q Was the PCB application one that would support several researchers and the like?

A Well, we only had one. And two technicians. So gross margins were not -- not tremendous.

Q The total number of people you had working on

PCBs --

A No, not PCBs. You said dielectrics, I believe. Is that right?

Q No, I asked about PCBs. Or I meant to if I didn't.

A I guess we had as many as 10, 12 working on substitute products.

Q Is that a fair number of people for a relatively small-volume business as you've described it?

A It's as many as I could beg, borrow and steal.

MR. LACEY: Okay.

MR. SHOEBOTHAM: If this is a convenient place, can we go off the record just a second?

MR. LACEY: Sure.

[Recess]

VIDEO OPERATOR: We're now back on the record.

MR. LACEY:

Q Dr. Richard, let me show you a document marked as 30 and ask you if you can tell me what this is.

A It's a page that gives the physical constants on Aroclor 1242, and the date is 4/57.

Q And what are physical constants?

A These would be physical properties.

Q Are those the result of a test actually performed on the material as of that time?

A It's before my time. Made by Ellenberg. That's all I can say about it.

Q Okay. Were there physical constants data sheets that were made at the time that you were associated with functional fluids?

A We provided information so that a chart like that might be made on various products. I don't know the specific ones. Measure physical constants.

Q Who actually prepared these charts?

A Presumably the man signing it.

Q Well, I guess --

A I never knew Ellenberg, so -- I knew the name, but that's it.

Q During the time that you were in the functional fluid group with regard to the technical matters you dealt with, what department or what group prepared these physical constants data sheets?

A It was often marketing. It provided -- the information would come from literature or from actual measurements that we might do or physical laboratories at Monsanto might do or could be done from the outside if we didn't have the equipment to do it.

Q Do you know how often these physical constants data sheets were revised?

A No, I don't. I'd have to make a direct study of it.

Q Let me show you Document 508 through 511 and first ask you: Have you seen that before?

A I don't recall having actually seen these five pages. Is I probably saw some of the data, but that's not -- I don't think I saw this document per se. I don't recall it.

Q That document deals, does it not, with the experimental MCS1016?

A That's correct.

Q And that was a material that your group worked on. Is that correct?

A That's correct.

Q Who in your group was responsible for the 1016 work?

A Dr. Munch was the -- I'd say the principal person involved. But he had help from other sources.

Q The document has what appears to be a form of letter, and attached to it are some materials that relate to, according to the headings, Capacitor Dielectric, MCS1016 and Aroclor 1242. What's the relationship between the MCS1016 and Aroclor 1242?

A Would you explain a little bit more about what you mean by relationship?

Q Well, why are those two things appended to that document together and how does one relate to the other, if at all?

A MCS1016 was intended to be a dielectric fluid that would be used in place of Aroclor 1242 with less higher chlorinated isomers in it and therefore less of a load on the environment if it got out.

Q Now, let me show you for comparison purposes again Document 30, which relates to Aroclor 1242, and have you compare that with the information on Aroclor 1242 attached to Document 508 through 511.

A What about it?

Q Would you turn to the section of Document 508 and following that contains the data on Aroclor 1242? There is a listing of properties there, is there not?

A Yes.

Q That's Sheet No. 511. Would you compare the listing of properties on Sheet 511 with the listing on Sheet 30?

A Do you want me to go down point by point?

Q Really, I just want you to scan it, I suppose, at this point and tell me if there are any significant differences.

A It would take me quite a bit of time to go through point by point.

Q Can you look at it long enough to see if there are any significant differences? You need not to mark on those if you can avoid that.

A There may be differences, but I would prefer to do this quietly and compare point by point.

MR. LACEY: That's fine. Feel free to do that. Just don't mark on the originals, if you would.

MR. SHOEBOTHAM: Why don't we do this.

Will it take you a couple of minutes to run that analysis?

THE WITNESS: It will take me more than that, because I've got to look through 30 items and see whether the items are the same or different.

MR. SHOEBOTHAM: Let's let Dr. Richard go off camera to go through that.

MR. LACEY: Certainly.

[Recess]

VIDEO OPERATOR: We're now back on the record.

