industry.

A That last one was a study of the employees of the factory, the plant in which Messrs Wallace and Dendinger worked.

Q Have you reviewed that study?

A I have studied the report, yes.

Q And that was the report prepared by Dr Shindell?

A Yes.

Q Did you know of Dr Shindell before you saw his report?

A No.

Q Going back for a minute to Dr Chiazze, were you aware that Dr Chiazze's initial work was paid for by the Trade Industry for the PVC manufacturers of the United States?

A I cannot recall that but if he says it, I am sure it was.

Q And your suggestion with regard to the conclusions or hypotheses that Dr Chiazze derived from his study, was that they should be further analysed and were, and that further research should be done?

A Yes.

Q Are you aware of any efforts by the American PVC industry to sponsor further studies of PVC fabrication employees in the light of the results reported by Dr Chiazze in his 1981 work?

A I have no idea what they have done, I am not in touch with the industry.

URL 11612

Q Was your recommendation, however, that follow-up studies be done?

A I think that would be a reasonable thing to do, yes and Dr Shindell, of course, could be cited, I suppose, as one such study.

Q Then let us talk about Dr Shindell's study. Do you have a copy of that with you, doctor?

A I could get it, yes. (Pause) Yes, I have.

Q I would like to direct your attention if I could to Table II in Dr Shindell's study that appears at page 12. Do you have that in front of you, sir?

A Yes.

Q What is your understanding as to the job categories in which Mr Wallace and Mr Dendinger were employed?

A My understanding is that they were employed in the categories described there as inspection shipping - - no, I am sorry, coating and finishing.

Q Your understanding is that both---

A I am sorry, I think I may be wrong on this. I thought one was inspecting, was he not?

Q Let me make a representation.

A Can you remind me?

Q It is my understanding that Mr Wallace was classified as a coating finishing employee and Mr Dendinger was classified as an inspection shipping employee.

A In other words I was right in both cases but for the wrong reasons.

Q I suppose so. What I would like to do doctor, is to have you contrast the Shindell study with the Chiazze study. How would you classify this study that Dr Shindell did in terms of epidemiologic categories?

A This is a cohort study and as such is the type of study that one likes to carry out to test a hypothesis.

Q One of the hypotheses that Dr Chiazze proposed in his 1981 article was that there was an increase in the proportion of total cancer deaths among white male PVC fabrication employees?

A Yes.

Q So one of the follow-ups that you would have suggested to confirm or disprove Dr Chiazze's hypothesis was the cohort study done by Dr Shindell?

A Yes.

Q What I would like to do, Dr Doll, is to have you look at Table II and the total cancers reported in the coating finishing and the inspection shipping categories, in which my clients decedents worked. If we can take the coating finishing category first in which Mr Wallace was employed and determine the total number of cancers that would have been expected in a general population, we could take that by adding the 1.4 expected respiratory cancers and the 2.47 expected other cancers. Would that be correct?

UAL 11614

A Yes.

Q Could we go off the record for just a minute, please?

(Whereupon there followed a discussion off the record)

BY MR DELLI BOVI:

Q Dr Doll, referring to Table II in Dr Shindell's study and the two categories of employees which Mr Dendinger and Mr Wallace worked, there are data reported in both of respiratory cancers and other cancers, correct?

A Yes.

Q And these are categories that were set up by Dr Shindell for purposes of his analysis?

A Yes.

Q I would like to direct your attention to the exhibits that we have on the easel which I will mark as Plaintiffs Exhibit Doll 3. I would like, if you would, to refer to the respiratory cancer deaths and the other cancer deaths in the job classifications in which Mr Wallace and Mr Dendinger were classified and tell me whether or not the figures that are on Exhibit 3 are identical to those appearing in Dr Shindell's study?

A Yes, they are.

Q What I would like---

A I have not checked the addition but I am assuming the addition is correct.

Q I hope so. What I would like you to do, Dr Doll, is to do something Dr Shindell did not do in his study and that is

URL 11615

to determine in terms of total cancers in the job categories in which Mr Wallace and Mr Dendinger were employed, the significance of the observed deaths, versus the expected deaths. Would you be able to do that, sir?

A I would have to look at the tables of significance. From my general experience I would guess the coating and finishing one was not significant statistically, but the inspection and shipping was, but that is a guess and I would have to look at the table. You can doubtless tell me.

Q Let me go back to the findings that Dr Shindell came to himself. With regard to the respiratory cancers among the coating and finishing employees, Dr Shindell calculated the expected deaths at 1.4, correct?

A Yes.

Q What does that indicate, doctor?

A That had the people in those particular sections of the industry died at the same rate as the people of the same ages in the United States as a whole, from respiratory cancer, that 1.4 of them, if you can accept 0.4 of an individual, would have died of respiratory cancer.

Q As opposed to the 1.4 expected deaths, Dr Shindell reported actual deaths among employees at the plant where my clients' decedents worked?

A Yes.

Q Did Dr Shindell determine that that number of observed

URL 11616

deaths versus the number of expected deaths was statistically significant?

A Yes, he said it was but when I looked it up in my tables I found it was not but it is a quibble because it is round about 5% probability and whether it is 4% or 6% is scientifically of trivial importance. Actually, I make it nearer 6% than 4%.

Q And that means what, doctor?

A That means to have observed four or more deaths from respiratory cancer in that particular group of people of those ages over that period in the United States would have turned up only about once in twenty such groups that you looked at.

Q Next I would like to direct you to the inspection and shipping category of employees in which Mr Dendinger worked and to the other cancers. According to Dr Shindell's method of classification, would those other cancers include the colon cancer from which Mr Dendinger died?

A Yes.

Q In that category, Dr Doll, one would have expected, assuming the death rate from these other cancers among inspection shipping employees at Chrysler, was the same as that among a comparable general population, 1.95?

A Yes.

Q And in fact at Chrysler there were five employees who died of cancers other than respiratory cancer?

URL 11617

A Yes.

Q Is that number again, Dr Doll, statistically significant?

A This time I have no difficulty in agreeing with Dr Shindell.

Q In terms of testing Dr Chiazze's 1981 hypothesis of an increase in overall cancers among PVC fabrication employees, is it fair to total these four categories of employees to arrive at sum total figures?

A No.

Q Why is that, doctor?

A Because you have subscribed the population and picked out some groups with higher mortalities than other groups. You have left out the production and maintenance group which did not show such an excess. It showed, I think, 4 cancers against 3.72 expected and you left out the management and clerical group which showed no cancers against 1.79 expected and when you subdivide and look at a number of separate groups, then inevitably you are going to find some with statistically significant excesses. Had the prior hypothesis of Dr Chiazze been that people in the coating finishing and inspection shipping groups had a higher than expected mortality from cancer, then that would be a fair thing to do, but it was not. It was that all the employees of the PVC fabrication industry had an excess and, therefore, you have to look at the total. Again, you get your-

URL 11618

self into a situation in which you create another hypothesis when you find an excess in some subdivisions. You find now an excess in the coating finishing and inspection shipping divisions and that constitutes a new hypothesis which will have to be tested by further experience of those workers. I would like to carry that a little further because in testing a hypothesis I think it is important that you take into account the area in which the people were working. Dr Chiazze's hypothesis was based on the workers in, I think, seventeen plants, but my memory may be fallible about that, scattered throughout the United States and he, therefore, very properly or reasonably took the whole of the United States mortality experience as a standard to compare with it. If, however, you are looking at a plant in Ohio, then you need to see what the mortality from cancer is in Ohio, how that compares with the rest of the United States. I have not got the figures for that, it is a highly industrialised State or part of it, I believe is and I would expect the expected mortality from cancer to be higher than is estimated from the national United States rates.

Q To a significant degree?

A Yes.

Q Have you been presented with data for Ohio by any of the PVC manufacturers?

A No.

Q Did you consider the cancer deaths reported at the

URL 11619

Chrysler facility by Dr Shindell in coming to the opinions that you have suggested today?

A Dr Shindell's paper was not available at the time I made my review.

Q When did you first see Dr Shindell's paper?

A About two weeks ago, one week, ten days ago.

Q In terms of Mr Dendinger and Mr Wallace, I take it you do not have an opinion as to the cause of either gentleman's cancer?

A No.

Q Were you provided with any information about their age at the time of death, their diet, their family history or known history of cancer, their inhallation of tobacco smoke, if any, or their use of alcohol, if any?

A Yes, some limited data. Certainly precise data for age and some details for the other things that you mention but none of them in fact are relevant or would be regarded as relevant to the aetiology of their conditions. When I say that, I do not mean diet is not relevant to the aetiology of cancer of the colon, all I mean is the sort of information that could be given about the individual would not affect my assessment because one cannot really assess an individual's diets sufficiently precisely to be of any value on deciding if it is a cause of his cancer.

Q In terms of your opinions that you have expressed today,

IJRL 11620

you have not relied on the Shindell study at the Chrysler plant, the Chiazze study of PVC fabrication employees, the Molina study of PVC fabrication employees, is that correct?

A No. I have certainly taken them all into full account and weighed the evidence that they have produced before expressing my opinion which is an opinion based on all the data I have seen including the data which you have provided me with and which I was provided with in the last few months.

Q What determined whether or not a particular study made your list of references at the conclusion of your paper?

A Whether it was relevant to the conclusions which I reached in it. I did not list quite a number of studies which I read, including the Chiazze study because I did not think it was relevant to the conclusion which I reached.

Q Your belief then was that Chiazze was not relevant?

A I thought that Chiazze's study was not helping in any way assess what the effects of vinyl chloride were.

Q That Molina was not relevant?

A Molina was definitely not relevant.

Q And Shindell was not relevant?

A Shindell I only recently took into account in expressing my opinion today.

Q The report with the review that you authored and appeared in the Scandinavian journal, was commissioned by the Manufacturing Chemists Association?

