MEETING

OF THE

SCIENTIFIC REVIEW PANEL ON TOXIC AIR CONTAMINANTS

CALIFORNIA AIR RESOURCES BOARD

SOUTH SAN FRANCISCO CONFERENCE CENTER

255 SOUTH AIRPORT BOULEVARD

SOUTH SAN FRANCISCO, CALIFORNIA

WEDNESDAY, APRIL 22, 1998

9:00 A.M.

Janet H. Nicol
Certified Shorthand Reporter
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APPEARANCES

MEMBERS PRESENT:

Dr. John Froines, Chairman
Dr. Paul D. Blanc
Dr. Craig Byus
Dr. Gary Friedman
Dr. Anthony Fucaloro
Dr. Stanley Glantz
Dr. Peter S. Kennedy
Dr. Hanspeter Witschi

REPRESENTING THE CALIFORNIA AIR RESOURCES BOARD:

Mr. Manjit Ahuja
Mr. Donald Ames, Assistant Chief
Mr. Robert Krieger, Associate Air Pollution Specialist
Dr. Michael Lipsett
Mr. Peter Mathews, Office of the Ombudsman
Mr. Kirk Oliver, Staff Counsel
Mr. Ralph Propper
Ms. Genevieve Shiroma, Chief, AQMB

REPRESENTING THE OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT:

Dr. George Alexeeff, Chief, Air Toxicology & Epidemiology
Dr. John Budroe, Staff Toxicologist
Dr. Stanley Dawson, Staff Toxicologist
Dr. Melanie Marty, Senior Toxicologist

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P R O C E E D I N G S

ACTING CHAIRMAN FROINES: I'd like to call the meeting to order. I think we have a long day ahead of us and the sooner we get started, the better.

I should say that we have one logistical issue to deal with, and that is that I think it's important for all the panel members to be able to attend the discussion.

And as you can see and know, Jim Seiber was not able to be with us because he's in the Netherlands.

But we have one further conflict, which is that Paul Blanc has to go up to UC San Francisco to give a talk at noon.

So I would propose that we take a lunch break at 11:45. Paul can get up to San Francisco, his talk runs until 12:30, and he promises that he'll be back by 1:00 under pain of death and burning.

So if that's okay with everybody else, we can do that.

Bill, is that okay with you?

I think that given the logistics of lunch, that might make sense anyway. So 11:45 to 1:00 will be our break.

So we'll try and go as far as possible this morning. Although Genevieve and George have said that they have a fairly extended period of description of most recent

events.

And so I think that without my taking time to make any other comments, we all are deluged with loads of material, and the one thing I will say is that you do have draft findings which I put together, and I wanted to make everybody on the panel aware that I tried to make those findings very simple. I tried to make those findings by and large reasonably straightforward in the hopes that the panel would then make subsequent modifications.

So I wasn't trying to write anything like a final draft at all. I was simply trying to put something together that we would have to work from. So please take that as a draft in process.

DR. BLANC: John, is this on? Can people hear me? How about now?

Well, John, I'll talk loudly.

Could you map out for us what, in broad terms, what the agenda is today? Because appropre of your comment on the draft findings, what I would suggest is that after whatever initial presentation the staff has for us that we actually use your very useful draft as a kind of template or guideline for how we can structure our discussion, because I found that your draft was so useful that I can just see going through it point by point and coming to closure as a group on each of the various subparts of it as a way of

organizing our discussion, if that would be acceptable to the other panel members.

ACTING CHAIRMAN FROINES: For those that are confused, since I developed two drafts, you need to know what he's talking about. He's talking about the draft where I went through some of the definitional issues.

DR. BLANC: No. I actually mean the draft of your findings.

DR. FUCALORO: He's talking about the 22 points.

DR. BLANC: I would just go through the 22 points. I think we can refer to the other memo as needed when we come to questions of definitions and what our charge is, but I just found your draft findings so useful that it would probably be a good way to structure our focus discussion.

ACTING CHAIRMAN FROINES: Well, I think that that's an interesting suggestion.

Normally what's happened in the past is that after the presentation is made by staff of our ARB and OEHHA and during that time there are always questions that can be raised of the staff during their presentations, but then in a sense it reverts to the panel itself.

