	NO. E-149,519
CHARLES DOUGLAS YORK	IN THE DISTRICT COURT OF
vs.	JEFFERSON COUNTY, TEXAS
TEXACO INC., ET AL	172ND JUDICIAL DISTRICT

DEPOSITION OF
RICHARD IRONS, Ph.D.

On October 26, 1998, the oral deposition of RICHARD IRONS, Ph.D., a witness in the above-styled cause, was taken at the instance of the Plaintiff in the offices of Fulbright & Jaworski, 1301 McKinney, Houston, Texas, pursuant to Stipulation attached hereto.

Those persons present were as follows:

MR. HERSHEL HOBSON
Attorney at Law
2190 Harrison Avenue
Beaumont, Texas 77701
Counsel for Plaintiff,
CHARLES DOUGLAS YORK

MR. LARRY THORPE
Reaud, Morgan & Quinn
801 Laurel Street
Beaumont, Texas 77701
Counsel for Plaintiff,
CHARLES DOUGLAS YORK

MR. STEPHEN DILLARD
Fulbright & Jaworski
1301 McKinney
Houston, Texas 77010
Counsel for Defendants,
Mobil Chemical Company, Inc.
Texaco, Inc.,
Texaco Chemical Company
Texaco Refining and Marketing
Chevron, U.S.A., Inc.,
Chevron Chemical Company
Unocal Corporation

MR. CHARLES STANTON PERRY
Mehaffy & Weber
500 Dallas Street, Suite 1200
Houston, Texas 77002
Counsel for Defendant,
Du Pont

MR. KIRK MARTIN
Jenkins, Grove & Martin
2615 Calder Avenue, Fifth Floor
Beaumont, Texas 77702
Counsel for Defendant,
American Petrofina

STARLA LEE FOUST, CSR
Charlotte Smith Reporting, Inc.
235 Orleans Street
The Kyle Building
Beaumont, Texas 77701-2399

VIDEOTAPE OPERATOR/TECHNICIAN:
Warriene Flatt
Legal Images
P.O. Box 315
Gilchrist, Texas 77617

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EXHIBITS INDEX

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THE REPORTER: Please state the stipulations on the record.
MR. HOBSON: Texas Rules of Civil Procedure.
MR. DILLARD: He will read and sign.
THE VIDEOGRAPHER: We're on the record at 2:02 p.m.

RICHARD IRONS, Ph.D.,
having been duly sworn, testified as follows,
to-wit:

EXAMINATION BY MR. HOBSON:
Q What questions have you been asked to answer in this case, Dr. Irons?
A Basically I was asked to evaluate the case materials that were provided to me and to render an opinion as to whether or not Mr. York's aplastic anemia, in fact - whether it was more probable than not that it was associated with exposure to benzene and that it was a benzene-induced aplastic anemia.
Q The last answer that you gave there about his aplastic anemia and his exposure and whether or not his aplastic anemia was caused by benzene - is

there a sequence there that you went through? Did you evaluate exposure first and then the kind of aplastic anemia he has, or how did you do that in your mind?
A Based upon the order in which the materials were made available to me, the first analysis that I performed was to evaluate the medical records and the pattern of presentation and the characteristics of his aplastic anemia in the context of what I would expect to see associated with benzene, and subsequent to that to review the documentation and the depositions that were made available to me in order to evaluate the - his potential likelihood that exposure to benzene was associated with that. So, the pattern and presentation of aplastic anemia first and the opportunity for exposure second.
Q On behalf of which Defendants are you appearing as an expert witness in this case?
A You would have to ask someone with expertise other than mine for that. I believe Texaco. I am not certain what other Defendants are involved in this case.
Q So, I take it your contact so far in this case has been through Mr. Dillard, then --

A That's correct.
Q -- and not any other attorneys associated with the case?
A Not to the best of my recollection.
Q You said that you started off with evaluating the case materials. What case materials have you been provided with and in what order and when?
A I made a brief list of what I received in this case: The medical records in general - and I haven't in my notes distinguished those, although, they are rather massive - and a variety of different depositions.
Q Did you delineate whose depositions you have been provided?
A Yes.
Q May I have who those were, please?
A Charles Douglas York, Frank Gardner, Ethan Natelson, John Bickers, John Dement, Frank Parker, Craig Morin.
Q That's all the depositions you have been provided in this case?
A That's correct.
Q And about when did you receive those depositions?

A Certainly the major - most of them, I received in March and April of this year, between January and March and April of this year.
Q And when were you first contacted about being an expert in this case?
A I believe the first time I had any kind of conversations at all would have been by telephone with Mr. Dillard; and to the best of my recollection it was in 1997, probably in the summer of 1997.
Q Besides Mr. York's medical records and the depositions you listed, what else have you been provided?
A I believe that's it.
Q Did you receive the attachments to any of the depositions that you were provided?
A Yes. The -- I have received the exhibits to some of these, not all of them.
Q Did you receive the documents that Mr. Morin had been provided?
A No.
Q Let's talk about the first part of what you did. The pattern of exposure I think is what you said was the first element that you considered; is that right?
A No, the pattern of presentation --

Q I beg your pardon -
A -- of Mr. York's disease.
Q The pattern of presentation. Tell me what you saw in the way of pattern of presentation, please.
A Well, essentially there were some records and some analyses that were performed on bone marrow and peripheral blood immediately preceding the definitive diagnosis, suggesting sideroblastic anemia.
This was immediately followed by an extensive workup and diagnosis of aplastic anemia. The presentation was that of a classic idiopathic aplastic anemia, primary aplastic anemia, pancytopenia, and acellular bone marrow with ringed sideroblasts, initial treatment refactory to B12 and folate. These were the principal characteristics that were important to me.
Q All right. What literature do you have that says that this is a characteristic pattern of presentation for an idiopathic aplastic anemia?
A What literature do I have?
Q Yes, sir.
A Certainly this is a pattern that is described throughout the literature - certainly the

articles and books published by Dr. Young; Jandl in his hematology text describes a similar pattern. Certainly the characteristics of a primary aplastic anemia are found in many articles. I provided some - brought some with me here today. I would say that the best central source for a description of this pattern would be the work by Dr. Young. Dr. Natelson, who I believe is a treating doctor in this case, has also published cases describing this pattern.
Q Well, sir, I'm trying to find out can you point me to a page in a text or an article that says that this is a pattern of presentation that is typical for idiopathic aplastic anemia?
A No. I don't have Dr. Young's book here, but that would be the first place that I would look for a general description.
Q Yes, sir. Just so I'm clear, I'm looking for a statement that idiopathic aplastic anemia follows this pattern of presentation.
A Yes. Well, first of all, the criteria for aplastic anemia include pancytopenia and an acellular marrow. So, those would be two criteria that I would expect to see.
Q Is that in any kind of aplastic anemia or

only idiopathic aplastic anemia?
A Idiopathic, most certainly; it would not apply in general to any aplastic anemia. Certainly in the case of benzene, the prevailing presentation would be different. -For one thing one does not usually expect to see in the majority of patients an acellular marrow. Those aplastic anemias that have been associated with benzene tend to have a moderate cellularity or even hypercellularity.
Also, the pancytopenia is usually preceded by in many cases a lymphocytopenia and in some cases a thrombocytopenia.
The other characteristic that is really quite remarkable for benzene is the absence of demonstration or at least recognition of ringed sideroblasts associated with benzene-induced aplastic anemia.
Q Okay. But you still haven't told me the reference for idiopathic aplastic anemia.
A Well, I have referred you to Neal Young's book. I don't have a copy of it here. I'm trying to see whether in the materials I have brought I see a general description. So far, I haven't seen one. (Reviewing documents) I don't think I have precisely what you are asking for with me.