URL 11621

A It depends what you mean by "commissioned". If by "commissioned", you mean was I paid to do it, the answer is no. If by "commissioned" you mean was I asked to do it in an honorary capacity, the answer is yes. I said I was glad to do it, it was an interesting and important subject and I would do it on the understanding they made a contribution to a charity which I named. So, depending what you mean by "commissioned", there is my answer.

Q And, if you do not mind my inquiry, could you tell me the amount of the contribution MCA agreed to pay?

A Oh, I will have to look it up. It might have been $10,000, 7,000. It was not paid to me, it was paid to the charity.

Q Can you tell me for certain whether or not the study was commissioned before or after 1985?

A No, I cannot. I think it was before, probably. I know it was about two years before I could start on it. I did the work in 1986. I would guess it was 1984 I was asked to do it but it might have been 1985.

Q Could you tell me, doctor, precisely what assignment you received from the MCA?

A I cannot remember the exact wording. It was about three lines to review the evidence on the effect of vinyl chloride on man with specific reference to whether there was any increase of any cancer other than angiosarcoma of the liver.

UAL 11622

I think that was the way it was put.

Q Do you know whether or not that study was sought by the MCA after Mr Dendinger and Mr Wallace filed their litigation?

A I have no idea. I do not know when they filed it.

Q Of the four major studies that your article reviews, three were - at least at the time you wrote the article - unpublished?

A Yes. They are published now.

Q Are all four of the studies that you have reviewed published?

A No, the American study, to my knowledge, has not been published yet although I believe it is available to anyone who asks for it.

Q How did the United States study come to your knowledge?

A It came to my knowledge because when I started doing the review I was dealing with a lot of separate papers about populations exposed to vinyl chloride in the United States and there was one of them done by an American organization, I forget the name, Equitable and Environmental Health Inc., that covered a substantial number of plants and there was a follow up study to this by a man beginning with C---

Q Cooper?

A Cooper, and I wondered whether the individual studies reported by other authors were included in these two studies. Clearly, in a review you do not want to add in the same amount

of data three or four times as reported by different people. It is important you only include one set of data on one occasion, so I enquired of the chemical industry through the Imperial Chemical Industries in England, whether I could be told whether these studies of Cooper and Tabershaw and Gaffey covered the other studies and I was told that they did and then I was told also that another study was being carried out and I said that a follow up study was being carried out and I said it is silly for me to give an opinion until I had seen the follow up study, so I waited till I had seen the follow up study. I made the same inquiries in England. I had a report of Fox and Collier of the British Industry and I wrote to the Health and Safety Executive in England to ask if they were doing any further studies and they told me there was this government study that covered the whole industry in England and I said: "I must wait and have the results of both these studies before I can give an opinion." Could we go off the record for a moment while the refreshments come in?

MR DELLI BOVI: Yes, why don't we go off the record.

(Whereupon there followed a short adjournment)

BY MR DELLI BOVI:

Q Dr Doll, I am going to hand you what I have marked as Plaintiffs Exhibit 4. Would you review this document and tell me whether or not this is a copy of the study that is cited in your review that was prepared from the Chemical Manufacturers

URL 11624

Association. (Document handed to the witness)

A Yes, that is the one.

Q To your knowledge, that study remains unpublished?

A Yes. What I am saying by that is I do not know if it is published.

Q One of the other studies referred to in your references as reference 16 is a 1978 study by Equitable Environmental Health entitled: "Epidemiological Study of Vinyl Chloride Workers: Final Report to Manufacturing Chemists Association." Do you have a copy of that report with you this afternoon?

A No, I do not have a copy of that with me. This was subsumed in this later report and it is a long time since I read it. It is not relevant to my review.

Q So, among the references that you cited in your review are references that are not relevant to it?

A I cited and gave reasons why I have not incldued them, saying the data in it has been subsumed in the later one, but I cited it because otherwise people might have wondered why I did not mention it.

Q Where did you obtain the 1978 Equitable Environmental Health Report?

A I cannot remember now. I am guessing, probably from Imperial Chemical Industries or I might have had it from Cooper himself. I think that was the one that Cooper published, was it not?

URL 11625

Q Was that study, to your knowledge, ever published?
A Not to my knowledge, no.
Q Imperial Chemical Industries---
A Wait a minute. We have got Cooper as a separate one, have we not?
Q Yes.
A Now, this one, I think that was a preliminary report to Cooper so Cooper would be regarded as the publication of number 16. I think that is right. So, the answer, therefore, would be yes it was published if I am correct, but I really have to check to make sure I am being correct on that. Earlier observations, that is right. Yes, yes. Without going back and looking at the data, my recollection is that 12 was the publication in effect of 16, but I would not want to swear to it without checking.
Q Dr Doll, can you tell us what a carcinogen is?
A I wish I could. What one means by a carcinogen is any agent which will cause cancer in any animal if that animal is exposed to it in any conditions the experimenter likes to think. An agent capable of causing cancer in some circumstances.
Q Is vinyl chloride a carcinogen?
A Yes.
Q What is a human carcinogen?
A A human carcinogen is a carcinogen shown to cause cancer in humans.

UAL 11626

Q Is vinyl chloride a human carcinogen?
A Yes.
Q What is a mutagen?
A That is very much more difficult to define because it has a very wide connotation of meanings given to it by different workers. Essentially, it is something which damages the DNA in a cell, causes the DNA which is the material that holds all the codes as to how that cell is to operate, which causes that DNA to be altered in some say.
Q Is vinyl chloride a mutagen?
A Yes.
Q Is it your understanding that prior to the 1970 work of Professor Viola, there were a large numberof studies done concerning the acute, the sub-acute and the chronic health effects on humans of over exposure to vinyl chloride?
A Yes.
Q Could you outline for us some of the acute, the sub-acute and chronic effects of exposure to vinyl chloride that were reported prior to 1970?
A The first effect, of course, is just unconsciousness, if it is a sufficiently high dose of the gas, but once the concentration to which individuals are exposed is kept down to lower levels, then it is found that chronic exposure at these lower levels would cause some damage to the liver, they would cause damage to the terminal phalanges, the bones in the fingers.

URL 11627

I forget the technical term - acro-ostiolytis. Also that it would have some effect on the circulatory system, producing symptoms that are known medically as Raynaud phenomena. Those are the principal effects I can recall.

Q Do you recall whether or not much of the work done into the health effects of exposure to vinyl chloride prior to 1970 was done in the Eastern European nations?

A I know of one report from the Soviet Union, but no, I am afraid I cannot answer that.

MR BUNDA: I am going to interpose an objection that the cross examination is going beyond the scope of the direct examination.

BY MR DELLI BOVI:

Q Have you looked into the history of the medical and scientific articles dealing with the toxicity of vinyl chloride as part of your assignment for the CMA?

A Only levels below those which produce the so-called vinyl chloride syndrome which I did not think was necessary for me to investigate because that was well established and as far as I knew was agreed by everybody and not controversial but I certainly looked to see if there were any other long term effects on individuals which would show up in mortality rates from diseases other than cancer.

Q Is it your understanding that evidence of the carcinogencity of vinyl chloride was first reported by Professor Viola

URL 11628

in 1970?

A Yes.

MR BUNDA: I would like to interpose a continuing objection on the basis the cross examination is going beyond the scope of direct examination.

BY MR DELLI BOVI:

Q I would like to hand you, doctor, a series of medical journal articles and have you identify them for me, if you would. Can we go off the record for just a second while I find them. Never mind, I have them.

MR BUNDA: I would like to go off the record for a second.

(Whereupon there followed a discussion off the record)

MR BUNDA: I am also going to object to the introduction of these exhibits or the showing the witness these exhibits in their present form since they have stickers all over them and I think that that is prejudicial. If you have any clean copies I have no objection to the doctor being questioned about those.

MR DELLI BOVI: I have no clean copies.

MR BUNDA: Then I object.

BY MR DELLI BOVI:

Q Doctor, I show you Exhibit 5. You can feel free to ignore all stickers on there other than those that refer to your testimony. (Document handed to the witness)

URL 11629

MR BUNDA: Objection, I move to strike.

BY MR DELLI BOVI:

Q Have you seen that document before in that form or any other form?

A Yes, I believe this is one of the documents I was provided when I was asked if I would give evidence in this case. I had not seen it before then.

Q The first time you saw Dr Viola's 1970 publication in the Italian medical journal was in 1985?

A No, I said 1988, just a week or so ago. I had not thought it necessary to look for this article as I knew, of course, Dr Viola's publication of 1971 and it seemed to me that subsumed the earlier evidence and I did not think it necessary to go to the preliminary report in 1970.

Q Well, Dr Doll, you had to have seen that document prior to 1988.

A Did I? Yes.

MR BUNDA: Objection. Argumentative.

BY MR DELLI BOVI:

Q Is it your testimony you first saw that article this year?

A I am confused slightly. I think there is an article by Viola of 1971.

Q That is correct, in Cancer Research.

A As far as I can recall I have only read Viola's article

URL 11630

of 1971 before this last few weeks. I saw no reason for looking up Viola's article of 1970 and I am not aware of having seen it before.

MR BUNDA: I am also going to interpose an objection on the basis there has been no other occasion that that document is in the form in which it appeared in the Italian journals. My understanding is that it is a translation and on that basis I believe the questions are improper because they infer that that is a copy of the form in which the articles were published and I think that is not borne out by the facts. So I do not have to continue to object, I believe there will be a second article following the objections which I made with regard to the stickers and with regard to the fact it is a translation, also applies to that article, also authored by Dr Viola.

BY MR DELLI BOVI:

Q I would like to refer you to an article you co- authored in 1985. Would you take a look at that and indicate whether your first reference in that 1985 work was to Dr Viola's 1970 publication, in the medical journal article. (Document handed to the witness)

A Yes, it was.

