IN THE UNITED STATES DISTRICT COURT

FOR THE NORTHERN DISTRICT OF ILLINOIS

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THE UNITED STATES OF AMERICA, :

Plaintiff :

VS. : NO. 78 C 1004

OUTBOARD MARINE CORPORATION
and MONSANTO COMPANY, :

Defendants :

- x

DEPOSITION of E. SCOTT TUCKER, taken on behalf of the Defendant Outboard Marine Corporation, in the above-entitled matter, pursuant to the Federal Rules of Civil Procedure, before Mary B. Richardson, a Notary Public in and for the State of Connecticut, on Thursday, April 15, 1982, commencing at 9:20 a.m., at the offices of AMF, Inc., 689 Hope Street, Stamford, Connecticut.

A P P E A R A N C E S:

For the Plaintiff:

ELIZABETH STEIN, ESQ.
DEPARTMENT OF JUSTICE
Pollution Control Section
Washington, D.C. 20530

For the Defendant Outboard Marine Corporation:

PHELAN, POPE & JOHN, LTD.
BY: ROSEANN OLIVER, ESQ.
30 North LaSalle Street
Chicago, Illinois 60602

And

MARTIN, CRAIG, CHESTER & SONNENSCHEIN
BY: JOANNA C. NEW, ESQ.
115 South LaSalle Street
Chicago, Illinois 60603

For the Defendant Monsanto Company and Dr. E. Scott Tucker:

KIRKLAND & ELLIS
BY: JAMES H. SCHINK, ESQ.
200 East Randolph Drive
Chicago, Illinois 60601

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(The stipulations set forth in previous depositions taken in the above matter will also apply to the deposition of Dr. E. Scott Tucker.)

D R. E. S C O T T T U C K E R,

after first being duly sworn, was examined and testified upon his oath as follows:

DIRECT EXAMINATION BY MISS OLIVER:

Q Would you state your name for the record, please?

A Yes, my name is Dr. E. Scott Tucker, III.

MISS OLIVER: Let the record show this is a deposition of Dr. E. Scott Tucker, taken pursuant to Notice and the agreement of the parties under the Federal Rules of Civil Procedure.

Q Dr. Tucker, you were employed by Monsanto?

A Yes.

Q What were the dates of your employment with Monsanto?

A I began my employment in, I think, mid-year of 1966 and, I think, you will correct me if I am wrong, I was employed there up until, let's see, it would be 1978, July.

Q You are now employed by AMF, Incorporated?

A That is correct.

Q When did you join AMF?

A This June it will be three years. I joined AMF

in 1979, June.

Q Did you work at another place of employment between the time you left Monsanto and the time you joined AMF?

A No.

Q What is your present position with AMF?

A My present position with AMF is that I am Manager of the Molecular Separations Laboratory.

Q Of what?

A The Molecular Separations Laboratory.

MR. SCHINK: Could you spell the last word?

THE WITNESS: S-e-p-a-r-a-t-i-o-n.

Q Have you held that position since June of 1979?

A No, I have not.

Q What was your position when you joined AMF?

A When I joined AMF, I joined as Manager of the analytical support group for the Microflake Division.

Q How long did you work in that position?

A I was in that position for two years.

Q Then, you became Manager of the Molecular Separations Laboratory?

A AMF divested themselves of the Microflake Division at that time. I transferred into corporate research as a

research specialist in December of '81.

Q Could you describe for us briefly your educational background?

A Yes, I have an Associate's Degree from the University of Michigan. I have a Bachelor's Degree from Michigan State University. And I have a Ph.D. from the University of Iowa.

Q What is your Associate's Degree in?

A Science.

Q When did you receive that degree?

A I believe that was in -- let me think for a second -- it would be 1961.

Q When did you get your Bachelor's Degree from Michigan State?

A 1963.

Q And in what?

A Chemistry, Analytical.

Q What is your Ph.D. in?

A My Ph.D. is in Analytical Organic Chemistry.

Q What year did you receive it?

A It was officially given to me in 1967, but I left school in '66.

Q When you left school in 1966, did you find a

position of employment?

A Yes. At that particular time the market was pretty good, so I had my choice, but I chose Monsanto.

Q Have you worked in the field of chemistry or analytical chemistry in any other places besides Monsanto and AMF?

A Well, I wouldn't consider it work, but in graduate school I certainly was in that area.

Q With what companies did you work?

A In graduate school?

Q Uh-huh.

A It was simply the University of Iowa. So to answer your question directly, no other companies.

Q When you joined Monsanto in 1966, what was your job?

A I was hired as a senior research specialist.

Q What did you do?

A Well, I performed -- let's see -- okay, it was as part of the analytical support group for several research groups in the Organic Chemistry Division. And I did analytical chemistry of all sorts.

Q How big was your analytical support group in 1966?

A I believe in 1966 I think around twenty or twenty-five people in the section that I was in.

Q Were those all chemists?

A Yes. I think the professional to non-professional ratio was on the order of two to one, but even the non-professionals were really chemical technicians.

Q Does the number of twenty to twenty-five include the technicians as well?

A Yes.

Q Did you have a group leader?

A At that particular time, I was a senior research specialist and, yes, I did have a group leader.

Q Who was that?

A That was Dr. Robert Keller. Shortly thereafter -- no, Dr. Robert Keller.

Q Were you provided with your assignments by Dr. Keller?

A Yes.

Q Did you initiate or did your group initiate any research?

A Yes. As well as being a service group, we had research function.

Q How long did you hold the position of Senior

Research Specialist?

A I believe three years.

Q In about 1969 did your title change?

A In 1969 I was promoted to Group Leader.

Q You took Dr. Keller's place in effect?

A No, Dr. Keller at that time was Section Manager. As I was going to mention, right after I came to work there Dr. Keller became promoted to Section Manager, if I remember correctly. And I reported to Martin Dietrich for a while, who was the group leader at that time.

Q Do I understand correctly that your support group was part of a section?

A That is correct.

Q What was the section called?

A The section was referred to at that time as Applied Sciences.

Q In 1966, how many chemists were in the Applied Sciences Section?

A I believe I previously stated that the total head count was on the order of about twenty to twenty-five and that the ratio of professionals to non-professionals was roughly two to one. There were no engineers, to my knowledge, in the group at that time. I believe we had some statisticians.

Q Were there other groups within the section besides the analytical support group?

A Yes. As a matter of fact, the Applied Sciences has around four or five groups.

Q What were the other groups?

A There was the analytical chemistry group. There was the spectroscopy group. There was the chromatography group. And then, there was the statistics and then, we had a process chemistry instrumentation group.

Q Did those five groups comprise the entire research section?

A For the Organic Division, yes. Correction, it comprised the entire analytical support group for the Organic Division. The analytical group supported other types of research groups that contained organic chemists, engineers, et cetera. In other words, we supported plasticizers, functional fluids and things of this sort.

Q You were in a division or department called Research and Development, right?

A I believe that is true.

Q Could you tell me in 1966 approximately how many chemists were working at Monsanto in the Research and Development Section or Department?

A I really cannot give you an accurate figure, but there were a lot of people.

Q When you say there were twenty to twenty-five chemists in your group --

MR. SCHINK: No, he said twenty to twenty-five people. Some of them were trained chemists and others were technicians.

MISS OLIVER: You are right.

A If I may, I would like to correct something. It wasn't my group; it was the section that I was part of.

Q Right, that is what I am referring to when I speak of your group. I am not meaning to imply that you were head of the group at that time.

A Thank you.

Q When you told me that there were twenty to twenty-five persons working in your group, including chemists and chemical technicians, would it be fair to say that there were twenty to twenty-five persons in each of the four other groups that you mentioned?

A As I indicated, I really don't know. At that particular time I wasn't very much concerned about the head counts nor administrative functions. You know, I was fresh out of school and I was more interested in science.

Q When you left Monsanto in 1978, were you in the Research and Development?

A Yes, in the Applied Sciences.

Q Can you give me an estimate of how many chemists and chemical technicians were employed in that group when you left in 1978?

A Gosh, I don't know. It would be in excess of 100, I would guess. It depends on how you categorize who reports to whom. They had plant laboratories, et cetera, et cetera.

Q How long were you the group leader for the analytical chemistry group?

A You know, let's see, I believe I took that position in -- I was promoted in 1969 and I believe I held that position until roughly around 19 -- let me think -- '74, '75. Even up to '76. I am not really sure.

Q What was your next job with Monsanto?

A My next job assignment was as a research specialist.

Q In what area?

A Initially in the spectroscopy area.

Q Any other areas?

A Yes, also radochemistry.

Q Any others?

A Not really, no. Those are general enough to cover it.

Q How long were you a research specialist?

A I believe I was a research specialist until my date of termination.

Q And then approximately a two-year period from 1976 to 1978, when you left Monsanto, you worked in the areas of spectroscopy and radiochemistry?

A That is correct.

Q In the period of 1966 to 1969, when you were Senior Research Specialist, what research projects were you involved in that were not connected to a service-type of project?

A Could you state that again? I am sorry, that was a long question.

Q Sure, let me go back a minute. You stated a little earlier that your analytical support group was a service-type group. And I understand that to mean that it, as requested by other parts of Monsanto, other divisions, would provide analytical chemistry work as requested, right?

A That's correct.

Q You also stated that your group performed research

functions as well as service functions?

A That is correct.

Q My question is: What were the research projects that you were involved in?

A Okay, the research for a group such as the one that I was involved in really entailed keeping abreast of the best analytical techniques available that were applicable to the products that we manufactured or that were manufactured by the groups that we supported. In other words, basically new technology, that kind of thing.

Q How would you keep yourself informed of the best available analytical techniques in the period of 1966 to 1969?

A Well, there are a variety of ways. First of all, through the literature. Most professionals spend a great deal of time reading literature and this is where the newer techniques are published. Secondly, through instrument manufacturers. And thirdly, and also with Monsanto corporate research.

Q I take it you read the literature in the period of 1966 to 1969 concerning new techniques?

A I read the literature that I had a professional interest in, yes.

Q What area did you have a professional interest in?

A Initially, when I began working for Monsanto, I was involved in areas like atomic absorption spectroscopy, x-ray emission and emission analysis, spectroscopic analysis.

Q How did you -- strike that.

Did you have personal contact with instrument manufacturers?

A Yes. Two ways. Well, three ways, really, via advertisements and scientific publications, via vendors that visited the research center and via attendance at technical conferences.

Q I would presume that instrument vendors would call on Monsanto and show the latest technology they had and try and sell it to a company as large as Monsanto?

A Correct.

Q Would you meet personally with vendors as they came in?

A Yes.

Q How would you use the Monsanto corporate research people as a way of keeping up to date on the best analytical techniques available?

A The group that I was in was more of a line function.

In other words, we had line responsibility for processes and in support of those people that develop research on those processes.

Q You are referring, when you talk about line, to certain product lines of Monsanto?

A That is correct. Corporate research has a different function. They are not a line function, they are a staff function. As such, they don't really have to justify the types of techniques or new instruments that they purchase on a line basis. They just simply purchase them because they are brand new. For example, they might spend a million and a half for a two-hundred or two-hundred-twenty-megacycle N and R and just investigate it as a technique for what it can do in terms of molecular structure determination. We would never be able to do that type of thing because we couldn't justify it because we didn't have a project from one of our line functions that needed an instrument like that. So, we would utilize them if we ever needed an instrument like that. We would utilize their expertise.

Q Were you located in St. Louis during the entire time you worked for Monsanto?

A That is correct. The St. Louis area. There are

nineteen municipalities in St. Louis plus St. Louis.

Q Were there different Monsanto facilities where you worked over the years?

A Yes.

Q When you joined in 1966 and you worked until 1969, what facility did you work in?

A We were down on their South Second Street facility and it was the old Organic Division research building. It was right adjacent to the Queeny plant.

Q Okay, how long were you at that location?

A I was there until they transferred us to the international headquarters in Creve Coeur, Missouri, and I believe it was in the 1970's that they transferred us.

Q Where was Corporate Research located?

A Corporate Research was located in Creve Coeur at the international headquarters.

Q Am I correct that the Monsanto plant or at least some of them in research had research laboratories?

A Yes, they had support laboratories which were even more of a line function than we were.

Q Would the Queeny plant have a laboratory?

A Yes, it was mainly a QC laboratory, however.

Q Quality control?

A That is correct.

Q Because of your proximity to the Queeny plant, were you called upon more often than other places called upon you to do analytical work?

A Yes. The groups that we supported had processes in the various plants. And when they needed analytical support, we provided analytical support to them.

Q Did you do analytical support work for the Krummrich plant?

A Yes, we did.

Q Did the Krummrich plant have a laboratory as well?

A Yes, they did. They have a quality control laboratory.

Q Are you familiar with the Anniston, Alabama plant?

A Yes, I am.

Q Did you also perform any analytical work for the Anniston plant?

A Yes, I did.

Q Did Anniston have a laboratory?

A Yes.

Q Do you know what type of laboratory they had?

A Very small quality control laboratory.

Q When you say "very small," how many people?

A I would imagine no more than probably two or three. They only had a small number of products at that plant.

Q Two or three chemists working?

A I would say one chemist and probably a couple of technicians.

Q This is in the period from 1966 to 1969?

A That would be my guess.

Q Was that Anniston laboratory smaller than the Queeny or the Krummrich?

A Very, very much smaller.

Q How many people -- strike that.

How many chemists worked at Krummrich in that period from 1966 to '69?

A I really don't know. I would suspicion --

MR. SCHINK: He would have to guess.

A I would have to guess.

Q Could you tell me in terms of, when you say that Anniston was what? Much, much smaller than the Queeny or Krummrich plants, give me an idea of two or three or five times smaller?

A The only way I could relate it would be to say that Anniston, Alabama manufactured roughly two or three

different products, whereas plants like Queeny and Krummrich might manufacture fifty to one hundred different products.

Q There would be more than ten chemists at each of the Queeny and Krummrich plants?

A Yes.

Q Did you visit all the plants during the time you were in the Applied Sciences?

A I visited the Queeny plant, obviously, because it was right next door. I had occasion to visit the Krummrich plant later on.

Q Later on in about what period of time?

A I think around starting -- let's say sometime after 1968.

Q How about Anniston?

A No. No, I never visited the Anniston, Alabama plant.

Q Did you speak with chemists down there on occasion?

A Yes.

Q Do you know whether the Queeny plant in 1966 had a GS instrument or -- I am sorry, strike that -- a GC instrument?

A Yes, they had gas chromatographs.

Q How about the Krummrich plant in the period of 1966? Did they have any gas chromatograms?

A '66 or later, I am certain they had gas chromatographs.

Q When you say "'66 or later," can you tell me whether in the period of 1966 to the period of 1969?

A Yes, they had gas chromatographs during that period.

Q How about the Anniston, Alabama plant?

A I do not believe Anniston, Alabama did.

Q Do you know what the gas chromatograms were used for at the Queeny and the Krummrich plants?

A They were primarily used as quality control instruments. They were gross rough instruments. They used thermal conductivity detectors, TC detectors, and they may or may not have had the more sensitive flame ionization detective systems.

Q How would those instruments be used for quality control?

A To determine the percent of purity in the product before it was shipped or something of that sort. Gross analysis, there is a 99.8 percent para zylene or whatever.

Q You mean whether a product has 99 percent of some substance that it is either supposed to have or not have?

A That is correct. It was a quality control function. In other words, is the product we are manufacturing the same as the product we were manufacturing before, et cetera, et cetera, on a gross level.

Q Do you know what instruments or how the Anniston plant performed quality control functions if it didn't have a gas chromatogram?

A No.

MR. SCHINK: Chromatograph.

MISS OLIVER: Gas chromatograph, I am sorry.

Q Did you have communications or contact with Monsanto customers during the period of 1966 to 1969?

A Not any contacts that I can distinctly remember. I may have. It wasn't a general policy for research people to directly work with customers unless they were working with their research laboratories. Generally, we worked through the marketing people or through the sales people or through the process research people who were directly involved with the customers.

Q Do you know when the Anniston, Alabama plant got a gas chromatograph in its laboratory?

A I don't remember the specific date, but, yes, I have knowledge when they got one.

Q Can you tell me approximately when that might have been or when it was?

A I would have to guess.

MR. SCHINK: You don't have to guess.

Q It was after 1969, I take it?

A I would think so.

Q Do you know why it got a gas chromatograph?

A Yes.

Q Why was that?

A To do PCB analysis.

Q Was the Anniston plant not capable of doing PCB analysis without a gas chromatograph?

MR. SCHINK: I object to the form of the question unless you clarify what you mean by "PCB analysis."

Q Dr. Tucker, what do you mean by "PCB analysis"?

A I meant residue analysis of environmental samples for very low levels of polychlorinated biphenyls, parts per billion, parts per trillion levels.

Q Was the Anniston plant not capable of doing PCB analysis for environmental samples before obtaining the gas

chromatograph?

A No.

Q To your knowledge was the --

MR. SCHINK: Could you clarify that? Do you mean, no, it was not capable of doing it?

THE WITNESS: No, it was not capable of doing it.

Q Was the Anniston, Alabama plant capable of analyzing environmental samples to find PCB's in parts per million levels before obtaining the gas chromatograph?

A No.

Q Was the Anniston, Alabama plant capable of finding PCB's in parts per million levels in samples in which it knew that PCB's would probably be present?

A No.

Q Do you know what equipment the Anniston, Alabama plant had before it obtained the gas chromatograph?

A No, but I know they didn't have a gas chromatograph.

Q In your opinion the only way to analyze for PCB's in samples is with a gas chromatograph?

MR. SCHINK: Do you mean just a gas chromatogram or a gas chromatogram in conjunction with others?

MISS OLIVER: Well, he has just been talking about a gas chromatogram.

A A gas chromatograph isn't an instrument for detection of anything; it's very simply a instrument for separating components that are volative in the sample in question. In conjunction with the gas chromatograph, one needs a system of some sort to detect and get some idea of what the identity of the materials coming through the gas chromatograph after they are separated are.

Q Is it your opinion then, Dr. Tucker, that a gas chromatograph, the use of the gas chromatograph by itself without another instrument attached to it or connected with it would not enable you to, in the period of 1966 to '70, be able to identify PCB's in the sample?

A What kind of samples?

MR. SCHINK: We are talking about environmental samples?

MISS OLIVER: Yes.

A Yes.

MS. STEIN: I am sorry, can I hear the question again?

(The record was read back.)

A And I said yes.

Q Dr. Tucker, just so we understand each other, what do you mean when you refer to environmental samples?

A Without being facetious, samples that are taken in the environment; soil, water, air, any kind of avian, aquatic, animal type samples.

Q Do you include in that effluent samples?

A Effluent samples are certainly in the environment, but they are a specialized type of sample.

Q Did you include in your answer, referring to the ability or capability of the gas chromatograph, environmental samples, did you include effluent samples?

A Yes, in answer to your earlier question.

Q Dr. Tucker, what instruments were available with the gas chromatograph which would enable it to identify PCB's in the environmental samples again in the period of 1966 to 1970?

A 1966 to 1970 the prime detection system available for a gas chromatograph for the detection of chlorinated hydrocarbons was an electron capture detector.

Q Dr. Tucker, did your laboratory in 1966 have a gas chromatograph?

A Yes.

Q Did it have the electron capture detection device

associated with it?

A At that time the detection systems that were primarily used with the gas chromatograph were thermal conductivity and flame ionization detection. I am not exactly sure when electron capture had been purchased, but I don't think it would have been used or installed on that instrument.

Q In 1966?

A That is correct.

Q Let's go back, were the gas chromatographs that were available to you in 1966 with the accompanying detection instruments capable of identifying PCB's in an environmental sample?

A No.

Q When I refer to identifying, I am not -- I don't mean quantifying.

A I understand that.

Q And your answer is no?

A My answer is no.

Q Were the gas chromatographs that were available to you in 1966 up to the time that your electron capture detective device was installed not capable of separating the various chemicals within a sample so as to be able to

detect PCB's if they were present?

A Well, first of all, separation and detection are two different things. The gas chromatographs were capable of separating most volative constituents that could be introduced into it depending on the type of column that you used.

Q Why could the gas chromatographs that were available to you in 1966 not identify or detect PCB's?

A The reason is really fairly straightforward; the two types of detection systems that we were talking about are, number one, thermal conductivity and, number two, flame ionization detectors. Thermal conductivity is a very general non-specific detection system. It's also a relatively insensitive detection system. So, on those two counts, you couldn't really use it in any definitive fashion to measure very low levels of PCB's and say that you had PCB's.

Q When you speak of low levels of PCB's, are you talking about parts per million?

A Yes, that is correct, parts per million. The second type of detection system that was commonly used at that point in time was the flame ionization detector. The flame ionization detector again is a very general detector that responds to anything that has carbon-carbon, carbon-

hydrogen or any type of those kinds of bonds. It's very sensitive and much more sensitive than the TC detection systems, but it's very non-specific and responds to most anything, as I said, that has carbon-carbon, carbon-hydrogen bonds in it. And it is still not selective or sensitive enough to measure PCB's in environmental samples.

Q Would those two detection methods identify hydrocarbons as being present?

A They would detect hydrocarbons. Neither of those systems allows absolute identification of anything.

Q Would they detect chlorinated substances?

A If they had -- well, in the case of the flame ionization detector, if it had a carbon-carbon bond in it or a carbon-hydrogen bond in it, yes. Any bond that is capable of being ionized in hydrogen, oxygen or air flame will be detected by flame ionization detectors.

Q How about the thermal conductivity method?

A The thermal conductivity detector is really a thermal bridge through which one cell you pass the carrier gas with nothing in it and on the other arm of the bridge you pass the carrier gas plus something else and it measures the difference in the thermal conductivity of the two cells and you balance them off against each other. So anything

that is volatized into the one arm and goes through the carrier and changes the thermal conductivity as it passes the recorder, you get a different response. So it's a very general detector system.

Q I understand that, but could you identify a chlorinated substance?

A No, you could not identify a chlorinated substance with a thermal conductivity detector.

Q Dr. Tucker, in your professional opinion, were there any methods available besides electron capture detection capable of detecting and identifying and quantifying PCB's in environmental samples?

MR. SCHINK: I will object to the form of the question. It's not specific as to when. And secondly, it misstates his testimony. He said that the gas chromatograph was not capable of determining PCB's in environmental samples as of 1966.

A Can I ask you to speak up, please. I have a little bit of a cold.

Q Sure. Did you understand the question?

A Which question?

Q My question.

MISS OLIVER: Could you repeat it, please?

(The record was read back.)

MR. SCHINK: Same objections as to when. And it's a gross mischaracterization of the witness's testimony. He testified just to the contrary within the last couple of minutes.

Q Dr. Tucker, let me clarify the period of time. I am talking about up to 1971.

MR. SCHINK: Up to 19 when?

MISS OLIVER: '71.

A Well, basically, during that period of time there were two types of detection systems. One of which could be used to detect and infer that something was a chlorinated material, and another which could be used to detect and absolutely tell you what the molecular structure of the material was. Yes.

Q We are talking about PCB's as being a chlorinated substance?

A That's correct.

Q The electron capture detection device on the gas chromatograph would permit you to identify the presence of PCB's, correct?

A It would permit you to identify the presence of a

chlorinated material or an electron-capturing molecular species.

Q Is it your testimony that even with the electron capture detection device you would not be able to identify the substance as PCB's?

MR. SCHINK: When?

MISS OLIVER: Up until 1971.

MR. SCHINK: Object to the form of the question.

A What I am saying is the electron capture detector is not an absolute means of determining a molecular structure. It's simply a very specific detection system that responds to a certain class of molecules, any chlorinated aromatic molecule; DDT, benzene hexachloride, heptachlor. Any chlorinated aromatic type of material which is electron-capture active will respond in an electron capture detection system. So it's not an absolute means of identification by any means. It just simply is not. It's indicative.

Q Well, let me ask you this, if you were given an environmental sample in 1970 and asked to use your gas chromatograph-electron capture method to determine whether there were PCB's in that sample, could you do it?

A Yes, under certain circumstances.

Q Under what circumstances would you need?

A First of all, polychlorinated biphenyls, PCB's, there are roughly 210 isomers. And the way they are manufactured, to whatever degree of chlorination you chlorinate the material, you get a fingerprint or a pattern from the gas chromatograph as you separate the different isomers. And they are detected by the electron capture detector. If you are dealing with a virgin material, something that you manufacture yourself, like you take biphenyl and you chlorinate it in 48 percent chlorine or 42 percent or 54 percent chlorine and you run it in two or maybe three different kinds of columns, gas chromatographic columns with different phases in them, you will get a fingerprint. By that I mean you will get a series of peaks that are detected by the detector as they come off the column with specific retention. Now, if you do three different columns with different polarity liquid phases on the supports, you will get three different sets of fingerprints or peaks with retention times. Based on that, compared to a virgin standard, PCB's run under equivalent conditions, you can say with a great degree of probability that you are, yes, more than likely dealing with polychlorinated biphenyl samples. But even at that point in time

you are talking on a probability basis. You are saying it has a high degree of likelihood of being a PCB.

Q So what you are saying, Doctor, even when you have a sample and you compare it to a standard that you have run which has PCB's in it, that you know has PCB's, and compare it to that standard, all you get is a probability that you have PCB's in the sample? It still doesn't tell you in fact you have PCB's?

A That's correct.

MR. SCHINK: I object to the form of the question. Are you talking as of 1970, Miss Oliver?

MISS OLIVER: Yes. That's the period of time we are talking about.

A That's correct.

Q Would it be fair to say unless you have a standard to compare your gas chromatogram reading with, you may not even get that probability of knowing what you have in the sample?

A Yes.

Q I think you mentioned that before 1971 there were two methods to determine or try and identify PCB's. One was the electron capture method. What was the other?

A The method of choice as a detection system for a gas chromatograph to separate the materials was the electron capture. There was an alternate technique available that was in the embryonic stage at that particular point in time that was called a mass spectrometer. They were not, however, being used as a gas chromatographic detector at that particular point in time.

Q When you say that the mass spectrometer was in the embryonic stage, do you mean that it was just beginning to be used in the field?

A What I mean was that most of the instruments, mass spectrometers, that were around were devices that were built in academic institutions. The instrument companies were just beginning to look at things of this sort. They were also magnetic selector instruments and not quadrupole instruments. There was a big difference when the quadrupole instruments became available.

Q When did quadrupole instruments become available?

A I would have to guess in the mid-seventies, maybe even earlier, but commercially, I am talking.

