

1
2 UNITED STATES DISTRICT COURT
3 FOR THE NORTHERN DISTRICT OF OHIO
4 WESTERN DIVISION

5 MARY A. DENDINGER, et al.,

6 Plaintiffs,

7 -vs-

Case No. C87-7117

8 THE B.F. GOODRICH COMPANY,
9 FIRESTONE TIRE & RUBBER
10 COMPANY, CONOCO, INC.,
11 UNIROYAL, INC., UNION
12 CARBIDE CORPORATION,
13 TENNECO, INC., TENNECO
14 POLYMERS, INC., TENNECO
15 RESINS, INC., OCCIDENTAL
16 CHEMICAL CORPORATION, and
17 MAXUS ENERGY,

18 Defendants.

19
20 Examination of CARL ZENZ, taken at the
21 instance of the Plaintiffs, pursuant to the provisions of
22 Section 804.05 of the Wisconsin Statutes, pursuant to
23 stipulation by respective counsel, before TERESE M.
24 SCHIEBENES, a Notary Public in and for the State of
25 Wisconsin, at the offices of Dorothy M. Wagner and Assoc-
iates, Court Reporters and Notaries Public, Suite 400,
135 West Wells Street, Germania Building, Milwaukee,
Wisconsin, on the 13th day of October, 1988, beginning
at 10:00 a.m.

1
2 APPEARANCES:

3 MURRAY & MURRAY CO., L.P.A.
4 Represented by KIRK J. DELLI BOVI,
Attorney for the Plaintiffs.

5 FULLER & HENRY,
6 Represented by ROBERT A. BUNDA,
Attorney for the Defendants.

7
8 THEREUPON, the following proceedings were held:

9
10 CARL ZENZ, having been first duly sworn,
11 was examined and testified as follows:

12
13 EXAMINATION BY MR. DELLI BOVI:

14
15 Q Dr. Zenz, would you state your full name, please?

16 A Carl Zenz.

17 Q Your home address?

18 A 2418 Root River Parkway, West Allis, 53227.

19 Q What is your current occupation?

20 A I'm a consultant in occupational medicine.

21 Q Who do you consult to?

22 A I would consult to industry, attorneys sometimes,
23 private individuals, National Safety Council, and
24 others who have an interest in occupational health
25 matters.

1 Q And you have been a private consultant in occupational
2 medicine since 1977?
3 A Yes, sir.
4 Q How many times have you testified in court?
5 A Excluding worker's comp.?
6 Q Yes, sir.
7 A In what span of time?
8 Q Since 1977?
9 A I would say no more than a dozen times.
10 Q Did any of the worker's compensation cases in which
11 you testified involve occupational cancers?
12 A Yes.
13 Q Did any of the worker's compensation cases in which
14 you testified involve exposure to vinyl chloride?
15 A I don't recall for certain, but I don't think so.
16 Q In the worker's compensation cases in which you testi-
17 fied involving occupational cancers, what chemicals
18 were involved?
19 A I'll try to go back chronologically if memory serves
20 me well as far as I can go in this regard. Asbestos
21 fibers, a mixture of chemicals, of course, solvent
22 exposures such as trichloroethylene and similar solvents,
23 methylene chloride perhaps, silica exposure.
24 Q Silica dust?
25 A Silica dust, right. Nickel, nickel compound. I can't

1 really recall any specific substances.

2 Q In those worker's compensation cases in which you
3 testified that involved occupational cancers, who did
4 you testify on behalf of?

5 A It would be a mixture. In behalf of a worker or an
6 organization, an industry.

7 Q What about the asbestos case, who did you testify
8 on behalf of in that case?

9 A That was a worker.

10 Q The cases involving solvent exposure, the trichloro-
11 ethylene and methylene chloride?

12 A Also for workers.

13 Q The silica dust case?

14 A Let me reflect a moment on this.

15 Q Certainly.

16 A I think a few were for workers. The majority of silica
17 cases would have been for industry.

18 Q When you say a few were for workers, do you mean a few
19 of the silica dust cases or a few of the workers?

20 A A few of the cases.

21 Q And the case or cases involving nickel compounds?

22 A For the worker.

23 Q In those occupational cancer cases in which you
24 testified on behalf of the worker, was it your opinion
25 that the worker's occupational exposure to the chemical

1 in question was the cause of their cancer?

2 A Strongly correlated.

3 Q Did you render an opinion in those occupational cancer
4 cases in which you testified on behalf of the worker as
5 to whether it was more probable than not to a reasonable
6 degree of medical certainty that that worker's cancer
7 was caused by the occupational exposure to the chemical
8 in question?

9 A Yes, sir.

10 Q In order to reach that conclusion in each of those
11 cases, what factors did you evaluate?

12 A The factors I evaluated for these situations would be
13 the, naturally, the medical history, the physical
14 examinations, other pertinent medical records, such as
15 hospital findings, X-rays, laboratory tests, the
16 pathologist's reports, and, of course, exceedingly
17 important would have been the work exposure history,
18 type of jobs, how long exposed, the quantity of
19 exposure, the time of exposure, protection used, if
20 any.

21 And that, coupled with my experiences in
22 factories, of course, paints an entire picture. So
23 it would be the environmental aspects and the clinical
24 aspects with which I'd form an opinion.

25 Q Was your opinion based also on your review of the

1 medical and scientific literature?

2 A Of course.

3 Q Did you base your opinions in any of those worker's
4 compensation cases involving occupational cancers in
5 which you testified on behalf of the claimant solely
6 on the epidemiologic literature, or did you take all
7 of these factors into account in rendering your
8 opinion?

9 A All of these factors were the prime sources of my
10 opinion. However, when I began testifying, say in the
11 early '60's -- this is going beyond the 10-year period
12 you mentioned to me earlier -- epidemiology in
13 occupational medicine was an unknown science.

14 Q Is it your opinion that in order to render competent
15 medical opinions on the link or possible link between
16 an occupational exposure and a cancer is that all of
17 these factors you have listed must be taken into
18 account?

19 A Yes. And probably factors I haven't listed.

20 Q Are there any that you can recall for me that you
21 haven't listed that you feel should be taken into
22 account, and let me run through what you've testified
23 to already.

24 You talked about the medical history of
25 the individual, physical examinations, medical records,

1 including lab reports, pathology reports, work histories,
2 including length of exposure, quantity of exposure,
3 type of exposure, any respiratory protection that was
4 provided to the worker, your own experiences in the
5 industries in which the workers were employed, and
6 the relevant medical and scientific literature?