Q So, you were aware as early as 1985 of Dr Viola's 1970 publication?

A Oh, I have been aware of it earlier than that but as

URL 11631

I said, I did not regard it as necessary to read it, as Dr Viola published a paper in 1971 which was the definitive results of his study and I based all my conclusions on Viola's 1971 paper. This was a paper jointly by myself and three other colleagues and they doubtless thought if you are referring to Viola it was only reasonable to give the first reference to Viola, but the one that I read and studied is the 1971 one.

Q When were you first aware whether or not you read of the findings reported by Dr Viola in 1970?

A I cannot recall that I was aware of them reported in 1970. I was aware of them reported in 1971 - - oh, I suppose in 1975. When did I first start getting interested in vinyl chloride? When I gave a paper, joined in a discussion at the New York Academy of Sciences which must have been in the mid 1970s, I cannot remember the exact year, but I would say 1974 or 1975 I was aware of the 1971 paper.

Q What about the 1970 paper?

A It must have -- it was drawn to my attention when I read the 1971 paper because there was the reference presumably in it but I cannot recall having seen it until this last week or two.

Q Would you take a look at Professor Viola's 1971 document and see if there is in fact any reference to his 1971 publication?

(Document handed to the witness)

A No, there is a reference to his 1969 one, which I had

UHL 11632

heard of, of course.

Q Have you ever reviewed that publication, sir?

A No, because I have worked with Maltoni who continued his work and Maltoni told me all about the work and I had, therefore, known about this work, Viola's since the middle 1970s.

Q Do you know whether Dr Viola in his 1969 presentation at the International Cancer Congress in Tokyo discussed the subject of carcinogenicity of vinyl chloride?

A I cannot answer that with certainty. My belief is that he reported it in 1969. That is my understanding but I could not be held to that.

Q Whether or not it was reported in 1969, certainly by 1970 Dr Viola had authored a publication in one of the Italian medical journal articles, dealing with the carcinogenicity of vinyl chloride in animals?

A I dare say.

Q You, however, were not aware of either his 1969 or his 1970 publication until some years later?

A I was not aware of it until after the occurrence of the two or three cases of angiosarcoma in the Goodyear works in the early 1970s.

Q If the Goodyear angiosarcoma deaths were announced in 1974, then you would not have been aware of Dr Viola's 1970 paper until that time?

A That is right, yes.

Q Is Cancer Research a European publication?
A No.
Q Where is that published?
A The United States.
Q Are you aware of any evidence of an effort by the polyvinyl chloride industry in the United States to hide Dr Viola's 1970 publication from its customers, from the United States government and from the general public?
A No.
Q Would you regard such an effort, if it occurred, as evidencing a lack of corporate responsibility on the part of vinyl chloride and polyvinyl chloride manufacturers ---
MR BUNDA: Objection. Dr Doll, wait a second, let me interpose an objection on the basis it is speculative and is not based on any facts which are properly in evidence. You can go ahead and answer the question if you recall what it is.
BY THE WITNESS:
A No, it is too hypothetical for me to give any answer to.
BY MR DELLI BOVI:
Q Then, Dr Doll, I would like to make the question somewhat more concrete. Would you look at Plaintiffs' Exhibit Doll 6, please and tell me whether you have seen this document or reviewed this document before? (Document handed to the witness)

URL 11634

MR BUNDA: Again, I am interposing an objection on the basis it goes beyond the scope of the cross examination and, further more, it is irrelevant.

BY THE WITNESS:

A I am very happy to answer it because I have never seen it before.

BY MR DELLI BOVI:

Q I would like you also to take a look and tell me whether you have seen, prior to today, Plaintiffs' Exhibit 7 which is entitled: "Cancerogenic Effect of Vinyl Chloride, P.L.Viola (Regina Elene Institute for Cancer Research) Rome, Italy, presented at the Tenth International Cancer Congress, Houston, Texas. May 22-29, 1970".

MR BUNDA: Can I see that please? (Document handed to counsel) Again I am going to interpose an objection on the basis that this document contains multiple stickers and is prejudicial in its presentation. Furthermore, it appears to be a summary and it is difficult to determine where it comes from. So, I object on the basis of authenticity as well.

BY MR DELLI BOVI:

Q Have you seen Plaintiffs' Exhibit 7 before today? (Document handed to the witness)

A Well, I find that difficult to answer because I attended this conference, in fact I gave the opening lecture at it and

URL 11635

it is possible this is a photocopy of an abstract, in which case I might have seen it, but I cannot recall having seen it and my interest in vinyl chloride as a carcinogen only arose in 1974 or so when I heard about the angiosarcoma cases, so whether I saw it or not I do not know. It is possible I did, but it certainly made no impact on me if I saw it.

Q You indicated earlier that you had not seen Plaintiffs' Exhibit Doll 6 before. Is that correct? (Document handed to the witness)

A I indicated that. I would like to read it again just to make quite sure that I am not misleading you. (Pause) No, I am not aware of ever having seen that before.

Q You were a professor of epidemiology at Oxford College, 1970, 1971, 1972, 1973 and during those years you had not seen Dr Viola's 1970 article. It had not come to your attention during those years?

A I was actaully a professor of clinical medicine technically but my research was all in the field of epidemiology. I was au fait as I taught with the cancer research work throughout the world. I discussed many carcinogens with many cancer research workers and I can never recall anybody mentioning vinyl chloride as a carcinogen at all until after the angiosarcoma cases occurred in the Goodyear works.

Q In 1974?

A In 1974, yes. I certainly would not claim to have been

UHL 11636

completely up to date and obviously I was not, but there were a lot of things going on and certainly in the cancer research world generally, vinyl chloride was not being discussed as a potential hazard.

Q Please do not infer from my question that I am finding any fault at all in that fact but the fact is that you were an expert in epidemiology in the early 1970s and prior to 1974 none of Dr Viola's work or Dr Maltoni's work had come to your attention?

A That is true, yes. Of course, there were many, many animal carcinogens which had not been drawn to my attention at the same time.

Q Do you feel, Dr Doll, as a physician, that when a manufacturer of a product learns of studies that indicate a potential cancerogenic problem with that product, that they have a duty to disclose that information to their workers and to their customers?

MR BUNDA: Objection. I am going to interpose an objection on the basis it is speculative, it is a vague question, it improperly states the facts of the situation and further more, is irrelevant to this particular case.

BY THE WITNESS:

A My answer to the question would be I cannot give an answer to it because it depends upon the situation. I am very much opposed to frightening people unnecessarily. If you asked me whether on the basis of such findings, inquiries should be

URL 11637

made as to whether there were any hazards to humans, but I would say unhesitatingly yes, but the question of disclosure is always a very difficult one. There are so many things which can cause cancer in certain circumstances, and one has to, as a research worker, use your judgment as to what is proper information and what is scaremongering and I would not feel that I could pass judgment on actions taken many years ago on the basis of a totality of evidence of which I am not wholly aware.

BY MR DELLI BOVI:

Q Do you regard Dr Maltoni's 1970 and 1971 publications which has been marked as Doll Exhibits 5,7 and which I will mark as Doll Exhihit 8---

MR BUNDA: Hang on. Did you miss-state yourself. You mentioned Dr Maltoni. Did you mean Dr Viola?

MR DELLI BOVI: Dr Viola.

MR BUNDA: What is the exhibit number?

MR DELLI BOVI: 5, 7 and 8.

MR BUNDA: Again I object to the numerocity of the exhibit numbers.

BY MR DELLI BOVI:

Q Do you regard those documents, Dr Doll, as documents calling into serious question the carcinogenicity of vinyl chloride.

(Documents handed to the witness)

A I regard the one in 1971 in Cancer Research as so doing. The others I regard as preliminary reports and I think one would

URL 11638

be unwise to draw any conclusions, any important conclusions from them but the paper in 1971 by Viola, Bigotti and Caputo is certainly an important paper to which attention should be paid.

Q Is your understanding that Dr Viola, at the time he authored these papers, was employed by one of the European PVC manufacturers?

A I have no idea who he was employed by. I know Dr Maltoni personally but I do not know Dr Viola, I have never met him.

Q You indicate in your 1985 publication: "The idea that vinyl chloride might cause cancer was first suggested by Viola in 1970 as a result of experiments in rats". Correct?

A Yes, I said that but clearly it is wrong because he reported it in 1969, verbally, did he not, at the Houston conference.

MR BUNDA: I am going to object and move to strike. I think the Houston conference is 1970.

THE WITNESS: Ah, 1970.

BY MR DELLI BOVI:

Q Tokyo was 1969?

A 1966. I do not know what conference that was. The cancer conference was Tokyo, 1966.

Q The 16th Congress on Occupational Health.

A Oh, I did not know anything about that conference.

Q You indicated earlier that you were not aware of any

efforts by any PVC manufacturers in the United States to keep the 1970 findings of Dr Viola from being published in the United States?

A Yes.

Q Is it your belief, Dr Doll, that the PVC manufacturing industry after the publications of Dr Viola in 1970 and 1971, had an obligation to disclose Dr Viola's findings to their employees and to their customers?

MR BUNDA: Objection, I think it calls for speculation, it is a vague question, it is over broad and it is irrelevant to this case and mischaracterizes the information which is in evidence and the status of the situation which existed in 1970.

BY THE WITNESS:

A I do not think I could give an answer about what happened at that time. I was not aware of what was going on and it would be too speculative.

BY MR DELLI BOVI:

Q Dr Doll, I am not asking you to tell me or to tell this jury what happened. What I am asking you as a physician specialising in epidemiology, whether, based on the 1970 and 1971 studies of Viola, the PVC industry had a duty to disclose those findings to its customers and to its employees?