Q Well, Dr. Tucker, how would you, in 1970, come to identify PCB's using the mass spectrometer?

A The first attempts were made by using a variety

of selective extraction techniques, et cetera, liquid chromatographic techniques to separate what was chlorinated hydrocarbons from the other constituents in the environmental samples. At that point in time you try to concentrate the extraction down, keeping in mind that you are dealing with parts per billion, parts per trillion levels. And then, you try to introduce the samples into the mass spectrometer through a solid and try to get a mass spectrometer of what you could volatize off from the source.

Q Would you need a fingerprint in that method?

A Would you clarify "fingerprint"?

Q Well, fingerprint you referred to as a standard of virgin material showing what PCB's would look like.

A No, you would not because, on a theoretical basis, you can predict the fragmentation pattern that you get in a mass spectrometer. But you would feel a hell of a lot better about it to run a standard and get a match in terms of the ion distribution.

Q Again, would you -- strike that.

Were you using the mass spectrometer in 1977?

MR. SCHINK: Using it for purposes of PCB analysis in environmental samples?

MISS OLIVER: No, was he using it.

A Was I using one? No.

Q I take it you had one in your laboratory?

A We had one available to us, yes.

Q Did you, in the period of 1966 to 1971, do PCB analyses of samples on the mass spectrometer?

A At some point we did take extractions of environmental samples and look for PCB's in them, but we didn't use the mass spectrometer for analysis in the quantitative fashion. We were really using it to verify what we had.

Q Why did you not use it to identify PCB's?

A The equipment that we had at that particular time was not designed to handle large numbers of samples. As a matter of fact, it probably took three or four days to analyze the data that would come out of the instrument just simply from one sample. There were no microprocessors or control instruments or computers or things of that sort that we have now.

Q Dr. Tucker, have you had any contact with Monsanto people in the Research Department since you left in 1978?

A I have had no official contact.

Q Have you discussed PCB's with anyone at Monsanto since you left?

A No.

Q Have you ever testified in any type of hearing or trial concerning PCB's?

A Yes.

Q When did you testify?

A I provided expert witness testimony at the Toxic Substances Hearing on PCB's for Monsanto.

Q In 1977 or '76?

A I don't know exactly when it was, but it was --

Q In that time period?

A In that time frame, roughly.

Q Did you have a paper prepared?

A Did I? No.

Q Did you have written testimony?

A There was written testimony. I was not scheduled to testify, but then the questioning became very, very technical, so I believe our lawyer at that time asked if I could be allowed to testify and I testified the next day.

Q In what areas did you testify?

A Polychlorinated biphenyls.

Q In what specific areas?

A In my area of expertise, analytical chemistry.

Q What was the substance of your testimony, Dr. Tucker?

A This has been quite a while ago. My testimony was really to discuss the difficulty involved in absolutely identifying PCB's in very weathered environmental samples and basically to answer the people at the meeting's technical questions about analysis.

Q Was it your testimony or was it your opinion that it was difficult to identify PCB's in environmental samples as of 1976 or 1977?

A Yes, it was difficult. It requires a high skill level.

Q And I take it technology had advanced from 1968 or '69 or '70 in terms of identifying PCB's?

A Definitely.

Q So I guess it would have been more difficult in 1970 to identify PCB's in environmental samples?

A Than?

Q Than it was in 1976 or than it is today?

A Correct, correct.

Q Would it be your opinion then in 1970 it took a high level of skill in analytical chemistry to identify PCB's in environmental samples?

A Yes.

Q Okay, have you given any other testimony, Dr. Tucker?

A No.

Q Relating to PCB's?

A No.

Q Have you given a deposition in any type of case?

A No.

Q How have you prepared for this deposition today?

A You are referring to the deposition today?

Q Today.

A I met with Mr. Schink for a couple of hours yesterday and went over some documents that I believe are exhibits, some of which I wrote, some of which I received copies of.

Q Did you read any depositions?

A No.

Q When you joined Monsanto in 1966, Dr. Tucker, did you become aware that the product lines -- strike that -- that some of the product lines that Monsanto was selling contained PCB's?

A No, I was not aware of that in 1966 when I became employed by Monsanto.

Q When did you become aware of that?

A I believe it was probably in 1967 sometime.

Q By the way, Dr. Tucker, do you own any stock in Monsanto?

A No, as a matter of fact, I don't.

Q Have you been reimbursed from Monsanto for appearing at this deposition?

A No, I have not. It's strictly voluntary, gratis AMF.

Q Have you been asked by Mr. Schink to testify at the trial for Monsanto?

A No, I have not.

Q How did you learn, in 1967, that some of the products that Monsanto sold had PCB's in them?

A I was approached by my supervisor at that time who was Dr. Keller in conjunction with Dr. Richard and I believe Elmer Wheeler, who was in the Medical Department at that time, regarding a report that they had received from some of our people in Europe talking about some work I believe that Soren Jensen did and Gunther Widmark (phonetic spelling). And the information at that time said that there was a problem with polychlorinated biphenols.

MR. SCHINK: You had better spell that for

the reporter, polychlorinated biphenols, p-h-e-n-o-l-s. All the others were biphenyls, p-h-e-n-y-l-s.

Q Was that the first time you had heard of the Widmark and Jensen work?

A Yes. As a matter of fact, I only knew that they had reported this. I had not seen any of Widmark's or Soren's work at that time. I don't believe there were any publications available at that time.

Q Had the electron capture device been installed in your laboratory at that time?

A The time we just spoke of was my first introduction to the problem and it was about the time that I was asked to look into it and see what they meant by polychlorinated biphenols and whether that was an error. And secondly, just start familiarizing myself with that particular area.

Q Well, you had testified a little earlier, I think, at the time you started with Monsanto in 1966 there was a gas chromatogram in the laboratory and you thought there was an electron capture device that had been ordered, that had not yet arrived or been connected; is that correct?

A If I may clarify that, what I believe I testified

was that there was an electron capture device there in the chromatography group. I was not part of the chromatography group at that time. I subsequently found out they had it when I began looking around to get one and they had it on the shelf, and it had never been installed. But I was not part of the chromatography group at that time, I was in the analytical chemistry group and mainly interested in inorganic analysis versus organic analysis.

Q Well, up until the time that you were advised by Dr. Keller, Mr. Wheeler and Dr. Richard about the Jensen-Widmark work in Europe, had you done any work at all with respect to what Monsanto called its functional fluids?

A I had done work, but it was atomic absorption monitoring metal ions in the functional fluids.

Q For what purpose?

A I believe some of our fluids, if I remember correctly, we had at that time additives that had metal ions in them. In addition to that, of course, in a lot of the functional fluids you do not want metal ions and we always analyzed them to make sure we didn't have them. And secondly, in spent fluids, where they might have some jobs in the field, we would look to see what they were contaminated with. And my interest mainly was what organic constituents

were in the functional fluids.

Q Would it be correct to say up until 1967, at least, you did no analyses for identification of PCB's?

A That is correct.

Q When we have been talking about identifying PCB's up to the present time, Dr. Tucker, I have been referring to identification of PCB's in the substances and not identification of specific isomers that may be in a sample.

A Okay.

Q Did you understand that?

A Did I understand the difference between specific PCB isomers and the generic term PCB's? Yes.

Q And your answers to my questions concerning identification of PCB's referred to the identification of PCB's generally and not a specific isomer or the specific isomers in the PCB's; is that correct?

A That is correct.

Q Now, what were you told by Drs. Keller and Richard and Mr. Wheeler regarding the Jensen and Widmark work in Europe?

A Basically what they wanted to know, as I indicated earlier, was first of all was it really polychlorinated

biphenyls, and, if it was, of course, we didn't have much of an interest in that because I don't believe we manufactured too many polychlorinated biphenyls. However, we did manufacture some. And really to start looking into it, and just see what was really involved in terms of from a technical viewpoint, because that's what I was, an analytical chemist, and start to look at it and see what was really there, what they were talking about, et cetera, et cetera.

Q Do you know what Dr. -- or Mr. Wheeler's interest was in this discussion?

A Elmer Wheeler was in our corporate Medical Department. And they had general responsibility at the corporate level for industrial hygiene, things of this sort.

Q What was your understanding of why he was involved in this discussion in 1967?

A I believe it was because the information may have been communicated to him through the chain of command.

Q Were you told that there might be a possible environmental or health problem by the presence or the finding of (pause). . .?

A No, I think at that particular time there wasn't

any real concrete talk about environmental or health problems or anything of that sort. It was just the fact that Soren Jensen had seen these materials in environmental samples, and we weren't even sure at that time we were dealing with PCB's. The original telex had an error in it and it was "biphenols." And I am an analytical chemist and Soren is an analytical chemist.

Q Did you see the telex that came from Europe?

A I believe I did at one time.

Q Do you know who sent it?

A No, I don't know.

Q Do you know from what Monsanto group in Europe it was sent?

A I would have to guess.

Q Do you recall at that time in 1967 when you were first advised of the possibility of PCB's in the environment that there was an indication of any possible adverse effects on aquatic or avian life?

A No, I think just the opposite was true. Up to that point in time all the toxicology work that had been done with polychlorinated biphenyls had been found to be very innocuous. At that point in time, of course, the prime area of concern would have been industrial hygiene,

the fact that they were being found in the environment, if they were really polychlorinated biphenyls and not polychlorinated biphenols was of interest. And if they were widespread, as I believe Jensen was indicating, then, of course, that was of interest, too. We wanted to know why.

Q What was the interest?

A We were the sole manufacturers of the product in the United States.

Q And you were interested in finding out if PCB's were in the environment?

A That is correct.

Q Were you aware of the toxicity studies that had been done relating to PCB's in 1967?

A No.

Q Did you later become aware of the studies regarding PCB's?

A Yes.

Q Were you given an assignment by Drs. Keller or Richard or Mr. Wheeler?

A Yes.

MR. SCHINK: He has already testified twice about what the assignments were.

A My assignment was as an analytical chemist to be -- to become familiar with the techniques that were being employed and set them up to become functional in our laboratory.

Q How did you go about doing it?

A Well, the first thing I did was go to the literature and find out what people were using to measure DDT, and that was really the type of instrumentation that Soren and his people were using. And at that point in time I became very familiar with the gas chromatography and electron captures.

Q So in 1967 in order to identify and detect DDT, electron capture devices and gas chromatographs were being used?

A Yes, that is correct.

Q Did you visit Mr. Jensen?

A No, I did not.

Q Did you contact him?

A No, I did not.

Q Did you know him personally?

A Not at that time.

Q You later did, I take it?

A Yes.

Q When did you meet him?

A I was an invited participant at a conference in Brookhaven sponsored by the National Oceanographic Institute. And he was a key speaker there at that time.

Q When was that?

A I don't know, but I can check. I can check the dates. I don't exactly remember when that was. It was much later than 1967.

Q Did you discuss with Mr. Jensen his PCB findings?

A I think it was at a late enough date by that point in time that he had published virtually what he was going to publish. I imagine we probably did discuss it. We had other problems that we were interested in at that particular conference, and subsequent to that I became involved in a two-year study with the National Academy of Sciences in predicting ocean pollutants in general, so we were just more concerned about pollutants in general than specifically just PCB's. By that time PCB's had been identified and there had been a fair amount of work done, so it was, you know, what is next.

Q This meeting with Dr. Jensen was before you left Monsanto?

A That is correct.

Q Did Drs. Keller or Richard or Mr. Wheeler discuss with you at the first meeting that you had with them in 1967 any potential problems they foresaw if PCB's were confirmed in the environment?

A Could you define for me what you mean by "potential problems" -- that's a very general term -- please?

Q Any concerns to Monsanto if PCB's were in the environment?

A Yes. They were concerned simply that they were there and they really shouldn't be. I mean, they were not a natural constituent in the environment, so it was, "Gee, I wonder why it is there," and that was the type of concern that was initially there.

Q Was there any concern about what the effect of it being there would be on the environment?

A Yes. And I can't say exactly when this occurred, but, yes, if there is something, certainly we were sophisticated enough at that point in time to know, "Gee, we should find out what the hell is going on."

Q Were you aware of any solubility studies that had been done on PCB's at Monsanto before 1968?

A Solubility in?

MR. SCHINK: In what?

A Water?

Q Yes.

A I believe I did some solubility studies at Monsanto roughly around that period of time, yes.

Q After your meetings with Dr. Keller and Richard?

A I don't know. Let's put it this way: It would have to be because I really wasn't assigned the project until I met with those people.

Q Were you aware of any biodegradation studies relating to PCB's before your meeting with Dr. Keller and Dr. Richard and Mr. Wheeler?

A No.

Q When you received the assignment to find out about the report and to find out what analytical techniques were available to determine whether PCB's were in the environment, did you review the work that had been done in the Research Department relating to PCB's?

A What Research Department?

Q Your Research Department.

A The Monsanto Research Department?

Q Yes.

A No, because most of the research up until that

point in time was really product oriented and it was just gross analysis of the materials and how they performed in their use as functional fluids, dielectrics, et cetera. I did, however, look into trying to find out as much as I could about what we knew about the composition of our virgin fluids.

Q Well, did you try and find out what research work had been done by Monsanto with respect to its PCB products before this meeting with Dr. Richard and Dr. Keller?

A Not before the meeting, no.

Q Afterward, did you go back to try and find out what research had been done?

A Yes, I became very aware of what had been done and what had not been done, yes.

Q Can you tell me what research had been done with respect to PCB products by Monsanto before you became involved?

A Okay. The only work that I became aware of at that point in time was work that was germane to my particular assignment, and that was what were the compositions of these materials and that kind of thing. In other words, first of all, before I was even given the assignment, I didn't know what an aroclor was.

Q How did you find out what an aroclor was?

A I began talking to the process people who had developed the products over the years and to the research manufacturing-type people, the process chemists and things of that sort.

Q What other information did you find out?

A About PCB's?

Q Uh-huh.

A I would say nothing more than what I really was interested in to do my assignment.

Q Did you go back to look and see if any tests had been conducted by Monsanto on the solubility in water of PCB's?

A No. I believe I did the first test on the solubility.

Q You did the first test that had been done by Monsanto at any time as far as you know?

A To my knowledge.

Q How about biodegradation studies? Did you go back to see if any studies had been done by Monsanto on biodegradation of PCB's?

A I believe the people in my laboratory were the ones that did the first test on the biodegradation.

Q Again, after you were asked by Drs. Keller, Richard and Mr. Wheeler?

A After I was assigned the problem, yes.

Q Before, to your knowledge, there were no biodegradation studies undertaken by Monsanto?

A That's correct.

Q After this discussion with Dr. Keller and Dr. Richard and Mr. Wheeler, I think you told me that you looked into the analytical methods for DDT and familiarized yourself with those methods, right?

A Yes, I believe I said that.

Q And you talked to marketing people and other people who knew about the PCB products and advised yourself of the composition of the products?

MR. SCHINK: No, I don't think he testified to that. I don't think he testified he talked to anybody in marketing at that point.

MISS OLIVER: Well, he talked to people he knew.

MR. SCHINK: Well, he didn't say marketing. And rather than have you rehearsing his testimony and rehashing it, why don't you ask him new questions?

MISS OLIVER: Mr. Schink, I am not rehearsing anything. If you don't interrupt, we will go a lot quicker.

MR. SCHINK: Fine. And you don't have to recapitulate his testimony as a preface to each question and we will get along a heck of a lot faster.

MISS OLIVER: Let's just keep going.

Q Dr. Keller --

MR. SCHINK: This is Dr. Tucker.

Q I am sorry, put a little name tag on.

A I can do that if you would like.

Q Dr. Tucker, you told me you informed yourself of the composition of the fluids that had PCB's in them, right?

A Yes.

Q What other things did you do after talking with Dr. Keller and Dr. Richard and Mr. Wheeler?

A Well, I looked around for manufacturers who made the best available electron capture detectors. I looked around to purchase a biomedical gas chromatograph since it seemed to be the type of instrumentation that the people who were active in monitoring DDT and subsequently

became active in monitoring PCB's were using. I wrote up a request and we ordered the instrumentation.

Q Did you use the electron capture device that was in the other group in your department?

A Yes. We initially commandeered a gas chromatograph that was being used for other purposes, put the detector on it and began familiarizing ourselves with how it functioned and, et cetera, et cetera.

Q When did you put the electron capture device on the gas chromatograph and begin familiarizing yourself with the techniques?

A Shortly thereafter when I was given the assignment with Dr. Keller.

Q In 1967?

A I believe that to be true.

Q Dr. Tucker, do you recall any other steps you took with respect to this assignment that you were given by Dr. Keller and Dr. Richard initially?

A No, I believe I have covered that.

Q How did you go about attempting to confirm whether the findings by Dr. Jensen were accurate and involved, in fact, PCB's?

A I -- well, first of all, I believe at some point

in time we became aware of the exact chromatographic conditions which he was employing. In other words, the type of liquid phase, the type of columns and things of this sort.

Q How did you become aware of that?

A I believe sometime after that we received a pre-publication document authorized by Widmark and Jensen discussing the techniques that they employed for isolating and detecting and identifying the PCB's that they were seeing in the study that they were performing.

Q Did someone from Monsanto request that pre-publication manuscript?

A I don't know. I assume that that might be true.

Q Was that still in 1967?

A I believe it to be then, yes.

Q And you read the papers?

A Yes.

Q Now, some persons at Monsanto in the Research Department visited Dr. Jensen and Dr. Widmark to discuss PCB matters?

A Yes.

Q You are aware of that?

A Yes.

MR. SCHINK: You are jumping ahead now several years, Miss Oliver. I mean, you were talking about the 1967 time frame. Now, you are talking about something else.

MISS OLIVER: I just asked the question, Mr. Schink, and Dr. Tucker did answer.

THE WITNESS: There was no reference to time frame. You simply asked whether or not I knew they visited them. I said yes.

MISS OLIVER: Fine.

BY MISS OLIVER:

Q Were you advised at that time the visit was going to be made?

A Yes.

Q Did you have any discussions on questions to be asked or areas to be covered?

A Yes.

Q What were your areas of interest? On the visit?

A Those were being covered by Dr. Keller, who himself is an analytical chemist. And we discussed the things that we would like to know in terms of the techniques they were employing so we could incorporate them into our laboratory techniques so we could duplicate their work and

be damn sure what we were dealing with.

Q What were the things you wanted to know about?

A The isolation schemes that they used for isolating the PCB's from the sample they analyzed. Chromatographic conditions that they used to gas chromatograph the samples. The detectors, and absolute identification techniques, and things of that sort.

Q Up until the time that Dr. Keller was going to visit Dr. Jensen, had you been running samples on your own gas chromatograph to try and identify PCB's?

A Can we establish definitively when the trip was made?

Q Do you have a recollection when the trip was made?

A I don't have an exact recollection, no.

Q Do you recall before the trip to Dr. Jensen and Dr. Widmark that you were running any PCB samples?

MR. SCHINK: Are you talking now about environmental samples, Miss Oliver?

MISS OLIVER: Environmental samples in making any determinations as to whether PCB's were present or not.

A No, we were not running any environmental samples

at that time. We were running known samples.

Q You were running known samples to try and determine whether your electron capture device was picking up what was there?

A That's correct.

Q Were you satisfied that your method was picking up what was there?

A When we were dealing with known samples that I made up myself, yes. The first step in the development of any analytical procedure is to make up known samples and pretend they are unknown and see whether or not your equipment functions properly and tells you what you already know. If it does, you can say, fine, and we are ready to go on to some other things.

Q For how long a period of time did you run known samples?

A This would have been after we received the equipment, checked it out for manufacturer's specifications and that kind of thing. I would imagine a month or so or something like that.

Q For a month you ran known samples?

A Correct.

Q And then you were ready to go on to other things?

A We hoped we were, yes. That we would find out later.

Q What were the first environmental samples that you ran?

A I believe the very first environmental samples that we ran were some samples that were taken outside in the Mississippi River around our Krummrich plant.

Q And how were those presented to you?

A Presented?

Q How did you get them?

A How did I get them?

Q Uh-huh.

A I asked that people at the plant collect samples. The laboratory people over there had collected samples for other purposes, and I asked that they collect samples from the outfall and above the plant and below the plant and things of that sort. I don't know if I directly asked, but I indicated through the chain of command that this would be something that we were ready to do.

Q Did you expect to find PCB's from the outfall in the Krummrich plant?

A If I was going to find them anywhere, I would probably find them there. Yes, I anticipated we might.

Q Was this in the period shortly after you ran the known samples?

A It was after I ran the known samples, that is correct.

Q Was it before 1970?

A Yes. Well, I am not certain; it was in that period.

Q The period '68 or '69, '70? Somewhere in that period?

A I believe that information is well documented. And if you want specific dates, we could probably get specific dates. You are asking me to recall something that was twelve years ago, and I am going to tell you I will give the best guess I can.

Q That's all I am asking, Dr. Tucker.

A Time-wise, it was after we set up the techniques in our laboratory and after we had done known samples and after we indicated we would like samples, sometime after 1967.

Q Those were the first samples that you did?

A That's correct.

Q The first environmental samples that you ran?

A Yes.

Q From the Krummrich plant?

A Yes, that's correct.

Q Do you recall what -- strike that.

Do you recall whether you identified PCB's in those samples?

A Yes, I recall, and I think we did.

Q Do you recall in what levels you found PCB's?

A I would say parts per million.

Q Parts per million?

A In some it would be parts per million. In some it might be lower and in some it might be higher, but it was the parts per million range, let's say that.

Q Did you report those findings to anyone?

A Yes.

Q To whom?

A All findings on that kind of thing were reported generally to whoever submitted samples and also to my head boss at that time, who was Dr. Keller, and usually Dr. Richard would be copied because he was director of the functional fluids research group at that time.

Q Do you have any recall of any discussions with Dr. Keller or Dr. Richard concerning your first samples from the environment from the Krummrich plant?

A Discussions?

Q Discussions about what you were finding.

A Yes, definitely we discussed what we were finding.

Q What was the substance of those discussions?

A How sure was I that this was really true. You know, would I stake my professional reputation, et cetera, et cetera. It was pretty guessy in those days, you know. I was very confident at that point in time that what we were seeing were PCB's.

Q You were confident that what you were seeing was PCB's?

A That's correct.

Q Did you suggest that the other Monsanto plants should be sampled for PCB's?

A I don't recall whether I suggested that or not, but I believe we did that subsequently.

Q You did testing -- strike that -- analyses from samples from the Anniston plant as well, didn't you?

A I believe I did.

Q Do you recall that those analyses in your opinion confirmed the findings of PCB's from the Anniston plant?

A In some of the samples I am certain we probably found PCB's, keeping in mind the detection levels were very low parts per billion, parts per trillion. But, yes, I seem to recall we found PCB's in those samples.

Q Was there any program set up relating to what environmental samples you would analyze on a priority basis?

A Yes.

Q What was the priority?

A Well, at that time we had, you know, we had a certain manpower supply, et cetera, et cetera, and that kind of thing, so we analyzed those samples that they chose to be analyzed. I think we began and looked at some of our own plants and also at one time or another, I am not sure of the time frame, we had a customer service routine which we did offer customers, and we analyzed a lot of their samples for them and we even went to the extent of helping them set up their own techniques if they were a large enough operation. And we even validated a number of independent consultant laboratories and we made available these analyses to them. But we are talking a dynamic situation, not a static situation that occurred in one day.

Q In the initial period of your environmental

samples for PCB's, the early stages, was there a priority on the environmental samples that you would do? Were you asked to do Monsanto plants first?

A No, I don't think it was -- it was never officially set up that way, no. It was the natural thing to do because we could collect those samples easily. We had a mechanism in place for collecting those types of samples. But if you are asking me, say: A Priority is our plant; B Priority is someplace else, no, there was no priority like that set up.

Q But it's your recollection you did your plants first?

A Yes.

Q Now, we have been talking -- strike that.

Were these initial samples that you ran from the Monsanto plant water samples?

A Water and sediment.

Q Did you do sediment samples?

A In some instances, but first water.

Q Is there a difference in analyzing water and sediment for PCB's?

A Definitely.

Q Is one more difficult than the other?

A Yes.

Q Which is more difficult?

A The sediment samples are more difficult simply because of the composition of the matrix you are dealing with.

Q Did you do any other type of sampling or analyses besides water and sediment?

A Yes, I believe we obtained some fish samples from the Mississippi.

Q Why were you interested in doing PCB analyses for fish?

A Well, if I recall correctly, I believe Soren Jensen had reported on eagle feathers or something of this sort and had speculated a number of things. And also, you could look at DDT, which is a very similar kind of compound, so we were interested to see if they were in the fish, too.

Q Did you confirm they were in the fish in your opinion?

A Yes.

Q Did you compare the levels of PCB's in fish as compared to the water?

A Yes.

Q Did the fish have higher levels of PCB's than the water?

A Yes, I would say so. I mean, that would be a rather obvious situation, but yes.

Q Why would that be obvious?

A Well, first of all, PCB's are not very soluble in water, so if you take a water sample, that does not have much dendritic-type of materials in it, so then you are not going to see much about, if anything, about the solubility of the PCB's in the water, which is quite low. They are very hydrophobic.

Q Why would you find higher levels in fish?

A The reason that eventually came out of it was a little thing called bioaccumulation. In other words, fish are -- you know, they breathe water just like you breathe air. So, as they breathe the water, of course, if there are PCB's in it, it's going past their gills.

Q And they accumulate PCB's?

A I believe that has been quite well established. Yes, they do.

Q When you were doing the analyses for PCB's in fish at the time you did those analyses, did you become aware that PCB's bioaccumulated in fish?

A Yes.

Q About what period of time were you convinced that PCB's were in fact in water, sediment and fish?

A Around the Krummrich plant when we analyzed there. Around there when I analyzed the Mississippi. The PCB's -- as we established earlier, that's the time I became convinced there were PCB's in the water and the fish and the sediment around the plants where they were manufactured.

Q Those were the first environmental samples that you ran?

A Yes.

Q Were you asked by anyone at Monsanto to give an opinion or give your recommendation on any action Monsanto should take as a result of your findings?

A The only --

MR. SCHINK: I object to the form of the question. It assumes that action was taken after those findings and not before the findings. And you have not established when this work was done, Miss Oliver, with any degree of specificity.

MISS OLIVER: I believe the record is clear on that, Mr. Schink.

MR. SCHINK: I object to the form of the

question. It's a misleading question and misstates the record.

