MF 500
DR. WILLIAM R. RICHARD, JR.

UNITED STATES DISTRICT COURT
DISTRICT OF SOUTH CAROLINA
ANDERSON DIVISION

CAROLE M. WHITFIELD, et al.,	)	
PLAINTIFFS,	)	
vs.	)	No. 8-84-3184-14
SANGAMO-WESTON, INC., et al.,	)	
DEFENDANTS.	)	

WILLIAM RALPH RICHARD, JR.

Taken on behalf of the Plaintiff

GORE REPORTING COMPANY

408 Olive Street St. Louis, Missouri
241-6750

HARTOLDMON0008970

UNITED STATES DISTRICT COURT
DISTRICT OF SOUTH CAROLINA
ANDERSON DIVISION

CAROLE M. WHITFIELD, ET AL.,	)	
PLAINTIFFS,	)	
VS.	)	NO. 8-84-3184-14
SANGAMO-WESTON, INC., ET AL.,	)	
DEFENDANTS.	)	

Deposition of Dr. William R. Richard, Jr., taken on behalf of the Plaintiffs, in Room 3114 of the Marriott Airport Hotel, in the County of St. Louis, State of Missouri, on the 9th day of July, 1987 before Thomas A. Gore, Certified Court Reporter and Notary Public.

Appearances of Counsel:

For The Plaintiffs:

Mr. W. Ronald Bonds
and Ms. Susan J. Herdina
1923 Main Street
P.O. Box 806
Barnwell, South Carolina 29812

For The Defendant Sangamo-Weston:

Mr. L. Gray Geddie, Jr.
Messrs. Ogletree, Deakins, Nash, Smoak and Stewart
1000 East North Street
Greenville, South Carolina 29602

For The Defendant Monsanto Company:

Mr. W. Francis Marion, Jr.
Messrs. Haynsworth, Marion, McVay and Guerard
P.O. Box 2048
Greenville, South Carolina 29602

- - - - - - -

WILLIAM R. RICHARD, JR.

Of lawful age, having been first duly sworn to testify the truth, the whole truth, and nothing but the truth in the case aforesaid, deposes and says in reply to oral interrogatories propounded as follows, to-wit:

DIRECT EXAMINATION

QUESTIONS BY MR. BONDS:

Q. Mr. Richard, if you will, state your full name.

A. William Ralph Richard, Junior.

Q. It's Dr. Richard, is it not?

A. Doctor.

Q. What's your address?

A. 729 Delchester Lane, Kirkwood, Missouri.

Q. Where are you employed?

A. I'm self-employed.

Q. If you would give me the benefit of your educational background after high school.

A. Graduate of Amherst College, class of '43. Majored in Chemistry. I have an M.S. Degree from the University of Michigan, M.S. Chem Degree in '47. Ph.D Degree granted in '51 from the University of Mass.

Q. The Ph.D is in what field?

A. Chemistry.

Q. Give me your employment record after you graduated from Amherst, the best you can.

A. I worked for Monsanto Chemical Company from '43 through '46, the Plastics Division, Springfield, Mass. I left in '46 to go back to graduate school at the University of Michigan. I returned to Monsanto in 1950 in Dayton, Ohio and came to work actually a little bit before the degree was granted. Finished up my Ph.D early. Worked in Dayton, Ohio for Monsanto until 1961.

Q. What did you do in Dayton, what was your job title?

A. I was a Research Chemist, Group Leader and Section Leader. Came to St. Louis in 1961 and worked in the R and E Division here in St. Louis. 1963 I went to the Organic Division as Manager of Fluids, Functional Fluids. Research Department. Organic Division was reorganized and combined in roughly 1970 into the Monsanto Industrial Company. I think that during part of that time in the Fluids Group I had the Paper Chemicals Group. Roughly 1976 the MIC Group was split and I went to the Monsanto Intermediates Company. I was Director of Research of Process Chemicals and

later on had Phosphorus Chemistry, Metal Phosphorus as well. The Intermediates Company was dissolved in 1983. I went back to the Industrial Company. Still Director of Research. And then became Director of Specialty Products in 1984, when it was reorganized again. I retired in December of '85.

Q. You understand that this deposition concerns the lawsuit of Whitfield, et al. against Sangamo-Weston and the Monsanto Company?

A. I understand that.

Q. It involves the chemical called poly-chlorinated biphenyls?

A. Yes.

Q. I'm going to ask you a series of questions about your involvement with the Monsanto Company and your responsibilities when you were with them. If at any time I ask you a question you don't understand or my question is not clear, ask me to clarify it and I will be glad to do that. If you don't, I will assume you do understand my question. Fair enough?

A. I will try to comply.

Q. You indicated that in 1963 you went with the Functional Fluids Group?

A. Yes.

Q. In the Organic Division; is that correct?

A. That is correct.

Q. What were the Functional Fluids that you had responsibility for?

A. These were materials that served the dielectric area, transformers and capacitors, hydraulic markets, jet engine lubricants, electronic coolants for aircraft. Hydraulics for aviation and industrial. Those are the principal products that we had.

Q. Did polychlorinated biphenyls fall within that group?

A. They did. Not entirely, though. The Plasticizer Group also had polychlorinated biphenyls in certain applications.

Q. The polychlorinated biphenyls were for us in in dielectric industry, the ones you had responsibility for?

A. That's correct.

Q. These would be termed process chemicals?

A. No. I said I went to Process Chemicals when I went to the Intermediates Company 2 years before that when I left Fluids. I left the Fluids Group in roughly 1974.

Q. As I understand the process, when a company such as Monsanto makes a chemical to be sold to a customer, the customer has or the customer does dictate the specifications that that chemical must meet before they are willing to purchase it; is that correct?

A. Depends on the applications. There's always a dialogue between the customer and Monsanto to see what we can make and what the customer wants, but we eventually have to agree to his specifications, and he has to agree to ours. It has to be mutual.