Q All right. Let's turn to what you answered a moment ago.
Do you have any human epidemiological studies that show that benzene-induced aplastic anemia meets the criteria that you previously described?
A In terms of the characteristics that I described for benzene-induced aplastic anemia?
Q Yes, sir.
A There are several descriptions in the literature in collections of cases associated with characterizing individuals poisoned by benzene and benzene-induced aplastic anemia and bone marrow suppression. The principal authors that I would refer you to are Goldwater and Greenburg, their analysis of rotogravure workers and benzene suppression and the aplasia associated with benzene poisoning.
Certainly the collective cases of Aksoy and I brought at least one reference with me there, but there are several. And he describes these same characteristics in both his book on benzene carcinogenesis, as well as some of the manuscripts. Those would be the principal references.
There are a number of other reports that

describe various aspects of this. The most recent would be a study of the workers in Brazil, I believe by Ruiz, that describes some of these same characteristics.
Q Are any of the those - the Goldwater and Greenburg, the Aksoy articles, or the Ruiz article - human epidemiological studies?
A The closest that comes to it is basically Greenburg and Goldwater, which is a controlled study. The Aksoy study really represents a collection of cases. The Ruiz study, I believe, is a collection; but let me look at it again. (Reviewing document) It's basically a series. It's not a quantitative study.
Q "It's" being the Ruiz study?
A Yes.
Q Okay. Let's talk about Goldwater and Greenburg for a moment then.
Do they report relative risk or statistical significance for their publication?
A No, they don't.
Q How many aplastic anemias did Goldwater and Greenburg report on?
A It is certainly based upon the criteria that they are using at that time. They have a

fairly -- They have approximately -- They have 80-plus individuals that have some evidence of bone marrow suppression or benzene poisoning. In their follow-up over several months, they have at least four that show persistent abnormalities over a year later.
Q Did the 80-plus total individuals that you told me about initially all have aplastic anemia?
A No.
Q How many had aplastic anemia?
A Well, using their criteria for persistent changes, they have at least four that are candidates based upon the current - what we would currently define as aplastic anemia.
Q Well, can you tell by looking at the Goldwater and Greenburg paper of those four that had persistent problems whether or not they, in fact, have or had what we would today call aplastic anemia?
A If we were going to reevaluate or rediagnose these patients based upon current criteria, it's not clear to me which of these would be reclassified as having a definitive aplastic anemia. Certainly many of them would be classified as having persistent hematopoietic abnormalities

associated with exposure.
Q Do Goldwater and Greenburg use the term "aplastic anemia" in their paper?
A No, they don't.
Q For the 80-plus total individuals who were initially seen, what were the controls?
A The controls were taken from individuals that had -- (Reviewing document) I'm trying to see if I can find a precise description. I have seen it before. The controls were matched to the extent that they provided a reasonable control for the working conditions except for the exposure to benzene. I do recall that. It was the first real control study of benzene-exposed workers, and the control group is included. I'm looking for a description.
Okay. 81 industrial workers that were employed in a factory where no demonstrable exposure to benzene existed was their description of the control group.
Q So, one control person for each case?
A I'm not exactly sure whether it's one-to-one. I think it was based more on the availability of individuals that fit the criteria. I'm not sure if it's one-to-one.

Q So, more just happenstance of who they could find and how many they needed?
A I think -- My understanding is it was a single group of workers. I don't think they collected them, but I'm not seeing a description of it right here.
Q But no attempt that you can see to match by age or sex or race or any other parameter?
A The age distribution was similar to those that were in the exposed group is all that is in this particular study. I do recall -- Well, I have had conversations with Dr. Goldwater about this group many years ago; but as I sit here, I can't recall what the nature of the description is.
Q Is there anyplace in Dr. Goldwater's and Dr. Greenburg's paper that says that this particular kind of disease presentation is the only kind you should expect to see from benzene?
A Well, at this point in time this was the only reasonably carefully studied large group of benzene-exposed - highly-exposed workers that had been conducted; so, I don't think that you would expect to see that kind of a conclusion.
Q And, in fact, don't see that kind of conclusion?

A No. This basically is the first carefully characterized exposure group that had any kind of controls done.
Q In any of the items that you brought, is there such a statement that benzene will produce only the pattern of presentation that you described earlier to the exclusion of others?
A Well, as I said before, one would not reasonably expect to see that; and they haven't said that. It's also impossible to prove a negative; so, I would be very surprised to see anyone make an affirmative statement that this should exclude all other possibilities. I certainly wouldn't say that.
Q I take it you would classify Mr. York's aplastic anemia as idiopathic?
A Yes.
Q Now, you said that another part of your presentation - I'm sorry - your evaluation was looking at opportunity for exposure?
A Yes.
Q What did you find in the way of opportunity for exposure to benzene for Mr. York?
A Well; the first thing that struck me was in the medical records there's an indication that - certainly a diagnosis - he had no previous

recollection of exposure to benzene. More importantly, the symptoms that he described were not consistent with those that -- Or the lack of symptoms was significant to me with respect to consistent with exposure levels that I expect to see associated with aplastic anemia.
So, in the initial material that I reviewed, that was all the information that I had that really provided me with any indication of what his exposure might have been or might not have been.
Mr. Morin's deposition is basically what I used in confirming my own impression that there is just no evidence that Mr. York was exposed to levels of benzene that would be consistent with the development of aplastic anemia.
Q Let's start with your assessment of what level of benzene exposure is necessary to produce aplastic anemia.
A Certainly if we read through the collection of cases, the anecdotal cases and the descriptions of hygiene conditions that are associated with the body of cases that exist in the literature today, most of these coming from the first half of the century, we are talking about

massive exposure levels, certainly exposures on the order of 100 parts per million or greater, repeated exposures, high levels. Those are actually low for some of the descriptions. So, certainly exposures in that, above 100 parts per million, are associated with the risk of developing aplastic anemia. There may or may not be exposures in the 50 to 100 parts per million range that may be associated with aplastic anemia. I don't think the literature is particularly clear on that. And these exposures are usually associated with a variety of other symptoms, as well.

Q Do you have any literature that you can cite me to that says that exposure below 100 parts per million to benzene will not produce aplastic anemia?

A Well, we have had this discussion before in different contexts. I don't think that it's appropriate and certainly it's not a scientifically valid exercise to try to prove a negative. What one does is look at what associations and what exposures have been associated with the development of the disease. And certainly in the case of aplastic anemia, we are dealing with what is widely considered to be a high-dose phenomenon.

The vast majority of cases involve exposures of 300, 600, 1,000 parts per million or greater. These are clearly associated with bone marrow suppression and aplastic anemia development. There are some references in the Greenburg work that some of the exposures may have been 100 parts per million or lower; but in the context in which they are reporting, you have to realize that these would be considered relatively low exposures.
So, I don't know of any study that would - that has even been designed to allow for -- As I said before, science, you don't prove a negative. So, I can't point to a study that says that exposures below 100 parts per million don't cause aplastic anemia. There are no credible exposure scenarios that I know of that would certainly associate aplastic anemia with actual exposures that didn't involve scenarios involving 50 ppm, 100 ppm, or greater.
Q What studies can you cite me to where exposures of less than 50 parts per million have been demonstrated in the work force - epidemiological studies, I'm talking about now - and where aplastic anemia was an outcome that was looked

for?
A Well, with the caveat that the exposure - certainly the low level exposures are, I have some real problems because they were modeled rather than actually measured. The China study certainly has evaluated aplastic anemia and has looked at exposure paradigms that at least ostensibly involve lower than 50 parts per million exposure.
There is no evidence that I have seen in those studies that aplastic anemia is associated with those particular exposure groups. And I must add also that the exposure scenarios that are described there are particularly unreliable for low level analysis, and that's been the subject of a number of discussions and published opinions.
Q When you say "low level" in that context, how do you use it?
A I believe their low level or their lowest level of exposure scenario bounds a range of 1 to 10 ppm years. I don't believe there are - Certainly Dr. Hayes hasn't indicated that there are any aplastic anemias in that group.
In general that study is divided into at least three different scenarios - 1 to 10, 10 to - and it depends upon the particular analysis they are

doing - what they call 10 to 30, and then greater than 30. Some of their exposure levels are greater than 100, however.
Q So, if I look in the Hayes papers, I will find the analysis that you are speaking of?
A If you look across the board, you will see the overall analysis of the modeling of the exposures. There are problems with that. The actual modeling only accounts for about 30 percent or about a third of the overall exposures they are attempting to in terms of overall exposure metric and probably only 3 percent of the high exposure groups.
They had nine aplastic anemias in the entire cohort. I don't believe any of them were associated with the lower exposure group. And even that group is consistent -- The exposure metric is consistent with excursions above 100 parts per million.
So, I don't think that study provides any indication that exposures of less than 100 or 50 ppm's on a repeated basis in ambient air is associated with aplastic anemia; but it certainly provides additional evidence that high-level exposure is associated with aplastic anemia.