BY MISS OLIVER:

Q Dr. Tucker, do you recall whether you were asked to give an opinion or make any recommendations on any actions that Monsanto should take or could take as a result of your findings?

A First of all, let me establish the fact very clearly that I was not in a policy-making capacity for Monsanto in any respect whatever. I was there as a professional scientist. And my opinion as a scientist was asked in terms of whether or not what I had seen was real and whether it was ten parts per million and/or twenty parts per million and how accurate were things like that. So, in terms of what should be done in the future, I did not make those kinds of decisions nor was I asked to. I was asked to provide support work for that study or things of that sort, but strictly in the analytical chemist area and my ability to analyze those samples or whatever samples and definitively or not definitively tell them whether there were PCB's there or how much.

Q Is it your answer you did not make any recommendations?

A Correct.

Q And you were not asked for your opinions?

A Absolutely my opinions were asked for.

Q With respect to what should be done or what could be done based on your findings?

A No, with respect to my ability to analyze samples for PCB's. How many samples could we handle, you know, this kind of thing. Do we need more manpower, do we need to order a new instrument, that kind of thing.

Q By the way, how many people were running PCB samples for you in the early period of time when you were running the Krummrich samples?

MR. SCHINK: Are we talking about 1970?

MISS OLIVER: I am talking about when he ran the samples.

MR. SCHINK: You have the documents on it. Why don't you establish it for the record, rather than making a record which is consciously an unclear record?

MISS OLIVER: It is not an unclear record.

MR. SCHINK: Well, I object to the form of the question.

MISS OLIVER: Object and let's go on with it.

We don't need your testimony on the record.

MR. SCHINK: Miss Oliver, why don't you proceed?

BY MISS OLIVER:

Q Dr. Tucker, my question was: How many people did you have running PCB samples when you did the first environmental samples from the Krummrich plant?

A Let's see, I think the effort by that time had been scaled up to the point where I have about four or five people working for me at that point in time.

Q How many people had run the known samples?

A It really started -- well, they all did at one time or another. It was part of the training.

Q Well, in the beginning?

A In the beginning it started out with me. Then, I was given a technician and then, after that, as more and more samples came in, et cetera, we needed more and more work effort. I got another technician and a Master's Degree chemist, a Bachelor's Degree chemist and another Bachelor's Degree chemist to work on the project. I didn't get them all at once. It was after the project developed and when more manpower was needed.

Q Did you run the biodegradation studies?

A Yes.

Q You personally?

A Yes, personally I ran some of them. I am a bench chemist; I like to spend maybe 25 or 50 percent of my time at the bench. That's the thing I like to do. However, there were some biodegradation studies that had been done in our Ruabon, U.K. area.

Q Dr. Tucker, were you able to identify the different aroclors in the Krummrich plant samples that you ran?

A Yes.

Q You could distinguish between Aroclor 1254 and 1248 and 1242?

A Yes, if they weren't what we call weathered samples.

Q Do you recall which aroclors you found in the Krummrich samples? I am talking about the initial environmental samples that you ran.

A I think what we found generally was what we manufactured there.

Q I am sorry? What?

A I think what we found generally reflected what we manufactured there. And since that was a prime manufacturing site, I think we found a little bit of everything, although

there may have been one that was more dominant than others, depending on the particular samples.

MISS OLIVER: Do you want to mark this as Exhibit Number 1.

(Defendant's Exhibit 1 duly marked for identification.)

Q Dr. Tucker, do you know why biodegradation studies had not been done on PCB's up to the time you began doing studies?

A Up until that point in time there had been no reason to be particularly concerned about biodegradation studies because we were not concerned whether they were biodegradable or not because, as far as we were concerned, they were not in the environment.

Q Do you know why no studies were done on solubility in water?

A I don't believe there was any reason to believe that these particular functional fluids were put in contact with water. They were not intended to be in contact with water. In fact, in the particular applications they were used for, if they had water in them, they were not useful.

Q Did someone relate to you that those were the reasons why no such studies had been done before you became

involved?

A No.

Q Was that your opinion on why those studies were not done?

A Yes.

Q You are not aware of any sampling or analyses or investigations done by Monsanto before the Jensen and Widmark information came to light concerning an attempt by Monsanto to determine the presence of PCB's in the environment?

A That's an awfully long question. I will answer it no because I am not aware of any studies that were done prior to the studies that I initiated.

Q You understood the question?

A I think so.

Q Do you want it read back?

A No. Just that it was really long, and to answer it yes or no is difficult. But no, until I was given the assignment on that kind of thing, there were no studies done, performed of that sort to my knowledge.

Q Are you aware of any studies performed by Monsanto before you became involved in the PCB matters to determine the toxicity of PCB's to fish?

A No.

Q Would you become involved in toxicity studies?

A Yes.

Q What was your involvement?

A My involvement was in the original planning and protocols for the studies because we had decided that we would do tissue analysis in conjunction with the normal types of toxicology studies.

Q Who decided to do tissue analyses?

A I don't know that it was any one person. If any particular portion of Monsanto decided, it would have been the Corporate Management Department.

Q And what was your involvement?

A My involvement was for the samples we had to have extra animals for these types of chronic, acute studies at various periods so we could do tissue residue analyses on them.

Q Well, did you do the tissue analyses?

A Yes.

Q Up until the time you became involved in doing tissue residue analysis, were you aware of any such sub-acute toxicity studies done by Monsanto with respect to PCB's?

A No.

Q Are you aware that any had been done?

A I only knew that they had probably run them through the normal trial hygiene toxicity studies that they had. I don't know what they were at that time.

Q Did you have any training in toxicology?

A Just my association with toxicologists in a support role.

Q Before becoming involved in PCB matters relating to toxicity studies, had you become involved in other toxicity work?

A No.

Q So that was your introduction to toxicology?

A Yes.

Q The Medical Department was responsible for these toxicity tests?

A Yes.

Q Who in the Medical Department?

A Emmett Kelly. He was the Director of the Medical Department.

Q Mr. Wheeler worked for him; is that correct?

A That's correct.

Q Monsanto obtained an outside consultant to perform toxicity studies for it called Biotest. Do you recall that?

A Monsanto obtained an outside consulting firm to do the toxicology studies, yes.

Q And that firm was Biotest?

A Yes, that was Industrial Biotest, Northbrook, Illinois.

Q And you worked with Industrial Biotest?

A Yes, I did.

Q Do you know when Industrial Biotest completed their studies?

A You mean totally completed all PCB studies?

Q Yes.

A I mean, they were not all started at once.

Q I understand that. But do you know when they were completed?

A No, I don't know. Probably the mid-seventies or somewhere like that, I imagine.

Q Were you involved with Industrial Biotest for the entire period of time they were doing studies for Monsanto relating to PCB's?

A Yes.

Q Were you advised of the results of their studies?

A Yes, I read the reports.

Q And you did some tissue analyses for PCB residues

in animals, right?

A Yes.

Q Based on all that work done by Biotest and your own analyses, do you have an opinion on the health effects of PCB's?

MR. SCHINK: Object. No foundation.

Q You can answer the question.

A I think I established that I am not a qualified toxicologist and that I am an analytical chemist. If you want my personal opinion, I would be happy to give it to you.

MR. SCHINK: They don't need your personal opinion.

Q Do you have an opinion?

A Yes.

Q What is that?

A I don't believe PCB's are particularly toxic.

Q Did you become aware, sometime during your work with PCB's for Monsanto, of an incident in Japan that was alleged to be related to PCB poisoning?

A Yes.

Q Did you review that situation for Monsanto?

A The analytical portion of it, yes.

Q And what did you do, specifically with respect to

the Japanese experiments?

A I looked at the data that we had gotten, the chromatograms, et cetera, et cetera, and things of that sort.

Q For what purpose?

A To determine, you know, that they were PCB's and that they were -- that kind of thing, that the chromatograms were chromatograms of PCB's.

Q Were you able to confirm that?

A Yes.

Q Someone asked you to look into that specific matter for Monsanto?

A Yes.

Q Who was that?

A I believe the request came directly from Dr. Keller.

Q Dr. Keller, your supervisor?

A Yes.

Q Were you also asked to meet with government agencies concerning PCB's?

A Yes.

Q Who asked you to do that?

A It was all the people involved; Dr. Keller, Dr.

Richard, Elmer Wheeler, et cetera.

Q What was the purpose of your meeting with government groups?

A Say that again, please.

Q What was the purpose of meeting with the government groups?

A The initial -- I believe the one time that I really met with a government group was when we gave a presentation on, an update, really, on what the situation was with PCB's as we had been able to find out via research. And the presentation was given to the President's Council on Environmental Quality.

Q Do you recall when that presentation was made?

A Not exactly, but I think it's a matter of record.

Q Did you meet with any State agency?

A Yes.

Q What State agency do you recall meeting with?

A I believe I met with the Michigan State Regulatory people.

Q Anyone else? Any other state?

A I don't really believe so.

Q How did you come to meet with Michigan?

A I was asked by the Medical Department to accompany

their people as a technical backup.

Q What was the purpose of the meeting, as you understood it?

A It had to do with PCB's, obviously, or I wouldn't have been asked, but I am very unclear as far as the details are concerned.

Q I would like you to look at what we have marked as Deposition Exhibit Number 1, Dr. Tucker, which is a memorandum entitled "Environmental Materials Analyzed by Monsanto for PCB's" dated April 17, 1970, from Dr. E. Keller to W. B. Papageorge. Showing you a list of names on the right-hand side, including yours, have you seen that document before?

A Yes.

Q Is this one of the documents you reviewed in preparing for the deposition?

A Yes, I looked at this document yesterday with Mr. Schink.

Q Have you seen it before yesterday?

A Yes.

Q Do you recall seeing it on or about April, 1970?

A Yes. Dr. Keller and I prepared that document. Dr. Keller and I prepared it together based upon information

I had in my laboratory.

Q So this was prepared by you and Dr. Keller as a summary of the work that you had done to date?

A That is correct.

Q It summarizes that PCB's had been found in water, sediment, air, fish, human fat and milk; is that correct?

A Correct.

Q And you had identified the PCB's as typical of Aroclor 1242, 1248 and 1254 and/or 1260 by that time; is that correct?

A Yes.

Q And the three pages attached to that cover memorandum are a list of the samples that you had analyzed?

A Correct.

Q And the list is by manufacturer, where the waterway in which the sample was found was located, the type of sample analyzed and an indication of which of the aroclors was found in the sample and an indication of what levels of PCB's were found and an indication of what technique you used to analyze them; is that correct?

A That's correct, that is what the document shows.

Q And the techniques for all the samples showed that electron captures-gas chromatographs were used?

A Yes.

Q On the third page there is a column called "Confirmatory Technique"?

A Correct.

Q And in addition, on some of the entries to EC/GC, there is also an entry of GC/mass. Could you tell me what the reference is?

A Yes. The "GC" obviously means gas chromatograph and "mass" simply is an acronym or a short abbreviation for mass spectrometry.

Q Used in conjunction with the gas chromatograph?

A That's correct.

Q And for some of the samples the mass spectrometry was used?

A Yes.

Q Does this document show or indicate that all of the samples listed on the three pages and attachments were analyzed by Monsanto for PCB's?

A Yes.

Q Did you prepare the list of environmental materials which is attached to Dr. Keller's memorandum?

A Did I prepare this?

Q The three pages that are attached to the cover

memorandum?

A This information was condensed from reports that I issued, yes.

Q Did you review this memorandum and the attachments which went out over Dr. Keller's signature before it was sent to Mr. Papageorge?

A Yes.

Q To the best of your recollection, did you review the information for accuracy?

A Yes.

Q Do you have any reason to believe that the information is not accurate today?

A No.

Q Would I be correct to say from Exhibit Number 1 that as of April 17, 1970, Monsanto had analyzed 167 samples for PCB's?

A That is correct. The document states that is a summary of the analysis of 167 samples.

Q Did you analyze the air sample that was provided?

A May I see the document or the exhibit?

Q Sure. The exhibit shows that, if I am correct, -- and correct me if I am wrong, that three air samples from the Monsanto Anniston plant were analyzed; is that correct?

A Yes. They were probably taken by the people at the plant site and sent to us.

Q And you did the analysis or people under you?

A Myself or my group did the analyses; that is correct.

Q Do you know who suggested that air samples be taken from the Anniston plant?

A No.

Q I notice from the Anniston plant there were also water, sediment and fish samples taken. Do you know who suggested that sediment samples be taken?

A No.

Q How about fish samples?

A No.

Q In the course of your analyzing for PCB's, Dr. Tucker, did you make any requests for certain types of samples?

A Yes.

Q What samples did you request?

A Well, we were generally interested in sampling everything, and again, we were because we were analytical chemists and we wanted to analyze everything. And when you are looking at the air around the plant, you naturally want

to look at the water and the sediment. Certainly, we always wanted to look at at least the water and sediment.

Q Did you ever make any requests for fish samples?

A No.

Q They were just provided to you by someone else?

A That's correct.

Q Did you make requests for sediment samples?

A Yes.

Q Some of the locations indicated on Exhibit Number 1 are identifiable, to me at least, as customers of Monsanto. Are some identifiable to you as customers, Dr. Tucker?

A Yes.

Q Was there a project set up within Monsanto to provide you with samples for analyses from customers?

A Yes.

Q Who was in charge of that project?

A I believe Don Pogue, if I remember correctly, was in charge of that project.

Q What was the purpose of the project, Dr. Tucker?

A Well, the purpose of the project was twofold: Number one was to analyze any samples for PCB's and at the same time to get some sort of idea what they might be able to reclaim.

Q Was it your understanding, Dr. Tucker, that Mr. Pogue's assignment was to determine whether there was a business opportunity for Monsanto in reclamation of industrial fluids?

A Yes.

Q That was the purpose of his visits to certain customers?

A Yes.

Q And you were interested in analyzing for PCB's?

A Correct.

Q So you were provided with the samples he took and you analyzed those samples for PCB's as part of your overall assignment to confirm that PCB's were in the environment?

A Yes.

MISS OLIVER: Mark this as Number 2.

(Defendant's Exhibit 2 duly marked for identification.)

MR. SCHINK: Off the record.

(DISCUSSION OFF THE RECORD)

BY MISS OLIVER:

Q Dr. Tucker, I would like you to look at what we have marked as Exhibit Number 2, which was produced to us by Monsanto in this case, and which is entitled "Aroclor

Defense - 1970 PCB Support Analysis," and ask you to identify what that document is.

A This is a Special Study Report, Number 70-21, that was issued from my group, the Analytical Chemistry Group.

Q This is called a Special Report?

MR. SCHINK: Special Study.

A Right, it's called a Special Study. We had a standard reporting format. We had three types of reports: One was Analytical Methods; one was Special Studies; and the other was called New Techniques.

Q Who prepared this report?

A I did.

Q It's entitled "Aroclor Defense - 1970 PCB Support Analysis." Why did you entitle this report "Aroclor Defense"?

A Because that's basically what it was.

Q Well, I don't understand. Was it intended to be a report defending findings of PCB's or aroclors in the environment?

A Any time you have a product, you find yourself defending against one thing or another. It may be the manufacturer or anything that jeopardizes the livelihood of the product. You do work that you really could call defensive.

In other words,-- well (pause). . .

Q Well, how was your aroclor analysis for PCB's defense work?

A Let's see. Can we take a break for a minute, please?

(NOON RECESS)

BY MISS OLIVER:

Q Dr. Tucker, you know you are still under oath?

A Yes.

Q When we broke for lunch, I know there was a question pending that you were going to answer.

A Well, could you repeat the question, please?

Q Well, the question was, Dr. Tucker, could you explain to me how your work analyzing for PCB's in the environment was considered defense of aroclors?

MR. SCHINK: I object to the form of the question. I don't think he has testified that he considered it to be a defense of aroclors, whatever that means. You may answer the question; I object to the form.

A The title "Aroclor Defense" I think really originated with Dr. Richard and it was in a sense defensive of the product line.

Q Did you understand your work that you were doing for Dr. Richard to be aroclor defense?

A In the sense that we were attempting to find out what was happening in the real world with our product, yes.

Q Did you have conversations with Dr. Richard before preparing this report on how Monsanto would defend the aroclor product lines?

A No, not really defense. I think we were really very honestly most interested in finding out just what was going on so we wouldn't be misled by facts that we weren't sure of how they were generated.

Q By the time you wrote this report or special study, Dr. Tucker, you were convinced that your findings of PCB's in the environmental samples were accurate, were you not?

A Yes, we were.

Q When was this report prepared? Exhibit Number 2?

A I believe it indicates that it was issued in February, 1971.

Q Was it intended by you to encompass the analytical work that your group had generated on PCB's in the year 1970?

A Yes.

Q What does the -- what is the meaning of "Special Study, 70-21"?

A Special Study, as I indicated earlier in my testimony, was one of the three categories under which we issued official reports which became part of the record and were filed in the Monsanto library. The number 70 refers to simply the year that it was issued and 21 happens to be the fact that it was the twenty-first report that was issued in that series. These series did not specifically deal with PCB's. We worked on other things besides PCB's.

Q Was this the only special study generated in 1970 relating to PCB's?

A I don't know. There may have been others.

Q As you sit here today, do you recall any others?

A Not specifically, but I am sure at this particular stage in the game that we were moving along well enough that there were probably other reports.

Q What does job number 13480/16300 mean?

A Okay, the two, the job numbers 13480 and 16300, were the means of accounting for the hours that were spent on different portions of the project. The costs were then apportioned to different people's research budgets. The job 13480 belonged to one group in the functional fluids -- research group which had an interest in PCB's, for whom we were doing work. And we would charge hours to that. And

the same goes for the 16300.

Q Who was the group that was given the number of 13480?

A They were all part of the functional fluids group. One would have referred to dielectrics; another would have referred to hydraulic fluids or something of that sort. I don't remember specifically.

Q You don't recall today what groups 13480 or 16300 referred to?

A No, I don't.

Q This report, which is Exhibit Number 2, refers in the first sentence to "analysis of numerous samples generated by internal Organic Division research on Aroclor and Aroclor Substitutes." Was that the work that you were doing?

A No, Organic Division was what we were part of. The Organic Division included everyone.

Q What were the samples that were being generated by the internal Organic Division research?

A I don't know. You would have to -- I would have to review this. Okay, this may have referred to people like Don Pogue who collected samples for us on these projects. Also people at the Krummrich plant who collected samples for us. Also people at the Queeny plant, the Delaware River plant,

the Pensacola plant, Monsanto, U.K., and things of that sort.

Q Did anyone -- strike that.

Was there any group within Monsanto in this period of 1970 that had responsibility for analyzing samples for PCB's besides your analytic chemistry group?

A In the United States, no. Let me correct that. I am not quite sure when the plant laboratories began analyzing samples for PCB's, but eventually we had a capability at the Krummrich plant and also at the Anniston plant. These were people that we taught how to do PCB analyses. We did also have people in the United Kingdom that had that capability and were doing their own analyses over there.

Q In 1970, to the best of your recollection, were there any other groups within Monsanto that were doing PCB analyses?

A Probably not, because, as you can see from the report, much of the report work involves samples from Krummrich, from Anniston, from U.K., so we were probably at that point in time the one group which was really doing the PCB analyses.

Q In the first sentence of this study there is also

a reference to "Several hundred assorted types of samples have been analyzed for PCB's." What do you mean by that statement?

A I meant that a variety of different samples had been analyzed for PCB's. Different locations, different matrixes and things of that sort.

Q Do you know where those assorted types of samples came from?

A They came primarily from the internal Organic Division people that collected for me. I very seldom collected any of my own samples.

Q Well, was there another group besides the internal Organic Division which provided you with any samples on which you did PCB analysis in this period of 1970?

MR. SCHINK: Are you asking in addition to those that he has already identified as covered by this memo?

MISS OLIVER: No, I am asking whether there are any.

A Yes, I think it is obvious from the report there are. There was a human fat biopsy sample that came from WARF as is indicated here. There were some milk samples from Maryland, Ohio and Massachusetts dairy farms. Yes, there

were other people that provided us with samples, but they came through the business people group to us.

Q In the summary section of the study, you referred to a total of 486 samples which were analyzed during 1970. Is that a correct statement, to the best of your knowledge?

A Yes.

Q How many people did you have doing the analytical work to do 486 samples?

A Well, over that period of time I think the group size eventually reached as high as seven.

Q Did this group do any other work in one year besides PCB analytical work?

A No, they were dedicated strictly to PCB analytical work.

Q In 1970, Dr. Tucker, how long would it take to -- from the time you received the sample until the time you got an identification and quantification of what was in that sample?

A Are you thinking in terms of elapsed time or actual time spent analyzing a particular sample?

Q The laboratory time and the time spent in analyzing.

A The laboratory time spent would be on the order of one or two days, depending on the level of PCB's in the

sample and whether or not they wanted absolute confirmation versus just an indication that there were PCB's there. But I would say one to two days, probably would be an elapsed time.

Q For the preparation of the sample and the running of the analysis and the determination?

A That's correct. The samples were received; they were logged in. Then, they were turned over to the appropriate people and they are extracted and run through separation procedures. And then, concentrated and run through the gas chromatograph and they had to be quantitated and looked at to be sure we were really seeing what we were seeing. And in some cases they were also taken for mass analyses.

Q Who did the reading of the gas chromatograms?

A I probably read most of them. However, there was a point in time when the other people became trained well enough. When it was obvious we were dealing with a fingerprint situation, they were able to do it.

Q In doing the 486 samples that you referred to in this study, did you identify the PCB's by looking at a fingerprint?

A Most of these, yes.

Q So you would compare your chromatograms with fingerprints of Aroclor 1242, 1248 and the other aroclors?

A Yes.

Q Did it take longer to identify and quantify sediment samples than water samples?

A Yes.

Q How long would it take to do sediment samples?

A Well, there was a little bit more cleanup involved with sediment samples. You had to do what we called a liquid-solid chromatography procedure for separating some of the interferences that would come from the sediment matrix before you could do the PCB analysis in the gas chromatograph. Whereas with the water samples, it is obviously a much more simple matrix. It didn't require the extra cleanup steps.

Q Would that take one day, two days, five days?

A To clean up the samples?

Q To do the extra step necessary.

A As I stated, the elapsed time for a sample from the time it came into the laboratory until it came out under optimum conditions is about two days. But during that period we might run forty samples a day. So, you know, it's like a production line.

Q What I am asking, I guess, is the two-day turn-around time from the time you got a sample to the time you got a result or an analysis for that sample, is that an average?

A Yes.

Q So, some took more than two days and some took maybe a day?

A Yes.

Q And sediment analysis took a little bit longer, right?

A Yes.

Q What about fish analysis? Did that take as long as sediment?

A It took longer.

Q Took longer than sediment?

A (Nods head.)

Q How long a turnaround time did fish analysis take?

A Probably -- I would say roughly about 50 percent more effort on fish sample than it would take on a sediment sample. There is much more involved in a sample preparation, and it's a much more, again, complex matrix.

Q How about the human fat samples? How long did they take?

A That probably would fit in the category with fish samples with the exception that it was not quite as complicated because you are already at the liquid stage.

Q How about the milk samples that you ran?

A Milk samples were particularly complicated to analyze because of the fact during the extraction procedure you ended up with emulsions, but it didn't usually take much longer than a fish sample. But they could, depending on the complication of a particular sample.

Q Did you prepare the tables attached to the Special Study Report?

A Yes.

MISS OLIVER: Mr. Schink, you advised us this morning a page is missing from this document.

MR. SCHINK: No, it appeared that the page numbered 11417 is not supposed to be there.

MISS OLIVER: 11417 is a duplicate of 11415; is that right?

MR. SCHINK: It appears to be.

Q Is the table that appears as part of your Special Study, Dr. Tucker, a listing of the samples that were analyzed by Monsanto in 1970?

A Yes.

MISS OLIVER: When we get the proper page from Mr. Schink, can we agree to replace the correct copy of Exhibit Number 2 for the one that we have today?

MR. SCHINK: Certainly.

Q On the table that appears as part of your study, Dr. Tucker, there is a column at the end called "Support Objective." I believe that is correct?

A Yes, that's correct.

Q And underneath that column for various samples there is an indication of "plant pollution control, customer service, collaborative analysis, residue research on synthetic samples" and "waste incineration." Can you read the last one at the bottom of page 11418?

A I think it says "non-divisional." It's very unclear from the Xerox.

Q What does "support objective" mean?

A It really refers to that portion of what we were attempting to do, where the sample came from. For example, I think the terms "customer service," "plant pollution control" and "collaborative analysis" are really self-explanatory. The "plant pollution" means the objective was to determine what was coming out of the plant. And "customer

service" was obviously a service that Monsanto was providing its customers in an attempt to help them decide whether they had a pollution problem associated with PCB's. The "collaborative analysis" was samples analyzed by another laboratory to make sure we were in agreement as to what the levels of PCB's were in those samples.

Q Am I correct that pages 11415 and 11416 go together as a spread sheet? Is that the way this document was prepared by you?

A Well, the sheets were together in the original document. (Looking) Yes.

Q So under "plant pollution control" objectives were samples listed from the Monsanto plants; is that correct?

A That's correct.

Q The objective of that analysis was to provide plant pollution control for the plants, right?

A It was to provide the people at the plants with information regarding the amounts of PCB's that might be getting out of the plants, so, yes.

Q In the next section under "customer service" is listed several customers of Monsanto, right?

A That's correct.

Q And these samples were provided to you by Mr. Pogue and his group; is that right?

A That's correct.

Q Now, if you look again at what we marked as Exhibit 1 this morning, the report from Dr. Keller on environmental materials analyzed by Monsanto for PCB's, this report that you prepared for Dr. Keller indicates that there were a total of 167 samples which have been analyzed by Monsanto for PCB's up to April 17, 1970; is that right?

A That's what it says.

Q That's right?

A That's correct.

Q When were these 167 samples done by people in your laboratory under your supervision?

A In 1970 prior to April. When they were specifically done, I don't know. What you would have to do is go back and get the log books and check those.

Q So from January 1st or 2nd, maybe, you began running environmental samples and you ran 167 samples up to April 17, 1970?

A Uh-huh, correct.

Q Did you run any environmental samples before January of 1970, Dr. Tucker?

A I don't believe we did, no.

Q Did you run your unknown -- strike that.

Did you run your known samples before 1970?

A Yes.

Q When in 1969 did you run your known samples?

A Probably late 1969. Or in 1969, I am really not exactly sure. How definitive do you want me to be? I mean, you say in 1969.

Q Well, your best recollection.

A In 1969, mid-1969, around in there somewhere.