Q. If you can't get mutuality, he probably doesn't buy it?

A. You don't sell it.

Q. During the period '63 through 1971 or really through 1974, I think you said, were you familiar with the manufacturing process by which PCBs were made?

A. In general, yes.

Q. If you would, how about taking me through that manufacturing process step-by-step.

A. I can do it in broad outline. I can't do it in detail. Where would you like me to start?

Q. As I understand it, you start with

benzene, do you not?

A. Okay. We started with benzene and in Anderson, Alabama we heated the benzene in a tube, high temperature, absence of any oxygen to generate biphenyls and terphenyls, some quatraphenyls.

Q. Is that known as pyrolysis?

A. Its pyrolysis, the action. You develop hydrogen and biphenyls plus these other isomers that I talked about, other compounds that I talked about. It's then separated, biphenyl is separated.

Q. From terphenyls?

A. And terphenyls and quatraphenyls, and then it was either used in Anniston, in the chlorination process, batch chlorination process or shipped to Krummrich and used in a continuous chlorination process to make chlorinated biphenyls.

Q. Let me stop you right there and ask you, if you will, to draw for me, as best you can, what the molecule of benzene looks like that you start with in that process.

A. Put the carbons in, too?

Q. Yes.

A. (INDICATING).

Q. You have drawn 2 six sided objects?

A. Well, one I just didn't put the carbon atoms in and I asked whether I should or not. It's equivalent.

Q. Tell me what those -- if you would, label them 1 and 2. Just above them so we can keep them straight.

A. They are both benzene, by my notation.

Q. The difference being, one, you did not indicate where the carbon molecules, atoms would be?

A. That's right.

Q. If you would explain the second one. With what you have actually drawn there.

A. I have drawn a ring with 6 carbon atoms in it and 6 hydrogen atoms connected to the carbons.

Q. That is pure benzene?

A. Representation for benzene.

Q. What happens in the process when you heat the benzene in a tube? Can you draw a representation of that and label it 3 as to what comes out of that process?

A. It loses hydrogen. The principal product

is biphenyls but there are some terphenyls, and if I drew another one it might be quatraphenyls.

Q. If you would label that one, the terphenyl, 4. What you labeled number 3 is the biphenyl which I understand is also known to chemists as diphenyl?

A. Yes.

Q. The terphenyl is the representation of 3 of those rings?

A. 3 phenyls together.

Q. The quatraphenyl you mentioned would be 4?

A. Yes.

Q. Is there any other product produced at that step of the process when you create the biphenyls?

A. Some higher tars. Might be, in other words, 4 and 5 and a questionmark.

Q. You call those tars, t-a-r-s?

A. They are known as Montars.

Q. How are the biphenyl rings joined together?

A. Three 2-carbon atoms, separate rings.

Q. Are there carbon atoms at all 6 points on the biphenyl on each of the rings?

A. Yes.

Q. You have indicated that with a C, but basically there are carbon atoms at each of the 6 points?

A. Right.

Q. And 2 of those are joined together, one from each of the 2 rings in the biphenyl?

A. Yes, that is correct.

Q. What is the process known as when you separate the biphenyl from the ter and quatraphenyl and these tars?

A. Distillation.

Q. How do you do that?

A. Heat them in a still and take the biphenyl overhead.

Q. Take it how?

A. Overhead.

Q. Overhead?

A. Yes. It vaporizes and you recondense it.

Q. It is a distillation process?

A. Yes.

Q. What is the next step in creating polychlorinated biphenyls?

A. React with chlorine.

Q. You indicated you did that one way at Anniston and another way at Krummrich?

A. Yes.

Q. Tell me what you did at Anniston.

A. Add chlorine to biphenyl and form chlorinated or monochlor biphenyls plus HCL, the hydrogen chloride.

Q. That is the waste, the hydrogen chloride?

A. Yes.

Q. Where is the chlorine on the biphenyl ring, where would it be?

A. Well, a whole series of compounds was made and a whole series of isomers was made.

Q. Okay.

A. The simplest is mono.

Q. And that would have just one chlorine atom?

A. Yes; and the others would be more highly substituted.

Q. Is one more common than the other?

A. Depends on the degree of chlorination that you went to, how much chlorine you added. There are all sorts of isomers.

Q. I don't want you to draw all of them. As I understand it, there are approximately 209

different isomers that can be created.

A. Could be. I assume that is correct. Theoretically correct.

Q. What would you call -- would you call the last figure you have drawn there, would that be a polychlorinated biphenyl?

A. I would probably label it dichlorobiphenyl.

Q. Di meaning 2 chlorine atoms?

A. 2, but it could be a poly as well.

Q. Poly just means many and di means 2; or poly means more than one?

A. If we take poly as meaning more than one, this is a polychlorinated biphenyl.

Q. Now, is the bond the same in that particular isomer, if you would label that one -- label that one 3 and label this one 1, 2 and 3. You have them in step one and step 2 with Roman numerals.

What is the bond between the 2 benzene rings at that point, still carbon?

A. Still carbon.

Q. Is there still a carbon at each of the 6 points on the ring?

A. Right.

Q. Is there a hydrogen at each of the 6 points on the ring?

A. No longer.

Q. The chlorine has taken the place of 2 hydrogen atoms?

A. Displaced it, right.

Q. When it displaced it, that is when you created the hydrogen chloride?

A. Yes.

Q. And you have to scrub that from the process?

A. Right. From the off-gas of the process.

Q. The mixture that you have now, what do you call that, when you have all of the isomers together and you finish this process and you scrubbed out the hydrogen chloride; is there a name for that product?

A. A Monsanto name or a generic name?

Q. A generic name.

A. Polychlorinated biphenyls.

Q. It would be a mixture of most of the isomers possible?

A. No. Nowhere near the 209.

Q. Okay. When Monsanto, as I understand it, sold polychlorinated biphenyls to the dielectric

industry they sold a product known as Aroclor 1242; is that correct?