Q Any other papers that you would cite me to for this proposition?
MR. DILLARD: Herschel, y'all talked about several propositions. Just to make sure that the record is clear, which one are you referring to?
MR. HOBSON: The papers that demonstrate no association between aplastic anemia where they specifically looked for - and exposures to benzene below 50 parts per million.

(By Mr. Hobson)
Q That was what you were answering, I think, was it not?
A Well, as I said before, I don't know any study that is going to demonstrate no association. There are numerous studies in the petroleum industry looking at mortality in the petroleum industry that provide a surrogate for benzene exposure, and you certainly don't see any increases in aplastic anemia in those studies.
So, conversely if what you are asking is:

Are there any studies associated with either specifically benzene or where benzene is certainly a potential agent in the occupational setting, that have evaluated mortality rates that would have encompassed aplastic anemia, there are several petroleum refinery studies - Wong, some of the more recent studies by Schattner - that demonstrate no increased mortality and certainly have not observed an increased incidence of aplastic anemia in those populations.
Q In the -- Let's take the Wong petroleum refinery studies then. Which of those can you show that breaks out the refinery workers with occupational exposure to benzene?
A I don't have those with me today. I'm not in a position where I could do that.
Q Are you telling me that they do break out the refinery workers with occupational exposure to benzene and quantitate or semiquantitate those exposures?
A Dr. Wong's studies certainly have looked at exposure in the petroleum industry. I believe, if I'm not mistaken - and I may be not citing this exactly right - but I think that Dr. Schnatter has recently published at least one, if not more than

one, study looking at mortality in the refinery industry in a variety of different plants. And I do not recall seeing any increased incidence of aplastic anemia in those studies.
Q Well, let's go at it this way: Is everyone who works in a petroleum refinery equally exposed to benzene?
A Surely not.
Q Which ones are more highly exposed than others?
A Well, certainly those that have the potential for exposure are going to be those who work in a benzene production area or an area where the solvent content of - or the benzene content in the solvents is going to be higher and where there is an opportunity for exposure.
Q And what percentage of the particular refinery population would that be?
A That, I couldn't tell you as I sit here.
Q Half of them or more?
MR. PERRY: I'll object to the form.
A As I sit here, I couldn't tell you. I think it's going to vary with the individual cohort that you are looking at or evaluating.

Q So, in order to know the answer to that question, one would have to evaluate the exposures of the cohorts specifically for benzene?
A At least in terms of whatever the surrogate for exposure is. What I'm saying is I know of no studies in that industry or in refinery studies, of which there are some recent studies, that I recall showing any increased incidence of aplastic anemia in those studies.
So, certainly if, in fact, one were going to define a potential group that would have higher exposure to benzene than others, refinery workers in an environment where there is potential for exposure to benzene would certainly qualify.
Q Well, surely it would depend on how diluted you made the benzene-exposed group - would it's not - as to whether you would find any outcome?
A Not necessarily. It would depend -- If, in fact, the exposure is the critical issue here, then the level of exposure would be a major determinant of whether you would see an increase at all.
Q Did you say two different names? I'm having a hard time following you. You said "Shattner" and then you just said --

A "Schnatter."
Q "Schnatter." And that's only -- You did not say "Shattner"?
A I don't believe so. She is a candidate for governor in Colorado.
Q Schnatter?
A Schattner.
Q Easy for you to say. Let's spell the one you said so that we will have it right.
A I believe that he spells it S-c-h-n-a-t-t-e-r.
Q And you say you believe that Schnatter has published studies of refinery workers?
A That's correct.
Q That break out their benzene exposure?
A That at least evaluate benzene exposure, yes.
Q And whose refinery was being studied - or refineries?
A There's a series of companies. I can't tell you as I sit here.
Q You didn't bring those with you?
A No, I did not.
Q All right. Let's go back to our pattern

of presentation. Is there anything about the genetics of Mr. York that you think is germane to this case one way or the other?
A It would have been useful to have had cytogenetic data at the time of his diagnosis. That apparently was not done. And the reason for that is that in, certainly, cases of secondary aplastic anemia and in cases of benzene poisoning, it is not unusual to see clonal chromosomal aberrations. However, I think a functional surrogate to that certainly in the context of reaching my opinion is the fact that he was, in fact, successfully treated with anticlonacyte globulin, which is clearly a pattern that is seen in primary idiopathic aplastic anemia. Certainly in aplastic anemias with clonal injury, that is not usually the most prevalent outcome.
So, his successful treatment with immunosuppressive therapy is consistent, more consistent with a primary than a secondary. Other than that, I have no cytogenetic information one way or the other.
Q Let's talk about how you are using primary versus secondary.
A Primary is basically -- What I mean as

primary idiopathic aplastic anemia, secondary would be aplastic anemia, in this case obviously secondary to benzene.
Q So, secondary aplastic anemia is any aplastic anemia caused by something?
A Yes, or with a known cause.
Q Are you saying, then, that all aplastic anemias with a known cause are fatal?
A No. Secondary aplastic anemias tend to have a poorer prognosis, and certainly the literature description of cases associated with benzene have a poor prognosis.
Q Does that mean that the cases that are secondary to benzene exposure in the literature don't survive?
A It means they have a poor prognosis. They have a less likelihood of survival. And certainly those that have clonal lesions independent of their origin have a poorer survival.
Q But they are not always fatal?
A Not always fatal, no. They have a less favorable prognosis than primary idiopathic following treatment.
Q So, you are saying that the fact that Mr. York didn't die from his aplastic anemia is

indication that benzene didn't cause it?
A No. I'm saying that his very positive - in fact, remarkable response to immunosuppressive treatment is more consistent with a primary idiopathic aplastic anemia than one that has a clonal lesion or one that would be associated with benzene exposure.
Q But one doesn't exclude the other?
A I'm not sure what you mean. I wouldn't exclude anything. What I'm saying is that the likelihood, it's much more probable that a favorable response to treatment is associated with the primary idiopathic aplastic anemia than a secondary or one that has a clonal lesion. That's well-described in the literature.
Q Are you saying that you can show me a case -- I'm sorry.
Are you saying that there are no cases recorded where benzene is reported to be the causative agent of aplastic anemia where a rapid recovery was made?
A To my knowledge I know of no studies that have described any group of patients with a benzene-induced aplastic anemia where immunosuppressive therapy has proved successful. If

you look at the aplastic anemia literature in general, those with clonal lesions which would be more consistent with the benzene exposure have a poorer prognosis.
That doesn't mean that none of them survive. It simply means that they have much less likelihood. Certainly in the case of Mr. York, we are dealing with an individual who had an extremely favorable response to therapy - remarkable, even. It was very early. It was complete with one series of treatment, and it's been a persistent recovery remission for the better part of 15 years. That's an incredibly favorable response.
Q Is there no other 15-year survival reported in a benzene-induced aplastic anemia?
A Where you have a diagnosis of aplastic anemia, I'm sure there have been some cases of recovery. I wouldn't exclude that possibility. It's not impossible. I don't know of any series that I can point to where one has even a significant subgroup of individuals like that. Certainly the prevailing description of those cases is a fairly poor prognosis, either with respect to lack of response to therapy or a subsequent relapse.
Q In the four patients that Drs. Goldburg

and Goldwater - I'm sorry - Goldwater and Greenburg reported, did all four of those people with persistent disease die --
A I'm not sure.
Q -- from the disease?
A I'm not sure. I'm not sure how far they go.
(Reviewing document) No. They only went out two years, and those four individuals had distinctly abnormal blood pressures at two years.
Q But no report as to whether they resolved or did not?
A I have no information on that.
Q Is there anything in any of the references that you brought that says that the pattern of presentation that you describe for benzene and aplastic anemia is typical for benzene?
A Well, if you look at them as a whole, you see a picture that is reasonably consistent and is not consistent with what you expect to see in primary idiopathic aplastic anemia.
Probably the closest to describing a consistent pattern or at least recognizing a consistent pattern is that of the study of Ruiz, et al. It's a relatively recent study. Most of the