7 A Yes. I didn't mention genetic factors, which any one
8 of us would want to consider, too. And I should also
9 say that in my experiences during these past ten,
10 twenty, thirty years or more with rare, rare exceptions,
11 I've always visited the work site.

12 MR. BUNDA: For the record, he also mentioned
13 an analysis of the medical records.

14 A I didn't mention biopsies, but I mentioned pathologic-
15 al and insustrial hygiene findings, the analyses of
16 the contaminant in the work room. That's included in
17 the environmental component.

18 Q What about the personal or social history of the
19 individual?

20 A Always included as part of the medical history, of
21 course, and that could be broken down into great de-
22 tail, if needed.

23 Q What about those workers compensation cases in which
24 you've testified on behalf of the industry wherein
25 occupational cancer was claimed? Did you in those

1 cases render an opinion to a reasonable degree of
2 professional certainty that the occupational exposure
3 to the chemical in question did not cause the worker's
4 cancer?

5 A Yes.

6 Q And in rendering that opinion, did you consider the
7 same list of factors that you've given to me that you
8 testified -- I don't mean testified -- that you took
9 into account in rendering your opinions on behalf of
10 the claimant in the other cases?

11 A Essentially yes. But I would have, of course, consid-
12 erable body of data collected by other people, other
13 professionals, either locally, nationally, or inter-
14 nationally, which I would, of course, had a chance
15 to review and study.

16 Q Is it your opinion, therefore, that in order to
17 render competent medical testimony as to the absence
18 of a causal connection between an occupational
19 exposure and a cancer in the worker that you likewise
20 have to consider all of the factors that you've
21 enumerated and cannot rely exclusively on one or two
22 of those factors?

23 MR. BUNDA: I'll object to the question on the
24 basis that it's vague.

25 BY MR. DELLI BOVI:

1 Q You can go ahead and answer.

2 A I'll try. Let me collect my thoughts on this. It's
3 a real complicated question you've tossed at me.

4 Q Certainly.

5 A Well, in this respect, let me say that if I were aware
6 of working conditions and had available the environ-
7 mental monitoring data by certified or noncertified
8 industrial hygiene people or other scientific persons
9 that made determinations of contaminants or exposure
10 levels in the work area or off the work area, hobbies
11 for example, and external causes away from work, and
12 these exposures were found to be far below any
13 internationally accepted norms or limit, guidelines, I
14 would base my opinion and judgment on these measurable
15 microscopic values that there could not be sufficient
16 quantity to cause a reaction in the body such as a
17 cancer.

18 Q Is it your opinion, therefore, that there is a no-
19 effects level of exposure to a carcinogen?

20 A Yes. Otherwise we wouldn't be here, any of us.

21 Q You believe that there is a level of exposure to a
22 carcinogen at which no individual will develop a
23 cancer?

24 A Probably, but I can't be 100 percent certain on that.

25 Q Have you ever expressed that opinion on any of your

1 publications?

2 A I'd have to refresh myself to answer that question.
3 That's a difficult memory retrieval matter.

4 Q Have you reviewed, in connection with this case, the
5 correspondence of Mr. Peterson to Dr. Shindell?

6 A Yes. I have seen that.

7 Q Are you aware from Dr. Peterson's letter to Shindell
8 of the airborne levels of vinyl chloride reported in
9 the Chrysler plant as the result of testing conducted
10 in and after April of 1974?

11 A I'm aware, but I would like to quickly refresh myself,
12 if I may, please?

13 Q Certainly.

14 A Thank you.

15 Q I'm going to hand you Peterson's April 7, 1987, letter
16 to Shindell. I would just like you to focus on, Dr.
17 Zenz as you're going through that, on the vinyl
18 chloride that's discussed about solvents. We'll get
19 into that later.

20 A I just found what I was trying to refresh myself on.
21 Thank you. I'm skipping the other solvents now.
22 Let me look at this graph presentation again. Thank
23 you. Appreciate the review again.

24 Q Certainly. You are familiar then with the findings
25 of Mr. Shindell that were reported of Mr. Peterson --

1 excuse me -- that were reported to Shindell in April
2 of 1987?

3 A Yes, sir.

4 Q Have you been furnished with any other information
5 regarding the airborne levels of vinyl chloride at
6 the Chrysler facility other than this document?

7 A Yes. I recall seeing documents prepared by the
8 hygienist from the Ohio Occupational Health Group.

9 Q Do you mean the Ohio Group or the Chrysler Industrial
10 Hygiene Group?

11 A Both, I think.

12 Q Do you know whether or not it was on the basis of his
13 analysis of that data that Mr. Peterson prepared his
14 April 7, 1987, letter to Shindell?

15 A Yes. I believe he did do just that.

16 Q You're aware then that in 1974, there was air monitoring
17 conducted at the Chrysler facility to determine the
18 airborne concentrations of vinyl chloride in atmospheres
19 that the Chrysler employees would be working in?

20 A Yes.

21 Q Have you seen prior to today what has been marked as
22 Exhibit Peterson 2?

23 A I don't recall seeing this. May I look at it, please?

24 Q Certainly.

25 A May I ask who derived this and prepared this?

1 Q Certainly. This was derived by Mr. Peterson. He
2 testified yesterday that he took the data that was
3 supplied to him by Mr. Bunda, determined arithmetic
4 and geometric means, and calculated standard deviations
5 from those figures.

6 A Based on air sampling analyses by other people such
7 as Chrysler Hygienists and Division of Health in Ohio?

8 Q I know it was based on Chrysler IH air sampling.
9 Whether it also included State of Ohio, I'm not sure,
10 but Mr. Peterson did testify yesterday that it was from
11 this data, that is, Peterson Exhibit 2, that was based
12 on the information supplied to him by Mr. Bunda that
13 he prepared April 7, 1987.

14 A I see.

15 Q Looking at Exhibit 2, which summarizes the data
16 collected from the Chrysler facility as a result of
17 air sampling in '74, is it your understanding that the
18 air sampling done in the blender/calender area
19 revealed airborne vinyl chloride monomer concentrations
20 as high as 29 parts per million?

21 MR. BUNDA: I'm going to object to that.
22 What you're asking is his understanding, and then
23 you're pointing to a number on Exhibit 2 which is
24 derived from other materials. I think that if you're
25 asking him to read that, that has no relevance to this

1 case.