A. Yes. During certain periods of time.

Q. During which periods of time?

A. Well, up to about 19 -- I don't know specifically, but --

Q. In the '70s sometime?

A. Yes. Up until the time when we sold Aroclor 1016.

Q. Let's talk about pre '71. That Aroclor 1242 prior to '71 was sold to General Electric, Westinghouse, Sangamo Electric and other capacitor manufacturers; is that correct?

A. Yes.

Q. As a dielectric fluid?

A. Right.

Q. How do you arrive at Aroclor 1242 from the process you have just described? And I understand that Aroclor 1242 is 42 percent chlorine.

A. Approximately.

Q. But made up of many different isomers.

A. Compounds and isomers.

Q. How would you get to that point?

A. Well, adding a certain amount of

chlorine --

Q. An additional amount of chlorine or --

A. You control the amount of chlorine, the time and the temperature of chlorination.

Q. Okay. That is in step 2, we have been talking about, in the chlorination process?

A. That's right.

Q. If you added the right amount of chlorine, held it at the right temperature for the correct times, then you would come out with a mixture of isomers that would be approximately 42 percent chlorine; is that correct?

A. Yes. Right.

Q. You said there might be other compounds in there. What would they be?

A. I didn't say that there were other compounds, that I know of. What compounds were these?

Q. I don't know. I said awhile ago it would be a mixture of those isomers, and I thought you said those isomers and other compounds.

A. Well, compounds I would call the dichlor compounds and the -- di, tri and so forth, different compounds. I would call isomers all the di's and the tri's and so forth would be isomers

of dichlorobiphenyl or trichlorobiphenyl.

Q. In your experience with Monsanto Company from 1963 to '71, is it true that in large chemical processes waste materials are created, as a general rule?

A. Waste products are created. Sometimes they are called byproducts, sometimes they are waste products.

Q. Would there be any benzene left after this step when you had created the diphenyl, would there be any just benzene atoms in that product that weren't biphenyl?

A. By the time it got through distillation it would be very low. I don't know the analytical amounts, but they would be extremely low.

Q. Could it be as high as low parts per million?

A. I don't know how many parts per million.

Q. Isn't it in true in either the late '60s or early '70s Monsanto tested its polychlorinated biphenyls to see if they contain a product called -- a byproduct called polychlorinated dibenzofurans?

A. We probably, on occasion, tested for that compound.

Q. In the late '60s?

A. I don't know specifically, but probably.

Q. Were they found?

A. They were not found at that time.

Q. Were they ever found?

A. My understanding is they were found sometime after I left the group. Sometime after '74.

Q. What range were they found in, amount?

A. Parts per million.

Q. Were you involved in the first testing where they were not found?

A. I was not directly involved although the analytical people were paid out of my budget.

Q. Was that a Dr. Keller?

A. That's right. His group, Applied Science Group, did most of the analytical testing for it.

Q. Did they remove the dibenzofurans when they found them?

A. They probably isolated them in an analytical way if they found them, but they couldn't find them at that time.

Q. Do you know why they couldn't find them at that time?

A. No.

Q. Isn't it true that you can't make polychlorinated biphenyls in a great enough quantity to sell commercially without creating some polychlorinated dibenzofurans?

A. We looked analytically to see if we made any of the polychlorinated dibenzofurans and we did not isolate or find them at that time.

Q. And you don't remember what date that test took place?

A. You would have to look at the record, analytical records. I don't recall.

Q. Dr. Keller did the testing, as you recall?

A. People that worked for Dr. Keller. He was the Manager in charge of Applied Science.

Q. Do you know when they were found, what year they were found in the product?

A. I think you should go back to somebody that had direct contact during that time. I left the Fluids Group before that time.

Q. And you left it in '74, I believe?

A. Roughly, yes.

Q. And you don't recall what level, in the late '60s, they were looking for, what analytical capability they had at that time?

A. It was parts per million on the sensitivity they had. You would have to check the exact numbers with analytical people.

Q. How were polychlorinated dibenzofurans created when you create polychlorinated biphenyls, what happens in the process?

A. I actually don't know how they are created, if they are created. But I have been forced to speculate on how they might be created.

Q. If you have an idea I would like for you to share it with me.

A. The only thing I can say is oxygen must, in some form, be present.

Q. And if it is present what happens? Does it happen in the chlorination step or does it happen in the step --

A. I couldn't honestly tell you, I don't know.

Q. And it's your testimony you don't remember what level they were found at by Dr. Keller after you left Fluids?

A. That's right. I was not concerned at that time.

Q. Is it possible that they could be created at either the paralysis step or the chlorination

step?

A. It's theoretically possible that that is true.

Q. Is it possible that dibenzodioxygen could be created in either of those steps, through the manufacturing process of polychlorinated biphenyls?

A. Much less likely.

Q. But it's yet possible?

A. You can draw a reaction that might indicate that you could, but it's very much less possible because you have to split a carbon carbon bond in some way and add more oxygen. Much more difficult.

Q. What if you took Aroclor 1242 and set it on fire and just burned it out in the open, out in an open field?

A. I think that's been done. I don't have direct knowledge of that. Ask somebody who has really done the analytical work on it.

Q. What if you mix Aroclor 1242 and trichlor benzene and burn that mixture in an open field?

A. Again, I have no direct knowledge of that.

Q. Did the process for making

polychlorinated biphenyls change at any time between 1963 and 1974 when you left the Fluids Group?

A. Did the process change?

Q. Yes.

A. Basic process remained always the same. Chlorination was continuous. Chlorination was put in before '63 and remained the same at Anniston. There were no major changes. In fact, I can't think of minor changes either.

Q. The work that Dr. Keller did on polychlorinated dibenzofurans, was that done on a batch basis from Anniston or was that done from the Krummrich plant?

A. I don't know. You would have to look at the analytical results. He might have done both.

Q. Can you give me any reason he would have found polychlorinated dibenzofurans in '74, but not the late '60s when he looked at them, if the process remained basically the same?