rest of these were performed in a context where it was the state of the art, this was the disease at hand, and they were characterizing what was seen. So, they weren't really referring to older literature in terms of consistency. The Ruiz study does make some references to what is seen in the older literature.
Q Well, I guess what I'm trying to find out is that what I hear you saying is it's your assessment, your opinion, that there is this pattern of presentation that is typical for benzene; and I'm trying to find out is that something that other people have said in writing?
Oh, yes. Certainly if you look at Aksoy and in his book, to a lesser extent the publication I brought - but there are several - he describes the characteristics that are seen associated with benzene - the aplasia - and with benzene poisoning. And he describes essentially these same features. Ruiz, as well, describes some of the same features. It's a pattern that has been seen and that is basically not a pattern that I have devined. I'm reflecting what these authors have said.
Yes Sir. But do they say - these

authors - that it's typical for benzene?
A Certainly Aksoy describes the prevailing presentation with lymphocytopenia as being characteristic of benzene and has been repeatedly reported. Ruiz notes the nature of the bone marrow cellularity. Vigliani -- Some of your original Vigliani studies suggest that the benzene presents with a relatively unique presentation.
So, I think if you take these authors as a group, this particular pattern has been described; and several aspects of it appear to be consistently seen in benzene-exposed populations in different decades and on different continents.
Q Yes, sir. But can you show me in their papers where they say that this is a typical presentation for benzene-induced aplastic anemia?
A I can show you in these various papers where each of the aspects that I am describing are reported as being consistent with and typical of benzene-exposed individuals. And, so, taken as a whole I think this literature supports a relatively unique presentation for benzene compared to that which you expect to see in primary idiopathic aplastic anemia.
This opinion is shared by the authors that

I am citing.
Q All right. If it's that pervasive throughout the papers, can you show me one where it uses the term "typical"?
A That particular wording? No. As I said before, the characteristics that they are describing are typical. They are describing a prevailing pattern of presentation.
In the case of Aksoy, he's describing a prevailing pattern of presentation; and he describes the initial changes that are seen with benzene that are not seen in other cases of aplastic anemia.
In the case of Ruiz, for example, he points out in none of the patients ringed sideroblasts were observed.
Ringed sideroblasts are a very frequent observation in cases of primary idiopathic aplastic anemia. I can't think of a single case in the benzene literature where that has been observed.
Q Can you show me, then, where it says in the benzene literature that if you find ringed sideroblasts, you should ignore any benzene exposure and attribute this to idiopathic aplastic anemia?
A I never said that.
As I said before, my opinion in this case

is based upon two observations: One, that the presentation of Mr. York - of Mr. York's aplastic anemia is more consistent a priori with a primary idiopathic aplastic anemia than with a pattern I would expect to see with benzene; and, two, that I have seen no evidence that he was exposed to benzene at concentrations or in a scenario of exposures that would be anything like what is associated with development of aplastic anemia secondary to benzene.
Q In your assessment of Mr. York's exposure to benzene, did you consider whether or not he was washing his hands or tools in benzene?
A I have seen no evidence that would lead me to believe that that, in fact, was the case.
Q Would washing your hands and tools and clothes in benzene present a significant exposure to benzene in your view?
A If what you are asking me is would washing your hands and clothes and tools in benzene provide the kind of exposure that would be consistent with the development of aplastic anemia if, in fact, one were to do that day in and day out repeatedly for some period of time depending upon the susceptibility of the individual from six months to 20 years, that would certainly be consistent with an

exposure level that could lead to the development of aplastic anemia.
But then, again, there would be other symptomatology that I don't see in the records, I don't see in his medical records; and it's inconceivable to me that he could experience such an exposure without additional symptomatology.
Q What other symptomatology would you expect one to have who washed their hands and tools and clothes in benzene?
A Dizziness, headaches, central nervous system effects, dermatological abnormalities, problems with -- Certainly the hands would be subject to a great deal of damage, defatting. I don't see anything in any of the records that would lead me to believe that he had encountered these kinds of exposures.
Q So, without those kinds of exposures - I'm sorry. Without those kinds of symptoms, you say it just can't be possible for a person to wash their hands and tools and clothes in benzene on a regular basis?
A What I'm saying is in the absence of industrial hygiene data or evidence to support that

kind of exposure, that the lack of that collateral symptomatology is not consistent with exposure to the levels necessary to produce aplastic anemia. That is not to exclude the possibility that anyone might have occasion - although certainly I wouldn't recommend it - to wash their tools in benzene. It would require not just a single exposure at that level, but multiple exposures for a considerable duration of time to produce the kind of exposure necessary to produce aplastic anemia based upon what we know about the disease.
Q So, washing your tools every day for six months, every workday for six months, five days a week?
A If an individual did that, I would expect to see additional evidence of toxicity, if only dermal. There is no evidence anywhere in the medical records that I can see that those complaints were made.
And, in fact, Mr. York testified or at least said to his treating doctors that he did not know that he was exposed to benzene. He certainly didn't describe that in his initial presentation. And I think it's inconceivable that an individual would work in that environment, have that kind of

exposure and not at least be cognizant of the exposure.
Q I'm interested in your concepts. I would like to talk more about people washing their hands with benzene or washing their tools with benzene or washing their clothes with benzene.
Would you know one way or the other if this has gone on in the Gulf Coast refineries in the Beaumont/Port Arthur area in the past?
A I have no knowledge with respect to that and have never seen any demonstrable evidence that that, in fact, has occurred.
I am saying that in the case of Mr. York, that indicating that he was not previously exposed to benzene at the time of his diagnosis is not consistent with someone who had repeatedly washed his clothes and tools in benzene. He would be aware that he had been exposed to benzene.
Q I'm interested in the symptomatology - the dizziness, the dermatitis, the other things that you describe. Are you saying that if a person regularly washed their hands or tools or clothes in benzene, maybe not every day, but on a regular basis, that that would just be something totally inconsistent with having no reports of dermatitis and dizziness

in the work force?
MR. PERRY: Object to the form.
A It is not -- I find it highly unlikely and I don't see how it's consistent that you can describe a scenario in which an individual was exposed to levels that have been associated with the development of aplastic anemia in the past without incurring those types of symptomatology.
The exposures that have been described in the past, it's charitable to say that exposures at 100 parts per million are associated with aplastic anemia. The vast majority have involved exposures that probably exceeded 300 and maybe as much as 1,000 parts per million; but you would expect to have some central nervous system minor symptomatology at least between 50 and 150 parts per million.
And to not recognize any exposure is not consistent with exposure at those levels.
Q I take it, then, that Drs. Goldwater and Greenburg reported central nervous system effects in the people with aplastic anemia that they studied?
A Goldwater and Greenburg focused on the hematologic abnormalities that are associated with benzene exposure. I don't recall whether they

discussed other symptomatology at all.
Certainly there are a number of other
references, including those that I brought with me
here today, that describe exposures associated with
the development of frank aplastic anemia in which
those types of symptoms are frequently reported.
And those levels of exposure - the levels of
exposure that have been documented exceed - greatly
exceed the symptomatology that we have discussed.
Q I guess I'm having a little bit of a
problem. Are you saying that these symptoms are
frequently reported or that they are always reported
for benzene-induced aplastic anemia people?
A They are very frequently reported. I
would -- Without scouring the literature, I'm not
prepared to tell you always ever.
Q What about in the ones that you have
brought? Can you tell me for the papers that you
have brought where you have a benzene-induced
aplastic anemia that there were reports from the
victims that they had dizziness, they had
dermatitis, that they had the other symptoms that
you described earlier?
A It will take me a minute.
(Reviewing documents) Certain --