2 A That could be an analytic error if you look at the
3 whole picture.

4 MR. BUNDA: To be accurate, we need to go back
5 to look to the exposure levels.

6 A And figure how that figure came to be and what time of
7 the day and who did the analysis and so forth.
8 The sample could have been contaminated. It's a common
9 problem in collecting samples in working areas is
10 contamination.

11 MR. BUNDA: Especially since none of the other
12 exposures approach that.

13 A That's right.

14 BY MR. DELLI BOVI:

15 Q Did you assume, Dr. Zenz, when you reviewed the air
16 sampling that was done by Chrysler that the results
17 were valid or invalid?

18 A I had to assume that they were reasonably scientifically
19 valid, made by competent personnel.

20 Q Let me hand you Page 2 of a data sheet from the
21 Chrysler facility that refers to a sampling taken on
22 May 9 and May 10, 1974, and refers to a Jim Broady
23 loading/blender of 29 parts per million; do you see
24 that, sir?

25 A Yes, sir, I do.

1 Q And is that one of the documents that was provided to
2 you by Mr. Bunda?

3 A Yes, I think so.

4 Q All right. For purposes of your opinions that you will
5 express in this case, did you assume that that was a
6 valid sample or an invalid sample?

7 A Looking at all of the findings, I assumed it was valid.

8 Q Now, let's go next to the receiving/storage area.

9 A Excuse me. May I have that previous document back with
10 Mr. Broady's name on it. I just want to check and see
11 who long -- whether there was a one-hour sample or
12 four-hour or eight-hours. It doesn't give that data
13 here at all.

14 MR. BUNDA: That's an indication--

15 A This is incomplete. I only have Page 2.

16 BY MR. DELLI BOVI:

17 Q If we move down to the receiving/storage category,
18 do you see levels reported there in May and November
19 of 1974 of 29, 27, 22, 17, and 50 parts per million?

20 MR. BUNDA: Same objection. I think that we
21 ought to look at the underlying documents to understand
22 those figures.

23 A Within that same month, there are exposure levels
24 reported of 0.60 parts per million.

25 Q Yes, sir. I understand that.

1 A I'd have to look at all this in total.

2 Q Fine. Here it is.

3 A May I?

4 Q Sure. You were supplied with all those documents by
5 Mr. Bunda, correct?

6 A Yes.

7 Q Would you look at the data that reports these levels,
8 receiving/storage, May 10, 1974.

9 A (Witness complies.) Sampling rate was meteamin (phon-
10 etic), which is typical, and for the most part, ten
11 minutes duration. This is a report, a letter of
12 February 11, 1974.

13 This is what I'm trying to determine,
14 whether or not this is a peak instantaneous sample for
15 a short duration of time or a sample for the entire day.
16 That's very important to me.

17 Q Why would that be important to you?

18 A Well, any of us can be exposed to a spill, for
19 example, of isotone in the bathroom and have a heavy
20 exposure to 200 parts per million for minutes, and
21 that could be tested for and reported as heavy
22 exposure, but it would be just that one moment.

23 A ten minute test period from my point
24 of view is not good industrial hygiene technique.

25 Q Is it your opinion that the sampling that was done at

1 Chrysler in 1974 and thereafter is or is not represent-
2 ative of the employee exposures to vinyl chloride at
3 that plant?

4 A Fairly representative from what you've given me, from
5 what I've read. Considering the era, fifteen years
6 ago, I'm surprised at the good industrial workmanship
7 performed by Ohio and Chrysler. I'm pleased.

8 Q Are you aware of any sampling done by Chrysler or the
9 State or the Federal Government at the Chrysler facil-
10 ity prior to 1974 for vinyl chloride?

11 A Yes. In the documents provided by Mr. Bunda.

12 Q And where is that information?

13 A You've just given me a copy. Of course, dated in
14 1968. Unfortunately, I can't read all of the copies,
15 but I note that in December of 1968, vinyl chloride
16 was reported as a trace at all calendering stations.

17 Of course, I can't be aware of other
18 studies made at earlier dates at Chrysler Corporation;
19 that would be beyond the scope of my information.

20 Q Well, I'd like you to assume that Chrysler didn't
21 operate or own the facility prior to 1968. Are you
22 aware of any reported levels of workers exposure to
23 vinyl chloride at the Chrysler plant prior to the
24 data that was collected in and after 1974?

25 MR. BUNDA: I'll object. I think that that

1 was asked and answered. He's indicated they found a
2 trace in 1968.

3 BY MR. DELLI BOVI:

4 Q Are you aware of any other tracing between 1968 and
5 1974 of vinyl chloride levels in the Chrysler plant
6 other than that reported in 1968 correspondence?

7 A Well, the information given me has been directed for
8 this episode today antedates 1968. That's all I have.

9 Q Postdates 1968?

10 A Postdates, excuse me.

11 Q And my question is are you aware of any other sampling
12 other than that reported in the 1968 correspondence for
13 vinyl chloride at Chrysler between 1968 and 1974?

14 A I'd have to look at the Ohio documentation once again,
15 please, if I may?

16 Q Certainly.

17 A They stated in a report in February of '74 -- that is
18 the Ohio personnel, State of Ohio -- they made
19 previous studies in the '60's at Chrysler's request.

20 Q Does it refer to vinyl chloride?

21 A I'm hoping to find that. They mention other solvents,
22 of course. All right. Here we come to the main
23 production lines.

24 I would have to refer to the American
25 Conference of Governmental Industrial Hygienists

1 threshold limited values document of the '60's and
2 '70's. They are published annually, and if I recall,
3 at that time vinyl chloride probably was in the range
4 of 200 parts per million or above.

5 Q There was an ACGIH TLV for vinyl chloride prior to
6 '74 time frame of 500 parts per million.

7 A Thank you for refreshing me.

8 Q Certainly.

9 A In reviewing the documentation and studies of the plant
10 facility by the Ohio Health Personnel, State of Ohio
11 Health Personnel, they may have been more concerned
12 with other solvents than vinyl chloride at that time,
13 and this is why I find that this scant information on
14 vinyl chloride at present, but I must pursue this a
15 bit further, please.