A. I'm not sure he found them before '74.

Q. After '74?

A. Say it again, please.

Q. Can you give me any reason why, if the process for making polychlorinated biphenyls

remained the same from 1963 through 1974, why he would have found polychlorinated dibenzofurans after '74 and he didn't find them in the late '60s?

A. If the process remained the same from '63 to '74 you said?

Q. Yes.

A. Why didn't he find them at that time?

Q. Yes.

A. And what was the other part of the question?

Q. What I'm asking you basically is the process, as far as you know, remained the same from '63 until, really, Monsanto quit making polychlorinated biphenyls, did it not?

A. Until we sold Aroclor 1016.

Q. How did that change the process?

A. What we did was we built a fractionation column and fractionated out the more highly chlorinated isomers, five chloro and six chloro containing isomers so that the environmental hazards would be mitigated and we retained -- put less monochlor and dichlor in there so we had a narrower cut.

Q. Cut it on both ends?

A. Cut both sides.

Q. And went to the middle?

A. And went to the middle to try to get the fire resistance the dielectric people, the transformer people wanted without putting a load on the environment, which was mainly in the five and six chlorinated materials.

Q. How would the fractionated step work when you fractionated those out?

A. By distillation and in a column, a packed column, probably, tall column, carefully controlled temperature.

Q. Let me ask you this question: Do you know which Aroclor Dr. Keller found PCDFs in?

A. Not specifically.

Q. Do you know it was 1016?

A. I don't think it was, but I don't know that.

Q. Let's assume it wasn't 1016, it was 1242 or 1254, and go back to my original question. What I'm asking you is: Can you think of any reason if the process by which polychlorinated bifenyls was made did not change between 1963 and the time Dr. Keller found polychlorinated dibenzofurans, why did he not find them in the

late '60s? That's my question. Can you assign a reason to that?

A. He looked with the best analytical methods he could and he knew, and the best equipment he could it get hold of, and he didn't find them during that period.

Q. Are you saying, then, the analytical equipment improved between the late '60s and when he did find them?

A. You might make that assumption, but I think you have to go back to the people that actually did the experiments and analytical work.

Q. And ask them?

A. And make sure that is the case.

Q. Is that your assumption?

A. I didn't have to make an assumption on this, and I'm not going to. I think you should go back to the analytical people and make sure that the methods were either more sensitive or accurate in later years.

Q. Let me ask this question: If the analytical method was more sensitive and they were found in the later years, would it be your understanding that they were also present in the earlier years, but just couldn't be detected?

A. You might make that assumption, yes.

(DISCUSSION OFF THE RECORD).

Q. If I understand your testimony correctly, there were no major changes or improvements in the process by which polychlorinated biphenyls were made between 1963 and when the company stopped making them, I guess in '77?

A. Tried to keep the process pretty much the same and make electrical grade, electrical grade --

Q. Dichlor -- I mean Aroclor?

A. Aroclor, yes.

Q. Isn't it true that the electrical industry did not want pure polychlorinated biphenyls but instead wanted a consistent polychlorinated diphenyl?

A. They wanted, I suppose both, but it was more important to keep the quality the same than it was to --

(DISCUSSION OFF THE RECORD).

Q. Is it fair to say that nobody tested the polychlorinated biphenyl made by Monsanto to see if it had polychlorinated dibenzofurans in it prior to Dr. Keller's attempt in the late '60s?

A. That is probably correct.

Q. So, there's no way you could say how much PCDF, polychlorinated dibenzofurans, were in the product during the early '50s -- I mean late '50s and early '60s?

A. That is before my time. You'd have to check with the records. Ellen Berger or somebody.

Q. If nobody tested for them you can't say how much was there?

A. I can't say what happened before 1963.

Q. How about between 1963 and the time Dr. Keller first made his attempt to determine the level?

A. We did not test other than what would be in Keller's group during that period.

Q. So, my point is nobody would know what level of dibenzofurans were present prior to that?

A. Prior to '63 they might have tested, I don't know that.

Q. Is it true that the more oxygen that might be accidentally introduced into either of the 2 steps the more likely and the greater the amount of the PCDFs that might be created in the process?

A. That might be true.

Q. Getting back to the electrical industry, is it true that the electrical industry rather than wanting perfect PCBs, actually wanted a consistent low level of contamination in the Aroclor?

A. They wanted a product which was uniform and had electrical properties that were meeting specifications.

Q. That didn't answer my question. Is it true that they did not want perfect polychlorinated biphenyls, but they wanted consistently low levels of contamination in --

A. I must repeat. As far as I know the dielectric industry wanted product to be consistent and to meet specifications.

Q. To meet specifications would it have low levels of contamination in it?

A. You couldn't have very much in the way of impurities in that and still meet the specification.

Q. Your answer is no? They did not want low levels of contamination?

A. I didn't say that.

Q. Well, let's go at it again, then.

A. All right.

Q. Isn't it true that the electrical industry did not want pure polychlorinated biphenyls, but they wanted polychlorinated biphenyls that had low levels of contamination in them?

A. I'm not sure that they wanted low levels of contamination. What sort of contamination are you talking about?

Q. The kind of contamination you and I talked about in this process.

A. The only thing I can say is the dielectric industry, I can't speak for them, I know, they wanted us to make consistent product and meet their specifications.

Q. Let me ask you the question this way, then: Did your batches of polychlorinated biphenyls that met their specifications have low levels of contamination in them?

A. What do you mean by contamination; ionic contamination?

Q. Any kind of contamination you had in it. You made it. When it met their specs did it have low levels of contamination in it?

A. Ionic purity in it?

Q. Low levels of contamination, as the

converse of the statement.

A. The word contamination puzzles me.

Q. Would it meet their specs if it didn't have any polychlorinated dibenzofurans in it?

A. Yes.

Q. Would it it meet their specs if it had parts per million of polychlorinated dibenzofurans in it?

A. I'm not sure of that.

Q. Did they ever reject any because it had low levels of polychlorinated dibenzofurans in it?

A. Nobody knew we had any and we didn't know we had any chlorinated dibenzofurans from '63 through '74. It was not an issue.