Q Between mid-1969 and January of 1970 you ran no environmental samples?

A To my knowledge, no, none.

Q Why not?

A Probably because we weren't prepared with the techniques to really go and look at environmental samples.

Q Well, you had run enough known samples to convince you that you could find what you knew was there by mid-1969, correct?

A We were convinced that if we put it there and we ran the samples and we found it, that it was there, yes. It's kind of a developmental thing. My memory is not that clear as to the day or even the month that we began doing

this and doing that back in 1969. But I am sure it's a matter of record because most of these things were logged in.

Q Your laboratory notebook would have an indication of what sample was run on the day it was done in the lab?

A It would indicate when the sample was received and samples were handled on an A.S.A.P. basis.

Q Did anyone at Monsanto ask you for reports as you were doing samples or ask you for results as you were doing analyses?

A Yes, I think there were reports, but they would all come out in a documented form, either in a memo or a special study, which was in addition to a report form, really a record-keeping form, too.

Q Who got those reports?

A The people who would probably see it, Dr. Keller certainly would receive one, and Dr. Richard, and I imagine Elmer Wheeler in the Medical Department. They would be the prime people. And generally, unless someone else was specifically interested, it would be up to them to distribute them to their people.

Q Was there a retention period for keeping the lab notebooks that would document sample analyses?

A As far as I know, they have always been kept.

Q Were the lab notebooks that were prepared for purposes of doing the PCB sampling or PCB analyses in existence when you left Monsanto in 1978?

A Yes.

Q Where are those lab notebooks kept?

A I don't know where they were kept. And when I left Monsanto, they were turned over to Dr. Keller.

Q Were they in your possession before you left Monsanto?

A Many of them were, yes. We had a practice, as we filled up notebooks periodically, these would go to the library, if I remember correctly, for microfilming and things of that sort. And then, we would get them back and retain them ourselves. But everything was kept. It was general practice to retain everything.

Q Did you meet with Dr. Richard on a regular basis to discuss PCB matters in the period of '68, '69 and '70?

A Yes.

Q How often would you meet with him?

A Really as often as he deemed necessary or whenever I felt that I had information that was going to be reported. I don't think we had set up an official -- you know, like we

would meet every two weeks or things of that sort, but we worked very closely on the thing, so (pause). . .

Q Did Dr. Richard ever tell you in 1968 or 1969 that Monsanto should discontinue the sale of PCB products?

A I don't think so. No, I don't recollect him ever saying anything of that sort.

Q Were you involved in working on the substitute products to PCB products?

A Yes.

MISS OLIVER: Mark this as Number 3.

(Defendant's Exhibit 3 duly marked for identification.)

Q I would like you to look at what I marked as Exhibit Number 3 of your deposition, which I see was also marked in Dr. Richard's deposition as 19. Could you identify that document for me -- or that part of the document for me?

A Yes, it's -- I think this is a functional fluids internal monthly summary that is issued by Bill Richard and his people, and it involves work that we were doing for them.

Q Did you provide the information to Dr. Richard that appears in this functional fluid monthly summary?

A Yes.

Q And there is a handwritten date up at the top that

says December, 1968. Does that date appear accurate to you for this document?

A Let's see. I would have to guess. I have no reason to be suspicious of it, but I have no reason to confirm it as being December, '68. But it could well be, yes.

Q Well, does it refresh your recollection at all as to when the GC-electron capture system was operational with respect to aroclors?

A Again, I have no reason --

MR. SCHINK: The question is, looking at that document now and assuming that was prepared in December of 1968, is your memory now refreshed that it was in December, 1968 that the GC-electron capture system was operational? Do you now have that recollection in your mind that you can testify to that based on this view of this document?

THE WITNESS: Yes.

Q Page two of the document, which has a typewritten page 14 at the top, in paragraph two there is a statement that quotes: Some tissue samples are now in hand and verification of outline procedure will soon begin. Does that refresh your

recollection as to when you may have received or did receive tissue samples for PCB analysis?

MR. SCHINK: Are you now referring to environmental tissue samples, Miss Oliver, or tissue samples from other sources?

MISS OLIVER: Tissue samples.

MR. SCHINK: Are you referring to environmental tissue samples or the tissue samples the witness testified he worked with in conjunction with the IBT studies?

MISS OLIVER: I am referring to any tissue studies.

MR. SCHINK: All right, I object to the question.

A It appears that these tissue samples were from Industrial Biotest laboratories and they were animals we had purposely dosed with PCB's to provide samples for method development.

Q So as of December, 1969, to the best of your recollection, you had obtained tissue samples from some test animals in conjunction with Industrial Biotest?

A Yes.

Q In paragraph three, the first statement is, quote:

After closely reviewing the available literature, I find it difficult to dispute the identification of the interfering peaks as polychlorinated biphenyls. To the best of your knowledge, is that a correct statement as of December, 1968?

A Yes, in the context that it appears in the paragraph.

Q That paragraph goes on to say, the second to the last sentence, quote: If polychlorinated biphenyls are found, it still does not prove that aroclors are the initial source of contamination. Do you know what that statement means?

A It means basically what it says, that at that particular point in time, I don't think we were yet thoroughly convinced that aroclors were the source of the PCB's in the environment.

Q Well, what other source of PCB's did you consider possible?

A Environmental combustion, auto engines, incinerators, incinerated wastes. There are a multitude of ways PCB's could be formed to get into the environment. This is true of not only PCB's, but other types of pollutants. We did not have enough proof to say, yes, aroclors were the total source of PCB's in the environment. We really didn't know. You see,

at this particular point in time, this was the first case of an industrial chemical that had not been intentionally spread around that was found in the environment, so it was very new for people to think this way.

Q So you thought there was a possibility in December of 1968 that PCB's might have been manufactured as a byproduct of other uses, other chemicals, that might be appearing in the environment in that way?

A Correct.

Q When, after December of 1968, did you confirm your opinion that aroclors were the source of PCB contamination?

A I don't know exactly when. But I think, as we generated more and more information and we got to thinking more and more about how these things were used and had been used over the years, it became more and more evident to us that maybe and perhaps and for sure that aroclors were probably the source of PCB's in the environment. Whether the total source is still questionable. I mean, there are still other places they might come from. But it eventually became obvious that the dominance of PCB's in the environment was from the manufacture of aroclors or PCB-type fluids.

Q By the time you completed the Krummrich plant samples and determined that PCB's were in those environmental

samples, was it your opinion that PCB's were -- strike that -- aroclors were the source of the contamination?

MR. SCHINK: I object to the form of the question. When are you referring to now, Miss Oliver? These documents indicate continuing analysis and there is more than one document that indicates continuing analysis of Krummrich. What are you referring to in your question?

MISS OLIVER: You are right. Maybe we can clarify this, Mr. Schink.

Q Between January and April, to the best of your recollection, you performed analyses on 167 samples, correct?

A Correct.

Q And the laboratory records that were kept would confirm when, in fact, those analyses were done, correct?

A Right.

Q And as you sit here today, to the best of your recollection, they were done between January and April, 1970?

A Correct.

Q And the 167 samples that were initially done included the Krummrich plant samples that you testified earlier that you did first?

A Yes.

Q So those would have probably been done, in your opinion, to the best of your recollection, in January of 1970?

A Yes.

MISS OLIVER: Now, could you go back and read the question that I asked before Mr. Schink objected.

MR. SCHINK: I have the same objection to the form of the question, but you may read it back.

(The following question was read back by the court reporter: "By the time you completed the Krummrich plant samples and determined that PCB's were in those environmental samples, was it your opinion that PCB's were -- strike that -- aroclors were the source of the contamination?")

A Yes.

Q Going back a minute to Exhibit Number 3, the second page, there is a statement at the end of paragraph three before the subparagraphs, quote: To help us determine if aroclors are the actual source of contamination, the following experiments have been planned. And underneath there are four subparagraphs. And the first one under A is water solubility of aroclors. Dr. Tucker, can you tell how water

solubility experiments would help you to determine whether aroclors were the actual source of contamination?

A Well, the water solubility studies were simply to determine if water came in contact with the aroclors, how much would be carried around. In other words, if you had aroclor in the soil or sediment or if you had aroclor in the process or something of that sort, and you wash water over it, how much could you anticipate would be solubilized and would go with that water into the environment or wherever it went. So that was basically what that was about.

Q That study was done by you?

A Yes.

Q And the second or -- strike that.

Who prepared these four experiments that were planned in the summer of 1968?

A These primarily came from, I think, Dr. Richard and his people.

Q Did you have any input into what type of experiment should be done?

A Did I have any input?

Q Yes.

A Yes.

Q Did you agree that a water solubility test should

be done?

A Yes.

Q And was that for the purpose you just stated a minute ago?

A Yes, to determine the mobility of PCB's when they came in contact with water.

Q Who suggested that contamination might be caused by aroclors having come in contact with water and being washed with water?

A I don't know specifically. It probably came from the process people.

Q Who are the process people?

A People in Dr. Richard's group.

Q The people in the functional fluids group?

A That is correct.

Q Did Dr. Richard or anyone from his group discuss with you why they may have thought that PCB's were being washed with water and that's how they were a contamination source?

A No.

Q The second experiment suggested here is incineration of aroclor-containing paper. How would that test or experiment help you determine if aroclors were the actual

source of contamination?

A As I am sure you are well aware, aroclor was used to produce encapsulated carbonless carbon paper. And the paper itself, while much of it was recycled, a lot of it could be destroyed by incineration. So what you are really looking for here was how mobile were polychlorinated biphenyls in the environment.

Q Was that test performed?

A Yes.

Q When was that test performed?

A About the period of time that we are discussing here.

Q What did you find?

A The tests involved taking carbonless carbon paper and placing them in a chamber. This is a laboratory test. The paper was then burned and the off-gases were then collected and analyzed for PCB's. And as you might suspicion, we found the PCB's.

Q The test was conducted in early 1969, to the best of your recollection?

A Yes.

Q How about the water solubility of aroclors test or experiment? When was that performed?

A Around that same period of time.

Q What did you find from that test?

A We found again, as you might suspicion, that the water solubility of the aroclors was extremely low in pure water and you weren't dealing with what you call a classical solubility that you have with ionic species. But they were soluble in water, but at extremely low levels, like parts per billion or trillion.

Q But you determined that PCB's or aroclors coming in contact with water could be a source of contamination? That was being found?

A Yes.

MR. SCHINK: At the levels indicated, parts per billion and parts per trillion.

Q How about parts per million?

A I don't think parts per million unless the water was very heavily laden with sediment.

Q The third experiment here is analysis of air, water and soil samples from around your manufacturing sites. How was that experiment going to tell you whether aroclors were the actual source of contamination that had been found?

A Well, if we couldn't find polychlorinated biphenyls in and around the plant sites that manufactured the materials,

then, they probably obviously couldn't be a source of contamination.

Q When was that experiment done?

A I believe this is an indication of experiments that were to be done, and it was done, I am certain, after this period, shortly thereafter.

Q After 1969?

A I believe.

Q Did you again find that, yes, in fact, there were PCB's in air, water and soil samples from around your manufacturing sites?

A I believe we established that previously, yes.

Q The last experiment indicated there is feeding studies with pesticides that might be metabolized to PCB's. Did you perform that experiment?

A I believe we did some feeding of DDT. And I think that was the only one. However, we might have looked at some other chlorinated hydrocarbons that we knew had been intentionally sprayed in the environment to see whether or not -- to see if the peaks or materials isolated from the tissues after these compounds had been metabolized would look like the polychlorinated biphenyls.

Q That was to determine whether either DDT could

somehow change into PCB's or appear to be PCB's; is that correct?

A That's correct.

Q Were these studies done in conjunction with Industrial Biotest?

A All feeding studies or any animal toxicology studies were not done within Monsanto; they were done externally, yes.

Q Were these feeding studies with pesticides done in early 1969 along with the other experiments?

MR. SCHINK: I object to that. He didn't say the third one was done in early '69. He indicated it was done after the date of this memo.

MISS OLIVER: I believe he said in 1969.

MR. SCHINK: Now, you are using early 1969. You are changing his testimony.

MISS OLIVER: Let me clarify that, Mr. Schink.

Q Were the feeding studies done in early 1969?

A I believe they were initiated at that point in time, but we actually got the tissue samples and analyzed them -- I am not really sure, but yes, obviously, these were things we either going to do or initiate, so they were done sometime after this report was issued.

Q After December of 1968?

A Correct.

MR. SCHINK: Well, you represent that's when this report was issued, Miss Oliver.

MISS OLIVER: Well, Dr. Tucker can take my representation, which I believe Dr. Richard testified to in his deposition.

MR. SCHINK: Well, I don't know whether that is the case or not.

MISS OLIVER: Well, let's go on.

Q These four experiments that appear on Exhibit Number 3, Dr. Tucker, were they all begun in early 1969?

A As I indicated, there is no doubt that these experiments were initiated after the date that appears on this memo, and it appears that it is 1968, so they were probably done in 1969. Whether or not A was initiated before B or B was initiated before C, I don't really recall.

Q Were they matters of priority to you in any way with respect to your PCB analytical work assignments?

A Yes, they were obviously priorities.

Q If you look at the fourth page of this document, which appears to be page thirty-four of this functional fluid monthly summary, the last two sentences indicate that

aroclor analysis of sediment samples had been taken from Snow Creek. Do you know where Snow Creek was? What was that?

A Anniston, Alabama is Snow Creek.

Q This is an indication that one sediment sample from the plant outfall contained .25 percent aroclor. Do you recall, Dr. Tucker, that sediment samples from the plant outfall at Anniston had been collected and analyzed as of December, 1968?

A Yes.

Q And you had analyzed at least one sediment sample from Anniston?

A From this document it appears that way, yes.

MR. SCHINK: The question was: Do you remember that independently from what this document says?

A I don't remember it specifically. I know we did our samples from the Anniston plant. I do remember Snow Creek.

Q Do you have any reason to believe that the information provided in this functional fluid monthly summary is incorrect or inaccurate?

A No.

Q By the way, were the functional fluid monthly summaries prepared on a regular basis, to your knowledge?

A Yes.

Q And they were prepared by Dr. Richard or his staff?

A Yes.

Q Did you review them?

A No. I got copies of them, but I didn't review them prior to publication.

Q But you would review them after receiving copies to be kept up to date on what work was going on?

A Yes.

Q Which included review of what work was indicated that you were doing?

A Yes.

Q And if there was some --

MR. SCHINK: I don't think there is any indication that the Snow Creek aroclor sample is something that Dr. Tucker did. Indeed, quite the contrary. It doesn't even talk about a PCB analysis. You don't mean to imply that is what he was doing, do you?

MISS OLIVER: Of course not. I am just

(No omission - page 123 follows

talking about what the document says.

MR. SCHINK: Well, Miss Oliver, you don't mean to suggest that that document says that Dr. Tucker was doing that work, do you, with your questions?

MISS OLIVER: I asked him if he knew about it, Mr. Schink, and he said he did. That's all I asked. And let me ask the question: Are you testifying now that he didn't perform the samples?

MR. SCHINK: I am not testifying. You didn't ask that. I want to make sure it is not implicit in your question.

MISS OLIVER: The question is clear, Mr. Schink, and the answer was very clear.

MR. SCHINK: Clearly misleading, did you say, or clear?

MISS OLIVER: The answer was misleading. Let's not argue on the record, Mr. Schink.

Q Dr. Tucker, in reviewing the functional fluid monthly summaries, after you received a copy, if you recognized that there were any inaccuracies as to what Dr. Richard or his staff were reporting as to the work that was being done or planned for your group, you would have so

advised him?

A If the work was done by me, yes, I would have advised him. No question about it.

Q Did you conclude at some point in time that chlorinated hydrocarbon insecticides were metabolizing for PCB's?

A Did I conclude -- can I rephrase that question?

Q Sure.

A Did I conclude that chlorinated hydrocarbon pesticides were being metabolized into bona fide poly-chlorinated biphenyls?

Q Yes, that's fine.

A I believe the conclusion was they probably weren't.

Q They were not?

A Were not.

Q Dr. Tucker --

MR. SCHINK: Miss Oliver, I would like to interject something for the record. You marked as an exhibit a document which bears the numbers 800 through 803, which throughout your examination of this witness you identified as a December, 1968 functional fluid monthly summary. The last two pages of that document have a different handwritten

identification at the top, and it appears on their face not to be part of the December, 1968 summary. Nevertheless, you represented to this witness that you were reading to him from the December, 1968 summary, which in fact, you weren't; you were reading from a later summary. And I would like to state that because I think you might want to clarify the record in that respect, Miss Oliver, because as it is right now, it is grossly misleading. And I am sure you did that inadvertently.

MISS OLIVER: Well, the documents that were produced to us by Monsanto were produced to us in that manner. And if they were misleading --

MR. SCHINK: Miss Oliver, you stated on the record that the sentence you read to this witness was taken from a December, 1968 monthly summary, when manifestly it was not. You further testified that Dr. Richard said that. I believe that is contrary to fact. I think as an officer of the court you have a duty to accurately represent to the witness the documents that you are showing him. And you have not done so.

MISS OLIVER: Let me state, first of all, to

you, and I don't want to clutter up the record with argument, Monsanto had provided the document without providing page numbers 13 and 14 and then stapled to it pages 33 and 34, in the manner that they have consistently done in this case.

MR. SCHINK: That is your statement for attempting to mislead the witness. I think that's an inappropriate excuse.

MISS OLIVER: Let me clarify. I don't want any misunderstanding, certainly, on my part.

Q Dr. Tucker, there appears to be, on page 33 and 34 of this document, the last two pages, a handwritten note that says "FFMS, January and February, 1969." According to Mr. Schink, that may refer to a functional fluid summary in January and February, 1969. The first two pages of the document that were attached referred to the monthly summary December of 1968. So that there is no misunderstanding, do you have any reason to believe that the Snow Creek sediment sample referred to on the last page of this document was done and analyzed by Monsanto before January or February of 1969?

MR. SCHINK: I object to the form of the question.

MISS OLIVER: You can object all you want, Mr. Schink.

MR. SCHINK: I have, Miss Oliver.

A Let me put it this way, I find it rather confusing that we have two handwritten dates on the pages, neither of which are verified by any typed thing on it, so in terms of my memory for that period of time, as far as I am concerned, it could be '69 or it could be '68.

Q Okay, that's fine. Thank you.

You don't know one way or the other?

A I don't know.

Q The handwritten notations on this document are because Monsanto deleted portions to us in providing it to us and we don't have the entire document with the cover sheet on it, so I am not trying to mislead you, as these were the way these documents were provided. I just don't want you to think we were given the entire document.

Do you recall sending Dr. Jensen any of the aroclors to perform any work on?

A Yes, I believe there was a request through Dick Baxter through Ron Liggett (phonetic spelling) at our Ruabon facility for specific isomers for identification purposes that we had in our possession.

Q Who was Mr. Baxter?

A Dick Baxter I believe was kind of like Richard's counterpart in Europe, although I don't know specifically his function. At any rate, we received the request for the individual isomers that had been isolated over the years for one reason or another and we, in turn, promptly put them together and sent them to the people.

Q There were individual isomers that had been isolated by Monsanto from aroclors?

A Yes. As a matter of fact, one particular isomer. As you know, one of the uses of aroclors as a functional fluid was because they were liquids at all different temperatures. There was one particular isomer, the four-four prime dichlorobiphenyl, that was insoluble in that mixture and from time to time it would precipitate out for protracted periods of time. So that was one way a particular isomer has been isolated. There were reasons for synthesizing other individual isomers to see what effects they had on the functional fluid properties that were made out of these PCB's.

Q What group performed this identification of isomers?

A Dr. Richard's group.

Q How many isomers had been separated and identified?

MR. SCHINK: When?

MISS OLIVER: Up until the time that Mr. Jensen or Dr. Jensen asked for some isomers.

A I believe we probably had on the order of fifteen to twenty, maybe.

Q And these isomers had been separated and identified not for purposes of PCB identification? That had come in connection with Dr. Jensen's work?

A No, they were not produced for those purposes.

Q Do you know when they were produced?

A Somewhere between -- I would say starting in the 1940's when the synthetic techniques were available to that particular date. They had been produced over the years by interested organic synthesis chemists in the Organic Division.

Q Do you know how the isomers would be separated and produced?

A I don't think they were really separated. I think a lot of the isomers were made through specific synthesis routes whereby you are not just directly chlorinating biphenyl where you get a mixture, but where you might take two different materials and then combine them and you might

only come up with one isomer or a couple of isomers.

MISS OLIVER: Why don't you mark this as the next number.

(Defendant's Exhibit 4 duly marked for identification.)

Q Dr. Tucker, I would like to show you what we marked as Exhibit Number 4, which is a memorandum dated January 30, 1969, with your name at the bottom to a Dave Wood in Brussels, Belgium, and ask if you identify that as being prepared by you?

A Yes, I think I recognize that as a document I prepared.

Q And you sent to Mr. Wood in Brussels?

A That is correct.

Q Did Mr. Wood supply Dr. Jensen with the chlorinated biphenyl isomers?

A They may have supplied them with some of them, yes. I believe that's one of the questions in the memo.

Q Do you recall a response from Mr. Wood?

A I believe he did respond to it. I don't recall specifically a response from him on that.

Q What was your purpose in asking whether -- strike that -- asking which chlorinated biphenyl isomers had been

supplied to Dr. Jensen?

A Primarily because we probably did not want to duplicate those which we were supplying because we only had milligram quantities of these materials to start with.

Q So you were supplying isomers to Dr. Jensen as well?

A I believe we did through Ruabon. I did not supply them directly to Soren Jensen. At least, I don't remember doing it. But I am sure I did not.

Q There is a reference in your memorandum to the identification done by other companies or persons. Can you tell me what that reference is?

A I believe it states, "Has Daeyer, Progil or Kuhlman done any identification work," and what I was trying to find out is whether or not any manufacturers of polychlorinated biphenyls had an active program so that we could get information from them.

Q Were these three other manufacturers of PCB's in Europe?

A Those are three of the other manufacturers in Europe.

Q Monsanto also manufactured and sold PCB's in Europe?

A Yes.

Q Did you receive any information about other manufacturers of PCB's?

A Yes.

Q What did you learn?

A I don't recall specifically, but I know there was a response from them.

Q Did any of the other manufacturers identify PCB's in the environment?

MR. SCHINK: When?

MISS OLIVER: At any time that Dr. Tucker knows of.

A It's my recollection that the European community was not very excited about the whole problem. So whether or not they did anything specifically, I don't recall any specific information from these people. And as a matter of fact, I am sure they did not.

MISS OLIVER: Off the record.

(DISCUSSION OFF THE RECORD)

Do you want to mark this as the next document.

(Defendant's Exhibit 5 duly marked for identification.)

Q Dr. Tucker, I would like you to look at what we

have marked as Exhibit Number 5, which is a document that was prepared by Dr. Richard. Take a minute to look at it, if you would like.

MR. SCHINK: This is not a document that was on its face addressed to the witness. What kind of review do you want him to make of this document?

MISS OLIVER: I want him to look at it and tell me if he has seen this document before today, first of all.

A I don't recall seeing this document before.

Q By September of 1969, Dr. Tucker, had you reached a conclusion, did you have an opinion on the degradation rate of aroclors?

A By September of 1969, I really don't know whether I had an opinion at that time. I definitely developed an opinion after a while because I did a lot of work with it. But whether or not my exact opinion was in September of 1969, I don't recall.

Q You provided Dr. Richard with all the information that you had developed on a regular basis, did you not?

A Yes, we did.

Q Based on the work that you had done, Dr. Tucker, up to September of 1969, did you agree with Dr. Richard's

statement that the "Department of Interior and/or State authorities could monitor plant outfall and find parts per million of chlorinated biphenyls at Krummrich or Anniston any time they choose to do so"?

A Yes.

Q As of September, 1969, based on the work that you had done in this matter, would you agree with Dr. Richard's statement that "Aroclor degradation rate will be slow"?

A Yes, I would agree with that statement.

Q Do you recall Dr. Richard discussing with you that Monsanto would have to restrict uses and clean up as much as you could starting immediately?

MR. SCHINK: When?

MISS OLIVER: In this period.

MR. SCHINK: What period?

MISS OLIVER: Up to September, 1969.

MR. SCHINK: Do you recall in September of 1969 that discussion with Dr. Richard?

MISS OLIVER: Any time up to that period of time.

A I don't recall the time frame, but we certainly had those kinds of discussions.

Q When you became involved in PCB matters starting

in 1967, did you keep yourself apprised of literature and developments concerning effects of PCB's in animals and humans?

A Yes. Animals. I haven't seen too many human studies with the exception of the Japanese Institute.

Q I would like to show you a document that was marked at the Johnson deposition. Do you know Norman Johnson?

A Norm Johnson, yes, I know Norm Johnson.

Q Did you work with him when he was at Monsanto and you were at Monsanto?

A I had occasion to work with him when I became involved with PCB's, yes.

Q This document is Exhibit Number 1 to Norman Johnson's deposition. And it is a copy, a correspondence from Mr. Wheeler, and a copy of a paper presented by Joseph C. Street. Dated October 9th, 1969. Do you recall seeing this paper from Dr. Street?

A Yes.

Q Did you see it in 1969?

A I don't know exactly when I saw it. Probably shortly after it was published, if it was published. Was it published?

Q This was a pre-publication manuscript that was provided to Monsanto.

A I may have seen the pre-publication pre-print and, again, I may have seen it when it was actually published. I do believe Street actually published this, did he not?

Q He did. The subject matter of professor Street's paper is on the comparitive effects of polychlorinated biphenyls in organo-chlorine pesticides in induction of hepatic microsomal enzymes. Before reading Dr. Street's or Professor Street's paper, had you been aware of the possibility of PCB's inducing hepatic microsomal enzymes?

A No.

Q What do you understand that to mean?

A I understand it to mean that chlorinated hydrocarbons in general as a class have this particular property in avian and animal-type samples.

Q What is that property?

A I am not really that clear on exactly what the technical aspects of it are. As I stated previously, I am not a toxicologist.

Q What was the purpose for your reviewing Professor Street's paper or reading it?

A It dealt with PCB's, which I was professionally

interested in.

Q Did you discuss Professor Street's paper with anyone at Monsanto?

A I don't remember specifically discussing his paper with anyone at Monsanto. I could have.

Q Was the question of induction of hepatic microsomal enzymes discussed within Monsanto as it related to PCB's?