MR. LACEY:

Q Have you had a chance to compare the data on 30 with the data on 511?

A I've looked at it.

Q Okay. What differences did you note?

A Some of the properties measured are different, test methods are different, some of the properties emphasized are different. The main difference is that just one is just typical. It's -- when you say typical, it has less than official meaning. I don't think this was meant as a physical constants sheet in the same sense that Ellenberg prepared this. Differences are 1957 to '62. Those are the differences I see.

Q Is one more technical than the other?

A I'm sure they were prepared for different reasons.

Q What is the purpose of a physical constants data sheet?

A There are many reasons. One could be engineering, building a plant, one could be for setting up specifications. You pick certain physical constants that you might want to monitor. Some might be for design, some might be for the intended use so that the user could calculate whether he was interested in the fluid. There would be many reasons.

Q Can you tell from the Document 508 through 511 what the purpose of the sheet attached to it as 511 was?

A I think that's a question for Mr. Benignus, who wrote the letter. I think that would be the best question.

Q My question is: Can you tell? Or is it too obtuse to know?

A Well, the letter says that he was writing this to introduce Aroclor MCS1016, possibly to the capacitor people. It's not addressed to any particular person or company. I don't know where it was sent.

Q But it is apparent, is it not, that that sheet on 1242 that's attached as 511 was to be sent to potential customers or customers?

A You'll have to ask Benignus on that.

Q You don't know?

A I don't know.

Q Okay.

Were physical constants data sheets supplied to customers like that one marked 30?

A This again is a question for details of Benignus. I did not normally send out material to customers.

Q You just don't know?

A I don't know.

Q Okay.

On Document 30 there is given a formula, is

there not?

A Says formula on the sheet.

Q And what is the formula that's given?

A It's an empirical formula for trichlor -- probably for trichlorbenzene -- trichlorbiphenyl. But you can't really tell. It's -- you know, it's just that. It's an empirical formula.

Q Well, we can -- or can you tell as a chemist what chemical that is?

A It's just for an average chlorine content of 3. I'm sure Ellenberg knew that it was a series of mixtures and isomers and so forth.

Q That data sheet doesn't indicate that, though, however, does it?

A The formula does not indicate that. Just an empirical formula.

Q Well, if one were to look at that formula, one would conclude that Aroclor 1242 was made up entirely of PCBs containing three chlorine atoms to each molecule, wouldn't they?

A You might imply that if you didn't know the background and the chemistry of 1242.

Q And what would the actual formula for 1242 be?

A It would be complicated to figure it out. I

don't know the exact empirical formula.

Q Would the exact empirical formula vary even from batch to batch?

A Depends on how precise you want it. How many decimal places you carried out the hydrogen chlorine valence.

Q It would not necessarily be perfectly identical, I take it.

A Well, it depends on how many places you were talking about. If you're just talking to the nearest place, nearest number, it would probably be pretty accurate and constant. If you're talking about six or eight places out, it may be different.

Q Let me show you Document 1473, 1474. Do you recognize this form of document?

A Not specifically. I see it's marked an OSHA form, OSHA 20, May 1971. I don't think I ever particularly remember anything about OSHA documents or filling them out.

Q Okay.

Are you familiar with the specific blending of particular Inerteens or Pyranols?

A I'm not familiar with the details of the blending. I know we did blend some mixtures for both GE and for Westinghouse.

Q But what those blends were and why they're done you do not know?

A Oh, well, yes, I know some were blended for transformers; some were blended for stabilizers when they were requested.

Q Let me show you Document 2026, which is a part of a document beginning at 1967 and going to 2051, where there is given at the bottom there the blending for Pyranol 1467 and 1470, both of which apparently are transformer oils. Are you familiar with a particular reason for the different formulas there?

A When it says Pyranol, that would mean that GE was calling the shot on what blends they wanted.

Q Okay. And that would not be something, then, that would be developed by your group?

A No.

Q Let me ask you about Pydraul A-200. Are you familiar with that product?

A Yes.

Q What was Pydraul A-200?

A A blend of two aroclors. I think the two were 1242 and 1248, possibly 1254 and 1242. I'm not sure which.