Q. I understand it wasn't an issue.

A. When you can't analyze for it and you don't know it's there --

Q. I'm not trying to get into that argument with you. What I'm trying to -- my point is that you found them when you got the analytical capability. Your process had not changed.

A. You will have to -- from '74 on when they found it you will have to talk to people that were in charge of the operations.

Q. Do you know of your own knowledge whether

the process was substantially changed after you left in '74?

A. I don't know that it was changed. I don't know that it was not changed. I don't think it was changed.

Q. You don't think it was?

A. I was not in charge of the operation, I was not directly connected with the plant or the research during that time.

Q. I understand that. But my point is: If it wasn't changed and the analytical capability was finally developed and you found low levels of polychlorinated dibenzofurans in the polychlorinated biphenyls being made by Monsanto, isn't it a reasonable conclusion that the batches that had been made prior to the batches where the PCDFs were found also contained PCDFs?

A. If everything you assumed was true the final assumption might be right.

Q. Haven't you testified to that?

A. I haven't testified I know what happened from '74 through the time that the analytical procedure was whatever; improved, by your thought.

Q. You told me that you didn't think the

process changed substantially?

A. I said the -- I said manufacturing during -- from 1963 through '74, when I was in charge of it, did not change substantially. I didn't testify what happened after 1974.

Q. I asked you do you know that it changed after '74?

A. I don't know. I don't think it did, but I don't know that.

Q. That was my thought. You didn't think it did. I said if you assumed that it didn't isn't it reasonable to assume there were PCDFs --

A. If you wanted to make all those assumptions then that was true.

Q. Did Monsanto ever make a batch of PCBs that didn't have contamination or impurities in it?

MR. GEDDIE: By impurities do you mean PCDFs?

A. Any impurities. We talked about a number of impurities.

A. You have to define contamination and impurities. If you do that --

Q. Can you tell me that you ever made a batch of PCBs that contained only the 2 hundred 9

isomers possible to make in that process and nothing else?

A. We would analyze for what we could during that time. I don't know what the -- impurity levels were so low we didn't detect any known compound we could identify.

MR. MARION: When you talk about PCBs would contain something other than 209 isomers are you defining that to be impurities?

Q. Yes. Anything other than the 209 isomers.

MR. MARION: I certainly didn't understand.

Q. Did you ever make a batch that didn't contain anything other than the 209 isomers?

A. You must understand if you meet electrical resistivity, dissipation factors and electrical properties, that this is a very sensitive detection and during those times probably analytical methods would be very difficult to identify other compounds in there that were at this level. We looked for other contaminants in products and so forth, but I don't know that there were any things -- maybe sodium chloride, calcium chloride, things like this,

water.

Q. Did your group handle PCBs, polychlorinated biphenyls, in their everyday duties?

A. Some of them did and some did not.

Q. What precations did they take in handling them?

A. Normal precations. Don't get it on your clothing, or if you do, wash up. Use -- in heating use hoods. Electrical properties, the material was handled in brown bottles. That's about it. Clean up spills. Be careful. Later on, of course, there were all sorts of disposal methods put in place to make sure it didn't go down the sewer and so forth.

Q. At some point in time it became known PCBs were accumulating in the environment, did it not, in the '70s?

A. Right. Late '60s, really.

Q. Is it true that PCBs, as industrial products, weren't intended to be placed into the environment in the first place?

A. For the most part that is true. There was one application, NCR carbonless paper that got wide distribution, but the fluids were not

obviously -- were not intended to reach the environment.

Q. Were you involved at all in the toxicity warnings that would accompany the products, the PCB?

A. No, that wasn't my area of responsibility.

Q. That was the Medical Department?

A. Marketing. Maybe Legal.

Q. Do you know whether or not the company informed their customers of the toxicity information they had with regard to PCBs?

A. In a general way I knew that. You have to ask the Marketing and Medical and Legal people.

Q. Can you draw on that piece of paper for me what a dibenzofuran looks like?

A. As I testified before --

Q. Make that 3, if you don't mind.

A. I'm not an expert on dibenzofuran chemistry. Is that what you would like me to draw, though, dibenzofuran?

Q. Yes. Indicate the carbons and the hydrogens, if you will, on that drawing, if possible.

A. (INDICATING).

Q. You have indicated the carbons are at the 6 points?

A. Right.

Q. And you indicated an oxygen bond between the 2 rings as opposed to a carbon bond?

A. Both. One carbon bond and one oxygen bond.

Q. What would happen if chlorine were added to the dibenzofuran? Say 2 chlorines.

A. Just add chlorine. I would expect that you would get substitutions. I don't know where.

Q. That substitution would occur chlorine for what?

A. Presumably chlorine for hydrogen. You are asking me about an area that I don't actually know.

Q. Now, where are the hydrogens on the dibenzofuran that you have drawn next to number 3, are they at points --

A. The points not occupied by chlorine on these rings. And they are not there, not in that (INDICATING).

Q. Do you know how dibenzofuran would be created if there was oxygen in the pyrolysis step,

introduced into the pyrolysis step, what would be the nature of the change that would occur to the -- would it occur to the biphenyl molecule or would it occur independent of the biphenyl molecule?

A. I don't know the answer to that. It could -- I suppose theoretically it could be either one.

Q. It could be 2 benzene molecules uniting with the oxygen?

A. 2 benzene molecules to form diphenyl oxide.

Q. No. What you do in the pyrolysis step, you are bonding together 2 benzene molecules; is that correct?

A. Correct. Okay.

Q. And so what I'm asking you is: If you created a dibenzofuran in that step would it be a reaction of oxygen and 2 independent benzene rings or would it be oxygen reacting with the biphenyl after it's formed?