Parenthetically certainly Aksoy describes these types of symptoms in shoe workers exposed.
Q What do you mean by "parenthetically"?
A If you read his book, he describes the symptomatology.
Q Is that what you are reading now?
A (Reviewing document) I am looking now at one of the papers that I brought with me that is from - that is looking at hematological effects in chronic benzene poisoning in 217 workers. And it clearly describes the hematological abnormalities. I'm seeing whether they report some of the other findings.
They don't describe any collateral symptomatology in this paper, but in his book he definitely does.
This is typical of several that I brought that basically examine -- They are either from the U.S. Public Health Service or the National Safety Council that describe exposure scenarios for benzene in industry in the Twenties and Thirties. And it describes a variety of conditions in which hematologic abnormality has been found in patients and where symptoms included not only blood changes, but seen as symptoms, gastrointestinal symptoms,

irritation of the respiratory tract, weakness, headache, eye irritation, which is expected or typical in individuals exposed to extremely high levels.
Q Is what you are saying that you think it's probable that a person would experience these systems if they develop a benzene-induced aplastic anemia, but not necessarily so?
A I think it is much more probable, much more likely than not, that individuals exposed to levels of benzene that are associated with aplastic anemia are going to have these other types of symptomatology.
Q But they may not.
A I think that it's possible they may not, but highly unlikely.
Q Now, this list of symptoms that you just read to me, what were the exposure levels that are associated with each of those?
A Well, here in one case it says that – The term “benzol” is used because this is the old nonenclature. Benzol concentration in the air – and this is from the description that I was just reading you – in the air of five of the rooms was fairly low. And they are referring to 200 parts per

million.
Another group that they are looking at, they have low level in summer of 130 parts per million to a high of 330.
Here is one 430 to 500 parts per million.
Here is another where the average was 1800 parts per million and the maximum was 4,140 parts per million.
Here is a table looking at concentration of vapors in parts per million that ranges from 70 parts per million to the 4,140 that I described.
Q Well, does the table give the range of concentrations for exposure, the places where the aplastic anemia were found, and the symptoms for each of the -
A No, it doesn't outline it. It basically outlines created fashion, the different - describes or categorizes rooms in terms of what they are calling relatively low, intermediate, to high exposure. The -
Q Are all the symptoms reported in all the rooms?
A I would imagine without even going through and trying to look at this in the context in which you have put the question, you would expect to see

headache, fatigue, dizziness associated with any exposures above 100 parts per million, for sure. And as you approach 4,000, you expect to see confusion, listlessness.
Actually this refers to a report by Arnold Leeman showing that 4700 parts per million benzene produces listlessness and confusion after half an hour and within a few hours may cause loss of consciousness. I would say that's unusually charitable. I would imagine that some individuals would probably lose consciousness at 5,000 parts per million in less than an hour.
Here's a description by dose from the OHIO PUBLIC HEALTH JOURNAL. 6,000 parts -- 6,260 parts per million causes local symptoms. 15,000 parts per million is poisonous. 4,000 parts per million is poisonous. 900 parts per million caused local symptoms. There are a variety of different collections and descriptions like that throughout this. We are talking about incredibly high exposure levels.
Q And what are you reading from?
A This is a report by the National Safety Council on Benzol, May, 1926.
Q How did you happen to find that particular

article, Dr. Irons?
A I don't know how I found this. I don't know when I got this.
Q Where was it published?
A National Bureau of Casualty and Surety Underwriters. It's one of several aspects of the literature that I have acquired on benzene over the years.
Q But it was distributed by the National Safety Council, you said?
A Yes.
Q In 1926?
A Yes.
Q Well, would workmen tolerate working with benzene where they have to wash their hands and tools and clothes with benzene, with all these symptoms?
A I have no knowledge of that. I wouldn't. But I can't -- I have no basis for giving you an informed opinion on what others might or might not tolerate.
MR. HOBSON: Let's take a short break, if you don't mind.
THE VIDEOGRAPHER: We're off the record at 3:22.

(A BRIEF RECESS WAS TAKEN.)

THE VIDEOGRAPHER: We are on the record at 3:34.

(By Mr. Hobson)
Q To change gears with you a little bit, did you see the Notice that I sent out?
A (Witness nods head affirmatively)
Q Did you bring what you published - the last ten items?
A Yes. I think that's it. (Tendering) It's close, if not exact.
Q (Reviewing documents) When is the last time you did any work for the API?
A This year.
Q Have you continued to get money from them since the last time we had a deposition together?
A I don't remember when exactly the last time we met; but I have been funded at various levels more or less continually since then, I believe.
Q Well, how much is your current funding level from API?
A I suspect this next year it will be on the

level of $100,000 total.
Q And "next year" being '99?
A Yes, basically. I'm not exactly sure what the fiscal year is for that, but it's close.
Q What about for this year?
A I believe it's been 200.
Q And the year before?
A It would have been the same.
Q And the year before?
A Now we are getting into -- I believe it was more, but I'm not sure how much more. It might have been 300. I don't recall.
Q Has your level of funding from the American Petroleum Institute been more than $300,000 a year since you have been in Colorado?
A It might have been from 350 at one point, but that would have been total. That would not be what I would see. That would be the total amount of the award, but I wouldn't see all of it.
Q The award -- When you say "the award," what do you mean by that?
A Well, whatever the total amount is that was part of the grant from API, the University is going to take overhead from that.
Q And the overhead -- What's left after

overhead goes to you?
A Goes to my laboratory or to others.
But
Q And what has the API been getting for its money these last four or five years from you?
A Certainly the project that I have been working on for the past year has been focusing on three separate areas of work. One has been looking at the effects of benzene on - and benzene metabolites on lymphoid biology - B and T cell ontogeny, as well as activation.
Additional studies we have done have been focusing on the development of a long-term bone marrow culture model system for looking at and integrating various aspects of toxicity. The API's focus is benzene. Ours is benzene, as well as a variety of other substances, but primarily developing a long-term culture model.
And another aspect of work we have been doing has been focusing on looking at alterations in metabolism and cell-specific differentiation in bone marrow associated with a variety of factors - hydroquinone being one of them, benzene metabolites, but also looking at other environmental factors.
In this case we have been looking at

smokers and evaluating potential alterations in the hematopoietic regulation as a consequence of cigarette smoking.
Q And the API has been funding that?
A Yes.
Q What do you think their interest is?
MR. DILLARD: Objection. Calls for speculation.
MR. HOBSON: No. I asked what he thinks that they think.
A They have been extremely interested in determining whether or not there are other populations of cells in bone marrow that are capable of metabolizing or bioactivating benzene metabolites besides the myeloid series. We have been looking at that for a number of years, and we are reaching a conclusion with respect to those studies.
As part of that, I recommended to them that if they were concerned about looking at metabolism they should also focus on looking at altered regulation of differentiation because I think that that is going to impact on metabolism and its susceptibility. And it's my hypothesis that smoking conveys a risk of developing leukemia over and above the contribution it makes to the body

burden of benzene and benzene metabolites. And this is because the literature is replete with examples of altered hematopoietic parameters in smokers. So, it was basically my suggestion that they fund a pilot study to determine whether, in fact, that is the case. I don't think they are going to be interested in funding that in terms of understanding mechanisms; but if, in fact, we do describe alterations in hematopoietic regulation in smokers, it will form the basis for additional grants to different sponsors besides API.

Q What are you doing specifically to test this hypothesis of yours in the laboratory?

A We are looking at clonogenic function. We are looking at altered clonogenic response. We are looking at phenotypic changes in surface markers. We are looking at different populations themselves to see whether or not there are shifts in the differentiation paradigm that we see in normal bone marrow compared to that which we see - or in smokers compared to that which we see in nonsmokers. I think that if smoking conveys a risk of leukemia, that's probably the most important contribution that it makes; and, that is, altered differentiation.