Normally what we have done is say under Part A Tony will be the lead replacing Jim Seiber for this meeting and what Tony would then do is make any comments that he chooses to make and then he would then ask for comments from

panel members around the room.

If you're suggesting that rather than go around the room, we go through the document on Part A during that time, that's another way of doing it. So we should decide that pretty quickly.

DR. BLANC: Well, that's why I bring it up right at the start, because I think it would sort of guarantee that at the end of the day we had given a balanced amount of time and had a draft, a modified draft document, that would be our product at the end of the day.

But I guess I would ask Tony if you would feel comfortable with the first half if, let's say, the first ten points for example address some of the key areas of the salient features of that part of the document and then you actually reviewed the -- or coordinated the discussion on the health, so I would assume that the points 11 through 22 or the 11 through 19 or so of your draft document would, you know, since you formulated it that way.

ACTING CHAIRMAN FROINES: If we did that, what that then means is that we go through and say Stan has a point that's not in the document that he can raise that at an appropriate time.

DR. BLANC: Yeah.

DR. FUCALORO: Since you have more experience in these sort of things I'll do whatever you wish. I can

handle it either way.

ACTING CHAIRMAN FROINES: What do others feel?

DR. GLANTZ: I actually think that's a good idea because often the findings get kind of rushed at the end of the meeting, and this way we would focus on the findings.

And, I mean, I think, though, there are -- I do have a few comments on the actual document, the report, that I think we would want to have.

I think what we maybe ought to do is follow Paul's suggestion. Probably in the context of that discussion there will be some changes to the report brought up, but then after we've done that, to just go through the report with anything anybody hasn't talked about to make sure that because we are approving the report too, and as well as issuing the findings, so we want to make sure everybody is happy with the report.

I think it's a good idea, actually.

ACTING CHAIRMAN FROINES: Peter -- probably shouldn't have put Peter and Hanspeter next to each other, because every time we turn that way, one or the other is going to answer.

Well, that seems, unless there's dramatic disagreement, it seems to me we're going to go that way. I think it will work fine. It will help, if -- this is such an immense document what we need to do is to try to organize

how we approach it so we can systematically get through in a reasonable period of time with significant depth to the discussion. I think that's important that we have the level of depth that's required for making the determination.

So having worked on these internal matters, Genevieve, if you could introduce yourself and others.

And so that -- everybody does have the staff -- the two documents that I prepared, right?

DR. GLANTZ: One document?

ACTING CHAIRMAN FROINES: One was the definitional one and one was the findings.

DR. GLANTZ: Is the definitional one this e-mail?

ACTING CHAIRMAN FROINES: Yes.

And we will also be making available to you this morning two other documents that I received this morning. They are both from the National Institute for Occupational Safety and Health, and they both represent new risk assessments that have been conducted by NIOSH and are going to be published in the July issue of the American Journal of Industrial Medicine. So we'll have that as another risk assessment approach, and I'll get Peter to work on that.

I don't think there's any other -- everybody has the Allan Smith document, because that was in the comments, I believe. And that's a very nice document and I hope we have it as some discussion point, because anything that

helps simplify any of these discussions I think is to our advantage.

So anyway, Genevieve.

MS. SHIROMA: Thank you. Good morning, Dr. Froines and members of the panel. My name is Genevieve Shiroma. I am chief of the Air Quality Measures Branch at the Air Resources Board.

My branch is responsible for implementing the toxic air contaminants identification program, specifically the exposure portion.

With me is Robert Krieger of my staff, who is lead on the exposure assessment for diesel exhaust.

In accordance with AB 1807, toxic air contaminate statutes, we are here today to seek, along with the staff of the Office of Environmental Health Hazard Assessment, to seek your approval of the February 1998 draft report proposed identification of diesel exhaust as a toxic air contaminant.

We will present an overview of the report, summarize the public comments received and we will also be proposing a number of revisions to the report for your assessment.

Now, this is an outline of today's presentation. I'll start out with a short introduction, and then we'll move on to an overview of the report.

Robert will give a short overview of the Part A exposure assessment.

Dr. George Alexeeff, with the OEHHA, will present the overview of the Part B health risk assessment.