A. Well, I would think that if it did, I don't know that it did --

Q. Okay.

A. -- it would be more likely it would react

with the biphenyl than it would the benzene.

(RECESS).

Q. At the 2 steps you indicated in the manufacture of polychlorinated biphenyls is there heat applied in each of those steps?

A. In the biphenyls, yes, there's heat applied.

Q. What temperature does it reach in step one? I know it's different depending on what --

A. It's really hot. I don't know. 8 hundred degrees, something like that.

Q. What about step 2, the chlorination step?

A. Much more mild. I would say, oh, 150 centigrade, something like that. Maybe less.

Q. In the distillation step which follows the step where the biphenyl is actually created, what would the heat be in that step?

A. I don't know exactly. It's under a vacuum.

Q. Not necessarily 8 hundred C?

A. Nowhere near that. I don't remember.

Q. Would it be in the hundred C range?

A. Something like that, probably.

Q. Now, Monsanto also sold a product known as Aroclor 1254; is that correct?

A. Correct.

Q. And that was approximately 54 percent chlorine by weight?

A. Right.

Q. You mentioned that at some point the company made a product that I believe was known as MSC or MCS 1016?

A. It was initially known as MCS, Monsanto Chemical Sample 1016 and later called Aroclor 1016.

Q. What is the difference between that and Aroclor 1242?

A. We described it earlier, a narrower cut.

Q. So it would biodegrade?

A. It would be more diodegradable and retain fire resistance and --

Q. Was it to replace Aroclor 1242?

A. Yes, in the electrical --

Q. You mentioned when Dr. Keller ran his tests to try to find the PCDFs we discussed, analytical records were created. Have you seen those records?

A. Not recently.

Q. Have you seen them in the past?

A. I don't know whether I actually saw them

or not.

Q. Do you know of your own knowledge they were created?

A. The memos would undoubtedly be somewhere.

MR. BONDS: I don't think we have seen those. We would like to see them.

MR. MARION: I will look into it.

MR. BONDS: Thank you.

Q. Do you know where they are today?

A. I don't know.

Q. Do you recall having your deposition taken on April 16, 1987 in a case entitled Cecil Scott against Monsanto Company?

A. Correct.

Q. I have only one copy of this, so what I will do is I will read you a portion of it and I want you to look at it and tell me whether or not that was your testimony on that day.

The first portion I will read starts on page 104 at line 3. And it is discussing the chlorination process.

The question is: Are there any impurities that are generated in that process?

And your answer was: There's HCL.

The next question: That's hydrogen

chloride gas?

Your answer: Hydrogen chloride gas.

Q. Anything else?

Your answer: 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 '70 -- late in the '70s -- I shouldn't say late in the '70s, but late in the '60s, early in the '70s.

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 are 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.

I will ask you if you take a look at that. I have it somewhat marked. Beginning on line 3.

(Plaintiffs' Deposition Exhibit Number 1 mark'd for identification).

Q. Did you read it?

A. Yes.

Q. Do you recall that as your testimony on that occasion?

A. It must be.

Q. Have you read that deposition since it was taken?

A. I read it.

Q. You have?

A. Yes.

Q. Did you sign it?

A. Yes.

Q. Before you testified here today have you reviewed any documents?

A. Have I reviewed any documents?

Q. For this deposition.

A. A few, yes.

Q. Can you tell me what they were?

A. A memo I wrote in about 1968.

Q. What did the memo concern?

A. With regard to research strategy for dealing with the environmental problem of polychlorinated biphenyls.

Q. Did it involve PCDF?

A. To my knowledge, no.

Q. What else?

A. A strategy in a little more detail that was a Committee's report presumably done by Wheeler and myself, Bob Keller, and I don't know who else on that Committee, but I reviewed that. Looked at an article -- at a memo to me from Munch.

Q. What did that have to do with? Did it have to do with outlawing of Aroclor 1016 or MCS 1016?

A. I don't know. Maybe a couple others. I didn't review too much.

Q. Did you review anything that had to do with polychlorinated dibenzofuran?

A. No. I think not.

Q. Prior to the deposition in the Scott case, did you review any documents other than the ones you mentioned to me?

A. Yes, there were other documents. I don't recall specifics.

Q. Would they have had anything to do with polychlorinated dibenzofuran?

A. No.

Q. I will go now to page 123 of your deposition in Scott and read several lines beginning at line 12 with the question:

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 -- they wanted --

Strike that. Your answer was:

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?

At that point there's an objection by your counsel and the question, a different question is asked. I will skip to line 10, through the objection.

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 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 billion?

A. Yeah.

A. One part per million it should be.

Q. What did I say?

A. Billion. I don't know if it reads that.

Q. You are right. That is line 20 and it reads ten to the minus six is one part per

million. On page 125.

Is that substantially correct?

A. Yes.

Q. You can't say that the PCBs that were produced by Monsanto for use as a dielectric in the electrical industry from 1963 to 1974 didn't contain PCDFs, can you?

A. All I can say is we did not detect it at the sensitivity level of our analytical methods at that time.

Q. You tried to detect it with those analytical methods?

A. I testified I didn't know exactly when it was tested, but during that period. You would have to get the record.

Q. So, is it fair to say they could have been there, but below your detection limit; is that correct?

A. You said that. Yes. You said that.

Q. I said it. Are you going to agree with it or disagree with it? Is that fair to say?

A. I repeat that the only thing positive that can be said is that we did not detect it by our best analytical methods during that time period.

Q. From '63 to '74?

A. Right.

Q. My question then is: It could have been there below your detection limit for all you know; is that correct?

A. Yes.

MR. BONDS: No further questions.

CROSS-EXAMINATION

QUESTIONS BY MR. GEDDIE:

Q. My name is Gray Geddie and I represent Sangamo-Weston. I have a few questions I would like to ask you.

In the examination by Mr. Bonds on the Scott deposition, many of the questions contained the word "contaminant" and there was an implication that contaminant meant only PCDF.