At this point up until the studies we have done, all of the data available on that has been indirect. It's not been bone marrow. It's been peripheral blood data. What we have done is focus in on bone marrow.
Q So, you are getting bone marrow from the clinical setting and determining whether it's from a smoker or nonsmoker and making these analyses?
A We have designed the study a little bit better and in a little bit more detail than that. We have identified smokers. We have a clinic twice a week in which we take bone marrows. We have been sampling smokers, and we have been matching those individuals with respect to age, gender, and other criteria so that we are looking at relatively comparable groups of individuals.
This is a small study. It's a pilot study to see if we, in fact, can observe any changes.
Q How do you induce these graduate students to give you bone marrow?
A These aren't graduate students. We can't find any graduate students who smoke. But basically ever since I have been in Colorado, we have been recruiting volunteers to give bone marrow; and we pay them a nominal sum of $200. We provide them

with a great deal of serologic and clinical data on themselves. That is part of the normal workup. And we have never had a dearth of applicants. We usually have a waiting list.
The smokers have been a little bit more difficult to recruit because there aren't that many people out there who will readily admit to smoking one- or two-pack days, and that's basically who we have been looking for.
Q Tell me how you are progressing with your bone marrow culture model.
A The proof is in the pudding for that system. And what we are looking at is whether or not we can provide long-term - and by "long-term" anything over six weeks is considered definitely long-term - bone marrow cultures that will continue to recapitulate progenitor cells and to maintain stem cell activity. At this point I can't tell you whether we are going to be successful or not.
Q That's kind of where we were two or three or four years ago when I took your deposition then, isn't it?
A We are a little bit further along than that. We definitely -- We can maintain cultures now out for six weeks with clonogenic activity and with

basically producing a variety of different cell types. We have recently shifted to a model that was originally used to characterize B lymphocyte ontogeny, and I think that's going to prove to be maybe more versatile than the widely-touted what are called long-term cultures today.
It's really the conditions and the nature of the cell populations that are seeded that make a difference.
Q Can you now start off with what you perceive to be pretty much the stem cell and cause it to divide either in lymphoid line or the myeloid line?
A We can give both lymphoid and myeloid differentiation in culture. When I last talked to you, I don't believe we could simultaneously get lymphoid. We can now.
Q What made the difference?
A Basically the different conditions in the media and the nature of the pattern of cytokines that are used. We have a short-term culture system, a liquid culture system that we published that allows us to look at the myeloid differentiation; and we are just beginning to analyze long-term culture data. Probably within the next six months

we will have something to say about that.
Q It has to do with the change in your culture technique that you were talking about?
A Cell husbandry basically. Stem cells don't like to be pushed.
Q I wouldn't know. I never met one. I was noticing one of the articles that you brought with you, the Rothman paper. There's quite a long list of co-authors of which you are one. I take it that you know the other co-authors?
A I know many of them.
Q Would you know if any of the other co-authors are also consultants to the American Petroleum Institute?
A Bill Bechtold may have been. I can't speak for him, and I certainly can't speak for him now. I don't see anyone else that I think or that I know for a fact was or is.
Q What about any of the other industry trade associations? Do you recognize any of the other co-authors to be affiliated with any of the industry trade associations; for instance, the CMA -
A Not that I know of.
Q -- the Society of Plastics, any of those people?

A Pardon?
Q Society of Plastics and the various trade associations?
A I wouldn't - I wouldn't have any information on that.
Q What has been your role in this particular study of the Chinese workers?
A We have analyzed lymphoid populations at one time or another. In that particular study we were responsible for the analysis of various cytokines and lymphokines, and I have consulted with them in terms of evaluating lymphoid function and monitoring effects on peripheral lymphocytes.
Q And I don't notice mention - and I haven't read the whole paper - but I don't notice mention of your work for the industry anywhere in the paper. Do you disclose that to your co-authors?
A Of course. That's not - that would not be something that would be relevant to that publication. I was not working -- The work that I did there was funded through the NCI, not through API.
Q Without going through each one of these, is any of the published work you have done been paid for by the API's money - in this stack that you have

handed me here?
A I would have to look at it.
Q Okay. (Tendering)
A (Reviewing documents) They never put these things in the same place. As it happens, no, not any of these.
Q I notice that some of those do deal with benzene and hydroquinone benzene metabolite. Did simply none of that information on benzene and benzene metabolites get funded by API?
A That's correct. The benzene and benzene metabolite studies you see there were funded predominantly by NIH.
Q I'm sorry. By whom?
A NIH.
Q How do you discern which part of your benzene work is paid for by NIH and what part of it is funded by API?
A It depends on the specific nature of the project that we are working on. I have described for you the three major areas we have been working on with respect to studies that are funded by API. Most of those are actually developmental or highly -- They are more risk taking in terms of developing methodology.

Most of the studies that we have been doing under NIH sponsorship are looking at molecular and cellular mechanisms, leukemogenesis, altered differentiation, and hematopoietic regulation. And, so, those molecular studies and the chromosomal studies, the cytogenetic work we are doing is funded through the National Institute of Environmental Health Sciences.

Q So, are you saying that you haven't published anything in the scientific literature that you have attributed funding to the API for?

A No, that's not correct. Certainly work - You asked for the last ten items.

Q Yes.

A If I had dug any deeper, I no doubt would have come up with papers that have API sponsorship. We probably have some abstracts that we have published this last year that have API sponsorship; but at this point, I don't have any papers that fall into that category.

Q When would you say was the last time that you published work that you attribute sponsorship to the API for?

A '95 or '96. I don't know what the last publication there is - whether it is '95. 1 think

in '95 we probably published one or two papers with API at least co-sponsorship, probably '95.
Q And would I find in the text of the publication the funding coming from API?
A Yes, in the acknowledgment it would be listed. There are some I have that I know list both NIH and API, and those would be studies where there were aspects of what we were doing that represented the product of both projects.
Q Are you funded by any other trade association besides the American Petroleum Institute?
A I have a grant from the Chemical Manufacturers Association examining potential mechanisms of butadiene toxicity and interactions between butadiene and other agents of concern with respect to synthetic rubber production.
I have a grant from a pharmaceutical company to look at molecular mechanisms of drug-induced aplastic anemia. That's been going for two years and I have reason to believe it will go for a third, but I can't guarantee it.
Q Who did you say funded that?
A Astra Pharmaceuticals.
Q And how long has your CMA funding been

ongoing?
A We had a break of about a year to six months this past year. It's just -- We have just entered into a new three-year - made a proposal, and it was funded to look at the aspects of synthetic rubber production that I just described. So, that's basically a new grant.
Q And prior to the gap, how much CMA funding had you received prior to that since leaving CIIT?
A Two to three years prior to that was when it started, and I believe it was -- I can't remember the precise amounts on that grant.
Q How much is the new grant for?
A $189,000 a year; and that's gross. That includes overhead.
Q What's your university overhead percentage there?
A I believe that the negotiated amount on nongovernment grants is 26 percent, but I could be wrong on that.
Q Is it higher or lower on government grants?
A It's higher, tends to be. It depends on the nature of the grant. I don't pretend to understand the subtleties of grant administration.

Q All right. Have we covered your trade
2 association funding that you have had since you have
3 gone from CIIT?
4 A I believe so.
5 Q One of the things I asked for, too, was
6 anything that you have submitted for publication,
7 but not yet published. Do you have anything in
8 press?
9 A I brought a couple of things that fit that
10 particular criteria. I had two things that are
11 submitted at the present time.
12 Q No title?
13 A One is "Benzene Metabolites, Hydroquinone,
14 and Catechol Act in Synergy to Induce Dose-Dependent
15 Hypoploidy and Minus 5 Q-31 in a Human Cell Line."
16 Q And where did you submit that?
A That was submitted to Leukemia Lymphoma.
18 Q And where are you in the publication
19 process?
20 A I'm waiting to -- It's been submitted. I
21 don't have any information on it.
22 I have another one which is entitled, "An
23 Essential Role for NF-kB in Human CD34 Bone Marrow
24 Cell Survival." And that's in submission to Blood.
25 And it's been revised and sent back; so, I'm