A I cannot answer that question because I am a scientist, not a politician and I spend my time trying to decide what data

URL 11640

means. I do not tell people what they should do and I cannot express an opinion on what people should have done or what people should do now. It is not my line.

Q You do not, in your capacity here at Oxford, advise industry or the Government on whether they should or should not disclose particular epidemiological data?

A No, I do not think so. I am trying to think if I do. I just publish my results in the scientific press and I think that is the responsibility of the scientist. Then, other people have to decide what they do about it. I remember when we first discovered that smoking caused cancer of the lung, we were always being asked what the Government should be doing about it and we said: "That is nothing to do with us." It took them seven years to tell the public that smoking caused cancer of the lung and I did not express an opinion on that.

Q Did you feel, based upon the initial results of your studies, that the public had a right to know what you found out?

A I do not feel things - - well, that is not true, I obviously do as a human being, but I try not to feel anything on a scientific matter as that can prejudice my scientific judgment as to what the cause of disease is. I try to keep quite separate from that field. I try to do work to find out what causes disease, publish it openly and then it is for others to decide what should be done, not for me.

Q I would like to read you an excerpt from Plaintiffs'

URL 11641

Doll Exhibit 6. I am going to represent to you that this was an internal memorandum prepared by R.N. Field of Union Carbide, as the result of a meeting of the Occupational Health Committee of the Manufacturing Chemists Associations. The date of the memorandum is November 23, 1971. "Publishing of Dr Viola's work in the United States could lead to serious problems with regard to the vinyl chloride monomer and resin industry. These are as follows:- 1) The Delaney amendment bans the use of any material in food that can cause cancer. 2) A law exists in Pennsylvania banning carcinogens from the air i.e. the allowable threshold limit is zero. 3) The present political climate in the United States is such that a campaign by Mr R. Nathan and others could force an industrial upheaval, via new laws for strict interpretation of the pollution and occupational health laws." Did the CMA, when they furnished you with materials for you to review in connection with your 1988 review in the Scandinavian medical journal, ever furnish you with a copy of that memorandum, sir?

A No.

Q Are you aware of any efforts by the polyvinyl chloride industry between 1970 and 1974 to make publicly known or to make known to their customers or to make known to their employees, the findings of Dr Viola?

A No.

Q Are you aware of any efforts by the polyvinyl chloride industry in the United States between 1970 and 1974 to conduct

URL 11642

epidemiological research of PVC fabrication employees, following the findings of Dr Viola.

MR BUNDA: I am going to interpose an objection to the whole line of questioning as I have done before, on the basis that it is irrelevant. I am also going to object on the basis that there is no foundation having been laid that this witness has any knowledge about this area of inquiry at all and I move to strike the whole line of questioning.

BY THE WITNESS:

A I can answer it very simply, I do not know anything between 1970 and 1988, I am just not aware of what the American industry has been doing apart from what is published.

BY MR DELLI BOVI:

Q Dr Doll, you presented a discussion paper to the New York Academy of Sciences in 1975, did you not, at a conference specifically held to discuss the carcinogenicity of vinyl chloride?

A Yes. I think my paper was a summing up, was it not. A conclusion to the discussions.

Q I am going to hand you what I will mark as Plaintiffs' Exhibit Doll 8. Could you identify that document, please, sir?

(Document handed to the witness)

A Yes. This is a report of my discussion and my contribution to the discussion.

Q That was at a conference discussing the carcinogenicity of vinyl chloride approximately a year after the public announce-

URL 11643

ment of the Goodrich angiosarcoma deaths?

A I cannot remember the whole discussion. Certainly vinyl chloride was part of it but I do not remember whether there were other things discussed or not. I have a very poor memory of the discussions. I only remember that in the report of it I was made to say something which I did not say but that is another matter.

Q Sure, and that particular point had nothing to do with vinyl chloride?

A Not that point, no.

Q In fact, that point is corrected in that exhibit?

A Yes.

Q That exhibit reflected your presentation in 1975 and does so accurately?

A Yes.

Q Is it your opinion that for any human carcinogen, including vinyl chloride, there is a safe level of exposure at which no potential carcinogenic effects will occur?

A That is something I wish I could answer. I really have not got an opinion on that. In cancer research we work on the assumption that unless there are strong reasons otherwise, we postulate that an effect is produced proportional to dose down to vanishingly small levels but whether this is so or not is a matter of great debate and which we really have no firm scientific evidence one way or another. We act on the assumption in the

UAL 11644

same way as we are acting on the assumption now that other people's tobacco smoke in a room will cause a risk to the people who are not smoking, but the scientific proof that this is so is such that I really have not got an opinion. What I have is a working rule, but not an opinion.

Q What is your working rule?

A The working rule is to assume that there is an effect proportional to dose down to vanishingly low levels, given that the material is a mutagen. If it is not a mutagen, then my working rule would be that is probably not the case and there would be a threshold below which it had no effect.

Q Vinyl chloride is a mutagen?

A Yes.

Q Therefore, your working rule is what?

A My working rule is that you would assume there was an effect proportional to dose down to vanishingly small levels. A vanishingly small effect but an effect.

Q A vanishingly small effect with regard to the general population, exposed, but a very---

A Yes.

Q But a very real effect for that person who develops the cancer?

MR BUNDA: Objection, calls for speculation. You can go ahead and answer.

URL 11645

BY THE WITNESS:

A Yes, this is true, but I believe society has to accept that there is such a thing as a negligible risk, otherwise society is not possible to run, it becomes socially impracticable.

Q Let us have a look at vinyl chloride in this concept of no safe level. You are aware, are you not - - let me back up one step. There are many types of cancer?

A Yes.

Q One of which is angiosarcoma of the liver?

A Yes.

Q Angiosarcoma of the liver is an exceedingly rare cancer?

A Yes.

Q And occurs approximately to one person out of every 10m or 20m?

A Approximately once to every 10m each year. That is, once to every 10m in a population in a year, yes.

Q You are aware of studies, are you not, postulating increased risk of cancer from vinyl chloride at exposure levels in the parts per billion?

A No. Oh, I am aware of some evidence that there may have been some cases produced in the surroundings of some factories in New York State where the concentrations to which people were exposed were of the order of parts per billion. Whether they really did cause cancer or not is difficult to say. What I have said and my policy in interpreting such data and,

UAL 11646

of course, this is coming up at the present moment in regard to clusters of leukaemia in regard to nuclear installations, first of all you have to decide is there a greater instance of this particular type of cancer in that neighbourhood. If you come to the conclusion there is a greater one than it would be reasonable to expect, you then have to say, well, what could it be due to and it is very easy to jump to a conclusion that it is due to a particular factory or a particular amount of waste that is being released, environmental pollution, just on the grounds that that material is known at high dose levels to cause some cancer. But, to conclude that the two are connected, you have to have some evidence that the amounts to which the people are exposed might reasonably be thought to produce the effect that is observed, otherwise you may be blinding yourself to some other causes and I can only conclude that the effect is due to the postulated pollutant if one can decide on the basis of the totality of the evidence available that the sort of hazard observed is of the order of magnitude of the sort of hazard that might be anticipated, so that the situation, the problem in each case is a difficult one which needs a lot of evidence. I left it open in relation to vinyl chloride and the vinyl chloride producing plants because we have not yet got sufficiently clear evidence of the dose to which people are exposed that have produced the measured risk we have been able to measure in the industry concerned.

URL 11647

Q It is your opinion, however, that vinyl chloride as a carcinogen and as a mutagen is capable of producing cancers at exposure levels in the parts per billion?

A No, I would not express it as my opinion. I would express it saying it is my belief we have to consider that as a possibility.

(Whereupon there followed a short adjournment)

BY MR DELLI BOVI:

Q Dr Doll, are you aware of any human carcinogens that Hermon Dendinger or Fred Wallace were exposed to at Chrysler other than vinyl chloride?

A I am not sure. Was not one of them exposed to ethylene dioxide? I am not sure. I have not looked into it.

Q Have any of the polyvinyl chloride manufacturers that are Defendants in this case presented you with any evidence indicating Mr Dendinger or Mr Wallace were exposed to any other human carcinogen?

A I should need to refresh my memory, to look at the papers I have had.

Q You indicated in your 1975 presentation to the New York Academy of Sciences: "Cancer is a process in which several factors are likely to participate. A particular chemical carcinogen is only one factor which interacts with a number of others that may depend on the environment or on the functional state of the body, and a simple linear relationship with one factor

URL 11648

"may be seen in all sorts of complex situations." Do you agree with that statement today?

A Yes and no. I would not put it quite in that form today. At that time I wrote that I was fairly confident in my own mind that there was a real effect creating a risk of cancer down to vanishingly low levels. In the past twelve or thirteen years I have learnt more about the repair mechanisms of the cell and I would be more open minded now as to whether that actually was the position or not. I would still say that that is a possibility but I will be much more open minded to the possibility that the human body was capable of dealing with very small amounts of carcinogen and thereby repairing the damage done than I was in 1975.

Q By the time you made that presentation in 1975, dozens of workers exposed to vinyl chloride had already died of angiosarcoma of the liver?

A I do not think that is quite true, is it. I would have thought it was under 20 by 1975, but we have the register of cases. That will tell us how many there were. How many were there?

Q There were 23 by the end of 1974 and I do not think we can tell from the way the data is presented how many there were in 1975.

A That is what I said. Not dozens but of the order of 20 is I think what I said.

URL 11649

Q At your presentation in 1975 you were critical, were you not, of the polyvinyl chloride industry's lack of monitoring its work force over years prior to 1975?

A Yes, I had been critical of many industries at their failure to maintain on-going studies or cohort studies of their work as I had been teaching this for the last thirty years. Whether the industry was in fact, had in fact started one then, I do not know. The Tabershaw and Gaffey study, when that was first commissioned, I cannot remember now, but it was certainly my view at that time that the industry ought to be organising a cohort study of its workers.