Does the word contaminant in that deposition, as you understood it, include substances other than PCDFs?

A. Yes.

Q. What would some of those be?

A. Might be biphenyl, might be water, might be inorganics, inorganic compounds, might be

HARTOLDMON0009019

ionics. Unknown.

Q. Did you or Dr. Keller run any test on these other contaminants?

A. Yes. They were part of the specifications. We always had some contaminants. We always had some, probably, HCL, probably had iron salts.

Q. To summarize, there are any number of contaminants other than PCDFs that would have been included in that definition of the word contaminant?

A. Contaminant is a very broad word. We tried to define it a little bit here. We didn't get into it, but contaminants is a very broad word.

Q. Are you aware that Sangamo-Weston is a capacitor manufacturer?

A. Yes.

Q. And you certainly are aware there were other companies in the capacitor business other than Sangamo?

A. That's true.

Q. Was Sangamo a large player in the capacitor industry or was it a relatively small member of the industry?

A. It was a relatively small member.

Q. Who were the largest members of the capacitor industry?

A. General Electric and Westinghouse.

Q. Was General Electric, in fact, by far the largest?

A. General Electric was the largest.

Q. Did you ever see any specifications from Sangamo-Weston, or any other member of the capacitor industry, that called for the presence of PCDFs in your product?

A. No specifications.

Q. Are you aware of any communication between Monsanto and Sangamo-Weston discussing the subject of PCDFs?

A. I'm not aware.

Q. Do you know that in fact there were none?

A. I can't say that either.

Q. Were there European tests done in the late 1960s and early '70s on the presence of PCDFs in PCBs?

A. Yes.

Q. Do you recall the name of a laboratory or the scientist who performed the studies?

A. I think his name was Voss.

Q. Did Dr. Voss analyze Monsanto PCBs for the presence of PCDF at that time?

A. I think he looked for impurities. I don't recall the exact impurity he was looking for.

Q. Did he find PCDFs in his analysis?

A. I think the answer is yes, he did find them in some chlorinated biphenyls.

Q. Did he find it in chlorinated biphenyls manufactured by Monsanto?

A. I think the answer in that case is no.

Q. You mentioned earlier in your deposition that for Monsanto employees working around PCBs that you had certain safety precations they must follow in handling the material. Do you recall that?

A. Yes.

Q. Were these precations also given for other chemicals?

A. True. We had safety precations on other solvents, organics.

Q. Were the precautions for PCBs any more stringent than for the other solvents you used in the manufacturing process?

MR. MARION: Which time frame are you

talking about?

Q. We can talk about during your employment between ,'63 and '74.

A. We had no reason to think Aroclors were particularly toxic. We wanted to use good hygiene and good housekeeping.

Q. Now, you also testified earlier that in your Division, which was the Fluid Group, you sold and marketed PCBs. Were there other groups within the Monsanto Company that marketed PCBs?

A. Yes, the Plasticizer Group marketed polychlorinated biphenyls.

Q. Could you explain what a plasticizer is?

A. Usually a liquid or sometimes a low melting solid which was used to make other polymers more flexible or more adhesive.

Q. Was it used in paints?

A. It was used in paints.

Q. Would these paints be expected to ultimately wind up in the environment, so to speak?

A. If they were leached in a certain way, sure. Yes.

Q. Were these type paints used to paint highways?

A. I don't recall specific applications.

Q. Were there any other groups within Monsanto that marketed PCBs?

A. Other than plasticizers? I think the answer is no.

Q. Maybe I can refresh you. Did the Agricultural Group market them for a while?

A. In some sort of agricultural spray or something?

Q. Pesticide or herbicide.

A. I'm not familiar with that application, I don't know.

Q. Now, Dr. Richard, were you in charge of the development of an alternative fluid for PCBs?

A. Yes.

Q. I want to hand you a memo dated September 9th, 1969 that appears to be authored by you and ask you if you recognize that document?

A. Yes.

Q. Is that your signature on the last page?

A. My initials, yes.

(Sangamo Deposition Exhibit Number 1 mark'd for identification).

Q. Dr. Richard, if you will forgive me I will look over your shoulder. Over on page 5 of

that memorandum there's a discussion of capacitor fluids and a basic description of the capacitor products. Do you recall that, sir?

A. Okay. Yes.

Q. All right. Does this date mark the beginning of Monsanto's attempts to develop an alternative dielectric fluid September 9th of 1969?

A. I don't know whether that is an exact date, but that could be the -- it's around that time. It might have been a little before, might be a little after. In that time frame, let's put it that way.

Q. At least from that time forward Monsanto embarked upon a research effort to develop an alternative fluid?

A. Yes.

(Sangamo Deposition Exhibit Number 2 mark'd for identification).

Q. Dr. Richard, in 1969 was there an alternative fluid available to the use of PCBs as a dielectric fluid?

A. There was no direct replacement. Mineral oil had been used previously, but it was not the same. There was no direct replacement at that

time.

Q. All right. Let me now show you what's been marked as Sangamo Exhibit 2, which is a memo from a Mr. R. H. Munch to you dated November 6, 1969. It's entitled New Dielectric Fluids.

A. Okay.

Q. Do you recall this document?

A. I have seen it.

Q. Does it describe the early efforts to develop a new dielectric fluid?

A. This is a letter from Dr. Munch to me describing his thoughts about how to develop such a new fluid.

Q. From that memorandum was the 1016 fluid developed?

A. Yes. And others, too.

Q. All right. Did Monsanto ever commercially produce a dielectric replacement for PCBs, Aroclors?

A. Would you say it again? Did we commercially produce? We produced Aroclor 1016 commercially.

Q. Aroclor 1016 still contained PCBs, did it not?

A. It did.

Q. And what was the difference between 1242 and 1016?

A. The principal difference was it contained fewer amounts of monochlor biphenyl and considerably less amounts of 5 chlorinated and 6 chlorinated isomers and compounds of Aroclor, chlorinated biphenyl.