Q And do you know what that was used for?

A Used as a hydraulic fluid and a turbine

lubricant.

Q A what?

A Turbine lubricant.

Q Was that a name that came from General Electric or --

A Pydraul? No. That was a Monsanto name.

Q So that blend was specified, then, by Monsanto people?

A Yes.

Q Was that specified by people in your group?

A I would think it would be specified by Mr. Stark. It might be specified by marketing.

Q Let me show you Document 11025, which is a finished product specification for Inerteen 54201CN.

A Okay.

Q I see there it indicates under the heading Research on that form what appears to be your name.

A Yes.

Q What involvement did you have in setting up that Inerteen specification?

A The Inerteen specification again would be set up by Westinghouse.

Q Do you know why your name is on that document?

A Sure. It would be a product that we would

have to -- would go in the fluids group. Lacey was the manufacturing man at Krummrich; quality control was done by Blauers at Queeny. But that would be it. We wouldn't call out the specification in Inerteen.

Q Did your group have anything to do with an Inerteen product like that one?

A We would try to make sure that we met that specification. Manufacturing would. But in general if it was okay, met the specification, research would not need to be involved. If something was wrong with it, then research would be called. Something inconsistent.

Q Let me show you you Document 5506, which refers to Aroclor 1242 nonelectrical grade.

A Okay.

Q What are the basic differences between electrical grade and nonelectrical grade Aroclor 1242?

A They ran less -- fewer tests possibly before they shipped it.

Q Was there actually any difference in the product?

A It came out of the same process. You would have to go back and make sure just the time, the conditions and so forth, but manufacturing would run probably fewer -- fewer tests possibly.

Q Were there --

A You would have to go back to control tests in the plant and find out.

Q Were there less steps taken in the refining of nonelectrical grade than in the refining of electrical grade?

A Process should be the same. 1242. Wouldn't want to change it.

Q Okay. Let me grab those things and get them out of your way.

A Excuse me. I was just looking at who had signed it.

Q Let me ask you generally about technical bulletins. What can you tell me about technical bulletins?

A Usually prepared by the -- either development, commercial development, or marketing people, with the help of other departments, such as research or medical or whatever was needed in the way of pulling a document together.

Q Let me --

A Possibly legal.

Q Let me show you some technical bulletins and ask you to let me know what role, if any, your department might have had in the development of the bulletins.

First let me show you a bulletin called the Aroclor Compounds 84 through 131.

A Is there a date on this?

Q Feel free to review it and give me your --

A Is there a date on it?

Q Well --

A I'm not sure.

Q There are -- in many of the cases of these documents -- numbers and codes which you may be able to help us date.

A I really can't. This looks like an early -- early Aroclor bulletin. I don't know, just why, just maybe from the style is all I'm going. I don't see a date in a quick perusal. The pictures you might be able to date. If the pictures were clear you could possibly date it from that.

Q How would the pictures --

A I'd say an early bulletin.

Q How would the pictures help you date it?

A Well, who was in the pictures. Looks like they were potentially Monsanto people. The style of the pictures is in the laboratory or whatever.

Q Would a document like that have had contributions made to it by the group like yours, whether it was actually your people or --

A All I can speak of is I don't think we contributed to that.

Q Okay.

Let me show you another technical bulletin, 132 through 157, and ask what, if anything, your group would have contributed to that bulletin.

MR. SHOEBOTHAM: I'm sorry. The numbers again? Could I --

THE WITNESS: Sure. 132.

MR. SHOEBOTHAM: Thank you.

THE WITNESS: Looks as if it's through 157. Is that correct?

MR. LACEY: I believe that's the last number.

THE WITNESS: Thank you.

I'd say again that -- quick judgment -- that this is a bulletin before my time in fluids and it seems to cover a combination of plasticizer uses and -- as well as electrical uses.

MR. LACEY:

Q It does --

A Looks like it's organic division. So it's before the -- before the reorganization. You can date it that way.

Q When we talk about before the reorganization, we're talking before 1970. Correct?

A Yes, right. Before that. But my guess is it's even before that.

Q And what causes you to believe it predates 1963?