Now, following that, Robert will then summarize the comments that we received on Part A and our proposed revisions.

Then Dr. Melanie Marty with OEHHA will summarize the Part B comments and present proposed revisions.

Now, as you know, we have a comprehensive -- we have a comprehensive air toxics program in California. The toxic air contaminant program was established by AB 1807 in 1983. The program is a two-phased program.

ACTING CHAIRMAN FROINES: Can I interrupt you before we start?

MS. SHIROMA: Yes, you may.

ACTING CHAIRMAN FROINES: Because when you went through all that, a little signal went off in my ear. And this reflects to George and Melanie.

The panel has had the benefit of reading the responses to the comments and so hopefully you can keep, you can address the most important comments in a reasonably efficient fashion, because I think that the panel needs to have a lot of time to discuss these things and so -- and the panel is very active and so the -- we should try and keep

the time for -- to go over things that people have already hopefully read to some minimum and if there's ever any question, the panel can reraise issues, the panel is not precluded, but I think we also need to make sure we move along at a reasonable pace.

MS. SHIROMA: That's fine. We'll keep it succinct and brief.

Again, just for an overview on the program, I have the definition of a toxic air contaminant up on the screen.

The program is a two-phased program.

A toxic air contaminant is defined in the law as an air pollutant which may cause or contribute to an increase in mortality or in serious illness or which may pose a present or potential hazard to human health.

The first phase of the program is the risk assessment or the identification phase.

The second phase is the risk management phase where the need for an appropriate degree of control of a toxic air contaminant is assessed.

As you know, we are in the first phase, the identification of diesel exhaust as a toxic air contaminant.

Now, for the benefit particularly of the new SRP, the newer SRP members, we thought at this point we'd have Kirk Oliver with our office of legal affairs, just briefly describe each of our responsibilities under the statute.

Now, Kirk has been delayed in traffic, and so I will just briefly go over the items that he wanted to outline for you and then he will be here eventually. If you have questions, he'll be here to answer questions.

ACTING CHAIRMAN FROINES: I just want to make one comment, that that definition I made available to the panel. I left one piece out. I just want to read it so that everybody has it in the back of their mind.

And that is it's section E under 39650. It says that while absolute and undisputed scientific evidence may not be available to determine the exact nature and extent of risk from toxic air contaminants, it is necessary to take action to protect public health.

I think that needs to be seen within the context of the definition as well.

DR. GLANTZ: Genevieve, if Kirk will ultimately get here, why don't you get on with the science and he can talk about the law when he gets here.

MS. SHIROMA: That would be fine.

One of the things that he wanted to make real clear is that the ARB indeed is responsible for the exposure part of the science, the OEHHA on the health part of the science, and that OEHHA by the statute is required to provide a range of risk.

And also to indicate whether or not there is a

threshold below which no adverse health effects are expected.

And then you, the SRP, are responsible for reviewing the report for sound science.

John, is that satisfactory with you?

ACTING CHAIRMAN FROINES: All right.

MS. SHIROMA: Okay. Then the next slide is just a list of the criteria we use for prioritization. It really is the first step of looking at entering a compound into the program. We look at things like potential risk to public health, the exposure, usage in California, persistence.

DR. FUCALORO: Excuse me. Just for clarification, this prioritization is for those substances that you currently have in the pipeline to consider, so this is the --

MS. SHIROMA: That's right. In previous meetings we've presented a list of several hundred substances that we continually prioritize.

The next one shows a flow chart of the process. Once we have selected a compound, we begin the process of producing the report. Very key part is that they're distributed for public review and comment with public workshops where interested parties can discuss the issues with both the staff and the Scientific Review Panel members.

After that we then go through looking at the

comments and revising the report accordingly.

We then submit it to you as we have.

Here is Kirk.

And go through a process of seeking your approval.

If you approve the report and you develop findings, which are then submitted to the Board, we then put out a hearing notice for a 45-day comment period, and then a Board hearing to take formal action to identify the substance.

Our Board simply determines in a regulatory format is this substance a toxic air contaminant and adds that then to the regulation.

Then at that point, the second phase, the right-hand side of the flow chart begins where the risk management phase begins where the degree of control is reassessed.