Q. Was it more biodegradable than 1242 fluid?

A. Yes, more biodegradable in the total composition, yes.

Q. When was this 1016 fluid placed in commercial use?

A. I don't recall exactly. I think in the early '70s. You would have to get the exact dates of introduction of MCS and the introduction dates of the Aroclor 1016.

Q. If I were to suggest the year 1971, would that refresh your memory?

A. That is approximately right.

Q. So, once 1016 was introduced commercially is it fair to say 1242 was no longer sold commercially?

A. 1242 was not sold for electrical uses after that. In other words, 1016 replaced 1242 in

the electrical business.

Q. Did Monsanto --

A. I should say capacitor business, too.

Q. Did Monsanto continue its research efforts to develop a non-PCB dielectric fluid?

A. Yes, we did.

Q. Did Monsanto ever produce commercially a non-PCB dielectric fluid?

A. I don't think we ever produced it commercially. We produced development quantities of a fluid or fluids.

Q. Do you recall the identity of those fluids?

A. The chemistry involved was sulfones, aromatic sulfones and aromatic -- alkyl aromatic hydrocarbons, blends of those two components.

Q. Does that particular fluid have a numerical designation?

A. I'm sure it did. I don't recall the exact numerical designation. Probably MCS numbers and we would have to look at the MCS number.

Q. Does the number MCS 1238 refresh your memory?

A. If MCS 1238 were samples to the capacitor people then MCS 1238 is a blend of aromatic

sulfones and alkyl aromatics.

Q. All right. Do you know if this PCB-free substitute was sent to Sangamo-Weston?

A. Specifically I don't have that information.

Q. Why was it not commercially produced?

A. The commercial decision not to produce was after I left, so -- when I was there we were developing that fluid for our potential replacement product.

Q. Was it a difficult job to develop a PCB-free alternative as a dielectric fluid?

A. Yes. We didn't know how to do it for a long time and we never did get a fully replaceable product, we didn't get the fire resistance that was in the chlorinated products. There was another step in this thing that is important and that is we were aiming for a product with the same dielectric constant or higher than Aroclor 1242 or Aroclor 1016 had, and the sulfones were the only class we came up with which came close to that criteria -- criterion.

MR. GEDDIE: That's all.

CROSS-EXAMINATION

QUESTIONS BY MR. MARION:

Q. Earlier you mentioned -- you were asked about studies of Voss, I believe.

A. Yes.

Q. And Voss analyzed PCB-containing compounds from other manufacturers through the world?

A. True. He had some from Europe, I know. I don't know about the Japanese.

Q. The Japanese produced one, I think "Kanaka"?

A. Yes.

Q. And there were several producers in Europe?

A. Yes.

Q. You were asked questions about your testimony from the case, I believe the Scott case. Did you make changes in your testimony once the form was sent to you?

A. I made minor corrections, spellings and things like that.

Q. Do you see those corrections on here (INDICATING)?

A. No. I don't see any corrections from

me.

MR. MARION: Thank you.

REDIRECT EXAMINATION

QUESTIONS BY MR. BONDS:

Q. Would those corrections you made substantially change the nature of the excerpts I read to you, and your answers?

A. The answer is no.

Q. Is it my understanding that Monsanto also manufactured poly chlorinated biphenyls in Europe; did they not?

A. Yes.

Q. Did Dr. Voss test European and/or United States poly chlorinated biphenyls?

A. My understanding is he tested U.S. and European.

Q. That was in the late '60s; is that correct?

A. Probably late '60s or early '70s.

Q. It's your understanding he did not find any PCDFs in either Aroclor 1254 or 1242?

A. I have not reviewed the article recently, so I can't answer the question.

Q. When the word contaminant was used in the Scott deposition, the excerpts I read to you, did you feel the word, at that time that you gave the testimony, included poly chlorinated dibenzofurans as well as the other contaminants you and Mr. Geddie spoke about?

A. Counsel in that area introduced the notion of dibenzofurans by having me draw a structure and then continued to hammer at that point.

Q. I'm talking about contaminants.

A. Right.

MR. BONDS: I don't have anything else.

COMES NOW THE WITNESS, Dr. William R. Richard, Jr., and having read the foregoing transcript of the deposition taken on the 9th day of June, 1987, acknowledges by signature hereto that it is a true and accurate transcript of the testimony given on the date hereinabove mentioned.

_____

Dr. William R. Richard, Jr.

Subscribed and sworn to me before this _____ day of _____, 1987.

My Commission expires: _____

_____

Notary Public

State of Missouri)
) SS.
City of St. Louis)

I, THOMAS A. GORE, a Notary Public in and for the State of Missouri, duly commissioned, qualified and authorized to administer oaths and to certify to depositions, do hereby certify that pursuant to Agreement in the civil cause now pending and undetermined in the United States District Court for the District of South Carolina, Anderson Division, to be used in the trial of said cause in said court, I was attended at the Marriott Hotel, Airport, in the County of St. Louis, State of Missouri, by the aforesaid witness; and by the aforesaid attorneys; on the 9th day of June, 1987.

The said witness, being of sound mind and being by me first carefully examined and duly cautioned and sworn to testify the truth, the whole truth, and nothing but the truth in the case aforesaid, thereupon testified as is shown in the foregoing transcript, said testimony being by me reported in shorthand and caused to be transcribed into typewriting, and that the foregoing pages correctly set forth the testimony of the

HARTOLDMON0009034

aforementioned witness, together with the questions propounded by counsel and remarks and objections of counsel thereto, and is in all respects a full, true, correct and complete transcript of the questions propounded to and the answers given by said witness; that signature of the deponent was not waived by agreement of counsel.

I further certify that I am not of counsel or attorney for either of the parties to said suit, not related to nor interested in any of the parties or their attorneys.

Witness my hand and notarial seal at St. Louis, Missouri, this _____ day of _____, 1987.

My Commission expires July 15, 1989.

_____

Notary Public in and for the State of Missouri