A Well, it talks about adhesives and thermal plasticity. And fluids group had -- resistance to drying, things like that. We just had no -- no -- no input at that time.

Q Is there anything about that document that has information of the type that would come from your group?

A That did come from it?

Q That would come from your group. And by that I'm not talking about necessarily while you were in charge of it, but the group that you had responsibility over from 1963 forward.

A I can only speak from the time that I had something to do with it. And I'm saying I don't think that our group from '63 on contributed to that, to this bulletin. I don't know that as a fact. I'm judging.

Q Well, who in Monsanto would know who contributed to these bulletins and the sources of information in them?

A You have to go back in history and you have to find people that would remember the history of

Aroclor before my time.

Q Let me show you another technical bulletin, 407 through 421, and ask if there's anything in there that would have been contributed to by your group.

A We could and probably did contribute to this bulletin. The reason is that Thermonol 55 was a relatively new product. We would have to measure -- either have measured them internally or measured externally and paid for the results for the physical properties of 55.

Q What page number is that found on in the document?

A It's on Page 3 of -- or 410 in your SCM. And Thermonol 55 properties are again given on 413, or Page 6 of this document. I think probably we would probably have something to do with the calculations in changing -- changing to Thermonol 55 or 66 from FR.

Q What page are those found on?

A Page 7. Protecting system.

Q What's the other number?

A 414. We probably had something to do with, on Page 9, system diagram possibly, some question -- we certainly developed the oxidation testing of 55. That's about it, though. I think that would be our contribution.

Q What would the purpose be of technical bulletins like this, if you know?

A To aid the customer. Aid the customer, principally.

Q They were not primarily for your internal reference purposes?

A Yes, they would -- it served in that capacity. But I think the major aim was to provide information to customers.

Q So the primary purpose --

A Potential customers or customers.

Q The primary purpose would be for people outside Monsanto. They would also serve a function for people within Monsanto. Correct?

A Could, yes.

Q Or might not serve a function for people in Monsanto, depending on the situation?

A It could serve a function inside Monsanto.

Q Okay.

A People who needed to be familiar with physical properties or the attendant use.

Q Who actually had the overall responsibility for generating technical bulletins?

A It indicated that the technical bulletins were the normal responsibility of marketing and, on

occasion, commercial development, particularly when a new product was introduced.

Q And who would have the responsibility for distributing them to customers or potential customers?

A Well, they would certainly be reviewed by procedures like the legal department, and I don't know what the distribution list was. And then I would guess that -- I would say that the business director would have overall responsibility.

Q I'm sorry. That's not my question. I'm talking about who would be in charge of actually distributing them out to customers?

A I don't know who would serve the -- I mean the customer list or the -- I don't know who had that.

Q Do you know who was responsible for having these bulletins updated, if they were, from time to time?

A Marketing would be a prime responsibility. It might be pushed by any one of the departments. Medical would -- could push. There was a job that Pappageorge pushed hard on. Research might indicate a change if they had a change in methodology. Improved methods or improved analytical.

Q Why would there be a push to update technical bulletins?

A To make customers aware of properties, make customers aware of new information.

Q Do you know whether or not some procedure was maintained whereby people who had received a prior version of a technical bulletin would receive the update of that bulletin?

A I'm not familiar with those details.

Q Are you familiar with any warnings that were placed on PCB-containing products?

A I know they were placed. It was not my responsibility nor did I have anything to do with the wording, labeling function. Might have furnished information, but that was not the province of research.

Q Would you be able to identify from looking at warnings when a particular warning was in use and when it was superseded?

A I could not.

Q When you first came into the functional fluid group, were warnings already being placed on the products that were sold by the group?

A I'm not familiar with that. Labeling is, as I said, the province of marketing, and manufacturing would be the place to check in terms of what was on what.

Q When information was given to customers

regarding proposed new products, did your group review that information before it was supplied to customers?

A I would say, in some cases, yes. In some cases we might not have.

Q Let me ask you to look at document beginning at 512 and continuing to 516 and ask if you reviewed that document before it was sent out.

A There's no indication that I reviewed it. And I have no recall of reviewing this particular article. Document.

Q Is that the type of document that someone in your group would have reviewed before it was sent out?