Q By 1968 or 1969, when Herman Dendinger first came to work at Chrysler, there had already been within the industry 9 angiosarcoma deaths?

A That certainly was not known at that time.

Q But was that not precisely the point you were making, that if the industry had done these cohort studies and follow ups of their workers, that they may well have discovered years prior to 1974, the carcinogenicity in humans of vinyl chloride?

A That was a criticism I made of industries throughout the world, not specifically of the vinyl chloride industry. Their behaviour was no different from all industries in all major countries. Some industries do no cohort studies at all. In the Soviet Union they do not do any at all and I have been nagging them for years that they should.

UAL 11650

Q Let me read a small excerpt from your 1975 presentation and afterwards my question will be if you still subscribe to this statement today. "I should like to re-emphasise a point that has already been made several times in this conference; that is, the one made by Dr Schweitzer when he said that all responsible industries - certainly all those that are large enough to employ a doctor - should maintain an on-going perspective study of the health of their working force. That does not mean keeping an eye on them while at work only; it means keeping an eye on them when they leave if they have been employed in the industry for (say) five or more years. Professor Schilling and many other people have been urging this for a long time. How we can have a situation in which a new risk is discovered in a major industry and then have to set up a prospective study to find out what is actually happening to process workers is incomprehensible to me."

A Yes, I have been teaching that since the middle 1950s.

Q You referred in your direct examinaiton to an article - - maybe you did not. One you wrote in 1986 called: "Cancer - a preventable disease" and that was a presentation that you made to the Royal Society of Medicine ?

A Yes.

Q I would like to read to you from page 20 of your presentation in 1986 that dealt with animal studies. My question will be the same as it was with the last paper, that is whether

URL 11651

you subscribe to that statement today. "Animals, however, vary greatly in the way they absorb, metabollise and respond to different chemicals and there are no observational data to justify such an assumption. That is not to say that we should ignore the results of laboratory tests in small rows, as there are sufficient grounds for believing that agents that cause cancer in one animal are quite likely to do so in others and it would be criminal to allow anyone to be exposed unnecessarily to a new chemical that was found to be a powerful carcinogen in several animal species just because there was no human evidence."

A Yes.

Q With respect to the cancer sustained by Fred Wallace, the mucoepidermoid cancer, you indicated that you did not believe that vinyl chloride was the source of that cancer because such cancers had not been produced in animal experiments?

A Yes and not in humans, in the human population or animal experiments .

Q Those were two different grounds for your opinion?

A Yes.

Q And you have reviewed the pathology report for Mr Wallace to know what cancer he died from?

A Yes.

Q I would like to refer you to Dr Viola's 1971 paper and the summary which reads in part: "The cutaneous tumours which

"always appeared in the area in which submaxillary and parotid glands are located, have been histologically recognised as epidermoid carcinomas, papillomas, and mucoepidermoid carcinomas."

A Yes.

Q At page 518 of his 1971 article, Dr Viola states, does he not: "A few tumours showed little nests of isolated pale cells of three types; mucin-producing cells (originating from the duct epithelium of sweat glands or salivary glands); squamous cells; and intermediate cells with minor tendencies towards differentiation."

A Yes.

Q Was it your understanding that Mr Wallace died of a poorly differentiated squamous cell, mucoepidermoid carcinoma---

A Yes, that is of a different organ to the ones that Viola is describing. Viola's description has been discounted since 1974, when it was appreciated that the tumours that Viola was describing were not tumours that had anything to do with the salivary glands at all but they were related to a zimbal gland of rats which is a serpaceous gland and has no relationship whatsoever to a salivary gland. This is uniformally accepted by every cancer research worker to whom I have spoken. At the time Dr Viola made his first observations he was not very experienced with the rat pathology and he attributed them incorrectly. His error has been corrected ever since 1974 and it is not questioned now.

Q Have you reviewed other scientific articles or case studies associating buccal cavity or cancers of the pharynx with exposure to vinyl chloride?

A I have read one article relating a cancer of the buccal cavity to someone who chewed plastic. That is the only article which I could think of which might be relevant to your question.

Q Did Tabershaw and Gaffey report an excess of buccal cavity and cancers of the pharynx in 1974 MCA study?

A That is quite possible but I would not pay any attention to that because I looked at their longer follow-up when they had the more complete data, that is preliminary data and their final data do not show any excess tumours in that category. There may be one excess compared to the expected, I cannot remember. 15 as compared to 13.5.

Q Have you referred or been furnished for your review prior to today, with any portions of the hearings held by the Occupational Health and Safety Administration in the United States relating to regulating vinyl chloride following public announcement of the Goodrich cancer deaths in 1974?

A Frankly, I find them too tedious to read and I never read those hearings, I prefer to read the basic science on which they are supposed to be based.

Q Do you know Mr Thomas Mancuso of the Pittsburgh School of Public Health?

A Yes, I do.

UAL 11654

Q Are you very familiar with work in areas of beryllium?

A Yes and several other areas.

Q Do you regard him as an expert in the area in which he practises?

A No, I regard him as a very unreliable person.

Q I would like to refer you to a portion of Dr Mancuso's testimony before the Occupational Health and Safety Administration and I would like to know after I read that extract whether or not you agree with it. "Further, the skin tumours frequently develop near the ear and submaxillary or the same areas as the salivary glands. It was postulated by the original investigators that vinyl chloride may enter the salivary gland system." Do you have opinion on whether vinyl chloride or its active metabollites, enter the salivary system in humans?

A I should be surprised if they do. I do not see why they should go up against the saliver, but I do not know of any results analysing the saliver in the salivary glands so I have not any positive evidence but it seems an unlikely thing.

Q "If this is subsequently confirmed, it raises the question whether tumours of the parotid glands can also occur as has been demonstrated in the rubber industry and this has been confirmed now by the testimony this morning that cancer of the parotid gland has been observed in animals."

A Well, he is incorrect in talking about it being observed in animals. He is basing himself on the erroneous reports of

URL 11655

Viola and I am not aware of any excess of cancer of the parotid glands in the rubber industry. Certainly none of the very detailed studies that have been carried out in this country in the rubber industry have shown any such effect.

Q How rare a cancer is a parotid gland carcinoma?

A I cannot give you a figure but it is a rare cancer.

Q There was a statistically significant increase in the deaths for parotid gland cancers at the Chrysler plant in Ohio, was there not, Dr Doll?

MR BUNDA: Objection.

BY THE WITNESS:

A Not to my knowledge. Was there? I have seen no evidence of that.

BY MR DELLI BOVI:

Q How is a parotid gland cancer classified under the ICDA8?

A It is classified with the cancers of the buccal cavity and pharynx.

Q Do you know whether a parotid gland carcinoma has its own number?

A It has a sub-number, a fourth digit number. I think it is separate from the submaxillary gland. It is a fourth digit number I believe.

Q Are you aware of any attempts by Tabershaw and Gaffey or by any of the other scientific investigators, to break out

URL 11656

from the category of buccal cavity and cancers of the pharynx, parotid gland cancers, so as to report those results separately?

A No.

Q You do not know then whether or not there may, within that group of buccal cavity and cancers of the pharynx, be an excess of parotid gland carcinomas based on the form on which the data has been presented to date?

A No. One can be sure it is not a big excess but you cannot be sure that within that group there was not three or four cases.

Q And that brings me to the United States study that you reviewed versus the United Kingdom study. In the United States study, the organisation hired by the MCA only broke down the number of cancers into about 33 categories?

A I do not know about only, it seems to me a very large number. It was a very good effort to break them down to as many as that.

Q Did not the United Kingdom study use 68 separate cancer categories for reporting purposes?

A No, they had 68 different causes of death but nothing like so many cancers. I think there were probably less cancers than in the American study but of the same order.

Q Did the United States study report an increase in the total number of cancers among the polyvinyl chloride workers study?

UAL 11657

A Total number of cancers you said?

Q Yes, sir.

A The answer is no - - sorry, the answer is yes in comparison with the United States. 383 against 343. 383 against 341-73. I must correct that, I am sorry. That is not what they reported. That is the adjustment that I made. They reported less than that. I increased the amount to take account of the deaths of unknown cause. I forget now precisely how many they reported. It could only have been about 360, I should think. What I did was to say, well they were not able to find out the cause of death of about 7% of the men that died and whereas they of course, included them in the total deaths when comparing the total 1500 deaths against the expected 1700, they did not include them in the individual causes and whether it is justifiable or not to assume that the deaths for which they did not discover a cause were evenly distributed, were equally distributed among all causes in the same way as the deaths for which they did discover a cause, is, of course, anybody's guess. What I did was assume they were and add those deaths on so as to get a worst possible place and that is the figure that I published, but it is not the figure that they reported. That may not be clear. I would be very glad to elaborate on that if that is a confusing point.

Q No, I understand what you are saying, Dr Doll. In terms of other cancers, did the United States study indicate a

URL 11658

statistically significant increase?

A I do not think they did for any other cancers. I am just refreshing my memory. Apart from the liver, of course.

Q Would you look at pages 71 ---

A Yes, the brain is down here. Significant excess of cancers of the brain. I am not sure about lympho-reticulo sarcoma. That might be significant.

Q On page 71 of your paper on other cancers, do you show a statistically significant excess?

A Page 71 is not referring to the American study, is it? You are talking about cancer of the lymphatic---

Q No, I am referring to the other cancers, right-hand column, page 71 about two-thirds of the way down?

A Ah, yes. Fine. This was the summation, not from the American study, this was the summation of the four studies which I regarded as providing the really important evidence, the main contribution of which came actually from the United Kingdom study. The American study did not show a significant excess of this group of other and unspecified cancers. The four studies added together does and as you will see in the report, I thought the most likely explanation of this was the mis-diagnosis of a few cases of angiosarcoma of the liver which would have appeared as secondary liver cancers.