16 Q Sure.

17 A No. I have no further information regarding studies
18 performed prior to 1968.

19 Q Or between 1968 and 1974?

20 A Only what has been provided by you or Mr. Bunda at
21 this point.

22 Q Other than the reference to vinyl chloride in the
23 correspondence in 1968, you were not aware of any
24 testing done at Chrysler to determine airborne levels
25 of vinyl chloride prior to April of 1974?

1 A No. That's not so. I mentioned moments ago that one
2 of the division of health from Ohio reported trace
3 levels.

4 Q In 1968?

5 A Yes, sir.

6 Q And that was recorded in correspondence in 1968?

7 A Yes, included with the recent materials.

8 Q Certainly. My question, Dr. Zenz, is except for that
9 reference, are you aware of any testing done at
10 Chrysler for airborne levels of vinyl chloride prior to
11 April of 1974?

12 A No.

13 Q Now, you indicated earlier that you regarded the
14 testing that Chrysler initiated in April of 1974 and
15 thereafter for airborne levels of vinyl chloride as
16 good industrial hygiene?

17 A Right. Yes, sir.

18 Q Was it good industrial hygiene not to test at all for
19 airborne levels of vinyl chloride at the plant between
20 1968 and April of 1974?

21 A It might have been, because they might have had good --
22 Perhaps for other materials, if we control the solvent
23 emission, say, for methyl ethyl ketone, by proper
24 industrial hygiene and engineering control, all other
25 solvents ought to be controlled simultaneously.

1 Q Is vinyl chloride a solvent?
2 A Yes, sir. Well, vinyl chloride monomer is gas.
3 Q Are you aware or have you been furnished with any
4 documentation indicating excessive solvent levels in
5 the Chrysler plant on the mezzanine level in the ink
6 room?
7 A I'd have to refresh myself, please.
8 Q Certainly.
9 A May I ask why you mentioned a mezzanine level?
10 Q Because that is an area of concern in this case.
11 A All right. Thank you. I could understand if you
12 asked me about the basement levels.
13 Q What I would like to do to speed it along is ask you
14 whether you've been shown any documentation of
15 citations to Chrysler in 1976 for excessive levels of
16 solvent exposure in the ink room or the mezzanine area
17 of the ink room?
18 A You say citations?
19 Q Yes, sir.
20 A By OSHA?
21 Q OSHA.
22 A In the '70's?
23 Q In 1976.
24 A I'm not aware of citations as such, sir.
25 Q All right. Are you aware of any testing for vinyl

1 chloride at the Chrysler facility that was ever done
2 on the mezzanine level of the ink room at any time?

3 A I don't recall that, no, sir.

4 Q You indicated earlier that one of the reasons that
5 there may not have been testing for vinyl chloride
6 prior to 1974 was because there were no reported
7 excursions of the TLV's for other materials, correct?

8 A Not entirely correct. What I meant was that other
9 solvents were of greater concern than vinyl chloride.
10 The main concern in those days against vinyl chloride
11 as an exposure was its inflammability and explosivity.

12 Q Is it your testimony here today that the only concern
13 of the PVC industry prior to 1974 relating to vinyl
14 chloride was with its explosivity?

15 A No. I didn't mean that.

16 MR. BUNDA: I'm going to object to the question.
17 I think it's an unfair question. We've been discussing
18 the conditions of the PVC fabricating plant of Chrysler.
19 Now, if you're going to expand it to all the PVC
20 industry including the monomer of vinyl chloride and
21 the manufacturing of polyvinyl chloride, then I think
22 the witness is going to have to recognize that you're
23 changing the scope of your question.

24 BY MR. DELLI BOVI:

25 Q Let's talk about Chrysler then. Is it your testimony

1 today that one of the reasons Chrysler may not have
2 performed testing for vinyl chloride monomer between
3 1968 and April of 1974 is because they had no reason
4 to be concerned about health effects relating to
5 vinyl chloride exposure other than explosivity?

6 A No, sir. I didn't say that, nor did I intend to give
7 that impression.

8 Q Well, I'd like you to assume they didn't between 1968
9 and April of 1974.

10 A If you wish me to, I can assume that, yes, sir.

11 Q You indicated that that may have been good industrial
12 hygiene practice not to have tested for vinyl chloride
13 during that six-year time frame?

14 A I might have been.

15 Q Why?

16 A In the processes of manufacturing these products,
17 many chemicals are used in great quantities far
18 exceeding that of vinyl chloride, like materials and
19 solvents that cause acute and rapid effects. If
20 these are controlled or were controlled, and I assume
21 that they may well have been controlled, then the
22 judgment of the industrial hygienist or the physician
23 in charge of the program would feel comfortable with
24 that in controlling the top-most irritative or toxic
25 materials would include the lesser and least dangerous

1 materials as well.

2 I can't very well go into a plant and say,
3 "test for everything, 400 substances." "I know you
4 are using 50 in this process, let's check out the most
5 troublesome areas first, and if these are under control,
6 fine."

7 Q What about chemicals that are used in a facility that
8 contain known or suspected carcinogens; is it good
9 industrial hygiene practice to test for the levels
10 of those known or suspected carcinogens?

11 A Yes. But I must back off to qualify my answer.
12 One would have to know the precise amount of the
13 substance present in that particular compound or mixture
14 first of all.

15 Q And where would one get that information, if you were
16 Chrysler? From the manufacturer of the product?

17 A If I were at that time with Chrysler, the first step
18 is to get the material safety data sheet from the
19 manufacturer, the provider of the product.

20 Q And you, in fact, in 19--

21 A But wait. I haven't finished. That material safety
22 data sheet may not be as thorough as I would have
23 wished at the time, because a supplier may not have been
24 the manufacturer, so I would go further and ask for the
25 manufacturer to give me the material safety data sheets

1 for all the ingredients put into those products, and
2 then I would have store analyses of the quantification
3 of the materials present.

4 This could involve one's own internal
5 laboratory in the research department, the quality
6 control laboratory, or to send a sample to an accredited
7 lab at a hospital or at a private laboratory and so
8 forth, and even ask the government people to use their
9 own laboratory for these tests.

10 These are the results I would then look at,
11 not singly, but there may be half a dozen of such data
12 sheets that I would be interested in.

13 I would order my own analyses and decide
14 what steps to take from there.

15 Q I want to put you in the shoes now, if I may, of an
16 occupational health physician or an industrial hygien-
17 ist at Chrysler between 1968 and the public announcement
18 of the Goodrich angiosarcoma deaths in early 1974.