A I am sure it was. I don't know what species was studied. I don't even recall -- well, I don't recall truthfully.

Q You have no recollection of any discussions within Monsanto about a possible effect on enzyme induction?

A No, I don't remember any specific discussions of that sort.

Q Were any studies ever undertaken by Monsanto through its consultants to study the induction of microsomal enzymes?

A I don't think any studies, to the best of my recollection. I don't think any studies were done with Industrial Biotest on microsomal enzyme induction. They might have picked up something of that sort in the blood chemistry that they normally do or the toxicology studies.

But again, I am not a toxicologist.

Q To your knowledge -- well, strike that.

You helped prepare the description, the protocol of the toxicity test or studies that were to be done by Biotest?

A Yes.

Q To your knowledge, do you have any recollection of any such enzyme induction studies or tests?

A No, I honestly do not.

Q Did you visit any research or development plants in Europe?

A No.

Q Did you make any trips to Europe relating to PCB's?

A No.

MISS OLIVER: Would you mark this as the next one.

(Defendant's Exhibit 6 duly marked for identification.)

Q Before I forget, Dr. Tucker, you referred a couple of times this morning to weathered samples. Do you recall that testimony?

A Weathered PCB samples, yes, that's correct.

Q What do you mean by that term?

A What I mean by that is that there are a variety of analyses which are done on samples, which I would say would be a long distance from direct contamination by polychlorinated biphenyls. And they found chlorinated biphenyls, but the earlier isomers were missing from the samples. And the samples were predominantly pentachloro-biphenyls and higher isomers. In other words, the predominant isomers not found in those samples were the mono-, di-, tri-, and tetrachlor biphenyls.

Q So the lower chlorinated isomers were not found and the higher chlorinated ones were?

A Yes.

Q How do you explain that fact or occurrence?

A For a long period of time we didn't. However, as we started doing laboratory work, tissue residue analysis, biodegradation and things of that sort, we and the community in general began to feel that the lower chlorinated biphenyls were metabolized, destroyed somehow, whereas the higher chlorinated biphenyls were not.

Q Do you recall approximately when you reached that conclusion?

A When we had definite laboratory data to support that conclusion.

Q When, in your opinion, was it supportable as a conclusion?

A When we began to generate data in the laboratory ourselves from tissues that were from animals that were being fed very low levels. And also when we began doing the semi-continuous activated sludge biodegradation studies. I published a paper on that particular topic. And I believe that was part of the information that was presented to the President's Council on Environmental Quality.

Q I want to show you Exhibit Number 6, which is a memorandum dated December 16th, 1969 from Mr. Garrett of the Medical Department at Monsanto to Howard Bergen. Do you know who Mr. Bergen was?

A Yes, Howard Bergen was Bill Richard's boss.

Q This memorandum refers to a meeting attended by Mr. Garrett and he indicates that you attended the meeting as well.

A Yes, I believe we made reference to this meeting earlier.

Q This is the meeting with the Michigan Water Resources Commission?

A Correct.

Q Would you read this memorandum and tell me whether

it refreshes your recollection as to when the meeting occurred and what was discussed at the meeting?

A Do you want me to read it out loud?

Q No, read it to yourself.

MR. SCHINK: If you have a fresh recollection, you can testify to it.

A Okay, may I ask to have the question reread?

Q Sure. Let me just repeat it and rephrase it.

Does reviewing this memorandum by Mr. Garrett refresh your recollection as to when this meeting of the Michigan Water Resources Commission occurred and what transpired at the meeting?

A Yes.

Q Did the meeting occur in the summer of 1969?

A It, in accordance with the date of this particular memorandum, yes, it did.

MR. SCHINK: The question is not whether the memo says that, but in looking at it, can you now put the memo down and in your own mind know that it took place at that time?

A It took place around that time.

Q I understand that is the best you can remember.

Do you remember that you attended the meeting with

Mr. Garrett?

A Yes.

Q What was the purpose of the meeting?

A As we -- I guess we had gone up to -- we wanted to go and discuss with the Michigan Water Resources Commission some allegations by some competitors that the Pydraul fluids were all bad, and that kind of thing. And I went up along as a technical backup as an expert on the analytical aspects of PCB analysis.

Q Were any of Monsanto's customers present as well?

A I don't think so.

Q Do you recall discussing the same matter with General Motors?

A I recall visiting General Motors, but I don't recall the exact discussion. But I mean these were all PCB-related topics.

Q So, you visited the General Motors plant in Michigan at the same time you met with the Michigan Water Resources Commission?

A I don't know. I know I visited General Motors' plant and talked to some people, but I don't recall that it was in conjunction with this trip. It may well have been.

Q What do you recall was discussed at the meeting with

the Michigan Water Resources Commission as specifically as you can today tell me?

A Without the help of that memo, I will tell you very truthfully, outside of saying we discussed PCB's and I probably discussed the analytical problems with PCB's, I couldn't tell you specifically what we discussed at that meeting. With the help of that memo, I can tell you what is in that memo after reading it.

MR. SCHINK: The question is really what you remember independent of what the memo says.

Q Do you recall what your input into that meeting was?

A You mean do I recall exactly what I said there or even the gist of what I said?

Q The gist of?

A No, I don't. I do know why I went along on those meetings and I assume it would have to do with the analytical portion of how to measure PCB's.

Q Mr. Garrett refers in his memorandum to an agreement by you to analyze some of the clams. Do you recall analyzing clams?

A No.

Q Do you recall Mr. Fetteroff?

A I recall the name because it is an unusual name, but I couldn't picture the man.

Q Do you know who he was?

A I don't recall him, no.

Q Do you recall any discussions with Mr. Garrett after that meeting about what was discussed with the Michigan people?

A I am sure we had discussions, but I don't recall exactly what we discussed.

Q Do you recall Mr. Garrett or anyone from Monsanto telling you that if 1242 was ever proven to be a persistent environmental contaminant, we could be out of business with our Aroclor-containing fluids in the State of Michigan?

A I don't think anybody needed to really tell me.

Q You knew that?

A Yes, I believed it.

Q At the time of this meeting in Michigan, you have not yet concluded that chlorinated Aroclors were generally in the environment?

A I don't think it really has been concluded that the lower chlorinated biphenyls are generally in the environment. I think it's been established just the opposite is probably true.

Q At the time of this meeting with the Michigan Water Resources Commission, did you have any reason to believe that Aroclor 1242 would be found in the environment?

A Yes, I think I probably had reason to believe this, especially around the plants where it was manufactured, where it wouldn't have a chance to degrede in any manner whatsoever. Yes, around the plants, certainly.

Q Who is Mr. Liggett (phonetic spelling)?

A Ron Liggett reported to Dick Baxter and he was like I would say a chief chemist or something like that over in Ruabon.

Q Was he working on Aroclor biodegradation studies?

A Yes, he and Gene Mainprize had done some work on the biodegradability of PCB's as well as other materials, too.

MISS OLIVER: Could this be marked.

(Defendant's Exhibit 7 duly marked for identification.)

Q Exhibit Number 7, Dr. Tucker, is a cover page, this time of the monthly summary January and February, 1970 for functional fluids. And the page that has been provided to us in this case by Monsanto is called "Aroclor Defense" and there are references in this document to biodegradation

work being done by Monsanto. Would you review this document and tell me whether this work, as indicated in this document, was being done by you or under your supervision?

A Yes, this appears to be work done under my supervision.

Q Is this an accurate statement of the work that was being done by your group in January-February of 1970?

MR. SCHINK: If you recall.

A Yes, I recall. This is -- yes, this is an accurate summary.

Q This document refers to biodegradation studies that were done on Aroclor 1222, 1242, 1248 and 1254. And the results indicated that only Aroclor 1222 was significantly degraded. Is that your recollection of the results of that study?

A I don't think this indicates the study was completed. But I think, at that particular point in time, there were -- these were the results we had, yes. As a matter of fact, this data was actually published in an environmental bulletin of contamination and toxicology.

Q And the semi-continuous activated sludge studies had been carried out at this time?

A They were being carried out. This particular type

of study requires a long period of acclimation in some cases before you get any type of degradation whatsoever. So these things were ongoing studies and they were sampled on a daily basis and monitored for rather protracted periods of time, sometimes eight weeks, sometimes three months.

Q There is a reference here to, quote: Some slight degradation of the lower chlorinated isomers in Aroclors 1242 and 1248 was observed. Did the studies that were done after this change that conclusion?

A The conclusion really did not change. What the finished synthesized overall studies showed was that biphenyl was very easily degraded. Monochloride, the di- and tri- went very quickly and some of the tetras. As you increase the degree of chlorination on the biphenyl molecule, it becomes more refractory. It's more difficult to biodegrade. I think that is well established.

Q Did you do any work, Dr. Tucker, with attempts to develop a method to reduce the Arocloric content in the Monsanto plant effluent?

A I don't know what you mean by a method to reduce. Can you -- did I participate? Well, I am not going to rephrase your questions. You know what you want to ask.

Q Did you participate in doing a method to remove

Aroclor from effluent at Monsanto plants?

A No. Let me be very careful on that because, if they were doing development work and if Krummrich did not have their electron capture TC's in place, we may have analyzed samples for them, but I didn't participate directly in how to do it. But we may have analyzed some samples for them, but I don't know. We weren't always told what the objective was. We knew where the samples were from and they were logged in as such, but it could have been a pollution study or --

Q So, one of your jobs or responsibilities was not to help develop a method?

A Only insofar as we might provide support in analyzing samples for PCB's.

MR. SCHINK: Only for customer support.

MISS OLIVER: Is that testimony again, Mr. Schink?

Can you mark that as the next exhibit.

(Defendant's Exhibit 8 duly marked for identification.)

Q Exhibit Number 8, Dr. Tucker, is an Aroclor Analytical Program to W. B. Papageorge from R. E. Keller, dated April 28, 1970. Can you identify this document as a

document prepared by Dr. Keller involving work you did or planned to do?

MR. SCHINK: Again, this is not a document Dr. Tucker is shown as having received. I don't think there is any foundation.

MISS OLIVER: You are right, Mr. Schink.

Q Have you see this document before, Dr. Tucker?

A Yes, I believe I probably saw that document.

Q You probably saw what? I am sorry?

A I believe I probably saw that document.

Q Did you help Dr. Keller prepare it?

A Yes, I believe I probably did.

Q Okay. By the way, in 1970 you became or were the group leader; is that right?

A That's correct.

Q And Dr. Keller was now the section manager?

A That's correct.

Q Did you have other responsibilities besides PCB matters?

A Yes.

Q How much of your time in 1970 was devoted to PCB analyses?

A Well, considering I worked about 140 percent of the

time, I would say 90 to PCB's and about 50 to the other. We spent a lot of time on PCB's, but we also had other responsibilities. And as time went on and the work load from PCB's did increase, the other responsibilities did decrease until virtually I was almost full time.

Q Can you give me an idea or an estimate as best you can as to when you became almost full time consumed with PCB matters?

A In or around 1970, early 1970.

Q Is Exhibit Number 8, the Aroclor Analytical Program, intended to be a summary of the projects to be done relating to PCB's?

A Yes. By the applied sciences section.

Q Only by your group, in other words?

A Yes.

Q Did you sit down with Dr. Keller and prepare the objectives and the actions that appear in the program?

A Yes.

Q I take it you discussed this program with him sometime prior to the date that the document bears of April 28, 1970?

A Yes.

Q Do you recall how many discussions you had with

Dr. Keller to prepare this program?

A We worked one-on-one, so it was as many discussions as were necessary. It wasn't like he was remote, twenty miles away or something like that. I reported directly to him at that time.

Q Was anyone else involved in preparing this program?

A Yes. At that particular time, Martin Dietrich and Ed Emery, who were also group leaders, were involved at that time.

Q The first paragraph in the program itself refers to the projects indicated or supportive to the objectives given in the management plan. What does that mean?

A I assume -- well, I assume there was a management plan, an overall plan, perhaps even issued by Wheeler or Richard. At least, that is what you would surmise from this. And this was the portion that we were going to contribute. I believe this was really an attempt to give the people an idea of the number of man weeks of effort that were going to be required and the timing that was going to be required so we could get our priorities, set priorities and get the proper manpower for the projects.

Q Do you recall seeing the management plan?

A No.

Q Do you know who determined the objectives that are listed on this document?

A Do I have direct knowledge of who?

Q Well, do you have any knowledge?

A I would assume that it would probably have been done between Wheeler and Richard and perhaps at even a higher level; I really don't know.

Q Do you recall that you were told the objectives were on a priority basis and your task in developing this program was to set out the action projects that would accomplish that objective?

A Yes. In other words, we were trying to basically spell out what we needed to do to accomplish the overall objectives, yes.

Q For example, objective number one is reduce and effectively control the PCB contents from the effluent from all Monsanto plants. To the best of your knowledge, that objective number one was decided upon by someone other than Dr. Keller or you?

A That's correct. We weren't at the policy decision-making level.

Q Did you and Dr. Keller and other persons in your group sit down and decide what actions should be taken to

achieve that objective?

A We sat down and decided what actions we would need to help them achieve the objectives, yes. In other words, the type of support that our group would have to provide and be prepared to provide.

Q So these three actions listed under objective one are the result of your discussions with Dr. Keller and the other people in his group?

A Yes.

Q Why did you decide that one of the actions should be to determine PCB residues in fish from the Choccolasso Creek at Anniston as a means of reducing and controlling PCB content of effluent?

A I don't think the determination of residues in fish will reduce or control the effluent from our plants. I think the objective is to find out what is there, so you know what you have to do to begin with and, secondly, how much is getting out and what kind of controls you need to take. For example, if you find absolutely huge levels, then, you know that the housekeeping is not very good. And if you find very, very minor levels, then, you would know it would be a much more difficult effort to contain. So, you are really trying to tell them what the situation was at that particular

time by looking at those types of samples.

Q What did you find at the Choccolasso Creek at Anniston?

A I believe we found PCB's in the fish.

Q In high levels or low levels?

A Could you qualify high and low for me?

Q Well, you just used the terms high levels and low levels.

A All right, in part, in some instances, depending on probably where the fish were taken, distance from the plant, type of species, whether it was a bottom feeder, et cetera, you would find, I would consider high to be part-per-million levels. I would consider low to be part-per-trillion levels.

Q Did you find some fish at part-per-million levels?

A Yes, I believe we did.

Q One of the other action plans was to transfer the G.C. methodology to the Krummrich plant; is that right?

A Yes.

Q As of this time in April of 1970, the Krummrich plant did not have a G.C. methodology or technique to be able to identify PCB's?

A That's correct.

Q And I take it that once the methodology was transferred to Krummrich, it would take some time to get the system working?

A Not as much time as it took us, but yes. It was our job to first develop the proper techniques and get them under our belts, so to speak, and then, at some point in time, as the sample load became quite large, it was decided that we should transfer this methodology to the quality control laboratories. And it was our job to show these people since we had already been through it.

Q Would it have been a couple of months or several months?

A Several months.

Q The objective number three on page two of the program is "Develop products to replace Aroclors for those uses in which Aroclors have been demonstrated to be harmful to the environment and cannot be prevented from escaping into the environment." To the best of your knowledge, Dr. Tucker, was objective number three an objective that was developed by persons at Monsanto other than you and Dr. Keller?

MR. SCHINK: Keller?

MISS OLIVER: Keller.

A Yes.

Q The action that is listed under objective number three is what you and Dr. Keller decided would be appropriate for your group to do to achieve that objective, right?

A Yes.

Q And the action is to "Develop techniques needed for purity or composition measurements and for biodegradation studies of replacements and replacement candidates."

Q Let's take the first part of that. First, what does techniques needed for purity or composition measurements mean?

A Well, it simply means if you have something, you want to know what is there. But now, purity determination is a gross determination and a trace determination -- I mean, you would have the major components and very minor components, so it's a different type of thing than when you are analyzing an environmental sample.

Q In April of 1970, when this program was developed, were you working on replacement Aroclor products?

A I was not, no.

Q At that time your group had not done any work on replacement products?

A No. As I -- well, no. Let me clarify that. My group was not responsible for coming up with replacement

candidates.

Q I understand. Did you do any work as you were asked to or requested to by other sections or groups concerning replacement products?

A We did eventually, yes.

Q In April of 1970, had you done any?

A I can't say in April of 1970 we had done any. We certainly probably did after that.

Q Fair enough. Did you do biodegradation studies of replacement products?

A Yes, we did.

Q Are you familiar with the product line called Pydraul?

A Yes.

Q Was it your understanding that Pydraul, which had been sold by Monsanto up until sometime in 1970, contained PCB's?

A Yes. Some of them. You realize Pydrauls were a family of fluids and they were phosphate esters, PCB's and a variety of things, so, yes, within the family of Pydrauls there were PCB-containing Pydraul fluids and PCB-Pydraul fluids.

Q For example, Pydraul F9 contained PCB's and

phosphate esters, did it not?

A I believe it did because I know some of them did. But whether or not F9 -- that doesn't mean anything to me.

Q How about Pydraul A200?

A I remember we had it, but what its exact composition, again I don't remember.

Q Do you recall that A200 contained Aroclor 1248 and Aroclor 1242?

A That sounds reasonable.

Q Do you recall a product called Pydraul 312?

A Yes.

Q What was its composition?

A Again, I don't remember the specific composition.

Q Did it contain PCB's?

A I think it did, but there were some that actually did not. But I am not too sure of that.

Q We can just refer to Pydrauls as A200, F9 and 312.

A Which we are going to state all contained PCB's?

Q All contained PCB's.

A Okay, fine.

Q Did you do biodegradation studies for Pydraul replacement fluids?

A Yes.

Q Do you recall a Pydraul replacement fluid called A200B?

A I don't recall the A200B specifically, but I know there were Pydraul replacement fluids, yes.

Q Were you -- strike that.

Do you know how many replacement fluids there were for Pydraul?

A You mean once they were actually marketed or actually proposed? Well, let me simplify it. I don't know the exact number or answer to either one of the questions that I put forth. I don't know how many. I don't even know how many Pydrauls they made.

Q Do you know how many Pydrauls your group was asked to do biodegradation studies on?

A We were asked to do some on the composite fluids. Normally, we did the biodegradation studies on the components to simplify the system because the biodegradation studies were complicated enough as they were.

Q Do you have a recollection that a Pydraul replacement fluid was developed and marketed by Monsanto which was manufactured with polychlorinated terphenyls?

A Yes, there were.

Q What was the terphenyl component in that Pydraul fluid?

A What was it?

Q Yes. Do you recall the Arocloric designation?

A Yes, I think those things they had -- the first two designations were 54 and the last two digits in some instances referred to the degree of chlorination of the terphenyl molecule. They made products, as I recall, like 5432, 5460 and things like that.

Q Were you asked to do biodegradation studies on those terphenyl aroclors?

A Yes.

Q Approximately when did you do those studies?

A I don't recall.

Q Do you recall what the results of those studies were?

A I believe we found -- this was quite a bit later. I believe we found, eventually established that they were not very biodegradable because they weren't very soluble either, so we played hell trying to get it into the water.

Q So, they were not soluble and they were not very biodegradable?

A That I believe was the final conclusion we reached.

Q So in that respect they were a lot like the biphenyls?

A Yes. Yes, except they were even less soluble in water and less volative and less mobile because, in fact, it's just another phenyl ring.that is added to biphenyl.

Q How long did those studies take to do? Over a period of a month? Six months?

A Okay, the standard biodegradation study usually took on the order of, say, eight to twelve weeks by the time you began feeding the bugs. You had to start out at various concentration levels and you monitored primarily biodegradation by looking for disappearance of the parent molecule. And then, you had to worry about volatility loss and you had to worry about the contact the materials had on the bacteria.

Q Do you know if those studies on the terphenyls were done before the product with terphenyl was marketed by Monsanto?

A I would suspicion that they were not because, at that particular point in time, we were running quite a bit behind on the biodegradation studies because we were just getting into them and really trying to figure out how to do it to begin with.

Q Did you discuss the results of your biodegradation

studies with Dr. Richard or Dr. Keller?

A Yes.

Q Concerning the terphenyls?

A I don't recall specifically the terphenyls. I don't think we did a lot of work on the terphenyls.

Q But you did find they were not very soluble and not very biodegradable?

A I recall that was the outcome of what we did do, yes.

Q Did you also find -- strike that.

Did you do any other work, analytical work, with the terphenyls?

A Yes.

Q What work was that?

A We attempted to develop techniques for electron capture-gas chromatographic determination of the terphenyls.

Q To identify the terphenyl samples?

A To characterize them and identify what was in them, yes.

Q Did you find in doing that work that PCB's masked or disguised the identification of the terphenyls?

A No.

Q Did you find it the other way around, that the

terphenyls disguised the appearance of the PCB's?

A No.

Q Did you ever become aware that PCB's had been found in the terphenyl products?

A Yes.

Q And how did you become aware of that fact?

A I believe we analyzed some samples of those eventually and we found that there were traces of PCB's in the terphenyl products.

Q Were the samples that you analyzed environmental samples?

A No.

Q What samples were they?

A They were product samples.

Q Do you know when those samples were analyzed?

A I don't remember, no.

Q That would be documented in your lab notebooks, I take it, right?

A It would be, probably, yes. However, those samples wouldQprobably not be treated the same as outside samples. But I am sure it's probably documented, yes.

Q What were you analyzing those product samples for?

A We were analyzing them for PCB's to see if they

were there.

Q And you found that they were?

A Yes.

Q Had someone asked you to look at those to find out if they were there?

A Yes.

Q Who was that?

A I believe the request probably came through Bill Richard or one of his people.

Q Did Dr. Richard and/or one of his people suspect there were PCB's in those samples?

A They wanted to know whether or not there were, yes. So, I believe they either suspicioned that PCB's were there or they wanted to make damn sure they weren't. One or the other.

Q Did you tell Dr. Richard that you found PCB's in the terphenyls?

A It was reported to Dr. Richard.

Q Did you report it directly?

A I don't recall reporting it directly to him, no.

Q Do you recall ever discussing that fact with Dr. Richard?

A I recall discussing it with Dr. Richard, yes. I

don't recall exactly when.

Q What do you recall discussing with Dr. Richard about your finding of the PCB's in the terphenyl product samples?

A The fact that we did see PCB's in the product samples. And I think the fact -- yes, the fact that we actually did see the materials.

Q Did you discuss with Dr. Richard whether Monsanto could continue to market the terphenyl product samples?

A I don't think there was any particular discussion at all once they discovered there were PCB's in this. I mean, it was rather obvious that if there were PCB's in it, they wouldn't continue using it as a substitute for PCB's.

Q Did you -- strike that.

Was there a replacement for the PCT's available when you found that there were PCB's in those products?

A I don't know whether there was or not at that particular point in time, but I am sure it was eventually replaced. I really don't know.

MISS OLIVER: Why don't we take a couple of minutes.

(SHORT RECESS)

BY MISS OLIVER:

Q Dr. Tucker, you were explaining to me a little bit ago about the biodegradation studies that were done not only on the terphenyls, but on all the Aroclors.

A Yes.

MR. SCHINK: And terphenyls are Aroclors, Miss Oliver.

MISS OLIVER: Right.

A Yes, but they are all referred to as Aroclors except one was the 5400 series. The other was the 1200 series and there was an exception to the rule that was Aroclor 1016.

Q How were those biodegradation studies done?

A There were three different types of studies that were employed. And in my laboratories or Monsanto's laboratories under my supervision, we used a test called the semi-continuous activated sludge test. We used a test called the river dioway test and we used a test called ultimate biodegradation, which had to do with the evolution of CO_2's, which is one of the ultimate degradation products of any carbon-containing molecule.

Q Well, did you use organisms in each of the three types of tests to determine whether they would eat away, so

to speak, at the Aroclors?

A We used common garden variety sewage bugs as the organism in question. And yes, we wanted to see whether or not these bugs would metabolize the compound we fed them.

Q Was it your opinion that, Dr. Tucker, the bugs that you fed for these degradation studies would be representative of the types of organisms that would exist, for example, in the bottom of a river?

A Yes, these were, as I tried to indicate, were common garden variety-type bugs. Our source of the bacteria that were used in these types of tests were twofold: One was from an activated sludge treatment facility, a municipal treatment facility. We simply went out and got two- or three- or five-gallon jugs and went in and took them back to the laboratory. The river dioway test involved going out and getting fresh river water with the natural population of bugs that were in that particular water. We used to get water from the Meramac River and the Mississippi River and use this water. The ultimate degradation test, usually we used a seed from the acclimated semi-continuous activated sludge material. These were very representative of environmental bacteria.

Q So you were convinced that what you were doing in

the laboratory was what, in fact, was happening in rivers and landfills and sewage areas where PCB's would be located?

MR. SCHINK: I object to the form of the question. You threw in landfills. That is a new subject. I object to the form. It's not been testified to at all about landfills.

Q Could you answer the question?

A We felt that the techniques we were using were the closest that we could get to what might be happening in the environment and to carry it out in the laboratory under controlled conditions.

Q Were you involved, Dr. Tucker, in any work related to a project within Monsanto to develop an incineration method for PCB's?

A Yes.

Q What was your involvement in that project?

A Could you name specifically the project you are referring to or may I mention one?

Q Well, the project that you recall you were involved in relating to incineration.

A The John Zink incinerator. Yes, we wanted to determine whether or not Aroclor fluids could be safely disposed of by incineration. Up until that point in time,

one of the reasons that Aroclor fluids were so useful was that they were not flammable because of the chlorine-hydrogen ratios in the molecule. So there was some serious doubt as to whether it would be feasible to destroy these materials completely in the incinerator. So I was asked to go out to John Zink in Tulsa, Oklahoma and sample an incinerator design, an actual incinerator that they had, that we would feed PCB's into to make sure that the decomposition conditions that were used completely decomposed the PCB's that were being fed. In other words, was the incinerator system capable of safely disposing of PCB's.

Q And your conclusion was that PCB's could be effectively destroyed by incineration?

A Yes. I would add "proper incineration."

MISS OLIVER: Can we mark that.

(Defendant's Exhibit 9 duly marked for identification.)

Q Dr. Tucker, I would like you to look at Exhibit Number 9, which is a Special Study Report 70-12 from the analytical chemistry group entitled "Study of the Completeness of Thermal Oxidation of Polychlorinated Biphenyls at John Zink Pollution Research" and ask if that is a study report that you helped prepare?

A Yes. This is a study report that I prepared.

Q That report is based on your visit to the John Zink Company concerning whether PCB's can be effectively incinerated?

A Yes.