A It might have been reviewed by Dr. Munch. I have no way of telling.

Q The document refers to the proposed production of MCS1016 and states that: Our laboratory has completed a capacitor life test study. Would that be your group that would do that type of study?

A If we did it, it would be done by Munch, yes.

Q Were your people able to conduct those type of studies?

A Small-scale capacitor testing we could do. Small scale. That meant limited -- very limited statistics. Just enough to maybe interest the customer.

Q It says here: We have an extensive research

program on materials for use in capacitor dielectric systems. Is that defining the research program that you had?

A The only thing -- the thing that was extensive about it was -- was we were searching in terms of alternate materials. But as far as our test capacity, capacitor test, it was very small compared to anything that anybody else had that was really in the business.

Q Would you characterize it as an extensive research program?

A Extensive in terms of synthesis, yes. More extensive than the dielectric people. But in terms of capacitor testing, nowhere near what was required.

MR. SHOEBOTHAM: Let's go off for a minute.

[Recess]

MR. SHOEBOTHAM: Back on the record.

Dr. Richard has an appointment tonight and tomorrow morning that he has to leave for, he has a 6:25 flight. It's now 5:30. So we have to leave. We've been here for about eight and a half hours, with an hour for lunch --

MR. LACEY: More than an hour for lunch.

MR. SHOEBOTHAM: Dr. Richard is also tired. I think this was a long enough day and certainly long

enough to complete the deposition, certainly when compared to some of the time limitations that have been imposed for experts in the case. So we need to leave at this time.

MR. LACEY: Dr. Richard, when is your appointment this evening?

MR. SHOEBOTHAM: Dr. Richard's appointment this evening is that his wife is going to meet him at the airport and he can't leave her standing out at the airport. He has a commitment tomorrow morning that he has to make, too.

MR. LACEY: There is another flight later this evening, is there not, Doctor?

MR. SHOEBOTHAM: I don't know what the airline schedule is, Mr. Lacey. But Dr. Richard needs to make the 6:25 flight that he is ticketed for.

MR. LACEY: We'll be happy to see if we can't make alternate arrangements for another flight. I know there's a later flight this evening. And I feel confident we can make arrangements to call his wife and advise her of the fact he will be on the later flight.

MR. SHOEBOTHAM: I appreciate that. But he has been testifying now since 9:00 this morning.

MR. LACEY: Actually, we didn't even start at nine, John.

MR. SHOEBOTHAM: We were here at a quarter of nine. So if we didn't start at nine, that wasn't our fault. He has been at it now since whenever we started this morning. It's been a long day for him and I need to get him on that airplane.

MR. LACEY: All right. We'll reserve our right to take it up with the court.

SIGNATURE OF WITNESS

I, William Richard Jr., solemnly swear or affirm, under the pains and penalties of perjury, that the foregoing 208 pages contain a true and correct transcript of the testimony given by me at the time and place stated, with the corrections, if any, and the reasons therefor noted on a separate sheet of paper and attached hereto, and that I am signing this before a Notary Public.

William Richard Jr.

THE STATE OF

Subscribed and sworn to before me, the undersigned authority, by the said William Richard Jr. on this the day of , 1987.

Notary Public in and for the State of

THE STATE OF TEXAS]

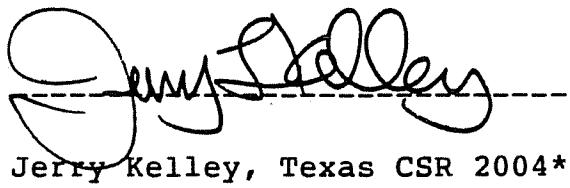
CERTIFICATE

I, Jerry Kelley, a Certified Shorthand Reporter, hereby certify that the foregoing testimony was given before me after the witness had been duly sworn.

I further certify that the foregoing is a true and correct copy of the transcript of the proceedings.

I further certify that I am neither attorney for, related to nor employed by any of the parties or any attorney of record in this cause, nor do I have a financial interest in the matter.

Witness my hand in Houston, Texas, on April 20, 1987.



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*My Certificate Expires
December 31, 1988

EXHIBIT #