19 Why during that '68 to '74 time frame would
20 you be requesting material safety data sheets from your
21 suppliers?

22 A I have a privilege of amplifying my answer, and I'll do
23 just that. I was the only physician present for the
24 NIOSH Consulting and Review Committee, which formulated
25 the material safety data sheets, so I was one of the

1 founders of that particular systematic process.

2 Q I understand that from your resume.

3 A Thank you. So I have a keen interest in good material
4 safety data sheets, and I know what needs to be done
5 to produce a good MSDS. I hope this helps in my
6 forthcoming answer.

7
8 Nevertheless, I do and would have relied
9 on laboratory data of direct analyses quantification of
10 a lab test, and I would request external verification
11 as I always have in the past from one or more labora-
12 tories.

13 Q What information does a material safety data sheet give
14 the recipient with regard to the hazards, health
15 hazards associated with the product that it refers to?

16 A Unfortunately, the worst scenario. We'd never
17 anticipated that.

18 Q What did you anticipate?

19 A I had anticipated an even-handed neutral report with
20 ample references and documentation to back up any
21 statements produced on these data sheets, good human
22 responses, good industrial hygiene responses to be
23 attached.

24 Unfortunately, and I must say this in
25 front of two attorneys who are dealing with these
matters nowadays, the material safety data sheets now

1 or for many years have had to state worst case obser-
2 vations, worst possibilities, and these are dictated
3 by corporate lawyers rather than scientific and even-
4 handed reports.

5 Q You were involved in 1975 as a consultant reviewing
6 the NIOSH criteria documents for the MSDS?

7 A Right.

8 Q Was it the intended purpose of the MSDS to make the
9 recipient of that document a full disclosure concerning
10 the potential health ramifications of exposure to the
11 product?

12 A Of course. Excuse me. It was before '74. That
13 involved over 456 compounds listed by the ACGIH,
14 and I probably reviewed one-third of those personally,
15 and I believe that period of time was in the early
16 '70's. I can't be precise as to the year, perhaps
17 '71, '72 through '74, '75.

18 Q Do you recall whether you reviewed vinyl chloride?

19 A I can't recall the specific materials, no.

20 Q Have you been provided by Mr. Bunda with any MSDS
21 authored by any PVC manufacturer prior to the public
22 announcement of the Goodrich angiosarcoma deaths?

23 A I havenot.

24 Q Have you ever seen any MSDS for any PVC resin published
25 prior to February of 1974?

1 A Widespread use of these data sheets didn't really take
2 place until after those dates in the mid to later
3 '70's, if I recall correctly. No, I was not.

4 Q Is it the responsibility of a manufacturer of a
5 chemical to disclose any of the material safety data
6 sheets, any of the hazardous components of that mater-
7 ial?

8 A Yes, it is.

9 Q Do you regard vinyl chloride as a hazardous material?

10 MR. BUNDA: You're talking about today?

11 MR. DELLI BOVI: Yes, today.

12 MR. BUNDA: Or 1974?

13 MR. DELLI BOVI: Let's talk about 1974.

14 MR. BUNDA: Well, you've got two questions.

15 Which do you want to talk about?

16 BY MR. DELLI BOVI:

17 Q Let's talk about 1974. In 1974, did you regard vinyl
18 chloride as hazardous material?

19 A If you tell me the concentrations and durations of
20 exposure, I can answer that.

21 Q Did you regard vinyl chloride in 1974 as a carcinogen?

22 A Yes. But that was based on heavy work exposures for
23 a long period, many years of high concentrations in
24 the thousands of parts per million.

25 Q If a manufacturer's product contains a known carcinogen

1 in measurable quantity, is the manufacturer obligated
2 in your opinion to disclose the existence of that
3 carcinogenic component in its MSDS?

4 A I'll try to answer that question based on the
5 present actions in the USA. I believe the concentra-
6 tion would have to be based on the suspect carcinogen
7 and the concentration of that substance or the amount
8 in that particular material, its component.

9 You may know the law better than I do.
10 It may be under one percent, if I recall, a mention
11 may have to be made on that material. But if we take
12 our children's plastic Lego toys or our grandchildren's
13 Lego toys, the components there individually would be
14 considered extremely dangerous.

15 Q What components?

16 A Butadiene, extirene (phonetic), to say nothing of the
17 lanolin dyes or other inorganic dyestuffs to color
18 these toys. And they are made by the billions each
19 year, and millions of children are playing with these
20 every day, every moment.

21 We couldn't very well say that these toys
22 contain such and such chemicals to produce these
23 beautiful colors and beautiful products. It would
24 scare the pants off everybody. No. You can't put
25 this down every substance, because it's no consequence

1 The process of manufacturing may eliminate the
2 potential for any exposure.

3 Like this table top, for example, is a
4 styrene compound. It's harmless.

5 Q Have you seen any MSDS for any PVC resin published
6 after February of 1974?

7 A Probably, yes.

8 Q And did those MSDS published after February of 1974
9 that you've seen disclose the existence of residual
10 vinyl chloride monomer in the resin?

11 A Yes. They should have mentioned that.

12 Q Are you aware today of any documents published by
13 Goodyear, Conoco, Tenneco, Firestone, Union Carbide,
14 Uniroyal, or Diamond Shamrock disclosing to any of
15 its PVC resin customers prior to 1974 that the resin
16 contained inreacted vinyl chloride monomer?

17 A The reason I hesitate to answer you immediately and
18 so positively is that in reviewing material safety
19 data sheets, and I see these frequently, I may only
20 make a cursory glance at its source, for example,
21 whether it's Union Carbide or Occidental or Shell,
22 whatever it may be. And this does not stick in one's
23 memory, so I can't answer that. I don't know.

24 Q Let me ask it another way then. Are you aware of any
25 MSDS published by any PVC resin manufacturer prior to

1 February of 1974 disclosing that its resin contained
2 unreacted vinyl chloride monomer?

3 A I can't answer that. I don't recall that.

4 Q When were you first aware of any studies in animals
5 reporting the development of cancers following exposure
6 to vinyl chloride?

7 A I believe it would be when I heard of the forthcoming
8 publication by Johnson and Kretch (phonetic) on the
9 angiosarcoma cases which may have been in '74, '75,
10 something on that order.

11 Q How did you find out about that before their work was
12 published?

13 A I was on the editorial board of the Journal and, of
14 course, we had periodic meetings of the editorial
15 Journal Board of Occupational Medicine, and I also knew
16 Dr. Johnson personally.