expecting to hear on it shortly.
Q And when you say "revised," that means it's gone out for peer review and it's come back with edited - editorial requests?
A Yes.
Q What else?
A In response to the subpoena, I brought manuscripts that have been submitted but not published.
Q All right. Let's take the first one of those, and tell me about it.
A The first one here was basically this same manuscript that we originally formatted for publication in - I believe it was Science and Nature. And they declined to review it because it didn't meet their criteria for general interest; so, that's basically the same as this.
I don't usually keep copies of manuscripts that have not been accepted for publication. I do have a couple of them that I happened to find.
Q That missed the knife?
A Well, I generally try to keep paper reduction. I would swim in paper if I kept everything that we ever wrote or everything I ever got. I happened to find this in a graduate student

file. It was a paper that was submitted, rejected for publication; and the graduate student has not rewritten it and I will not rewrite it for her.
Q Just the title so that we will have it in the record.
A "Hematopoietic Progenitor Cell Proliferation is Altered Following Induced Stress or Glucocorticoid Administration."
It requires editorial carving.
Q Did you review that prior to the graduate student submitting it?
A Sure, but I won't rewrite it for the graduate student; and, therefore, it is their responsibility to -- I mean, I will take it to a certain point; but I'm not going to rewrite it for them.
The other one I happen to have in hand is one that we are still working on that basically here's an example of what you were referring to. Here is a paper that the work represents projects co-sponsored by NIH and by API and by NCI that we submitted for publication in Blood and was rejected. And the title is "B Progenitor Cells Express Low Level Myeloperoxidase."
Q Were you given an explanation in writing

as to the reason for rejection?
A Oh, yes. We had a number of debates about this submission at the time and decided to send it to Blood in order to determine whether or not a rigorous peer review would support one opinion or the other. And they did. They basically said that the work was fine, but it didn't provide definitive evidence that nonmyeloid cells express myeloperoxidase.
This was a study that API wanted us to perform to determine if there were any other populations in bone marrow that were capable of metabolizing benzene metabolites. And it was an exceedingly difficult technological set of experiments and there were mixed opinions on the part of the authors as to what the results showed and the journal helped us come to a consensus on that.
Q That you didn't know what it showed?
A Well, not really. I mean, basically the journal - the reviewers indicated that while it was clear that the populations we described existed, we could not say that they were B cells and that, therefore, we could not conclude that other than myeloid cells were expressing myeloperoxidase.

That's part of the peer review process.
Q The paper here that you have recently published on dithiocarbamates as potential confounders in butadiene epidemiology, who was the sponsor of that?
A The Chemical Manufacturers Association.
Q Did I just miss it? I didn't see it listed here. But where would I find that?
A Let me see.
Q (Tendering)
A (Reviewing document) Okay. They are currently sponsoring our studies on this that are based or predicated upon this manuscript. They did not fund this paper. They are currently funding mechanistic studies to evaluate the potential for confounding that we hypothesized might exist in this paper.
Q Let me try and keep the piles somewhat together. You slid this across to me awhile ago, but I don't think it's in this.
A That's not.
Q It should have been in this pile.
Let's talk about your expert testimony for awhile, if we could. When was the last time you gave a deposition before today?

A I'll make it easy on myself. I believe the last deposition I gave was probably in a case called Friloux. It was either Friloux or Murray, but I have given both this year.
Q That is a list of appearances that you have got?
A Yes.
Q What period of time does it cover?
A From 1994 to the present.
Q And is there a reason why it starts in '94?
A I believe you asked for that, but I'm not sure.
Q Starting in '94?
MR. DILLARD: You asked for four years.
Q So, you prepared this specifically just for me?
A Not exactly. It coincides with also a list I prepared for presentation in Federal cases. Actually I don't think I edited it in any way for this.
Q And what's your current billing rates?
A $500 an hour.
Q And the $500 an hour - does it go to you

or the university?
A It goes to me.
Q So, there is no overhead figure on there for the university?
A No.
Q How many hours have you got in this case so far?
A I have previously billed about approximately - I don't have a record of it - approximately 600,060 - excuse me - 6,000 or $6,500, which would represent approximately 12 or 13 hours, something like that. And I probably have an equal amount of time that I have just recently put in preparation.
Q What is the most you've ever billed in a case?
A Probably $78,000. That was over ten years ago.
Q Which one was that?
A Skeene.
Q Skeene I or Skeene II or both?
A Skeene II.
Q Do you know what your billing was in Skeene I?
A I had no billing in Skeene I.

Q You weren't there?
A I wasn't there.
Q Can you give me an estimate of what percentage of your time - I'm sorry - what percentage of your income comes from litigation?
A Over the last few years, I would say it's averaged about 50 percent.
Q 15?
A 50.
Q 50?
A Yes.
Q Is that up or down from what it was earlier?
A It varies. It's hard to predict. I'm not sure what it's going to be this year. I know my total time this year will probably be less than it has been in the past years. I don't know what the total amount will be. It depends on basically income from other sources.
Q Has your income from litigation been more than 50 percent in the past for a year?
A Probably not. I can't say that for certain, but I don't believe so.
Q So, it's been rocking right along at 50 percent the last few years?

A Well, you know, it averages. It can go - It's been 40 sometimes. When I say "50," I'm basically just stating an average. It's been 35, 40. It may have exceeded 50. I don't know that it has. It depends upon my other sources of consulting income, primarily.
Q You have, I take it, a salary from the university activities?
A That's correct.
Q And, so, when you get a grant from the CMA or the API that goes through the university, then does that grant money go to pay part of your salary from the university?
A I have -- My salary is fully paid by the university. If I put my time on a research grant, they expect me to defray them through the grant, that cost. So, the amount of salary that I derive as a consequence of my research activities goes to the university; but my salary is paid 100 percent by the university, if that makes sense.
Q No, it really didn't; but let me see if I can restate it until I get it right.
You get paid a salary from the university?
A That's correct.
Q If you bring in grant money, some of that

grant money is used by the university to pay your salary; but your salary doesn't change?
A That's correct.
THE VIDEOGRAPHER: We need to change the tape. We are off the record at 4:13.

(A BRIEF RECESS WAS TAKEN.)

THE VIDEOGRAPHER: We are back on record at 4:14.

(By Mr. Hobson)
Q Does the amount of salary you get vary depending on how successful you are in bringing in I grant money, or is that just considered to be part of the job?
A Only very indirectly in the context that my performance is evaluated on the basis of several criteria, one of which is my success in doing research. It's also evaluated on the basis of my teaching, on my service, on my administrative contributions to the university, et cetera, et cetera.
Q And then in addition to litigation and

salary, then, you have consulting?
A My consulting income litigation is one part of that. I also derive income from consulting in the pharmaceutical industry that has nothing to do with litigation.
Q Tell me how that works.
A Just the same as litigation. It's basically consulting.
Q And what kinds of things do you do in consulting for pharmaceuticals?
A Drug development, designing and evaluating studies in support of registration with FDA or with international or other regulatory agencies around the world, evaluating potential hematopoietic or immunotoxic hazards associated with developmental drugs.
Q And you are working there for the pharmaceutical company, not for the agency that is considering the drug?
A Usually it's -- That's almost -- It's hard to give that a single answer. Invariably the pharmaceutical company has hired me as a consultant. On occasion that's been at the request of FDA in order to help interpret some of their studies. So, FDA will ask a company to provide my

services in evaluating their data.
Q So, FDA asks specifically for you, but gets the drug company to pick up your fee?
A That has happened at least once, yes.
Q More often, is it just the agency asking for an evaluation and the drug company picking you to do the work?
A Sometimes the agency is asked if I could provide expertise after I already was consulting for the company. That's happened.
Q Can you give me some idea of how many different drug companies you consult to?
A It varies. That's highly -- I mean, that's a function of who's having trouble with what. Usually if I'm called in, it's because there is a problem or a perceived problem or they're having a problem in interpretation. So, it's usually a Phase III drug. It's usually a drug in the latter stages of development. It's very hard to predict. It can be no activity or tremendous activity, and that's why my income fluctuates rather dramatically.
Q If we say this year, how many drug companies have you worked for this year?
A One.