Now, the next slide shows the types of criteria we took into consideration when we entered diesel exhaust back in 1989, in that the potential for non-cancer and cancer health effects, widespread exposure in California, the International Agency for Research on Cancer designation as a probable human carcinogen, US EPA had begun its evaluation of diesel exhaust health effects and overall method of criteria for the definition of a toxic air contaminant at that time.

Now, this next slide is a chronology just showing that again since 1989 there has been an extensive effort to go through a thorough public and scientific process.

Couple of items to note.

In January of 1996 the OEHHA, the ARB, the Health Effects Institute, National Institute of Occupational Safety and Health, World Health Organization and US EPA sponsored a human health study workshop.

October of '97 the ARB and OEHHA staff provided you, the panel, with an overview of the report and the types of comments we were receiving on the May draft.

And then on February 23rd we released this report.

In March you held a meeting with invited scientists.

Overall the draft report has been through three comment periods, three public workshops, and the staff have participated in numerous individual meetings with interested stakeholders.

Now, at this point we can move on to the overview of the report.

And, again, Kirk Oliver is here for questions.

I'm going to now turn the presentation over to Robert Krieger. After Robert we'll hear from Dr. Alexeeff.

Robert is going to give you, again, a short overview of the exposure assessment portion of the report.

DR. GLANTZ: Since Kirk just showed up, do you think it would be worth him just briefly saying what he was going to say?

MS. SHIROMA: Yes, I do, actually think it would be worth it.

ACTING CHAIRMAN FROINES: No more than five minutes.

DR. GLANTZ: Yeah, briefly.

MR. OLIVER: Thank you, Dr. Glantz and Dr. Froines and members of the panel. And I apologize for being late. The traffic in this area, as you know, is very heavy, and was so today.

And I promise I can get through this in less than five minutes, so let's get going on it.

The AB 1807 identification statute is quite clear on the responsibilities of the ARB, OEHHA and the Scientific Review Panel.

Primarily the ARB is to prepare a report in a form which may serve as the basis for regulatory action regarding the formal identification of the substance.

In doing this, the ARB staff is required to consider research and monitoring data, emissions inventory data, information on estimated actual exposures to substances based on geographic and demographic data, and on data derived from analytical methods that measure the

dispersion and concentrations of substances in ambient air and in indoor environments, as well as ambient conditions.

The OEHHA staff, at the request of ARB, is required to evaluate the health effects of and prepare recommendations regarding a substance, considering all available scientific data, including but not limited to relevant data provided by the ARB, the State Department of Health Services, the Occupational and Safety and Health Division of the Department of Industrial Relations, the Department of Pesticide Regulation, international and federal health agencies, private industry, academic researchers and public health and environmental organizations.

The OEHHA evaluation must assess the availability and quality of data on health effects, including potency, mode of action and other relevant biological factors of the substance.

The OEHHA evaluation is also required to contain an estimate of the levels of exposure which may cause or contribute to adverse health effects.

Where it can be established that a threshold of adverse health effects exists, the estimate shall include both of the following factors. One, the exposure level below which no adverse health effects are anticipated; and, two, an ample margin of safety which accounts for the

variable effects that heterogeneous human populations exposed to the substance under evaluation may experience, the uncertainties associated with the applicability of the data to human beings and the completeness and quality of the information available on potential human health exposure to the substance.

However, in cases where there is no threshold of significant health effects, the OEHHA is required to determine the range of risk to humans resulting from current or anticipated exposures to the substance.

The report compiled by the ARB and contributed to by OEHHA shall be made available to the public and must be formally reviewed by you, the Scientific Review Panel.

You're required to review the scientific procedures and methods used to support the data in the report, the data itself and the conclusions and assessments on which the report is based.

Your panel is required to submit its written findings to the ARB on this report within a specified time frame.

If you, the panel, determine that the health effects report is not based upon sound scientific knowledge, methods or practices, the report shall be returned to the ARB, and the ARB with OEHHA is required to prepare revisions to the report, which have to be resubmitted to you for

re-review.

Within ten days of the receipt by the ARB of your findings that the report does meet the legal requirements, the ARB staff is required to prepare a hearing notice and propose regulations for the proposed identification of the substance under review by you.