17 Q How long were you on the editorial board of the Journal
18 of Occupational Medicine?

19 A At least ten years.

20 Q Prior to 1974?

21 A Yes. At least until '78 or '79.

22 Q So you had been on that board since the mid to late
23 1960's?

24 A Yes, sir.

25 Q And at no time prior to your communication with

1 Johnson, which occurred shortly prior to the publica-
2 tion of his article in JOM, were you aware of any
3 reports concerning the development of cancers in
4 animals exposed to vinyl chloride?

5 A I was not at the time.

6 Q So the first thing you knew as an editor of the Journal
7 of Occupational Medicine about the potential carcino-
8 genicity of vinyl chloride was Johnson's communication
9 regarding his findings concerning angiosarcomas among
10 the Goodrich work force?

11 A Yes, sir.

12 Q Do you know as you sit here today whether or not the
13 PVC resin industry, prior to Johnson's communication
14 to you was, in fact, aware of animal experimentation
15 revealing the generation of cancers in animals exposed
16 to vinyl chloride?

17 A Yes, sir.

18 (Pending question read.)

19 Q What do you know about that?

20 A Immediately his report generated extreme interest.
21 and the literature searches were made and documents
22 were copied from journals and so forth.

23 Q And what did that reveal to you concerning the knowledge
24 that the PVC industry had prior to 1974 concerning
25 animal studies and vinyl chloride carcinogenicity?

1 A The industry as such had periodic meetings about many
2 matters, including this one I'm sure, for national
3 organizations. They probably had information
4 available published in the literature and oral
5 communication and so forth and the scientific meetings,
6 which may or may not have been published in transactions
7 later on, and of course, we all would have access to
8 that.

9 The interested industry representatives
10 would probably have access to some of the documents
11 perhaps a bit earlier than I would have had in some
12 instances. For example, when Viola made a report on
13 his animal study in Tokyo, I attended a congress.

14 I was the first to do human experimenta-
15 tion, and I presented that, but at that time I had no
16 interest in listening to his dissertation in rat
17 exposures. This would not a problem for six months to
18 a year later for general scientific dissemination.

19 Q So you were at the conference in Tokyo in '69?

20 A That was the National Congress of Occupational Health.

21 Q Occupational Health Congress?

22 A Right.

23 Q In 1969, July?

24 A September.

25 Q Where Viola presented the results of his experimentation

1 with rats in which he demonstrated the development of
2 cancer following exposure of vinyl chloride?

3 A Yes, sir.

4 Q Did you attend his presentation?

5 A I did not. I don't recall that at all.

6 Q Did you receive a copy of any written report of his
7 presentation?

8 A Not directly. I purchased several copies of the
9 complete transactions, including my own.

10 Q Do you still have those?

11 A I do.

12 Q Do you have a copy of that portion of that document
13 you purchased that relates to Viola's presentation?

14 A I would think so, but I would have to check the book
15 and the reference index.

16 Q Have you furnished a copy of that Viola presentation
17 to Mr. Bunda?

18 A I have not.

19 Q Would you kindly check for me either today or tomorrow
20 and see if you can find that reference, and if you
21 would forward a copy to Mr. Bunda--

22 MR. BUNDA: No, no. Wait a minute. You can
23 ask him questions here. We've gone through this whole
24 case and there have been question of witnesses to
25 present things. I've lost track of them quite frankly,

1 and I'd ask you to do a formal Request for them so
2 that that way it's on the record, and we can establish
3 what's record and what's not to be produced subsequent
4 to the deposition. I don't want to be accused later
5 of not producing something that I've simply forgotten
6 or not determined that we have to make a presentation,
7 because I haven't reviewed the deposition transcript.

8 MR. DELLI BOVI: I'll be glad to do it by
9 a formal Request. I just want to make sure Dr. Zenz
10 is agreeable to do that. I would be glad to pay you
11 for your time and photocopying expenses in collecting
12 that and transmitting it to Mr. Bunda.

13 MR. BUNDA: I don't think we have a problem.

14 BY MR. DELLI BOVI:

15 Q I'm just asking you because I've not been able to get
16 it from my other sources.

17 A I'm surprised, because of the beautiful Japanese
18 publication, they did an extremely fine job compared
19 to other country's reporting proceedings. I can get
20 that. I can see it on the shelf.

21 Please understand that during a conference
22 of this sort, there may be hundreds of papers presented,
23 and there are many interesting things to do and people
24 to meet, and it's impossible to cover all topics.

25 Q When did you first see a copy of Dr. Viola's article

1 that appeared in 1970 in March in Medicina De La Vora,
2 and I'll hand you a copy of that, a translation of that,
3 if you would like to take a look at that.

4 A I have a copy of this, and it was given to me by Mr.
5 Bunda. However, I was aware of this publication long
6 before I knew of Chrysler or you folks.

7 Q Were you aware of that publication prior to Johnson's
8 communication to you concerning the angiosarcoma deaths?

9 A You mean the Journal of Occupational Medicine form
10 report?

11 Q Yes, sir.

12 A No, I was not.

13 Q When were you first aware of the presentation that Dr.
14 Viola made to the International Cancer Congress in
15 Houston in May of 1970, and I'll hand you a document
16 that relates to that presentation?

17 A I'd like to clarify my answer. Probably in '73 or '74,
18 because at that time I was preparing a chapter for the
19 textbooks of Occupational Medicine on vinyl chloride,
20 and I probably submitted that chapter to the publisher
21 in '74, so it's sometime in '74, and I did have almost
22 all these references available to me.

23 Q Did you begin work on that publication prior to or
24 following Johnson's communication to you?

25 A That's a close one. Probably before, and of course,

1 when this was formally published in the literature,
2 I recall adding it to the chapter post haste.

3
4 Q What was your initial reason for preparing the chapter
5 on vinyl chloride?

6 A I was preparing the chapter on the occupational health
7 aspects of toxics in rubber manufacturing, and this
8 would have been one of the subjects included.

9 Q Was that study or that paper sponsored by anyone?

10 A Well, just a publisher, of course, medical text
11 publisher.

12 Q And were you aware when you started -- Were you not
13 aware when you started that work of the reports of
14 carcinogenicity in either humans or animals exposed
15 to vinyl chloride?