Q When you referred earlier in your testimony to proper incineration of PCB's, were you referring to incineration at 1600 degrees Fahrenheit to 2000 degrees Fahrenheit?

A That's what we found to be effective with this particular incinerator. I think it has been shown you can drop the temperature a little bit and still get pretty good decomposition.

Q How much can you drop the temperatures?

A Maybe twelve, fifteen, thirteen hundred HF from recent literature I have looked at. Still a fairly high temperature.

Q Were you involved in any other work relating to incineration of PCB's other than the John Zink research?

A Yes.

Q What other work?

A I was involved in partially evaluating data from the incinerator which was eventually set up at the Krummrich plant as a customer service for disposing of PCB-containing

fluids. And I was also involved for a very brief period of time with Enviro-Chem Division people and their Landguard municipal incinerator.

Q First of all, with the incinerator, was that eventually constructed by Monsanto in St. Louis?

A (Nods head.)

Q What was your role?

A My role there was primarily to make sure that the Krummrich laboratory was analyzing the samples properly.

Q Before materials would be incincerated, they would be analyzed?

A No, in the initial tests of the installation, once it was installed.

Q What would be analyzed?

A Stack gases.

Q To determine what was coming out of the incinerator were not PCB's?

A Right, right, that the incinerator would, indeed, function as it did at John Zink and that it was being operated properly, that is, the oxidation was complete and there were no significant levels or detectable levels of PCB's being emitted from the incinerator.

Q Was that your group's job or responsibility?

A No.

Q Or was it just an initial responsibility to make sure it was on track?

A To make sure that the Krummrich laboratory people were on track in their analysis of it, yes.

Q With respect to the Enviro-Chem Division, what was your participation in their project?

A Again, we provided the analytical sampling analyses of the unit on a trial basis to determine whether or not PCB-containing capacitators and things of that sort could be disposed of safely.

Q And how was Enviro-Chem disposing of these PCB's?

A Enviro-Chem was not disposing of the PCB's. This was a test installation and we wanted to see if the Enviro-Chem incinerator was capable of doing that. They were not doing it as a service or anything of that sort. We just wanted to check the Landguard unit out to see if it would be a convenient way to get rid of large capacitators where you can't get PCB fluids out easily. This incinerator chopped the units up and fed them into a gas-fired rotary kiln to boil off the volatiles, which were in turn used as a heat source. And the char that came out on the bottom was supposed to be a good landfill.

Q Do I understand that Enviro-Chem has an incinerator that was tested and analyzed by your group to determine whether it could accept capacitator PCB's?

A Yes.

Q What was your conclusion?

A The conclusion was it didn't do a very good job.

Q Well, how did you reach that conclusion? What did you find that led you to believe it wasn't doing a good job?

A We found PCB's in the areas we sampled, which meant they were not being completely decomposed in the incinerator Landguard system.

Q What is a Landguard system?

A It was a system that, I believe -- and I am not too clear on this because my only involvement was in this one particular instance, and it involved two or three days -- I think Enviro-Chem had what they called a Landguard system. What the objective was, they were going to take everybody's refuse, garbage, no matter what it was, and chop it all up and feed it into the rotary kiln to distill off the volatiles and use those as a fuel source and, then, take the char off the bottom, which obviously has a large reduced volume, and use it as a landfill. And they also had provisions for

removing ferrous metals and non-ferrous metals and gases and things of this sort.

Q Where was the system located?

A In the St. Louis area.

Q Enviro-Chem was a division of Monsanto?

A Yes.

Q When did you participate in this project for Enviro-Chem?

A I don't recall exactly.

Q Was it -- strike that.

Was the Monsanto incinerator in operation at the time you were involved with Enviro-Chem?

A I don't think it was.

Q Was it in the same time period when the Monsanto incinerator was gearing up for operation?

A It could have been.

Q Did you or your group continue to do environmental samples from the Monsanto manufacturing facilities including water, sediment and fish from approximately January of 1970 through 1975?

A The policy was that initially, if the plant didn't have the capability, and they really didn't because we were the only ones with the capability, we did the analysis. As

soon as it was established that there would be, you know, there should be monitoring and the sample load would be fairly high, then, the plants were instructed to buy the proper equipment. And we instructed them on how to operate it and verified through exchange of samples that they were, indeed, analyzing the samples properly at that point in time. The clients took over the responsibility for monitoring their effluent and doing their own PCB analysis. Occasionally after that date, if they were having problems or there was some question and they wanted some reassurance that they were doing it properly, we might do a sample for them.

Q With respect to the Anniston, Alabama plant, you are aware, are you not, it closed down in early 1970?

A Yes.

Q Do you know whether the Anniston plant ever did its own PCB analysis?

A Yes, they did.

Q Do you know when?

A Before they closed down. I am not being facetious, but some time after we analyzed samples for them and prior to their closing, they did have, at one time, electron capture-gas chromatography equipment. And we did train one of their operators to utilize the equipment.

Q You saw a document a few minutes ago that referred to providing the Krummrich plant with GC equipment or methodology in April of 1970?

A Yes.

Q And I think your testimony was that within several months after that it became operational at the plant?

A Yes.

Q Can you tell me whether the Anniston plant facility received the GC methodology about the same time the Krummrich plant did?

A I don't know. It would have been within that time period, certainly.

Q Do you have any recollection of your group identifying any target species of fish from the Anniston plant for further analysis by your group?

A I don't recall, no.

Q Do you recall a company called Agway?

A Yes.

Q Did you do work for them?

A Yes.

Q What work did you do for them?

A We analyzed some samples for PCB's for them.

Q And what kind of samples were they?

A I think they were -- I think they were like bread meal samples or something of that sort.

Q Duck feed?

A Pardon?

Q Duck feed?

A Yes, something of that sort.

Q Did you have direct contact with people from Agway?

A Yes, I believe I had contact with one individual from Agway.

Q Were you requested to do PCB analysis for Agway?

A Yes.

Q By the person at Agway?

A No, it was requested internally. I don't recall exactly who did it, but someone did. And I believe my discussions, if I remember correctly, were in terms of what kind of samples and what were my sample requirements.

Q To whom did you report the results?

A Probably to Bob Keller or to somebody internally.

Q Not directly to the customer or to Agway?

A No. It was a general policy that results were reported internally first. We had, as you do in almost virtually every company in the world, you have a chain of

command to which you report your results.

Q That was your practice, to report results of third parties outside of Monsanto to your supervisor or to the other persons within Monsanto?

A Yes.

Q I take it, Dr. Tucker, that in your work you were not involved with recommending or involved in the drafting of any letters to customers about PCB's?

A That's correct.

Q You were not consulted about letters that went out to customers?

A No, I was not.

Q And, likewise, I take it you were not involved in decisions or discussions on labeling of PCB products?

A That is correct.

Q Were you involved in any discussions regarding the -- strike that.

You are aware, are you not, that PCB products were withdrawn from the market by Monsanto?

A Voluntarily, yes.

Q Were you involved in any discussions regarding the timing of the withdrawal of products?

A No, I was not.

Q When did your involvement with PCB matters terminate?

A I think probably about two years before I left the company. Although it was kind of a gradual routine.

Q So that would be in 1968, approximately?

A 1968?

Q I mean, '78, I am sorry.

A Yes, probably around -- in 1978 or perhaps a little bit earlier.

Q What I meant to say, about 1976?

A That's correct. That's probably fairly close, yes.

Q I am getting my numbers transposed. Throughout the years from 1967, when you were first advised of PCB's reported in the environment --

MR. SCHINK: I object to that "he was first advised that there were polychlorinated biphenyls in the environment." I think he has testified --

Q I take it that sometime shortly after that first notice to you of Dr. Jensen's work, you became aware that he was referring to PCB's?

A To polychlorinated biphenyls, yes.

Q From that first involvement by you in PCB matters up until the time you discontinued your involvement, would

it be fair to say that your work involved what you have testified about today in performing the analytical work and working with Biotest on the toxicity studies and performing certain projects in the incineration area?

A And the biodegradation, yes.

Q Any other projects that we haven't talked about?

A Directly related to PCB's, I hope? That's a rather broad question.

Q Yes, of course.

A No.

Q Were the biodegradation methods that you used on aroclors available for use on other things before you used that same methodology or technique on aroclors?

A Yes.

Q So that the method that was used was a standard biodegradation method?

MR. SCHINK: You are excluding in your question the method for analyzing the PCB levels?

MISS OLIVER: I am talking about just the three types of biodegradation tests that Dr. Tucker referred to.

A The three types of biodegradation tests that I referred to have been in use for a reasonable period of time

and they are used primarily for water-soluble compounds, especially for detergents and things of that sort. They are standard detergent tests.

Q Were there any tests or experiments used for water-soluble studies before you used, Dr. Tucker, those methods on aroclors?

A Yes.

Q What methods were those?

A I believe a number of people did soil degradation studies with DDT. And a lot of people did single-specie bacteria degradation tests. But these were mainly bacteriological-type tests. It's very debatable whether they relate to the environment, too.

Q Was there a reason why you did not use those types of tests and instead employed the three methods that are commonly used for detergent substances?

A We did look at the resonance time of PCB's in the soil. As you know, in addition to PCB degradation, there are a number of things that can go on in soils. Pure culture techniques we didn't feel really related that much to what was happening in the environment.

Q Why not?

A Because those kinds of bugs can't live without all

sorts of special media and laboratory conditions and things of that sort. It's really only indicative of what bacteria are capable of doing.

Q What did the soil tests that you conducted show?

A Well, these were done primarily to study the migration of polychlorinated biphenyls in different types of soil. And I published a paper, again, on that particular subject. And we were really more interested in how rapidly the PCB's could be leached out of the different types of soil with percolating ground water and things of this sort. We didn't do any soil degradation studies as such.

Q Were these soil studies that were conducted by you done in the early '70's or closer to the end of your involvement with PCB's?

A I think probably sometime in the early '70's. The problem really boils down to the fact that PCB's were never intended to be put in soil or water or air or anything of this sort. It was an industrial chemical and it should have been used as one. The fact that it didn't get used that way is very unfortunate.

Q Are you aware of any other industrial chemicals that were not used the way they were intended by Monsanto?

MR. SCHINK: Well, he has not been testifying

about Monsanto's use of PCB's.

MISS OLIVER: The use -- I think he has been testifying about the use Monsanto foresaw with the product.

MR. SCHINK: No, that is not his testimony.

MISS OLIVER: Well, let's not argue about his testimony.

MR. SCHINK: I object to the form of the question.

A Would you restate your question, please?

Q Sure. You testified that aroclors were not used the way they were intended to be by Monsanto; is that correct?

A No, that's incorrect.

Q Well, by whom?

A By the users of the materials. I think until it became known -- may I clarify that statement?

Q Sure.

A Until it became known that PCB's were really a problem, I think people had a tendency to treat PCB-containing fluids lightly, just like they treat a variety of chemicals nowadays lightly. But not as lightly as they used to, because in terms of knowledge, the knowledge was not

available as it is today. Bleach in the house and things of that sort had a tendency to get slopped around.

Q In your opinion, did Monsanto treat PCB-bearing fluids lightly?

A In my opinion, they did not.

Q Never?

A There is no such a thing as never. But in my opinion, they did not. I find Monsanto and some of the large corporate chemical companies are the most responsible. One good reason is liability and another reason is because there are people like you and I who very honestly work there.

Q Well, I guess my question was: Were you aware of any chemicals, industrial chemicals, that were not used the way they were intended besides PCB products?

A By Monsanto?

Q By Monsanto?

A No.

Q If PCB's were not intended to get out into the environment, how do you explain their presence outside Monsanto manufacturing plants?

A How do I explain the presence of polychlorinated biphenyls outside of Monsanto plants?

Q Uh-huh.

A I don't think until the complete story of polychlorinated biphenyls was unraveled over the past ten, fifteen years that anybody really realized that industrial chemicals could spread and become indigenous to the environment to the extent that they have. It's not just PCB's; it just so happens with PCB's we have ultrasensitive and specific detection procedures. There are a lot of chemicals out there that I am sure we are around right now that we are not capable of detecting as well as we can PCB's. So, I explain it by the fact that people at that time didn't have the knowledge that minor amounts of these materials were moving around the way they were. And the reason was they simply couldn't analyze them. And with the advent of the electron capture, we got a better picture as to how these things moved around in the environment, even though they are not intentionally spread in the environment as such was the case with DDT.

Q To your knowledge, Monsanto, the manufacturer of PCB fluids, was not aware that that was getting out into the environment?

A To my knowledge, they were not until we developed the capability to detect the PCB's in the environment or until the capability was developed by other people, too, for

that matter.

MISS OLIVER: Do you want to mark this.

(Defendant's Exhibit 10 duly marked for identification.)

Q Dr. Tucker, is Exhibit Number 10 entitled "Biodegradation of Polychlorinated Biphenyls" a paper written by you relating to your studies of PCB's?

A Yes.

Q Does that paper encompass the work you did for Monsanto relating to biodegradation studies of PCB's?

A Yes.

Q There is no date on that paper that I could find. Could you tell me approximately when that paper was prepared?

A I think this information was almost complete when we made the presentation to the Council on Environmental Quality.

MR. SCHINK: May 15, 1972, but that is not the date of that paper.

A The paper was published later, after peer review and things of that sort. I don't know exactly what the date is.

Q Did you do any analytical work on a non-PCB Pydraul fluid called 50E?

A I probably could have, yes.

Q Do you recall doing any work on that fluid?

A I recall 50E. I don't recall any specific work on it, but I certainly probably might have.

Q You couldn't tell me today what work you performed?

A No, I couldn't.

Q Did you do any work in the development of any methodology for removing PCB's from water streams?

A No.

Q Do you know when work on the development of 50E was begun by Monsanto?

A No.

Q Did you do any analytical work with regard to samples for the purpose of analyzing for phenels with an E?

A No.

Q You don't have any knowledge, do you, Dr. Tucker, of how a die cast plant operates?

A No.

Q Do you recall learning of any reports that impurities could be formed by the exposure of PCB's to high temperatures?

A No. No Monsanto reports.

Q Any reports?

A I have read the literature; I have read the open literature on it. And I am a chemist, so I am aware of the chemical reactions that can occur under a variety of conditions.

Q Did you perform any tests for Monsanto or any analysis in that area?

A No. For impurities in PCB's?

Q Right.

A No.

Q Were you ever involved in a project to quantify the amount of PCB's in the environment?

A You mean the total amount in the environment?

Q Yes.

A Yes.

Q When were you involved in that project?

A I worked a little bit with two fellows. One's name was Dr. Ian Nesbit and the other's name was Dr. Adele Sarafin (phonetic spelling). And they did a study that told where these things might be distributed and things of that sort in the environment. Now, are you referring to PCB's specifically and not pollutants in general?

Q Right.

A That's it.

Q Could you tell me -- I am sorry, I may have missed it -- approximately when this work took place?

A I don't recall when. I believe Sarafin and Nesbit published their data.

Q What was your involvement?

A Just to read the document and look at it. And Ian Nesbit and I worked with -- a little bit on a different project for the National Academy of Sciences, which was predicting ocean pollutants at that time in general, not PCB's in particular.

Q Did part of that work involve a determination of the amount of PCB's in the environment?

A No. It was merely to look at the paper that they had and see that things were, you know, in whack within the type of knowledge that I had of that kind of thing. That was merely all it was.

MR. SCHINK: Peer review?

THE WITNESS: No, they were really trying to put together a very honest estimate of how the things were moving in the environment and where they might be based on the number of pounds that had been made and the measurements of the water solubility, the rate at which they moved through

soil, their vapor pressure.

BY MISS OLIVER:

Q Did you agree with their conclusions, generally?

A Generally.

Q Regarding PCB's in the environment?

A What I can recollect of their study, yes, I do. Keeping well in mind that their results were probably -- the precision of their numbers could be plus or minus 100 percent. I mean it was really an estimate. They were trying to get a feeling for order of magnitude.

Q Do you know a Dr. Munch from Monsanto?

A Yes, a good friend of mine.

Q He was an analytical or is an analytical chemist as well?

A Yes. Years ago he was an analytical chemist.

Q Do you recall that he was involved in a project in which he attempted to determine the amount of PCB's in the environment?

A I don't recall Ralph's involvement in that.

Q Other than the attempt by Mr. Nesbit and his group, are you aware of any other attempts to estimate the amount of PCB's in the environment?

A I think there were some people who were fooling

around with numbers, but no serious well-documented attempts to do it, no.

Q So, in your opinion, there are no well-documented determinations?

A If you disregard Ian Nesbit's information.

Q Which could be accurate plus or minus 100 percent?

A Well, it could also be accurate plus or minus one percent. The point is they don't know.

Q That's good enough for me. Now, you mentioned earlier today that part of your work in the PCB area was to work with the Industrial Biotest Company on their toxicity studies that had been commissioned by Monsanto, right?

A That is correct.

MISS OLIVER: Will you mark that.

(Defendant's Exhibit 11 duly marked for identification.)

Do you want to mark that next.

(Defendant's Exhibit 12 duly marked for identification.)

Mark these.

(Defendant's Exhibits 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22 duly marked for identification.)

Q Dr. Tucker, I would like to show you an exhibit that was marked as Richard Deposition Exhibit Number 4 of the deposition of Dr. Richard in this case, which is a memorandum prepared in March of 1969. And I would be happy to have you look at it, but my question merely refers to the chart that appears on the last page. And I ask you if you have ever seen that chart before?

A I don't recall seeing this specific chart.

Q Were you asked by Dr. Richard or anyone in the Research and Development Department to participate in the preparation of a chart such as what appears here?

A No. Dr. Richard was certainly knowledgeable enough as well as Elmer Wheeler to prepare something like that by himself.

Q I would like to show you Exhibit Number 11, which is a 1968 letter, which appears to be from Mr. Garrett of Monsanto to a Merle K. Young, Chief Chemist at Woodstock Diecasting Corporation. Have you ever seen the letter before?

A No, I have not.

Q Do you know Dr. Young?

A No, I do not.

Q There is a reference in the letter that toxicity to fish of chlorinated hydrocarbon components in the Pydraul

fluid is 30-50 parts per million to goldfish. Based on your familiarity with matters involving PCB's, do you know what that is a reference to?

A You mean where this original information came from?

Q No, what that means.

A What toxicity 30 to 50 parts for goldfish means? Yes, I think I do.

Q Wait a minute, did you discuss with Mr. Garrett what he meant when he made the estimate in this letter?

A No.

MR. SCHINK: There is no foundation, Miss Oliver.

MISS OLIVER: Are you going to object?

MR. SCHINK: Yes.

Q Could you tell me what your understanding of that is?

MR. SCHINK: I object to the form of the question. No foundation.

A I would assume that is an LC50, which is a lethal concentration to kill on a predicted basis 50 percent of the goldfish population that are exposed to it.

Q In 1968 were you -- do you have any knowledge that that type of testing was done within Monsanto?

A I do not.

Q To your knowledge, no such testing was done within Monsanto in 1968?

A No. As far as I know in 1968 Monsanto had no internal aquatic toxicity testing facilities.

Q So you have no idea where Mr. Garrett could have gotten that information?

A No, I do not.

Q By the way, in 1968 was Mr. Garrett's position Manager of Pollution Abatement to your knowledge?

A I don't know if that was his specific title. It obviously says it. I knew that Jack Garrett was a manager and so was Elmer Wheeler. And they both reported to -- yes, that's correct, in the corporate Medical Department.

Q Do you know if there was a section or group or division within Monsanto known as Pollution Abatement in 1968?

A Not really. I wasn't aware of it. I am sure there probably was.

Q You don't know who was in it besides Mr. Garrett, I take it?

MR. SCHINK: Well, I object to the form of the question. The letter doesn't say there is that

section. It just says that's his title. It assumes facts that are not in evidence, Miss Oliver.

Q You don't know one way or the other whether there was such a department or section or group?

A I knew Jack Garrett and I knew he was concerned about those kinds of things. And I don't know if there was a section or a group. And I wasn't deeply involved in it at that time.

Q I would like to show you what we have marked as Exhibits 12 through 16 -- I am sorry, 12 through 21, and ask you if you could identify those exhibits as reports prepared by you or under your supervision regarding Biotest studies done for Monsanto?

A Okay, this -- what exhibit is this?

Q 12.

A That's 12, okay. Yes, this is a memo which I prepared regarding Aroclor wildlife, fish toxicity studies.

Q And you referred to Exhibit Number 12?

A Yes.

Q And you believed that the Biotest fish toxicity work should be repeated? Do you see that in the first paragraph there, Dr. Tucker?

A Yes.

Q Why did the fish toxicity work have to be repeated?

A Because I really felt the way they did the tests and the concentration they used, they didn't really know what the hell they were exposing the fish to.

Q What kind of tests were they doing?

A I believe they were doing static 96-hour exposure, TLM's.

Q What is that? What kind of test is it?

A You have an aquarium or a beaker or a container or something with the fish in it and the water in it and you put a certain concentration of the material in question in it, and then you monitor the fish for 96 hours for mortality, usually done at three levels.

Q What are the three levels?

A They are usually chosen to try and bracket the LC50 or the TLM or whatever you want to call it. They have a variety of terms. It depends on the compound, how toxic it is, how water soluble.

Q So, for Aroclors, they were running static 96-hour TLM tests?

A Yes.

Q And you felt they should be rerun?

A Yes.

Q Were they rerun?

A I think they probably were.

Q Were the static 96-hour TLM tests for fish tests that were in use in 1969 and before then?

A Yes, these were standard methods.

Q Was Exhibit Number 13 prepared by you as a summary of Aroclor wildlife analytic studies?

A Yes, Exhibit 13 is a memo from myself to Dr. Robert Keller with copies going to Dr. Richard.

Q And that summarizes the work done in the month of May, 1969; is that correct?

A That's correct.

Q This was prepared by you as part of your practice or custom of reporting on what was happening?

A Yes. I am not sure whether that was me because the memo was dated the 24th. Okay, there is me; that's me.

Q Exhibit Number 14, is that a report prepared by you, a memorandum prepared by you reporting on Biotest's four-day fish toxicity studies?

A Yes, Exhibit 14 is a memorandum prepared by myself directed to Elmer Wheeler with copies going to Dr. Richard and Dr. Keller and it's on the Biotest four-day fish

toxicity tests.

Q And the memorandum is dated July, 1969; is that correct?

A That's correct.

Q And your memorandum here is telling Dr. Richard and Dr. Keller and Mr. Wheeler that the table attached to your memorandum tells the story fairly well. Could you tell me what "story" that table tells?

A Okay, without getting into a great deal of detail or taking a long time to refresh my memory, as I recall, it indicates that the results were not what I considered correct. And that there was some discrepancies in it that I felt couldn't be explained by the materials that they were testing, and things of that sort. And as I alluded to earlier, I felt that the tests were not done properly.

Q These refer back -- these tests refer back to the previous document where you recommended that the 96-hour fish test be redone?

A Where I recommended they be redone. I think, as you can see, in this instance, we did residue analysis of water samples that were taken and of the fish. And in some instances where they were exposed to Aroclor 1254 we found DDT. So it was rather obvious something had been mixed up.

And these results were very suspicious and we felt they should be repeated. They monitor Biotests very closely on these particular studies.

Q Just so I understand this, for example, under the test material in the first column, the first entry is Aroclor 1242 present BW. What is "BW"?

A Bluegill.

Q That was the fish tested?

A That was the species we tested.

Q And .1 parts per million?

A Was the concentration added to the water that the fish were in.

Q And they were kept in water for twenty-four hours?

A They were monitored for twenty-four hours.

Q And PCB levels found in the water at the end of the twenty-four hours was .078 parts per million?

A In this particular instance, as well as the fact it was 1242, which is what they put in.

Q None of the fish died?

A That's correct.

Q None of the fish were analyzed for PCB's?

A That's correct, in this particular instance.

Q Do you know why?

A Because none of the fish died.

Q Okay, the purpose of the study was only to analyze for PCB's in fish that died after a certain period of time?

A Yes, in this particular instance the objective was only to analyze, if I remember correctly, the mortalities, those fish that died, so we would know what the concentration in the fish was when it died.

Q Another entry, the third from the bottom, Aroclor 1254 test material, bluegills were again used, right?

A That's correct.

Q And the next column shows the amount of PCB concentration added to the water and the 96 hours that the fish were held in the water, correct?

A Correct.

Q Then the measurements of the PCB's found in the water?

A This shows, in my opinion, whoever added the material didn't do it properly. He was supposed to add .32 parts per million Aroclor 1254. And we analyzed the water to check it and we found .008 parts per million of 1254 and .05033 parts per million or 1242, indicating the wrong material had been put in.

Q So your explanation was that 1242 had somehow been put in along with the 1254, correct?

A That's right. Whoever did it mixed things up.

Q In the next column it shows zero fish dead after 96 hours; is that correct?

A That's correct.

Q Here there were ten fish analyzed?

A The only thing I could say relative to what I said before, we may have just chosen a random matrix in terms of how I analyzed it. As I said, I didn't take the time to review it.

Q There is a concentration of PCB's found in the fish. There is 53.6 parts per million of 1254?

A That's correct. And I believe these concentrations are on the lipid basis, but I am not positive. I would really have to look at the data closely.

Q Does the comparison between the parts per million found in the water and the parts per million found in the fish indicate to you the bioaccumulation of PCB's in the fish?

A No. As I indicated, the information that was generated in this particular thing indicated that the experiment was performed improperly and that all the data from this were very suspicious and that we felt, since the

quality checks that we had didn't come out properly, it should be repeated. To take erroneous data and assume bioaccumulation, I wouldn't want to do that with this. But you are asking me did chlorinated hydrocarbon accumulate, I would say yes.

Q But if you performed a four-day fish toxicity study properly, you would still expect to find greater concentrations of PCB's in fish than you would in the water analyzed, wouldn't you?

A Yes, I would anticipate that, yes.

Q And you anticipated that in 1969 when the studies were being done, didn't you?

A No, I think that's primarily one of the reasons we were doing those studies. I anticipate that now because I know it to be a fact. I don't know whether I anticipated that it would occur here. I probably did if we were looking for it. We certainly were trying to establish one way or the other whether it did or not.

Q Was Exhibit Number 15 prepared by you on or about September 11, 1970?

A Yes.

Q Attached to it is a Special Study Report 70-17 concerning the determination of polychlorinated biphenyl

residues in rats from thirty-day arocloric feeding studies. Was this a report prepared under your direction on Biotest studies of rats?