Q Your studies showed an increase in the rate of lung cancer to those who were heavily exposed?

A It depends what you mean by "increased" . Not, I think, a significantly increased one. The lung cancer mortality as a whole amongst the vinyl chloride exposed workers was almost precisely what was expected on national data, though I think national data are very hazardous to use in comparison with observed deaths from lung cancer because the mortality rate does vary so from one part of the country to another and I do prefer to use regional rates but when you broke the lung cancers down to groups of people employed for a longer period against shorter period or observed more than twenty years after first employment compared with those observed for shorter periods, sooner after first employment, then you invariably got a higher mortality in the groups that one might regard as the more likely to show an excess, but the differences in total were not such as to lead to a clear evidence of an excess from lung cancer but just to suggest that there might be such an excess.

Q Did the German and Swedish studies, were they consistent with that?

A No. I will have to refresh my memory. The German one was not, if I remember rightly, but I will have to check. Where are we now. No, the German one did not show an excess, that was 23½ against 24½ expected. The Norwegian and the Swedish ones did, from tiny numbers, both added together, was 5 against 4½ - - 8 against 4½ expected and the Italian did not show any, so when you added the four studies together you got an observed of

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31½ - the half comes in because of some of the adjustments the Germans made against an expected of 30.7, so I would say the subsidiary studies really supported the idea there was no excess from lung cancer but I do not think you should put too much weight on the subsidiary studies. I regarded them as subsidiary studies because so much of their period of observation were at a time before any occupational cancer could be expected to occur that is to say the first twenty years after observation and the evidence from the studies is really scientifically trivial. The only thing of any importance amongst them is that they did show that angiosarcoma were occurring in all these plants. That is the only thing I put my money on.

Q You say angiosarcomas occur in cases with nine years' latency?

A Not angiosarcomas. One.

Q And you have seen angiosarcomas with exposures of less than fifteen years?

A Yes much less than fifteen years.

(Whereupon there followed a short adjournment)

BY MR DELLI BOVI:

Q Dr Doll, if a chemical is found as a result of animal studies to be a potential carcinogen, do you have an opinion as to whether the manufacturer of a product that contains that chemical has responsibility to disclose to its customers that that chemical is in its product?

URL 11661

MR BUNDA: Objection.

BY THE WITNESS:

A That is an impossible question to answer. It depends on circumstances too much.

BY MR DELLI BOVI:

Q Do you know whether or not any polyvinyl chloride manufacturer in the United States prior to 1974 disclosed to its customers that its product contained vinyl chloride?

A I know nothing about what the polyvinyl chloride manufacturers disclosed to its customers in 1974 or 1988. I am not aware of their activities.

Q Dr Doll, are people in the United States continuing to die from cancers that they contract as a result of occupational exposure to vinyl chloride?

A Oh, of course.

Q In terms of angiosarcoma deaths, how many have we seen to date, reported cases?

A Worldwide or in the United States?

Q Worldwide.

A Worldwide, something of the order of 120.

Q Do you have an opinion or have you expressed an opinion as to how many more angiosarcoma cases we are likely to see as a result of occupational exposure to vinyl chloride?

A Yes.

Q What is your opinion. sir?

URL 11662

A I said that I thought it might be something of the order - I am speaking from memory - 250, but I might be out by 50.

Q So your opinion then in terms of angiosarcoma deaths, is that we have not yet reached the halfway point?

MR BUNDA: Objection. I am going to object again to this questioning on the grounds that it exceeded the scope of direct examination and also on the basis of relevancy.

THE WITNESS: Where does this put me in relation to answering questions. We do not have a judge to say he objects to the question or not.

MR DELLI BOVI: For the purposes of the questions, you answer my question regardless of his objection---

THE WITNESS: And subsequently?

MR DELLI BOVI: They decide if the question will stand or not.

THE WITNESS: Would you repeat the question?

BY MR DELLI BOVI:

Q Certainly. In terms of the number of angiosarcoma deaths that you would anticipate would result from occupational exposure to vinyl chloride, we have not yet reached the halfway point?

A I think that is probably true, yes.

Q If, in fact, vinyl chloride causes cancers in humans other than angiosarcoma of the liver, there may in fact have been

UAL 11663

many more people who have died and will continue to die as a result of occupational exposure to that chemical.

MR BUNDA: I am going to object again on the same grounds as before and also because it calls for speculation. So that I will not be interrupting the tape constantly, I am going to have a continuing objection to this line of question.

BY THE WITNESS:

A My estimate is there will be no such deaths occur in the future.

BY MR DELLI BOVI:

Q On what do you base that opinion, doctor?

A I base that opinion on a mixture of animal evidence and human evidence of what we have seen to date of people that have been heavily exposed to vinyl chloride.

Q The studies that you have referred to in your review, include only employees that worked in the PVC industry for one year or more?

A Yes, I think that is true. I am just wondering, I think some of the studies included people for shorter periods but I tried to exclude them and I think I did in the principal studies.

Q What is the reason for using a one year minimum employment period as opposed to say, three months?

A It is a matter of practicality. There is a big turn-

URL 11664

over in many industries and the turnover occurs in the early period. By the time people have been employed for a year they are likely to stay for a good deal longer and if you have a shorter period, a much shorter period, you are likely to under estimate the effect that you will observe by including a lot of people with very short periods of exposure. It is a matter for arbitrary decision just which people you should include. Sometimes people go so far as to include only people who had five years exposure. I have done that in some studies and it was done in one of these vinyl chloride studies. Some people include people that have had only one day's employment. I personally think that is a very unwise thing to do because you have a very big turnover of short term employees who give you very little details about the effects of short term exposure and make the study very, very difficult to do because you are tracing very mobile people. There is a third reason. People who change their jobs very quickly are a very unrepresentative group on the population and there are a number of studies recently that have suggested as a group they have more accidents, more cirrhosis of the liver, various diseases because of their personal characteristics. My general rule is to take a year as a practical working rule. That avoids the big turnover of very short term employees but does not reduce the size of the population too much, but it is an arbitrary decision and I would go with other people using other cut off periods.

UAL 11665

Q Does the use of a substantial shorter cut off period in a minimum period, say, three months, for example, have the effect of diluting the potential effects from exposure to the chemical in question?

A That is my belief although not all epidemiologists would take that view.

Q And you are aware that in this case, Dr Shindell's study of the Chrysler employees used a three months minimum employment duration rather than one year or more?

A Yes.

Q It is your opinion then that that would have the effect of diluting the effects from exposure?

A I would think it would.

Q Let us take a look also at the cut off period for the study. It is your opinion, of course, that occupational cancers have a latency period?

A Yes.

Q That is, that they take and may take many years between the time of initial exposure before the cancer manifests itself?

A Yes.

Q Is it, therefore, important when you are doing an epidemiologic study, to use a cut off date, a sufficient number of years prior to the time you do your research in order for the latent effects of exposure to the potential carcinogen or mutagen in issue to manifest themselves?

URL 11666

A You can do it that way, yes. I certainly think there is not much point in including people that started to be employed just in the last year or two. A better thing, of course, to do is when you present your results, to present them separately for people that have been observed in the first five years of their employment, five to nine years afterwards, ten to twenty years afterwards et cetera. That is the best thing to do and, of course, it is because of this that I have put so much more stress on the four principal studies because they are all studies in which a very substantial number of observations were made on people more than twenty years after their first exposure and many of the other studies that I did not include, including Dr Chiazze's study where they know nothing about the study of exposure, time since first employment, these will all be affected. They will all be affected by the high proportion with the short time since first exposure. That is really equivalent of saying they are not really relevant evidence. Occupational studies, unless you have a type of cancer which appears very quickly as, for example cancer of the bladder did following exposure to naphthylamine, the evidence within the first ten years, even within the first fifteen years, the first employment does not tell you much about cancer hazards.

Q Would you agree that the incorporation into an epidemiologic study of recently employed members of a cohort also has the effect of diluting the effects of exposure to the chemical

URL 11667

in question?

A Yes, it certainly does though, of course, a lot of people will include them because they will have in mind continuing the study for longer and you already have them included. If you begin by excluding them, then in ten years' time when you want to do a follow-up, you suddenly find you have not got some of the people you would like to have in, so most people, when doing an epidemiologic study, do include people who have been employed relatively recently so that they have the material prepared for a continuation study.

Q But in terms of the reporting of the analysis that recently employed portion of the cohort would be separately analysed?

A That is right.

Q Again, if we look at Dr Shindell's study, have you learnt that he included in his study, individuals first employed potentially as little as 90 days before the cut off period?

A I cannot remember honestly whether he did that.

Q If he had done that, would that also have the effect of diluting the effects of exposure to the chemical in question?

A Yes, but of course, it does not imply that he would necessarily have observed a greater risk if he had cut them off because I do not think from memory that he described exactly the date of first employment of all the people, but if he did, then that is a bald point.

Q Have you ever attempted to analyse the fourteen cancer deaths in the job categories in which Messrs Dendinger and Wallace were employed, to determine the latency period?

A My understanding is that none of them are likely to have had a long enough latent period to be of any interest, but I must check, I am not sure of the details of this study.

Q Incidentally Dr Doll, that binder of material you are going through, could you tell me where that came from?

A Yes, this was provided for me by the attorneys for the defence.

Q What does that binder consist of?

A It consists of 26 different sets of papers including most of the ones which you have discussed with me today.

Q Could I see it please?

A Yes. (Document handed to counsel)

Q Did you review all of the materials contained in this binder?

A If by that do you mean have I read them before today, yes.