16 A That book contained thousands of references, and I
17 have copies of most of them, so I can't answer you.

18 I may have included some of these even
19 before the Johnson and Kretch report came out, as a
20 matter of complete necessity, for the sake of complete
21 necessity.

22 Q When were you first aware of the article published by
23 Viola in cancer research in 1971 entitled, "Oncogenic
24 Response of Rat Skin, Lungs, and Bones to Vinyl
25 Chloride"?

A It might have been in 1973, because at that I was

1 actively engaged in producing this textbook. Because
2 of the lead time required by the publisher to put
3 out a book at a certain date meant that I had to
4 prepare things in advance.

5 All of the contributors had to do that, so
6 it was in '73 and no more than '74.

7 Q Do you know whether it was before or after your
8 communications with Johnson?

9 A I can't be sure of that.

10 Q Did you regard Dr. Viola's presentation at the
11 International Congress on occupational health in 1969
12 as an important presentation?

13 MR. BUNDA: I'm going to object to that,
14 because I think he's already testified he doesn't
15 recall being there when the presentation was made.
16 Nevertheless, you can answer.

17 A I was not present at the conference.

18 BY MR. DELLI BOVI:

19 Q Did you read his paper?

20 A Well, perhaps some years later.

21 Q Do you have any recollection of reading Viola's paper
22 that was given at the 1969 conference in Tokyo prior
23 to 1973 or 1974 when you began work on that book
24 chapter?

25 A I can say with some certainty that I probably read

1 excerpts or abstracts. One would need to do that to
2 make certain the reference was worthy of including in
3 the chapter of a text.

4 Q Do you recall whether or not following your review of
5 Viola's presentation at the 1969 International
6 Congress on Occupational Health you regarded that
7 paper as an important one?

8 A Probably not.

9 Q What about his 1979 publication in Medicina De La
10 Vora?

11 A '79?

12 Q '70. I'm sorry.

13 MR. BUNDA: Well again, I'm not sure that
14 we've established that he read that publication, so I
15 think there's a lack of foundation.

16 BY MR. DELLI BOVI:

17 Q Well, have you read it?

18 A I glanced through it, of course. His studies, of
19 course, dealt with animals, rats, and so on, and
20 naturally we look at these things but they are not
21 high on my occupational health priority list. And
22 the animal experiments, these were done by the
23 thousands all over the world with thousands of
24 substances, and let me say this, that the smaller the
25 species of animal, the greater chance of finding

1 tumors without finding exposure to anything, just
2 during their natural short lifetimes.

3 Q Are you aware of the incidence of naturally occurring
4 cancers in rats?

5 A Not specifically, no.

6 Q What about Dr. Viola's presentation at the International
7 Cancer Congress in Houston in 1970, have you reviewed
8 that paper prior to today?

9 A Yes. I have reviewed that in the past months.

10 Q Do you recall reviewing either that presentation or
11 the Medicina De La Vora article in 1973 or 1974,
12 when you were working on that book chapter?

13 A I could better answer if I had the book in front of me.
14 I recall the Viola reference alphabetically, but I
15 can't say more than that.

16 Q Did you regard Viola's presentation in Houston after
17 you read it as an important presentation?

18 MR. BUNDA: You mean after he read it a
19 couple months ago?

20 BY MR. DELLI BOVI:

21 Q When you first read it?

22 A I can't answer that.

23 Q What about his publication in cancer research in 1971,
24 did you regard that as an important publication, an
25 important article?

1 A I would have to say that nearly all articles published
2 in that esteemed journal should be regarded with some
3 great value.

4 Q Why? And I want to focus specifically on Viola's
5 article. Why was that article, when it was published
6 in 1971, important?

7 MR. BUNDA: Well, I don't think that's what he
8 testified to. Let's back up for a second.

9 A If you want me to give a review of a paper, I could do
10 that, but this report is based to a large extent on his
11 earlier reports as many papers are. It's still with
12 rats. Heavy exposures-- Heavy exposures again.
13 Please rephrase your question, sir.

14 BY MR. DELLI BOVI:

15 Q Do you know who sponsored Dr. Viola's work?

16 A No. I would assume his institute bore his salary
17 and so forth and expenses.

18 Q Do you know whether his research dealing with vinyl
19 chloride exposure to rats was sponsored by the
20 European PVC industry?

21 A I couldn't be sure of that.

22 Q Have you reviewed prior to today Dr. Dahl's testimony?

23 A Yes, sir.

24 (Short recess taken.)

25 BY MR. DELLI BOVI:

1 Q Dr. Zenz, my question before the break was whether or
2 not you regarded Dr. Viola's 1971 article in cancer
3 research after you read it as an important article.

4 MR. BUNDA: I'm going to object to the question.
5 I don't think there's a foundation laid as to exactly
6 when he read it, and I guess my objection also goes to
7 the point in time. Did he consider it important when
8 he read it in view of everything else he knew, or did
9 he consider it important when it first came out in 1971,
10 looking for hindsight.

11 A Could we temporarily go off the record?

12 (Discussion off the record.)

13 A Assuming that I did review a summary and abstract or
14 excerpts of the Viola publication on animal experimenta-
15 tion, I probably considered it of importance, yes.

16 BY MR. DELLI BOVI:

17 Q But --

18 A But more so from the animal results that I could then
19 extrapolate to man. That was my concern throughout
20 my career as to the validity of animals transposed to
21 a worker, a human.

22 Q Obviously you can't do the exposure studies on humans
23 in terms of what Viola did. You can't put humans in
24 a chemical chamber exposing them to 30 parts per
25 million of PVC and see whether or not humans get cancer.

1 A It's an animal statistic level naturally.

2 Q So one of the tools that researchers use to determine
3 the potential carcinogenicity of chemicals in man is
4 to do animal research, correct?

5 A Certainly, with this admonition: I prefer to see
6 studies for occupational purposes done with animals
7 as large as possible, and that would include the
8 primates, which would include then dogs, young and
9 large adults, monkeys, all the way up and including
10 baboons, if available.

11 Q Are you aware of any study sponsored by any U.S. PVC
12 resin manufacturer or any trade association of U.S.
13 PVC manufacturers dealing with the exposure of any
14 animals to vinyl chloride?

15 A I'll have to clarify my response to your question in
16 this manner: In reading a paper of any type, which
17 includes some of my publications, often an acknowledg-
18 ment footnote is present either in the beginning of
19 the first page or at the end of the text matter for
20 the references. We would say this study was supported
21 in part by the St. Luke's Hospital Research Foundation,
22 this study was supported in part by the American
23 Cancer Society or the Red Cross.