A Yes.

Q And you transmitted the report to Mr. Wheeler, correct?

A Yes.

Q You mention in the second paragraph of your memorandum to Mr. Wheeler, quote: These findings are significant in that this is the first laboratory proof that we have been able to generate that supports Ralph Munch's approach to producing a more "degradable" arocloric product for controlled usage. Could you tell me what Mr. Munch's approach was?

A Well, based on data that we had generated and what other people had been finding in the environment we had noticed that the materials that seemed to have the longest resonance time in the environment were the higher chlorinated biphenyls. And we at that time were wondering why this was so. And eventually we felt that that was due to the fact that these materials had a shorter -- the lower chlorinated materials had a shorter resonance time in the environment because they were degradable. So, as such, if

we were going to produce a useful PCB fluid that would not have the objectionable non-biodegradable components in it, we could do this by producing a fluid that would have, say, only the mono-, di- and tri- chlorobiphenyls in them, which weren't at that time considered to be a significant problem.

Q Those lower chlorinated biphenyls would appear in greater amounts in, for example, Aroclor 1242?

A Than what?

Q Than Aroclor 1260 or 1254?

A Yes.

Q How did these findings regarding the thirty-day aroclor feeding studies in rats support that approach?

A They supported it in the sense that in the tissue residue, in the tissues that we analyzed, the residues that we found were predominantly the higher chlorinated materials. In other words, rats that were exposed orally to fluids, PCB fluids that contained significant amounts of the lower chlorinated biphenyls, when we looked at their tissue, the residues retained by the tissues, there were none of these materials in them.

Q How about Exhibit Number 16, which is an Environmental Analytical Program - Toxicology Support Study, dated March through August of 1971, was this document

prepared in part by you?

A Yes.

Q And again it is a summary of the work done in the toxicological area with Biotest in the period of March through August, 1971?

A It's the work that we did in conjunction with Industrial Biotest. They may have been doing other tests in which there were no residue analyses, which we were not involved in, but yes.

Q And Exhibit Number 17 appears to be a report from you dated November 10th, 1971 regarding minutes of a meeting in November of 1971 with the Biotest laboratories?

A Yes, it is.

Q Exhibit Number 18 is an Environmental Analytical Program, Toxicology Support Studies for the period of November through December, 1971. Was that report prepared by you for purposes of summarizing the work that you were involved in with Biotest during that period of time?

A Yes.

Q And Number 19 is a Special Study 71-3 entitled "Determination of Polychlorinated Biphenyl Residues in White Leghorn Chickens." Is this a report prepared by you or under your supervision?

A Yes.

Q Regarding Biotest's studies?

A Yes.

Q Would this report have been -- is there any way to tell from this report when it was prepared?

MR. SCHINK: Other than the date in the lower left-hand corner?

MISS OLIVER: Well, is this the date, 3-73?

A Yes, that was the date it was typed.

Q And on page number five in the bottom left-hand corner there is a date of 3-73, and that indicates the date of this report?

A Yes.

Q Exhibit 20 is a Special Study 71-9. This is another report prepared by you or at your direction on PCB residues in dog tissues?

A Yes.

Q And again, this was in conjunction with the work you were doing with Biotest?

A Yes.

Q And the date on the last page of the report is 12/72. And that's the date this report was prepared?

A Yes.

Q Exhibit Number 21 is similar, Special Study 71-7, relating to studies of PCB residues in albino rats. Is this a report prepared by you in conjunction with the Industrial Biotest work?

A Yes.

Q The date on the last page of the report is 10/71. Is that the date of this report?

A Yes, that's the date it was typed.

Q Were all these reports that we have just reviewed relating to summaries of work done by Biotest in connection with your work on PCB's prepared by you in the regular course of your duties at Monsanto?

A Yes.

Q Exhibit Number 22 is another Special Study from the Analytical Chemistry Section on -- Numbered 70-11, entitled "Determination of PCB Residues in Fish from Lake Michigan." Is this a document that was prepared by you?

A Yes.

Q And it refers to analysis by Monsanto of certain fish residues?

A Fish extracts.

Q You obtained fish samples from Lake Michigan of fish and performed an analysis?

A No.

Q Would you explain to me what Monsanto did with respect to PCB residues from fish in Lake Michigan in this project?

A In this particular project, WARF Institute, Wisconsin Alumni Research Foundation Institute, was doing a survey study of Lake Michigan for pesticides. And at our -- we asked them to amend this study to include samples to be taken for PCB analysis, too. After I had visited the laboratory and talked to the people and, you know, checked out their analytical techniques, this type of thing. And they in turn, along with this, supplied us with the extracts from four fish and one human biopsy extract. And they said the fish were from Lake Michigan. All I know is what they sent me. And we in turn used our equipment to -- our laboratory to verify the presence of PCB's in these samples. And I think the objective primarily was to see whether or not they agreed with what WARF was finding.

Q When you say fish extracts were provided to you, what was provided?

A Generally, what is done, the whole fish, if it's small enough, or a portion of the fish, if it's not small enough, is taken and is thrown in a flask with hexane and

sodium sulphate and then blended or homogenized and the lipid content of the fish, that is partitioned into the hexane. The hexane is then isolated and evaporated off and the lipid portion was what was shipped to us for subsequent analysis.

Q So the fatty part of the fish is what you analyzed?

A Correct.

Q That is your understanding?

A Correct.

Q This summary of the PCB extracts, the fish extracts that confirmed for WARF is dated 4-70; is that correct?

A Yes.

Q So this report, Exhibit Number 22, was prepared by you in April, 1970?

A Yes, prepared and issued in April, 1970.

Q And am I correct that your analyses confirmed that Aroclor 1254 was found in all the samples provided to you by WARF?

A Yes.

Q Are these your handwritten notes that appear on the three pages following your typed report?

A Yes.

Q This is data on the three pages from which you prepared your typewritten report?

A Yes.

Q I apologize if I asked you this earlier, but to whom would the special studies be provided within Monsanto in this period of time in 1970?

A Certainly Dr. Keller would get a copy. The distribution beyond Keller was probably usually determined by him. Although I am quite certain Dr. Richard, Elmer Wheeler, those people were the people that would have gotten copies of that.

Q Who is J. Litschgi?

A Jerry Litschgi was a technician that worked for me at that time.

Q Did Dr. Keller assist or help you in any way analyzing the extracts and the biopsy extracts that were provided by WARF?

A No.

Q Did you do the work yourself?

A Some of the work I did myself. Some was done by people that reported to me. And I don't know that I specifically analyzed those samples. I probably did look at those fairly closely because they were corroborative type

samples.

Q After 1976, Dr. Tucker, have you done any work relating to PCB's?

A No.

MISS OLIVER: I don't have any other questions.

(Plaintiff's Exhibits A through J, inclusive, and M were duly marked for identification.)

BY MISS OLIVER:

Q Dr. Tucker, I forgot to ask you whether you recall attending any annual sales meetings or sales meetings to discuss the status of your work with PCB's?

A I remember fairly well that I did not attend any sales meetings or any annual sales meetings to discuss the results of any PCB findings.

Q Did you discuss at any sales meetings with Norman Johnson or salesmen what information could be communicated to customers relating to PCB's?

A I don't recall doing that. If I did do it, it would merely have to do with the accuracy of any of the analytical portion of it.

Q You have no recollection of attending sales meetings in 1970 for that purpose?

A No, I do not.

MISS OLIVER: I don't have anything else.

CROSS EXAMINATION BY MS. STEIN:

Q As a housekeeping matter with respect to Defendant's Exhibit Number 22, was that prepared by you in the ordinary course of your duties at Monsanto?

A Yes.

Q I am going to show you what has been previously marked as Defendant's Exhibit 1 for Identification, an April 17, 1970 memorandum. I believe you testified earlier that you had assisted Dr. Keller in the preparation of this memorandum and attachment; is that correct?

A Yes.

Q Was that worked on in the ordinary course of your duties at Monsanto?

A Yes.

Q And with respect to Defendant's 2 for Identification entitled "Aroclor Defense - 1970 PCB Support Analysis," I believe you testified that you prepared this and the attachments, which is the table at the back regarding the samples?

A Yes.

Q Okay, did you prepare that document in the course of your duties at Monsanto?

A Yes.

Q I'm going to show you a document that has been marked as Plaintiff's Exhibit A for Identification, a three-page document dated February 26th, 1969, and ask you if you recognize that document? It's previously been marked as Richard Deposition Exhibit 20.

MISS OLIVER: What is your deposition exhibit number?

MS. STEIN: A, the letter A.

MISS OLIVER: Yes.

A You asked me if I recognize it or what?

Q Yes.

A Yes, this is a memo report which I wrote to Lou Stark with copies to Keller, Richard and Wheeler.

Q Was that prepared in the ordinary course of your duties at Monsanto?

A Yes, it was.

Q The question I have for you is whether this document, the February 26th, 1969 Aroclor Water Solubility memorandum refreshes your recollection as to when you had run the known sample PCB's in your equipment at Monsanto?

A Could you repeat that, your question to me, please?

Q I will have the reporter read it back.

(The record was read back.)

A Yes, they were known samples that we had done, that we had prepared.

Q And was this one of the water solubility tests that you were discussing earlier in response to questions from Miss Oliver?

A Yes.

Q Okay, I am going to show you what has been marked as Plaintiff's Exhibit C for Identification, an April 2, 1970 memorandum, one page, from Don Pogue to you and entitled "PCB Analysis Effluent Samples." Do you recall seeing this memorandum before?

A Yes.

Q Do you recall running samples on all of the accounts that are mentioned, running effluent samples for PCB analysis for all of the accounts which are mentioned in the first paragraph of that memorandum?

A Yes. I believe these were all included in the subsequent report which I issued.

Q I am going to show you what has been marked as Plaintiff's Exhibit D for Identification and ask you if you have ever seen this document before?

A Yes, I have seen this document before.

Q Okay, was this prepared by Mr. Litschgi?

A It was prepared by Mr. Litschgi, right.

Q Was it while he was working for you?

A Yes.

Q Was this prepared under your direction or supervision?

A Yes.

Q Are these pages which at the -- have the bottom number 11223 through 11243, are these parts of the log book that you were referring to earlier?

A The answer to that question is yes and no. Partially they are. The first page is a standard form that was used by the Organic Chemicals Division Research Department to submit samples and report the results. This is the reverse side of the form. There used to be another side of the form where they put down what they wanted and we reported the results to them on the back of the form.

Q And it appears that the last page numbered 11243 is a Xerox copy of the log in which samples were logged in and given an OR log number.

Q What does an OR log number mean?

A OR simply stands for organic research. And they had used before a habit of labeling all newly synthesized

materials as OR such and such until it achieved the status or was given a product name or something of that sort. And we simply used it as an abbreviation for organic research. In other words, this would be organic research log number such and such.

Q The numbers on this page 11243 start at 173 and go down to 203. Does that have any significance? Is that by year or the totality or does it relate to the project number?

A The significance was the samples were logged in as they were received. In other words, number 173 could have been received at the same time or received before 174, et cetera, et cetera. Sometimes you might get ten samples, so you would label them 173 through 182 or whatever. And you would receive them all at the same time. But it has to do with the chronological order in which they were received.

Q Do the numbers on this particular page refer to the stages for PCB analysis?

A Yes.

Q Now, this Plaintiff's Exhibit D refers to samples taken from Johnson Motors. Do you recall doing those analyses?

A Yes, I recall analyzing the samples from Johnson

Motors and from a variety of other companies that were provided to me by Don Pogue.

Q What were your findings with respect to the -- do you know whether these samples referred to in Plaintiff's Exhibit D are the effluent samples that were referred to in Plaintiff's Exhibit C?

A Yes, I think that that is correct. Yes, they are.

Q And with respect to these samples that are listed in Plaintiff's Exhibit C, do you remember what your findings were with respect to the presence or absence of PCB's in those samples?

A In some we found PCB's and in some we probably did not. I don't remember specifically how much or which ones had more or anything of that sort. But it's a matter of record.

Q Do you recall whether the Johnson Motors' samples had PCB's?

MISS OLIVER: Which samples?

A I don't recall specifically that they did. I am sure they did.

MS. STEIN: The ones that are referred to in Plaintiff's Exhibit D.

MISS OLIVER: Okay.

Q I am going to show you what has been marked -- Was this Plaintiff's Exhibit D prepared in the course of Mr. Litschgi's duties at Monsanto?

A Yes.

Q I am going to show you what has been marked as Plaintiff's Exhibit E for Identification, a one-page memorandum with a -- excuse me, with a one-page attachment, dated May 11, 1970, and entitled "PCB Analysis Effluent Samples." And I would ask you to take a minute and look at that.

Okay, did you prepare this first page of Plaintiff's Exhibit E?

A Yes.

Q Did you prepare that in the course of your duties at Monsanto?

A Yes.

Q Did you prepare the second page as well?

A Yes.

Q Okay. And did you prepare that in the normal course of your duties at Monsanto?

A Yes.

Q Okay. Now, were these -- does this refresh your recollection as to the results of the effluent samples from

Johnson Motors? With regard to PCB content?

A Yes, it lists in the memo the PCB content that was found in the Johnson Motor samples.

Q Do you recall --

MISS OLIVER: For clarification, your Exhibit E refers not only to Johnson Motor samples but a number of other samples as well.

Q Other than writing this memorandum -- well, had Mr. Pogue requested you to do the sample analysis on Johnson Motors and the other customers? And I assume these are all customers that are listed on the second page of Plaintiff's Exhibit E?

A Whether or not they are all customers I can't attest to, but these samples were analyzed after Don Pogue asked us to analyze them, which I believe was established in one of the earlier exhibits.

Q Did he ask you to report back to him with the results of your sample analyses?

A Yes.

Q Is Plaintiff's Exhibit E your report back to him?

A Yes.

Q Did you discuss, other than writing these findings as they were summarized in Plaintiff's Exhibit E, did you

also discuss your findings with Mr. Pogue?

A I may have.

Q Do you recall whether you discussed the findings that are summarized in Plaintiff's Exhibit E with anyone other than Mr. Pogue at Monsanto?

A Not specifically. I am sure I probably did. I am sure I discussed them with Litschgi, who was the technician involved. And they were obviously communicated to other people on the distribution list. But as far as personally discussing them, I have no recollection of any individual. At least I can't remember any individual that I actually discussed them with.

Q Did you ever discuss them with anyone at Johnson Motors?

A No.

Q I believe earlier you indicated there was a procedure relating to contacts with customers and that was that generally the contacts with the customers -- you did not have direct contact with customers as a general rule, but rather the marketing or the sales people; is that correct?

A Yes, that's correct. Normally, the only time I would have contact with the customers would be at the request of the research people, such as Dr. Richard or

someone of that sort. And then, it would usually involve contact with their research people if they had a research laboratory, something like that. We might be trying to show them how to do the analysis or set up a program. But I did not report my reports outside of Monsanto. They were reported to whomever submitted the samples to me and those appropriate people, for example, Dr. Keller who was my immediate supervisor and Dr. Richard who was the supervisor of that particular research division.

Q Do you know whether there was a procedure once you had communicated the results to those people in-house that you normally report them to, was there a procedure for communicating the results of your analyses to the customers for whom the analyses had been done for?

MISS OLIVER: I object. No foundation. For the record, on the basis of lack of foundation.

Q Do you know whether or not there was such a procedure?

A Yes, there was a procedure. The samples were taken generally by the salesmen in the field or someone associated with Monsanto. They were usually taken with the permission of the people in question with the proviso that the results would be reported back to them. And generally, the chain

of command, it would go from me in some instances to Don Pogue, who might report them direct, or to whoever he got them from, and he eventually would report them to whoever we got the samples from.

Q Did you know Robert Damiani?

A I know Damiani's name. I don't know him personally.

Q You don't recall ever having any conversations with him?

A I don't believe I had any conversations with Damiani.

Q Did Mr. Pogue or anyone else at Monsanto ever confirm to you that the results that are summarized in Plaintiff's Exhibit E with respect to Johnson Motors were, in fact, communicated to Johnson Motors at or about the time of this memo?

A To the best of my recollection, and the conversations that I had with Don over the phone, et cetera, et cetera, I was left with the impression that these results would ultimately be reported back to the people who gave us the samples.

Q Did he ever tell you that he had, in fact, communicated this?

A I am sure in some instances he did. I don't specifically remember those instances.

Q I am going to show you a two-page document that has been marked as Plaintiff's Exhibit F for Identification. It's dated May 12, 1970, and entitled "Effluent Analyses," written by -- apparently by D. R. Pogue.

A It's written by Pogue.

Q To Robert A. Damiani. And your name is on the right-hand side as a c.c., I believe?

A That's correct.

MR. SCHINK: Are you including the attachments with that?

MS. STEIN: I only have the two-page one.

MR. SCHINK: Mr. Pogue testified there was an attachment which was Government Exhibit E and it's referenced in the document as an attachment.

MS. STEIN: Well, for the purposes of this question, it would just be the two pages.

MISS OLIVER: Is that F?

MS. STEIN: Correct.

Q I will ask you to take a moment and read that document.

A Okay, thank you.

Q Do you recall having seen the document before today?

A Yes.

Q Did you see it yesterday?

A Yes.

Q Do you recall seeing it before yesterday?

A Yes.

Q Do you recall seeing it at about the time it was written in May, 1970?

A Yes.

Q On the second page in the last paragraph, the names Briggs and Stratton (phonetic spellings) are mentioned. Do you know who those people are?

A I know Briggs and Stratton, but I don't know who they are specifically referring to, whether it's a plant or what.

Q Do you know why you would have been c.c.'ed on this Plaintiff's Exhibit F?

A Yes, this was the manner in which Don Pogue was letting me know what had been done with the results that I had reported to him.

Q I am going to show you what has been marked as Plaintiff's Exhibit G for Identification, a two-page memorandum

entitled "Call Report Number IF-16," referencing a call made on May 25th, 1970. Dr. Tucker, I see your name as a c.c., and ask you if you will review that document for me.

A Okay.

Q Do you recall seeing this document before yesterday or today?

A Yes.

Q Do you recall seeing it at or about the time that it was written in May of 1970?

A Yes.

Q I believe that you testified -- well, Plaintiff's Exhibit E is a summary of the results of your sample analyses for PCB's on a number of samples; is that correct?

A Yes.

Q Okay, on the second page of Plaintiff's Exhibit G, there is an item number two under a category "Further Action Required" addressed to you. And it says, "Analysis" -- I am assuming that is you even though it says S. E. Tucker"?

A Yes, that's me. They have the first initial reversed.

Q "Analysis of Chemical Composition of Stream Effluent North and South Discharge Samples," is that item or reference

to the samples that were the subject of Plaintiff's Exhibit E, at least insofar as they related to Johnson Motors or was that different work?

A I think what is going on here is that Don Pogue and Mr. Damiani visited Johnson Motors reporting results of our earlier analyses, and, as a result of that, "Further Action Required" was that they were going to obtain north and south discharge samples for us to analyze for chemical composition. In other words, not only PCB's, but total hexane, soluble oils, things like that.

Q So, this referred to a request that you do further analyses in addition to those that had been done in the early -- in the month of May of 1970?

A Yes, it indicates that. It is suggesting that as further action required.

Q Do you recall when the samples that had been received from Johnson Motors that are mentioned in Plaintiff's Exhibit E had been analyzed? Do you recall whether there was any of the sample that was left over after the analysis that is mentioned on the second page of Plaintiff's Exhibit E had been run?

A As a matter of practice, we were told to discard samples. So, if there were materials left over, and

undoubtedly there were, we didn't retain them.

Q Doctor, I direct your attention to the top of page 11258, and there are three samples from Johnson Motors there.

MR. SCHINK: Four.

MS. STEIN: Oh, you are right, four.

Q Johnson Motors north discharge, Johnson Motors south discharge and ditto marks and then Johnson Motors north discharge. Do you recall whether those samples that are listed there and those discharge points were supposed to be the same ones that were mentioned in item two of Plaintiff's Exhibit G?

MISS OLIVER: I am going to object. Again, the lack of foundation.

A I don't recall. It seems to me that they later wanted those samples analyzed not only for PCB's but for total, quote, Pydraul oil contents, and things of that nature. But that's my recollection.

Q I am going to show you what has been marked as Plaintiff's Exhibit H for Identification. It's a one-page memorandum from D. R. Pogue to Dr. Robert Keller dated September 22nd, 1970, entitled "Chemical Analyses Stream Effluent." And your name is a c.c. on this document. I will ask you to take a moment to look at that.

A Okay.

Q Before your preparation for this deposition, and the deposition itself, do you recall having seen this document?

A Yes.

Q Do you recall seeing it on or about September 22nd, 1970?

A Yes.

Q Do you know why you were c.c.'ed on this document?

A Yes. What Don is asking, he is going through official channels and he is asking Dr. Keller, who is my boss, to have these samples that he mentions here analyzed not only for PCB's but for total Pydraul, or whatever is in them, type contents. And I am copied in because I did the PCB analysis. And it's probably to Dr. Keller because Don Pogue is not sure who in Dr. Keller's section will do this other type of analysis. He knows I do the PCB analysis. There were other people that did other types of analysis in our section.

Q Did you do the additional analysis or did somebody else?

A I believe I did a portion of the additional analysis. And I believe somebody else also looked at it.

Q Do you recall what it related to?

A Yes, I believe we ran a standard extraction procedure on the samples to determine all -- to determine the gross water soluble, hexane soluble materials. In other words, the oils and things like that.

Q Do you recall what your findings were?

A I think we found that there were other materials there besides PCB's.

Q Okay, I am going to show you what has been marked as Plaintiff's Exhibit I for Identification and ask you if you recognize this document?

A Yes, I recognize the document.

Q Was this document prepared by you?

A Yes, it was.

Q And was it prepared by you in the normal course of your duties at Monsanto?

A Yes, it was.

Q Is this a summary of the additional analyses results that you did that are the subjects that are referred to in Plaintiff's Exhibits G and H?

A Yes, it is. As you can see by the log numbers.

Q So this relates then to additional work from those same samples?

A Yes, this relates to the request for additional analyses besides just PCB analyses on these particular samples.

Q On the bottom table on this one page it says -- there is a column headed "Approximate Percent Aroclor," and it has various numbers listed. Can you explain for me what that means?

A Well, I am going to try. Give me a chance to read this in depth.

Q Certainly.

A Okay. What this indicates is that we used a standard method for extracting the soluble and/or emulsified oil from the sample completely, which would not only include PCB's but hydrocarbons of this sort. In addition to the electron capture analysis results, which are listed in the far column on the bottom right of the page, these samples were also looked at by infrared analysis. And I believe the person in question who did it was Bernie Katlafsky. And what we were trying to do is see how much of the total hydrocarbons, our extract materials in the samples, were things other than aroclor as well as how much was aroclor, too. And the results agree quite well.

Q And am I correct that out of that hydorcarbon

fraction approximately 89 to 90 percent of one of the samples was aroclor?

A Yes, sample number 198, Johnson Motors north discharge, indicates that the approximate percent of aroclor in the extracted oil, not in the total sample, but in the extracted oil, that oil was 89 to 90 percent aroclor. Which, if you take 89 or 90 percent of the .011 grams of materials that was extracted, you would come up with this number in this range indicating the PCB contents.

MR. SCHINK: You are pointing to the 90 to 100 or 106 parts per million?

THE WITNESS: Yes.

Q That would be the same procedure that would be used with respect to samples 199 and 207?

A That's correct.

MISS OLIVER: What do you mean by "the same"? Interpreting the data?

MS. STEIN: The same procedure of extracting the hydrocarbon and then analyzing the aroclor and then developing this number in the far right-hand column.

A That's correct.

MS. STEIN: Excuse me for testifying.

Q I am skipping a couple of pages.

MISS OLIVER: For the record, there is no Exhibit B.

MS. STEIN: I don't have an Exhibit B. Wait a second, here it is. It's out of order. I will get it later.

Q I am going to show you what has been marked as Plaintiff's Exhibit M, a thick document beginning with page 11261, dated May 20, 1970, and entitled "Monthly Summary Details, April, 1970 Functional Fluids Research." I see that your name is on the list of addressees, and I will ask you if you recall having seen this document before?

A Yes, I recognize the document.

Q Was any of the work that was discussed in this monthly summary -- did any of this report relate to work that you had done?

A Yes. I actually wrote up what I did, which was then in turn incorporated into this monthly summary and published.

Q Would you point out for me the sections that you were responsible for in here?

A Yes, I would be happy to. Okay, the parts that I wrote and contributed to this particular research monthly

summary are listed as your numbers 11322, 11323 and 11324 and 11325, entitled "Aroclor Defense."

Q And you basically wrote pages 11322 and 11323 and 11324?

A Yes.

Q Was this a summary of the work that you were doing at that time that -- this was May of 1970 summarizing work done in April of 1970?

A Yes.

Q And this was prepared in the ordinary course of your duties at Monsanto?

A Yes.

MISS OLIVER: That part of that report.

MS. STEIN: That part of that report, that's right.

A Yes.

MS. STEIN: Let's go off the record for a minute.

(DISCUSSION OFF THE RECORD)

Q All right, on page 11325, I believe you said you contributed to this portion as well as the preceding three pages?

A Yes, that's correct. The others listed here are

Keller, Tucker, Emery and Dietrich. Keller is the section manager, Applied Sciences. Tucker, which is me, Emery and Dietrich are group leaders reporting to Keller.

Q Was this portion of the summary, this page 11325, circulated among all of you before agreement and reviewed before it was put into this summary?

A Yes.

Q Now, the second paragraph on page 11325 says "Water and sediment samples from six Pydraul customers were analyzed for PCB's. It's concluded that PCB's are finding their way to sewers, streams and lakes. In amounts as low and as much as amounts ranging from low PPB to high PPM were determined." At the time this was written, did you agree with that statement?

A Yes.

Q And that was the consensus of the authors of this portion of the report, as best you recall?

A I believe it was. It was my consensus.

Q Do you recall discussing with the other members of the team whether or not those findings, i.e., that the PCB's are finding their ways to sewers, streams and lakes, was something that should be discussed with customers?

A First of all, Keller, Tucker, Emery and Dietrich

were not in a position where they contacted customers or not. This material in turn obviously was reported to Dr. Richard and his people, so they were well aware of the fact that it should be discussed with customers.

MISS OLIVER: Is the answer to the question no, Dr. Tucker?

THE WITNESS: Would you repeat the question for me, please?

(The record was read back.)

A I don't believe I discussed that with these particular people. No.