Q And are the opinions that you have expressed today based in part on your reliance on the materials contained in this binder?

A No. My opinions that I have expressed today are based essentially on the review which I carried out and has been published in April, but of course, to that I have had to add

URL 11669

the details about Mr Wallace and Mr Dendinger which I knew nothing about. I have refreshed my memory about the early papers of Dr Viola and there are one or two new ones like the one of Dr Shindell you have talked about and there are some reports of the industrial hygiene reports of the amount of vinyl chloride detected, I think, by NIOSH inspectors in the Chrysler plant, but I need to refresh my memory as to who exactly made those measurements. I think those are the principal new bits of evidence that they drew to my attention.

Q One of the documents in that binder is the Molina Swedish study from 1981?

A Yes.

Q Does that study report: "An elevated risk of morbidity and mortality from tunours in the digestive organs"?

A Yes, if you remember, we discussed that before and I included in my review and decided it was a paper that was too unreliable to mean anything. The digestive organs that it refers to there, I think, I forget the exact number, but it does not separate out - - no, I cannot comment on that without refreshing my memory, but my view is that that paper is not really, cannot really be regarded as evidence. There are too many weaknesses in the paper.

Q Rendering your opinions with regard to the aetiology of the cancers of Fred Wallace and Herman Dendinger, or your opinions relating to the potential implication of vinyl chloride,

URL 11670

did you rely at all upon the indexes or summaries of their depositions that were provided to you and that you read?

A No, no. I would not feel able to do that without seeing the entire thing.

Q You are aware of the 1984 article by Maltoni that is not cited in your review, reporting angiosarcoma cases among workers in the PVC fabrication industry?

A No, I had not come across that until I was sent that report. That was news to me.

Q Did you receive this document after you authored your report that appeared in the Scandinavian journal?

A Yes. I would not have included it anyway - - yes, I would have included the statement that there were angiosarcomas reported in that plant, but I was not covering fabricaters and so the probability is that I would not have included anyway, but I had not seen it. When was it published?

Q 1984. Did you personally review or conduct the literature review for the report that you authored or did you have a research assistant perform that task for you?

A No, I did it myself which is to say, of course, one also made use of the automated techniques which medical libraries provide for you.

Q In forming the opinions you expressed regarding the cancer sustained by Fred Wallace and Herman Dendinger, did you rely at all on the industrial commission reports that are

UBL 11671

contained in the binder that Mr Bunda presented to you?

A No, I based my opinion entirely on the fact that those two types of cancers are not seen in people heavily exposed to vinyl chloride and not produced by vinyl chloride in animal experiments.

Q In connection with your assumptions concerning the vinyl chloride levels in the workplace at Chrysler, did you rely at all on the letters of August 25, 1986 and April 7, 1987 by Jack Peterson?

A That is the only information I have had. I think those are the only ones in that book, are they not? I have had no other information other than what is provided in that book about the levels at Chrysler works.

Q Is it important for an epidemiologist who is investigating a particular chemical, not to establish preconceived notions or assumptions as to what cancers that chemical can and cannot produce?

A Yes.

Q Have you read at all prior to today, the sworn testimony of Dr Shindell?

A No.

Q Have you been furnished prior to today with his testimony?

A No.

Q Have you read prior to today, the sworn testimony of

LRL 11672

any witness in this case?

A No.

Q Have you read prior to today the sworn testimony of Herman Dendinger and Fred Wallace?

A No.

Q In the Environmental Health Associates Study of 1986 - and I would like you to refer to your report if you would, at page 62, the right-hand column - it indicates that he studied a total of 10,173 men?

A I am sure that is right but I cannot see where you are pointing---

Q The first paragraph of the United States study.

A Page 62, I am sorry I was looking at 63. Yes.

Q That was his cohort?

A Yes.

Q Included in that 10,173 men were 1,176 men in five plants that produced homopolymers and copolymers with or without vinyl chloride monomer or polyvinyl chloride?

A Yes.

Q Is that correct?

A Yes.

Q So at least potentially incorporated into his data of a cohort of 10,173 men, were 1,176 men that may not even have been exposed to the chemical?

A I think that is unlikely the way it is phrased:

URL 11673

"with or without", but I am afraid you would have to ask a more experienced chemist than myself as to the implication of the homopolymers and copolymers.

Q If we look at page 1 of your review, did all four of the principal studies you relied on, the United States, the United Kingdom, the Canadian and the Italian study show an increase above the number expected of the number of observed cancers in the polyvinyl chloride workers?

A In comparison with the national expected, yes. The Canadian was not the national expected, it was the Quebec mortality rates.

Q But each of the studies showed an increase in the total numbers of cancers?

A Yes.

Q Dr Doll, do you know why, in terms of the United States figures, in Table I there is no data presented at all with respect to liver cancers?

A Yes. The authors were working with a particular ICD category in which liver and gall bladder were put together as one in the ICD category but they did, of course, publish separately a listing of the 39 cases, using the 7th revision, that they were using, they had not got the separate numbers, they had not got the separation of liver and gall bladder and that is a weakness of their study, but I think we can assume that the deaths were practically all cancers of the liver. The expected

deaths for cancer of the liver, I think I am right in saying, were not available separately from the American data at that period, but that may be wrong.

Q If we look at Table 4, did the results of the four principal studies, United States, United Kingdom, Canada and Italy, show an increase above that expected for cancers of the mouth and pharynx in the polyvinyl chloride and vinyl chloride workers?

A They showed 18 deaths against 16.6 expected.

Q For a PMR of 109?

A Yes.

Q If we go down to Table 5 which reports the studies from Germany, Norway, Sweden and Italy, encompassing 14 plants, did those four studies combined reveal an increase above the number expected of digestive system cancers excluding cancer of the liver?

MR BUNDA: Objection. I am going to object to the form of the question on the basis that when we are talking about an increase you have to have a data point from which you show an increase. I think it is a mischaracterisation of what the table shows. The table shows there is a greater number but I do not know if that is an increase or decrease.

BY THE WITNESS:

A The table showed a greater number but the excess was smaller than the deficiency in Table 4 in the principal studies

URL 11675

to which you have not drawn my attention which, of course, was 125 deaths against 166.4 expected. When you combine the two, you get an observed which is less than that expected.

BY MR DELLI BOVI:

Q One of the problems with these studies, when they are combined, is that the researchers have not reported their results in a uniform consistent manner?

A That is one of the difficulties that one has in combining them and one of the reasons why several of the subsidiary studies were regarded as subsidiary. The Swedish study, for example and the Norwegian study, both report their data in such an incomplete way they could not be usefully used, whereas the three of the principal ones reported them in a very detailed way. The Canadian one was not as detailed as one would like.

Q The Canadian one only dealt with a total of twenty deaths?

A Yes.

Q And the Canadian one was even less than the total number of cancer deaths at Chrysler?

A Yes.

Q The Italian study only dealt with 30 deaths?

A Yes, but they are both good and important studies in the sense that they had observations on people more than 25 years after they were first employed and they both had cases of angiosarcoma of the liver in them so they were relevant to include

URL 11676

and it would have been improper to have excluded them. Although the numbers are small, they are of real value in that they report relevant data.

Q In terms of the angiosarcoma deaths in the United States, you indicated in your 1985 article in British Journal for Industrial Medicine that 23 of the 33 cases that had been reported to date in the United States involved just two factories. Could I refer you to that document. (Document handed to the witness)

A Yes.

Q Have any of the PVC manufacturers disclosed to you at which of their facilities these large increases in the angiosarcoma deaths were experienced?

A I am afraid I cannot answer that question. I cannot remember whether it is in the angiosarcoma register or not. It has not been a question I have been asked.

Q Let me combine that point, that is the concentration of angiosarcoma deaths at a relatively small number of plants, with the differences in the results of the data you have reviewed. Some show an increase in brain cancer, some show an increase in thyroid cancer, some show an increase in melanomas, some show an excess in the digestive system, some show an excess in lung, some do not. Could those differences and the seeming irreconcilability of all the data, be due to what you described in one of the articles we talked about earlier as the need to consider

URL 11677

each facility and the cohorts exposure and the peculiarities of those facilities or the peculiarities of the particular vinyl chloride or polyvinyl chloride resin produced or used by those facilities into account?

A No, that is not the natural interpretation. The natural interpretation is this is exactly what you would expect to find if you look at 25 different reports and look at 25 different cancers in each of them. I guarantee whatever the chemical was, if you looked at as many different cohorts as have been looked at in relation to vinyl chloride and looked at as many different cancers in them, you would find precisely this: It is inevitable. This is exactly what chance means. If you look at 25 different types of cancer, one will show a significant excess by chance. That is the definition. If you look at 20 plants and 20 factories, then you are going to get 20 times that number of excesses and they will all be different. If you want to find an excess which you are going to relate to the particular conditions of the plant, you want to show that it is consistent in other plants that have the same chemical exposure, you want to show it occurs at the right time after exposures and it is concentrated on people who have had longer rather than shorter terms of exposure. All these are things you take into account. What you have described is what I would expect to find in any series of studies no matter what chemical you were looking at, irrespective if it was not a carcinogen.

URL 11678

MR DELLI BOVI: Could we go off the record for just a minute?

(Off the record)

BY MR DELLI BOVI:

Q Finally, Dr Doll, there are a number of exhibits that I would like you to identify for me. I understand that a number of those are your only copy and I will be more than happy to substitute a copy of that document for the original but I would like to get the documents marked so we are clear what we do and do not need copies of.

A May I just ask. Will you pay for the photocopying of them or who shall I charge?

Q Absolutely, I shall be more than happy to, as well as the time of who does it for me. Would you first identify Exhibit Doll 9.(Document handed to the witness)

A Yes.

Q What is that?