24 But, again, when I read these reports and
25 put them into my mental memory bank, we tend not to put

1 that portion of the report in one's mind, so I'm not
2 aware of the sponsorship of many of the scientific
3 reports published in the literature.

4 It may have been a cursory glance where it was
5 presented or sponsored in part or all of it, and this
6 is my explanation to your question.

7 Q Let me ask the question then, Doctor, in a broader
8 context. Other than the studies done by Viola and
9 Maltoni and prior to 1974, are you aware of any
10 studies conducted anywhere in North America in which
11 rats or other animals were exposed to vinyl chloride
12 in an attempt to determine whether or not the material
13 was carcinogenic?

14 A I've refreshed myself. Yes. I was aware of these
15 studies, and prominently among these would be one of
16 my friends who is probably still with Dow Chemical as
17 their chief toxicologist.

18 They did many animal, and listing refer-
19 ences of these documents you've given me and others
20 that I've seen, his animal experimentations stand out
21 prominently. So yes, I was aware, but not in great
22 detail or for your purposes today.

23 Q I'd like to read you a question and answer from Dr.
24 Dahl's deposition, and ask you if you agree with his
25 answer to the question:

1 MR. BUNDA: I'm going to object to this on the
2 grounds that it's irrelevant and improper. First of
3 all, I'm also going to object on the basis that it's
4 a vague question. Are you asking him whether he's
5 agreeing that you read the question correctly?

6 MR. DELLI BOVI: No. I'm asking whether or not
7 he agrees with the answer Dr. Dahl gave to the question.

8 BY MR. DELLI BOVI:

9 Q "Q Do you regard those documents, Dr. Dahl,
10 and that refers to these three Viola papers
11 that you have before you, as documents
12 calling into serious question the
13 carcinogenicity of vinyl chloride?

14 A I regard the one in 1971 in cancer research
15 as so doing. The others I regard as
16 preliminary reports, and I think one would
17 be unwise to draw any conclusions, any
18 important conclusions from them, but the
19 paper in 1971 by Viola, Maltoni, and Kaputa
20 is certainly an important paper to which
21 attention should be made."

22 Do you agree with Dr. Dahl's assessment of Dr. Viola's
23 1971 article?

24 A I can hardly disagree. He's the world's most prominent
25 epidemiologist in the field, and I've listened to his

1 lectures, and I know of him. He's the foremost
2 epidemiologist in the broad sense.

3 I'm not certain what experience he has in the
4 occupational medical sense directly. He probably has
5 reviewed more papers than I have on tumors, cancers.
6 I would have to go along with his assessment, of course.

7 Q Is there any testimony that you recall reading in
8 Dr. Dahl's deposition with which you disagree?

9 MR. BUNDA: Again, I'm going to object.
10 Dr. Dahl's deposition took over three hours. If you
11 want to point him to a specific passage, I think
12 that's perfectly reasonable, but to ask him to agree
13 with the entire deposition, I think is unfair.

14 BY MR. DELLI BOVI:

15 Q All right. Would you prefer that I do it that way,
16 Dr. Zenz?

17 A If I have a choice, of course, I'd insist that you
18 would, please.

19 Q Do you recall Dr. Dahl testifying -- and this is Page
20 107 of his deposition. I'll be glad to give you that
21 reference if you would like.

22 A I may have to refer to it because it took me over
23 three hours to go through it, and I can't recall all
24 the numerical sequences of the questions and answers.
25 If I may say so, this is a complete seminar on

1 epidemiology.

2 MR. DELLI BOVI: I move to strike the answer
3 as non-responsive.
4

5 BY MR. DELLI BOVI:

6 Q The testimony on Page 107, beginning at Line 7:

7 "A The working rule is to assume that there is
8 an effect proportional to dose down to vanish-
9 ingly low levels, given that the material is
10 a mutagen. If it is not a mutagen, then my
11 working rule would be that is probably not the
12 case and there would be a threshold below
13 which it had no effect."

14 Q Vinyl chloride is a mutagen?

15 A Yes.

16 Q Therefore, your working rule is what?

17 A My working rule is that you would assume there
18 was an effect proportional to dose down to
19 vanishingly small levels, a vanishingly small
20 effect, but an effect."

21 Do you agree with Dr. Dahl's testimony in that regard?

22 MR. BUNDA: I'm going to object to the question
23 because it unfairly characterizes Dr. Dahl's opinion
24 on this. If you were to show him on Page 106 where
25 the question was asked about whether he has an opinion,
I think you also have to read to Dr. Zenz the fact

1 that Dr. Dahl indicated that he does not have an
2 opinion, and he wished he could. Rather, he has a
3 working rule that he goes on until he gets additional
4 information which permits him to form an opinion.

5 So Dr. Zenz, why don't you read 106 in conjunc-
6 tion with 107. I think that will more fairly character-
7 ize it.

8 A On through the question to Dr. Dahl was:

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

13 A That is something that I wish I could answer.
14 I really have not got an opinion on that.
15 In cancer research, we work on the assumption
16 that unless there are strong reasons otherwise,
17 we postulate that an effect is produced
18 proportional to dose down to vanishingly
19 small levels.

20 Whether this is so or not is a matter of
21 great debate, and which we really have no firm
22 scientific evidence one way or another. We
23 act on the assumption in the same way as we
24 are acting on the assumption now that other
25 people's tobacco smoke in a room will cause a

1 risk to all the people who are not smoking.
2 But the scientific proof that this is so is
3 such that I really have not got an opinion.
4 I have a working rule, but not an opinion."

5 BY MR. DELLI BOVI:

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

10 A I certainly do. This is true for most substances
11 used known to man, including ionizing radiation, and
12 I can't argue with Professor Dahl. He's the most
13 eminent authority.

14 My only puzzlement with his expression is the
15 vanishingly small levels for man so precise that it
16 struck me as rather odd, but to me, that would be
17 parts per billion I would assume he's discussing.

18 Q So it's your testimony today that at least at levels
19 above parts per billion--

20 A I'm sorry. Parts per million, correct, parts per
21 million. Not for any specific material, however.

22 Q Let's talk about vinyl chloride. Is it your opinion
23 that there is a safe level of exposure to vinyl
24 chloride at which no potential carcinogenic effects
25 will occur?