Q And the previous year?
A Either last year or the year before, I did a great deal of work for two companies. This year it's one. The year before that, three or four years ago, I think it was probably -- No, there is one there. It varies. It just varies. It's usually - And also the nature and intensity of the project varies.
Q And the work you have done this year for the one company - has it been much in the way of quantity?
A Not much.
Q So, this year at least the main source of nonuniversity income has been litigation?
A Yes.
Q Let's see what you have brought with you here today, if we could. I'm going to set this stack aside and ask the court reporter to mark it as a separate stack.
I notice these are reprints. Did you bring these for us to keep, or would you like them back?
A You can keep those.
Q Okay.
A These are the only copies of these in

existence.
Q All right. And you are talking about the ones that were submitted or rejected?
A Either that or revised.
Q And will you trust our court reporter to keep those for you and return them to you?
A (Witness nods head affirmatively)
Q What else did you bring in front of you?
A A list of cases.
Q Okay.
A Notes that I have taken in this case.
Q That's three ruled notebook pages with handwriting, and it's your handwriting?
A Yes, it's my scribble.
A copy of the subpoena duces tecum, the list of materials that I reviewed in the case, two letters - submittal letters that accompanied material I received. I don't think these are all of them. I think there must have been another one, but I don't have it with me. It may be buried in the medical records.
Papers that I brought in that I reviewed with respect to this case. These are not all inclusive. Some of the others, as I mentioned, have been submitted by other experts in the case; but I

didn't bring them. I didn't bring Dr. Neal's book. I didn't bring Dr. Aksoy's book and a few references like that, but these are the ones that I wanted to make sure of.
Q Can you tell me any of the references that are attached to other depositions that you particularly utilized that you didn't bring?
A I would have to review them to give you a responsible answer to that. I looked at most of them -
Q So -
A -- if not all of them.
Q So, the ones you really planned on using are here today?
A Yes. I didn't -- Again, like, I brought an excerpt of Dr. Jandl's book. I didn't bring the book, but clearly that's a reference. Dr. Neal's book.
MR. DILLARD: You say "Dr. Neal." You mean Dr. -
THE WITNESS: I'm sorry. Neal Young. I'm mixing that up. I'm sorry.
A I have got one exhibit from Dr. Natelson, which is the most recent or at least a very recent

peripheral blood analysis of Mr. York.
And we have gone through the rest of it.
Q I think we have. Let's take a short break here, and maybe we can get the court reporter to mark some of these. I don't care to have some of that stack that's over there. I have forgotten what is there now. The list of things you brought or provided, I don't care for that piece of paper. I don't think -- I guess I will take the transmittal letters because they have dates on there. But there was something else in there that I didn't think I needed.
A The subpoena?
Q Yes, I don't need that. I have seen it somewhere. That's probably it.
So, if we could have the court reporter mark those in a short break, we'll come back and prove those up; and maybe I will be done.
THE VIDEOGRAPHER: We are off the record at 4:22.

(A BRIEF RECESS WAS TAKEN.)

(IRONS EXHIBIT NOS. 1 THROUGH

41, WERE MARKED FOR IDENTIFICATION.
SAME WILL BE FOUND AT THE CONCLUSION
OF THIS DEPOSITION.)

THE VIDEOGRAPHER: We are on the
record at 4:37.

(By Mr. Hobson)
Q Dr. Irons, we took a little break here;
and we marked the different items. 1 through 10,
that's the collection of recently-published articles
that you brought for me; is that right?
A That's right.
Q And then 11 through 32, that would be the
list of articles that you primarily are relying upon
in this case. Would that be so?
A That's correct.
Q And then from 33 through 37, that's the
publications that you said were offered for
publication, but not accepted?
A Not entirely. Some of those are currently
being considered for publication at the present
time.
Q That's right. And you went through which
one was and which one wasn't?

A That's correct.
Q And then the others are the miscellaneous letters, your handwritten notes, and your list of appearances, correct?
A That's correct.
Q In the information that you brought for me here today, is your new system, your new model for stem cell development set forth in any of these?
A I'm not sure what you are referring to.
Q I think you told me that you had changed your model, and I have forgotten exactly what you were saying before. But it somehow involved B lymphocytes so that you could then get differentiation of the myeloid and lymphoid line?
A Oh, in terms of an experimental model?
Q Yes, sir.
A No, because we haven't published anything on that. The proof is in the pudding with that, and there is no value in talking about it. One has to do it. So, until we have the culture system that allows us to do that, I don't have any publications on that.
Q And, so, all the information that you have published in the past is really on the earlier system, the earlier model?

A If you are talking about data derived from different experimental systems, we have the liquid culture system, we have a number of different analytical systems using bone marrow cells and cell lines. If you are talking about a long-term bone marrow culture system, we haven't published on it.
Q I'm thinking from our last visit that you were describing for me a model where you were able to take uncommitted stem cells and utilizing either benzene or benzene metabolites be able to create cells in the myeloid direction as opposed to the lymphoid line.
Do you remember our discussions about that?
A Yes. Well, vaguely. Certainly the liquid culture system I described or that is included here does that. It looks at myeloid differentiation.
Q But not lymphoid?
A That's correct.
Q And, so, the system doesn't really start with an undifferentiated stem cell that you can then direct in another direction, but it starts with a committed myeloid stem cell?
A For the -- Certainly for the models that are described - the culture system as described in

those publications, that's the case. We have published on different isolated effects of benzene metabolites in other substances on lymphoid ontogeny and lymphoid development; but those are looking at specific aspects of the process, not looking at a complete differentiation model.
Q Already committed and starting down the line and then you bombard them with some metabolites or benzene?
A Or very early effects that may precede a single lineage commitment, but we are looking at isolated cell populations as opposed to a functional differentiated model.
Q And I take it your hope is that your new culture models where you can get differentiation down both lines will expand your ability to look at different chemicals and their metabolites and how they affect the blood?
A It will make it easier. I think that we can do a lot by looking at the specific - with the specific systems we have, a lot more than we used to be able to because of the technologies that we have.
Obviously the hope is that we will be able to monitor effects in both lineages ideally in the

same system or, if necessary, in separate systems.
Q How about in systems that start with the progenitor stem cells?
A Well, for the progenitors, that's no problem. We have basically got that fairly well described. I mean, it's consistent with what is seen in both animal models and also in secondary leukemias in humans.
Q And the latest paper that you have published in that light would be what?
A Well, certainly the - looking at transcriptional regulation in a role of NF-kB in human progenitors, we've described a role for a transcriptional regulatory element that appears to be necessary for stem cell survival and for clonogenic response in bone marrow, certainly in the myeloid lineage.
So, that would be the latest; and that's one that has been submitted for publication.
Q And not one of the ones you brought here?
A Yes, it's one of the manuscripts.
Q Is that in this rubber-banded set?
A Yes.
Q And which number article would it be, please?

A 35.
Q All right, sir.
A In addition, we have been able now to analyze actual C34 positive human bone marrow cells for clonogenetic - clonogenic lesions in terms of cytogenetic aberrations in vitro. So, that is also a system that allows us to look at virtually all repopulating cells in terms of the potential for cytogenetic information.
Q Not published yet, though?
A No. The model has been published, but actually taking it to human bone marrow is something that we have -- The studies are completed, but I haven't analyzed the data.
Q And funding for that by?
A NIH.
Q And which chemicals or chemical metabolites would have been involved there?
A Hydroquinone for the first series - hydroquinone and catechol.
Q In this era of Dolbert and all of its proteges, have you -- I should say projects or proteges. Maybe "proteges" is the right word - projects.
Has your testimony ever been refused by

any court?
A I have had one court disallow a very narrow aspect of my testimony in a case. It was a very bizarre case. I don't know why he did it. The judge signed an order that was written verbatim by the plaintiff's attorney. It contains numerous errors, falsehoods, misrepresentations. It actually states an opinion I did not make in the case and never have made. The judge disallowed that particular aspect of my testimony. The Supreme Court stayed the case to review that order, and the case was recently settled.
Q And where was that pending?
A West Virginia.
Q Anyplace else?
A No.
MR. HOBSON: Well, I think that's all I've got. I appreciate your patience.
MR. DILLARD: We will reserve all our questions.
THE VIDEOGRAPHER: We are off the record at 4:46 p.m.

(WHEREUPON THE DEPOSITION WAS CONCLUDED.)