MS. STEIN: I know what happened to B, Plaintiff's Exhibit B. We won't use it because it was previously marked as a defendant's exhibit.

Q I will refer you to what has been marked as Defendant's Exhibit 8. On the first page of that document there are several projects mentioned and three teams; is that correct?

A That's correct.

Q And one of the -- team number three was supposed to "engage in characterization studies and regulatory agency work (dioxin)." Do you know what the characterization studies that are referred to in that item are?

A I do not have a recollection of exactly what they were looking at, what they were attempting to characterize.

Q Then, for the sub-heading, for the project's "regulatory agency work (dioxin)," do you know what that referred to?

A I don't know specifically what that referred to.

Q Do you have a general idea?

A Yes, I have a general idea.

Q Okay, can you tell me what that is?

A I think there was a great deal of concern about dioxin on this date from work done by other people. And I think they were probably -- I think, I don't know this -- that they may have been looking at PCB's to see whether or not they could detect dioxin or they may have been attempting to establish the proper methodology for detecting dioxins and PCB's. And Jim Muir was the mass spectroscopist at that time and that was the technique of choice.

MR. SCHINK: The question is what did it involve. You may even, if you want, look at the last page and see if that refreshes your recollection.

A Okay, my recollection was fairly accurate. It says "determine presence of dioxin and/or related toxic

materials in PCB products."

Q And in conjunction with the item that you just read, do you know whether or not there was any study done by team three or anybody else at Monsanto relating to the presence of dibenzofurans in PCB's?

A Yes, there was a study done.

Q Did you do that study?

A No, I did not.

Q Do you know who did that study?

A Yes.

Q Who was it?

A Drs. Muir and Dietrich.

Q Did they ever discuss with you what their findings were on that study?

A Yes.

Q What do you recall their findings were from those discussions?

A I recollect that we were unable to detect any chlorinated dibenzofurans in Monsanto products. And on the other hand, I believe we looked at some foreign or competitive products and that we were able to detect chlorinated dibenzofurans in their products.

Q What was the limits of detection of the detection

equipment that Monsanto was using at that time, if you know?

A The units of detection at that time were sub-parts-per-million levels.

Q Meaning in the part-per-billion range?

A Meaning in the high part-per-billion range, meaning if you got below, much below a part per million, it became very questionable if you had some. That's my recollection.

Q Okay, if that is the best you can do.

MS. STEIN: Would you mark this Plaintiff's Exhibit J as N?

(Plaintiff's Exhibit N duly marked for identification.)

Q Dr. Tucker, I will show you what has been marked as Plaintiff's Exhibit N for Identification, "Study of Aroclor Chemical Clean-Up Procedures for Use with Electron Capture Gas Chromatography Methods" and ask you to review that document.

A Okay.

Q I believe there are several additional pages in the back, but review those as well.

A I will.

Okay, I have reviewed the attached chromatograms.

Q Okay. Did you prepare this document?

A Yes, I both actually did the lab work and prepared the document.

Q Was it prepared by you in the ordinary course of your duties at Monsanto?

A Yes.

Q On the second page there is what appears to be a date on the left-hand side, 3/70, is that the date on which this was prepared?

A Yes.

Q Now, at the very top it appears there is some typed -- there is some typed material which has been partially cut off. And I believe it says "rough draft, not edited." Do you recall whether that is what that says or can you decipher what that says?

A Yes, it appears in the upper left-hand corner where it is cut off. I think there is enough of the type to see it does say "rough draft, not edited."

Q Did you ever do a final of this study of Aroclor Chemical Procedures for Use with Electron Capture Gas Chromatography Methods?

A Yes.

Q Do you know whether or not there were any significant differences between the final report of that

study and this one?

A I don't believe there were any significant changes in the final report relative to this copy that is labeled "rough draft, not edited" copy.

Q The procedures that are described in here, were those the ones that were used by Monsanto for the clean-up procedures in doing its PCB analysis?

A No.

Q What was this used for?

A What we were doing here is evaluating procedures that might have been used for or that were purported to be used by other ex -- outside, not ex, but outside Monsanto researchers. There were three treatments that were being looked at. One was called saponification. Another was treatment with sulfuric acid. And another was treatment with nitric acid. These procedures were being used to eliminate interferences that might appear in the electron capture chromatograms of the extracted samples. We found that the saponification procedure did not affect the PCB's. We also found that treatment with sulfuric acid did not affect the PCB's in the extract. And we did, at that time, at times use those procedures in some of our sample preparation workup schemes. However, we did find that under some

conditions the treatment with nitric acid affected the PCB's and eliminated them so you couldn't see them by electron capture gas chromatography. We did not ever use that procedure for analyzing Monsanto samples.

Q Could you briefly describe what saponification is?

A Yes, it consists of taking the sample extracts, getting rid of the solvent, placing the residual material in a flask and adding concentrated sodium hydroxide aqueous and reflexing the sample for a period of time with this and then cooling it down and re-extracting it with hexane and then analyzing the hexane extracts for the materials which survived the saponification treatment.

MS. STEIN: Let's mark this as Plaintiff's Exhibit O.

(Plaintiff's Exhibit O duly marked for identification.)

Q Dr. Tucker, I will show you a document that has been marked as Plaintiff's Exhibit O and ask you to review that.

A Okay, I have reviewed the document.

Q Did you prepare this document on or about November 20, 1970?

A Yes.

Q Did you prepare it in the ordinary course of your duties at Monsanto?

A Yes.

Q Did you prepare this figure one that is attached?

A Yes.

Q I believe that earlier you were talking about the various kinds of biodegradation studies that you were doing and one of them was river dioway?

A That's correct.

Q I believe you said you collected water samples from two rivers, I guess the Meramac and the Mississippi, and I am not quite sure what you did with them and how you did the biodegradation testing with those water samples. Could you describe that?

A Yes. What we were attempting to do and what you attempt to do in this particular kind of a test is you go to a river and you collect whatever requisite amount of water you need and in this water is the natural bug, natural bacteria or bacterial population that is normally present in river water. Be it the Mississippi or the Meramac or something of that sort. The bug population in there is very low. The amount of food that the bacteria can multiply on is very low. But you take this into the laboratory and then

you apportion it into several different flasks. And then you innoculate the flasks with the compound in question to see whether or not the natural population of bacteria in the river water will degrade the material.

Q In your experiments was there any kind of concentration of that natural bacterial population? Or did you just inject at that time water as you drew it out of the river without having concentrated that bacterial population?

A The bacterial population was not concentrated. The bacterial population was that which was in the river water and there was no attempt made to concentrate the population. Whatever was the bacterial population was then inoculated with the compound in question and the compound in question was monitored on a time basis to see whether or not the natural population present in the river water could degrade the material.

Q What were the conclusions of your river dioway studies? Well, did you do any of those river dioway studies on Aroclor 1242?

A Yes.

Q What were your conclusions with respect to river dioway biodegradation on Aroclor 1242?

A If I remember correctly, our conclusions were that

some of the lower chlorinated isomers were degraded, whereas the higher chlorinated isomers were not.

Q Do you recall approximately how long it took for these lower chlorinated isomers to degrade in the river dioway biodegradation studies?

A I don't remember exactly, but I do believe we did publish this information. Although I am not quite sure about that. I think that was in that article on -- I know -- well, I am trying to think. I do not recollect how rapidly they degrade under those conditions.

Q Let me ask you if you recall whether it was longer than a week?

A It might have been. It couldn't have been too long because, since you are not adding any extra nutrients to the river water, the bacterial population in there won't exist for too long a period of time without extra nutrients. So it has to be a week, month or something like that. Certainly no more than a month.

Q By lower chlorinated isomers, you are talking about mono, one, two and three chlorines?

A Yes, in almost all instances. The monochlor biphenyls underwent biodegradation rapidly. The dichloryls are a little bit more difficult. The trichloryls are more

difficult than the di's and the tetrachloryls were more difficult than the tri's. When you get into the penta is when you really saw very little, if any, degradation.

Q Did the position of the chlorine atom on the biphenyl have any impact on the rate at which the isomers biodegrade?

A Yes.

Q Was there any kind of generalization you could draw from that? For example, the two or two-primed or three- or three-primed chlorines?

A Yes, there are some general observations that you can draw from that. And let me start this way: For example, assume that we have a pentachloryl biphenyl where all the chlorines are in one of the biphenyl rings. That compound would most likely undergo primary biodegradation because it has one ring that is completely open and doesn't have any chlorine substitution on it whatsoever. If you had a pentachloryl biphenyl isomer that had three chlorines in one ring and two chlorines in another, it would probably degrade very slowly because the chlorine have the effect of keeping the bacteria from oxidizing the central ring structure. And there were a lot of studies done subsequent to our work, after our work, indicating that if the rings

were substituted with chlorine in a specific position that it hindered their biodegradation by bacteria. But generally speaking, the monochloryls all degraded and the dichloryls all degraded. When you got into the trichloryls, you might start running into some slowing down because you might have a chlorine in one ring and two in another. When you started getting into the tetras and above, of course, the ring structure became much more insulated from bacteria and the bacteria couldn't get to it to oxidize it. Bacteria are not very good at breaking down carbon chlorine bonds.

Q Dr. Tucker, do you know whether Aroclor 1242 contain -- any Aroclor 1242 as marketed contained any isomers of PCB's with tetrachloryl biphenyls or higher on them?

A Yes. Yes, Arocloric 1242 does contain biphenyl isomers which have four or more chlorines on them.

Q Is the same true for Aroclor 1248?

A Yes.

Q Would it be fair to say that even if Aroclor 1242 or Aroclor 1248 degraded, some components of that initial Aroclor would remain in the environment in the form of these higher chlorinated biphenyls?

A Yes.

Q Dr. Tucker, I believe you referred to a couple of

publications today relating to your biodegradation work; is that correct?

A Yes.

Q Do you have any other publications relating to PCB's?

A Yes.

Q Could you briefly describe them? And if you remember when they were published?

A I don't remember specifically when they were published, and I will tell you that right now. I have an article that was published on the mobility of polychlorinated biphenyls in different types of soil samples when these soil samples were leached with water. And I have a publication along with other people. All these publications have other authors on them, by the way. I have a publication on residue, PCB residues in animal tissues. And I think those are the extent of the actual journal-type PCB publications that I have.

Q By the way, let me back up for a minute here. When I was asking you about the biodegradation studies before, did Monsanto ever do any biodegradation work involving sediment samples, for example, injecting sediment samples with PCB's to see whether or not there would be any impact

on the biodegradation?

A No.

Q Dr. Tucker, did you retain Mr. Schink to represent you personally today?

A No.

MR. SCHINK: Do you mean by "retain," is he paying?

MS. STEIN: That's correct.

A No.

Q Earlier in response to a question from Miss Oliver regarding the use of gas chromatography in the quality control function of the plant laboratories, I believe you said that they would -- the procedure was used to determine the percent of purity of products on a gross level. Could you explain what you mean by "on a gross level"?

A Primarily what I mean on a gross level is that they were dealing with the actual product itself as it was manufactured. So they would run a gas chromatogram using maybe a TC detector or a flame ionization detector and look at the level and see if it matched previous production. So they were looking for gross differences, percent differences.

Q So it wasn't looking for impurities, specific

impurities, but rather the percent of the product. If it was an aroclor, the percent of the product that was in fact aroclor; is that correct? Without trying to identify specific impurities?

A They were looking for process impurities, but they were looking at it in the gross fashion. In other words, they would look at, for example, an Aroclor 1242 sample which has an unknown fingerprint and unknown number of peaks with the proper ratios and retention times under certain conditions. If they got peaks that didn't match that type of thing, then, they would assume there was something wrong and there were impurities in them. But this would be gross impurities like percent level.

Q But it wasn't intended to pick up a specific compound as an impurity within the Aroclor 1242?

A That's correct.

Q Earlier you referred to a Brookhaven conference?

A Yes.

Q Do you recall what year that conference was in?

A I don't exactly. I could look it up, but it was -- had to be in the late '60's or early '70's.

Q Do you recall where it was held?

A Brookhaven National Laboratories.

Q In connection with your environmental samples that you analyzed for PCB's, let's talk about 1970, now. I believe you said that you reported your findings to Dr. Keller; is that correct?

A That's correct.

Q And you had formed the opinion and you were pretty confident that you were, in fact, finding PCB's; is that correct?

A That's correct.

Q Do you remember in your conversations with Dr. Keller or anyone else in the Research Department of the Organic Chemicals Division whether or not people, anyone, disagreed with those findings?

MR. SCHINK: In 1970?

MS. STEIN: In 1970.

A I don't recall any disagreement with my findings.

MS. STEIN: I have no further questions.

Roseann, do you have something else?

MISS OLIVER: Yes, I just have a few.

REDIRECT EXAMINATION BY MISS OLIVER:

Q When you developed the -- strike that.

When you use the biodegradation study or method of collecting organisms from a river to determine if any

degradation would occur, in your opinion would the organisms, for purposes of biodegradation, that would be found in the river be representative of what you would find in a lake?

A Somewhat. Certainly not the exact population.

Q Did you ever do any sampling of lake water to collect a population of organisms for purposes of determining what the biodegradation would be?

A In lake water?

Q In lake water.

A I vaguely recall way back early going out and collecting water from what I would consider more of a pond than a lake and doing something with that. But I don't think we did very much at all with that type of thing.

Q When you say "way back," is that --

A When we were really searching for techniques to study the biodegradability of water-soluble compounds.

Q In the period of 1967, '68, around there?

MR. SCHINK: Well, Miss Oliver, he has already testified and you showed him documents that that program began sometime after. Are you trying to change that testimony?

MISS OLIVER: No, I am trying to clarify approximately when that was.

A I would say '69, '70, around there, something like that.

Q Did you prepare any reports on that collection?

A No.

Q And work?

A No.

Q Do you recall what the results were of that work?

A No. I vaguely remember even doing it.

Q You told me a little earlier, Dr. Tucker, that in about 1970 you were spending almost 100 percent of your time on PCB matters as Section Manager and you worked on PCB matters up until 1976. Did your approximate percentage of time that you spent on PCB matters remain the same from 1970 to 1976?

A Well, first of all, I wasn't Section Manager. I would have liked to have been, but I wasn't. I was Group Leader.

Q I am sorry, Group Leader.

A There is a big difference. Believe me. It started out as a portion of my function. It grew to the point where it was a full-time function. It stayed at the level of full-time function for a fair period of time. And then, it slowly went down as other people became trained and as Monsanto

withdrew from the business and things of this sort.

Q When you left the PCB business in 1976, how much of your time was spent on PCB matters the last year?

A Not very much.

Q 10 percent?

A Not that much, probably.

Q Dr. Tucker, I would like you to look again at Plaintiff's Exhibit E and I, which you testified were your reports to Mr. Pogue on the analysis you made of Johnson Motors' samples and other samples; is that correct?

A Yes.

Q Okay. To your recollection, are those the only analyses you have done relating to Johnson Motors' samples for PCB's?

A Yes.

Q You have no knowledge, Dr. Tucker, do you, that these analyses were, in fact, given to Johnson Motors?

MR. SCHINK: I object to the form of the question. It mischaracterizes the witness's testimony. He has already explained the procedure whereby data such as these would be conveyed.

MISS OLIVER: Mr. Schink, my question was does the witness have any knowledge that this data was,

in fact, communicated.

MR. SCHINK: Yes, I object to the form of the question. He has already answered that with respect to the various procedures that were in place in the department at that time as he understood them.

Q You don't have any knowledge that they were, in fact, given to Johnson Motors, do you, Dr. Tucker?

MS. STEIN: I object to the form of the question.

A I believe I testified earlier that I do have knowledge via an earlier exhibit on which I was copied, that the information which I know I transmitted to Mr. Pogue, he in turn transmitted to Mr. Damiani, who in turn, I assume, and I don't know this because I did not witness it, gave the information to the Johnson Motors people at the meeting that they had. I certainly know that it made it back to the man who was in contact with the Johnson Motors people. I did not witness the information being transferred.

Q You also have seen no document demonstrating that Mr. Damiani transferred that information to Johnson Motors, have you, Dr. Tucker?

A I have seen a document indicative of it, but I

have not seen a document which states these specific figures were given to him.

Q As a matter of fact, the document from Mr. Pogue to Mr. Damiani, which is carboned to you, you testified earlier indicates that is what Mr. Pogue did with the information you gave him. He transmitted it to Mr. Damiani; is that correct?

A That's right. But if I remember correctly, there is also a call report describing a meeting that Mr. Pogue and Mr. Damiani had with the Johnson people. It is my opinion, and you did ask my opinion, that the information was transmitted.

Q I didn't ask your opinion, I asked whether you had any knowledge.

Here is the call report, Exhibit H, is there any reference in this call report to the fact that this information identified as Exhibit I and Exhibit E were, in fact, given to Johnson Motors?

MS. STEIN: Objection to the form of the question. I believe there is a difference in terms of the timing on those. I think that Exhibit I succeeds Exhibit H and, if it was not done until later, I don't see how it could have been

incorporated in H.

MR. SCHINK: You don't have the document in front of you, Ms. Stein, but the document the witness is relying on was dated May 25th, which is two weeks after he sent the PCB analysis to Mr. Pogue and thirteen days after Mr. Pogue sent it to Mr. Damiani.

BY MISS OLIVER:

Q The question is, after reviewing the call report, that call report does not state, does it, Dr. Tucker, that the information you provided to Mr. Pogue on May 11th was given to Johnson Motors?

A (Reading.) It does not state that specifically.

Q In fact, at the end of the call report of May 25th, you are asked to analyze chemical composition of some of the samples, right?

MR. SCHINK: Of what samples, Miss Oliver? The second set of samples that are referred to at the bottom of the first page? Is that what your question is referring to? If it is not, it's vague.

MISS OLIVER: I am sorry, let me rephrase it.

Q You were asked by Mr. Pogue through this call

report to analyze chemical composition of stream effluent north and south discharge samples, correct?

A I am asked for, going to be asked, it's indicated in this report, to re-analyze the samples that I already have in my possession from Johnson Motors for total chemical composition versus PCB analysis alone.

Q So, you were not given a second set of samples?

A I do not believe I was given a second set of samples.

Q You had the original samples you got from Mr. Pogue and you did the initial analysis as shown on May 11th on those samples. You did the analysis shown on your memorandum of October 19th, correct?

A Correct.

Q And you were advised by Mr. Pogue that he was asking for that second analysis of those samples in May of 1970, correct?

A I believe there is a memorandum from Mr. Pogue to Dr. Keller asking that that be done. I don't recall the date exactly on that, but it was September 22nd, 1970.

Q Okay, you are referring to Exhibit H, the September 22nd, 1970 memorandum?

A Correct.

Q From May of 1970 to the time you reported the analyses on October 19, 1970, did you -- strike that.

From May of 1970 until September 22nd, 1970, did you perform any additional analyses on those samples that you obtained from Johnson Motors?

A No. The only two analyses, the only two times these samples were analyzed were twice; once for PCB's as we have established and then once for total chemical composition as we have established.

Q Were the samples that you report to Mr. Pogue in May of 1970 part of the 167 samples that you analyzed for PCB's in January and February of 1970?

A I don't recall. I would have to check the log numbers and look at the samples. I think there is documentation so.

MR. SCHINK: Exhibit Number 1. Is that what you are referring to, Miss Oliver, by 167 samples?

MISS OLIVER: Yes.

A Yes.

Q And Mr. Pogue was providing you with samples not only from Johnson Motors but from other customers of Monsanto; is that correct?

A Yes.

Q And you understood that Mr. Pogue's assignment was to attempt to determine whether there was a business opportunity for Monsanto to reclaim Pydraul for its customers?

MR. SCHINK: Objection, asked and answered.

A Yes.

Q Did you understand that that was the purpose of his going out and taking samples from these customers to determine the feasibility of reclaiming Pydraul?

A I believe I stated earlier that he had a twofold objective. That was one of them; that's correct. The other objective was to get a feeling on the PCB pollution aspect of it. And I think I stated that earlier.

Q And those samples were helpful to you in terms of determining whether there were PCB's in the environment or not, were they not?

A It was helpful to me in determining whether or not there were PCB's being discharged to the environment.

Q And they were helpful to Monsanto in determining whether PCB's were in the environment; isn't that right?

A As I said, they were helpful in helping us to determine if PCB's were being discharged to the environment. Obviously, if they are discharged to the environment, they

are probably there for some finite period of time.

Q One final question, I think: You referred a few times today to reports or studies that you prepared on things that you were working on entitled to "Aroclor Defense." Was that a title that was given to the work that you were doing by someone other than you?

A Yes.

Q Who was responsible for developing that title for the work being done relating to PCB's?

A I believe the term probably originated with Dr. Richard. I don't know that to be sure.

MISS OLIVER: I don't have any other questions.

MS. STEIN: I have a couple.

(Plaintiff's Exhibits P and Q duly marked for identification.)

RECROSS EXAMINATION BY MS. STEIN:

Q Let me show you what has been marked as Plaintiff's Exhibit P and ask if you can identify this document. It's a two-page document.

A Yes, I can identify the document.

Q Can you tell me what that is?

A Yes, it's a standard work request form. It's a Xerox of the front and back of the form. One side indicates

the work requested, the reason and any comment that the person requesting the work might have. There is also an area for sample identification. And then, the reverse side indicates the results.

Q Was Plaintiff's Exhibit P prepared under your direction or supervision?

A Yes, I requested that Mr. Litschgi submit these samples to Dr. Katlafsky for infrared analysis.

Q And were the two pages that comprised Plaintiff's Exhibit P prepared by Mr. Litschgi and Mr. Katlafsky in the course of their duties at Monsanto?

A Yes.

Q And can you tell me what the information is that is on Plaintiff's Exhibit P, what was done and what the results were?

A Okay, the original Johnson Motors' samples of the south discharge and the north discharge were re-analyzed as requested by Mr. Pogue for total organic content, basically, or oils. To do this they were simply extracted. The solvent used to extract the samples was removed. And the residual material was weighed and then submitted for infrared spectro-analysis.

Q Was this sort of a backup work for what is

contained in -- is Plaintiff's Exhibit P backup work from the lab underlying Plaintiff's Exhibit I and the information on that?

A Yes.

Q I will show you a one-page document that has been marked as Plaintiff's Exhibit Q for Identification, dated October 14, 1970, entitled "Chemical Analysis Stream Effluent Johnson Motors/Lester Industries." Is this document addressed to you?

A Yes.

Q Do you recall receiving this document on or about October 14, 1970?

A Yes.

Q Was this the transmission then to Mr. Pogue from you of the information?

A No, that was for --

Q Can you tell me what that was?

A This was a request from Mr. Pogue to me to analyze the Johnson Motors' and Lester Industries' samples for percent soluble and/or emulsified oil and grease and to estimate the percent of each specific material in the effluent samples.

Q Was the work then that was done, that is represented on Plaintiff's Exhibit P?

A Yes.

MS. STEIN: I have no further questions.

MISS OLIVER: One more.

BY MISS OLIVER:

Q This last document that was marked as Exhibit Q, Dr. Tucker, is requesting you to do an analysis that you reported to Mr. Pogue on October 22nd; is that correct?

MR. SCHINK: October 22nd?

A I believe it's October 19th.

Q On October 19th, I am sorry.

A Yes, this is an official request to go ahead and do that particular type of analyses on these samples. And yes, this was. The information generated via this request is the information reported on October 19, 1970, the document, Plaintiff's Exhibit I.

Q How did you send Plaintiff's Exhibit I to Mr. Pogue?

A The general procedures, I, at that time, was located on South Second Street in downtown St. Louis. The secretary would type up the memos and then, she would place them in the appropriate envelopes with people's names on them and their address. And Don Pogue, at that time, was in the general offices. It would go into the inter-company mail and be delivered to him.

Q Would that be delivered the same day as the memorandum was dated?

A More than likely. If not, certainly the next day. We had our own inter-company mail system. There was just a period of like about thirty minutes to get from the research center downtown to the internal headquarters.

Q You have never seen a document from Mr. Pogue to Mr. Damiani transmitting the information you provided Mr. Pogue in your October letter, have you?

MR. SCHINK: You are talking now about all the information or the PCB figures, Miss Oliver, which the witness has already testified previously were transmitted to Mr. Damiani?

MISS OLIVER: No, I am talking about all the information in the October 19, 1970 letter or memo.

A No.

Q And you have never seen anything in writing transmitting that information to Johnson Motors, have you, Dr. Tucker?

A No.

MISS OLIVER: I don't have anything.

CROSS EXAMINATION BY MR. SCHINK:

Q Dr. Tucker, do you have a belief that that information was transmitted to Johnson Motors?

MISS OLIVER: I am going to object to the form of the question as calling for speculation.

Q Do you have a belief that the information that you generated regarding the PCB levels in the Johnson Motors effluent was transmitted to Johnson Motors?

A Yes, I believe it was.

(Whereupon the deposition was adjourned at 7:05 p.m.)

STATE OF

COUNTY OF

_____
E. SCOTT TUCKER

E. Scott Tucker personally appeared before me at , , this day of , 1982, made oath and acknowledged this deposition to be a true and accurate transcription of his testimony.

_____
NOTARY PUBLIC

My commission expires:

C E R T I F I C A T E

STATE OF CONNECTICUT)
ss: DARIEN
COUNTY OF FAIRFIELD)

I, MARY B. RICHARDSON, a Notary Public duly commissioned and qualified in and for the County of Fairfield, State of Connecticut, do hereby certify that pursuant to the Federal Rules of Civil Procedure, there appeared before me on the 15th day of April, 1982, at 9:20 a.m., at the offices of AMF, Inc., 689 Hope Street, Stamford, Connecticut, the following named person, to wit: E. SCOTT TUCKER, who was by me duly sworn to testify to the truth of his knowledge concerning the matters in controversy in this cause; that he was thereupon carefully examined upon his oath and his examination reduced to writing under my directions; that the deposition is a true record of the testimony given by the witness.

I further certify that I am netther attorney nor counsel for nor related to nor employed by any of the parties to the action in which this deposition is taken, and further, that I am not a relative or employee of any attorney employed by the parties hereto, or financially interested in this cause.

In witness whereof I have hereunto set my hand and affixed my notarial seal this 27th day of June, 1982.

My Commission expires:
April, 1987

Mary B. Richardson
MARY B. RICHARDSON
NOTARY PUBLIC

MARY B. RICHARDSON
19 ALLWOOD ROAD
DARIEN, CONNECTICUT 06820

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