A A version of the United Kingdom report which has been published in the Scandinavian journal, Work, Environment and Health in June this year, provided me by Dr Jones in January, 1987. I see that it says the version I received in 16th January. It is not the press version and I cannot guarantee that it is precisely the same as that on which I based my final conclusions but it is certainly near enough it.

Q Did you indicate in your review who commissioned

URL 11679

Dr Jones to conduct that study?

A Yes, this was carried out by the Government, I suppose the equivalent of NIOSH. Our health and safety executive.

Q Would you identify Plaintiffs' Exhibit Doll 10, please? (Document handed to the witness)

A Yes, this is a translation of an Italian article that I arranged to have. The Italian article was sent to me by ICI in this country, it had not been published at the time, it has subsequently been published in English, but I have not got a copy of the English translation, only of the one I had made personally.

Q ICI is a European ---

A ICI is a big chemical industry that makes polyvinyl chloride.

Q Do you know Dr David Duffield?

A No.

Q Plaintiffs' Exhibit Doll 11 contains a number of your publications that I have requested, does it not? (Document handed to the witness)

A Yes.

Q Your preference is that we not mark the originals of those publications but you will provide me at my expense with copies of the publications that are listed on that exhibit?

A Yes indeed, they are my only copies of my own work and I prefer not to have them marked, but I am very happy to let you

URL 11680

have copies. Do you want copies of the two books?

Q I have reviewed them earlier. I do not have a need for copies of either of those.

A If you could be so good as to initial or that is not necessary. I am sure you will accept my withdrawal of the appropriate two?

MR DELLI BOVI: Certainly.

MR BUNDA: Rather than sending them directly to Mr Delli Bovi, since we are attaching the list, let us attach the articles to the transcript. So, why don't you provide them to the Court Reporter and she can attach them to the transcript.

THE WITNESS: Whatever you suggest.

BY MR DELLI BOVI:

Q Finally, Plaintiffs' Exhibit Doll 12 is a binder of materials that were presented to you for your review and which you have in fact reviewed concerning this case?

A Yes.

MR DELLI BOVI: That is all I have, Dr Doll. Thank you.

RE DIRECT

BY MR BUNDA:

Q I have a couple of questions. I realise the hour is late and we are all tired doing this but I just want to go over one or two things. I would like to refer you if I could to the

URL 11681

1981 study done by Dr Chiazze. Do you have that before you, that is Exhibit 2.

A Well, we have it in here so I can look at it here.

Q Let's make sure we have the exhibit. Do you have that?

MR DELLI BOVI: Certainly I have a pile of materials here.

THE WITNESS: I have it here, Exhibit 2.

MR DELLI BOVI: Do you mind, we have three copies of this study, could I have one of them please? (Document handed to counsel) Thank you.

BY MR BUNDA:

Q Did Dr Chiazze when he was doing this study, attempt to determine whether or not those people that he studied in the cohort deaths that he looked at, whether or not all of those people had had exposure to vinyl chloride?

A No. In fact, it is quite clear that a lot of them had not.

Q How can you tell that? For example, look at Table 5, please.

A Yes, that is the table I had in mind where 61% of the women with breast cancer had no exposure and 72.4% of the controls also selected from women who had died of other diseases had had no exposure and another substantial proportion who had had improbable exposure.

Q Of the cohort or deaths that you looked at in your study

URL 11682

did those people all have exposure to polyvinyl chloride or vinyl chloride?

A Well, there is a possibility that a few did not that worked in these plants producing homppolymers and copolymers. I am not quite sure whether they have exposure. Some of them may not have, but the great majority of all the others certainly did have. I would have to check my memory on the United Kingdom study as to whether there were any that had no exposure. I am not quite sure.

Q So would it be improper to compare the Chiazze study with your study in terms of comparing the number of deaths?

A Oh completely improper. They bear no relation to one another as far as hazards of vinyl chloride are concerned.

Q Getting back to the Chiazze study for just a second, why were those particular people in Table 5 looked at to determine their exposure?

A If I may elaborate, my previous answer ---

Q Oh, I am sorry.

A I was checking on the United Kingdom study and all 5,500 men who were employed had potential exposure to VCM for 25% of the work week. I thought that was the position but I wanted to check. Sorry, what was the first question?

Q Getting back to the Chiazze article of those people in Table 5 that we looked at before, what was the reason why the exposure information was determined for them?

URL 11683

A Because there was an excess, a higher proportion of deaths were attributed to breast cancer among the female workers than would be expected if the distribution had been the same as deaths in the United States as a whole and he wanted to investigate this further and he did the proper thing for an epidemiologist to do in this situation which is to do a nested case control study, that is to say one in which you make special inquiries about the affected patients and then you choose a group of other people who did not develop the same disease but who were matched in certain respects, same age and similar characteristics like that and compare the exposures of these two groups. That is what Dr Chiazze did.

Q What happened when he did that?

A Well, he found that of those with possible or definite exposure there were 4.5% of women who died of breast cancer and a possible or definite exposure in 7.5% in their matched controls. In other words, a higher proportion had had possible or definite exposure in the women that did not develop breast cancer but both proportions were extremely small.

Q It also showed, did it not, that a large percentage of women who had breast cancer had no exposure?

A It did. 75% had no exposure or improbable exposure.

Q What effect did that have on the hypothesis that vinyl chloride was somehow related to breast cancer?

A Oh, I think it made it quite clear that it was not

UAL 11684

related in any way.

Q During the cross examination we heard in the discussion of this article about a significant statistic with regard to all cancers and large intestine cancers. This breast cancer statistic was also deemed important by Dr Chiazze at first, was it not?

A Yes.

Q Is this case control study which he thereafter did, an example of the pitfalls that you can run into if you jump to conclusions about proportionate mortality results?

MR DELLI BOVI: Objection, leading. You can go ahead and answer.

BY THE WITNESS:

A I think it was a perfectly natural thing to do if you were wanting to see whether the findings that you had found from a proportionate mortality ratio study did have any significance in relation to the exposure to which the individuals were concerned. In this case it said certainly as far as the breast cancer was concerned, exposure of vinyl chloride was irrelevant.

Q Similarly we have no information available concerning whether those people who were shown as having colon cancer in the study, had any exposure to vinyl chloride?

A No such information.

Q Dr Doll, you were also asked how payment was made by the CMA to you after you were asked to do this comparison study

UKL 11685

which was recently published and you indicated a donation was made to charity. Do you recall that?

A Yes.

Q Can you please explain to the jury what is the relationship or how payment is being made to you as far as your consultation for the Defendants in this case?

A In the same way. I have always refused to take money from industry for any purpose in order to retain my independence and I made it a condition of appearing as a witness in this case that the normal consultation fee should be paid to charity and not to me directly.

MR BUNDA: Thank you, sir. That is all the questions I have.

FURTHER CROSS EXAMINATION

BY MR DELLI BOVI:

Q I would like you to assume that the trade industry for polyvinyl chloride manufacturers in the United States, Chemical Manufacturers Association, the Manufacturing Chemists Association sponsored and paid for Chiazze's initial work. As a result of that, would the raw data from Chiazze's original work be in the possession of that industry?

MR BUNDA: Objection, there is no foundation laid whether he has such knowledge.

BY THE WITNESS:

A It depends on the conditions under which Dr Chiazze

URL 11686

undertook the work. If I were to have undertaken the work, although as I pointed out I have never undertaken work for payment by industry, the condition would be I would be entitled to publish anything I wished about the data, it would be for me to dispose of. If that was Dr Chiazze's case, I just do not know.

BY MR DELLI BOVI:

Q Are you aware of any efforts by the American polyvinyl chloride manufacturers industry to sponsor a follow-up study of Chiazze's proportional mortality ratio study of PVC fabrication employees to test his hypotheses regarding the statistically significant increases in all cancers, large intestine cancers and other unspecified cancers in both males and females?

A I think your question includes a few postulates which I would not accept but perhaps it is not necessary for us to go over that. It is a question of the use of the term "statistically significant increases."

Q Statistically significant proportional distributions?

A Thank you. It is a point of some substance. No, I have no knowledge of what the PVC fabrication industry in the United States is doing at all in regard to anything.

MR DELLI BOVI: Thank you.

FURTHER RE DIRECT

BY MR BUNDA:

Q Doctor, I have one more question addressed to the last

URL 11687

question put to you. The continuing updating and following of the workers in the polyvinyl chloride manufacturing industry, the people who make polyvinyl chloride and the people who make vinyl chloride and the Tabershaw and Gaffey study updated by Cooper and updated again by the MCA, would that or would it not be relevant to the same question regarding issues raised in the Chiazze study?

A I do not have in mind what issues were being raised by the last question, but it seems to me a comparable question, yes.

Q I am sorry, what I meant by the issues raised were the concerns concerning intestinal cancer, proportional increases in total cancer and questions concerning breast cancer. Would those be addressed by the study involving polyvinyl chloride manufacturers done by the MCA?

A Insofar as there was any suggestion that those cancers were produced by exposure to vinyl chloride, yes.

MR BUNDA: Thank you.

(Whereupon the deposition concluded at 6.40pm)

URL 11688

CERTIFICATE OF COURT REPORTER

I, CHRISTINE MARY ARMSTRONG, Accredited Court Reporter, do hereby certify that I took stenotype notes in the foregoing deposition and that the transcript thereof is true and accurate and executed to the best of my skill and ability.

C. M. Armstrong

Christine M Armstrong
Tennyson & Company

17th August 1988

UAL 11689

CERTIFICATE OF WITNESS

I hereby declare that the foregoing is a transcript of my deposition; are the questions asked of me and my answers thereto; that I have read same and have made the necessary corrections, additions or changes to my answers that I deem necessary.

In witness thereof, I hereby subscribe my name this _____ day of _____, 198__.

_____
PROFESSOR SIR RICHARD DOLL

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