That ends my summary of your various responsibilities.

Are there any questions you have now?

MR. KRIEGER: Thank you, Kirk.

Thank you, Genevieve.

Good morning, Dr. Froines and members of the panel.

Right now I'd like to give you a brief presentation on the Part A exposure assessment.

Our Part A was also contributed, I'd like to also note, that Part A was contributed by the other divisions within the Air Resources Board, Monitoring and Laboratory Division, the Technical Support Division, the Research Division, Mobile Source Division, and our Stationary Source Division.

I'll begin my overview of Part A with the properties of diesel exhaust.

As you know, diesel exhaust is a complex mixture of thousands of gases and fine particles emitted by internal

combustion engines.

Some of the components are known human carcinogens, like arsenic and benzene.

It also includes over 40 substances that have been identified as toxic air contaminants and by the US EPA as hazardous air pollutants. Over 90 percent of these particles are less than one micron in diameter.

This overhead shows the 40 compounds that are federal hazardous air pollutants and have been identified by the Air Resources Board as toxic air contaminants. 17 of these also have IARC, or International Agency for Research on Cancer, designations.

This slide shows the sources of emissions of diesel exhaust in California. The majority of these emissions, as you can see, come from on-road motor vehicles.

To characterize exposure to diesel exhaust, we use particulate matter concentrations. To estimate population-weighted average outdoor concentrations of diesel exhaust, PM 10, we use receptor modeling techniques which include chemical mass balance results from several studies, ambient PM 10 monitoring network data, and the 1990 emissions inventory.

From the results of this analysis, we estimated that Californians in 1990 were exposed to a population-weighted average outdoor concentration of three

micrograms per cubic meter.

We have also estimated in 1995 and future year outdoor average concentrations.

These future concentrations, important to note, take into account the measures and control measures by ARB that have been adopted to date.

In December of 1993 we conducted a study to determine near-source concentrations near a Long Beach freeway. The results indicate that near-source concentrations may be up to three times that of outdoor ambient air concentrations.

This slide gives you an indication of what other researchers have done to measure outdoor atmospheric concentrations of diesel exhaust PM.

The comparison shows well with those of other researchers.

We estimated the outdoor population-weighted concentration in a model to calculate indoor and total air exposures. This model, the California population indoor exposure model, accounts for the amount of time spent indoors and outdoors.

The model was developed under contract to ARB to improve estimates of population exposures to toxic air contaminants. The model uses relevant data, such as distributions of California building air exchange rates,

activity patterns data, and air concentrations of diesel exhaust particles as inputs to develop indoor and population exposure estimates across all environments.

The estimated average indoor exposure is in 1990 to be two micrograms per cubic meter and the average total air exposure, including outdoor and indoor, to be 2.1 micrograms per cubic meter.

We have also done the comparable analysis for the indoor and total exposure analysis for 1995 and 2010 as shown in the overhead.

Now I want to address some of the findings of the CE-CERT study, or the College of Engineering Center for Environmental Research and Technology at the University of California at Riverside.

I will provide some background on the purpose of the study and then a brief summary of the results.

To address the effects of diesel fuel composition, we have on the toxic exhaust --

ACTING CHAIRMAN FROINES: Excuse me. Is the average population-weighted average for Southern California 3.6 micrograms per cubic meter?

MR. KRIEGER: Yes, that's the outdoor average.

ACTING CHAIRMAN FROINES: What's the range?

MR. KRIEGER: The range of exposures for outdoor concentrations goes from .2 to 3.6.

ACTING CHAIRMAN FROINES: That can't be an average then.

MR. KRIEGER: That's not an average.

ACTING CHAIRMAN FROINES: What's the range? What's the distribution look like?

MR. KRIEGER: Within the South Coast?

ACTING CHAIRMAN FROINES: Yes.

MS. SHIROMA: We'll look that up.

MR. KRIEGER: We'll look that up for you.

ACTING CHAIRMAN FROINES: I'm particularly curious because of your RCL, because if you're up to 3.6 and heading towards five, you're starting to get to another number.

MR. KRIEGER: In order to make the best use of the study designed for the CE-CERT study, a technical advisor committee was formed, which included members from the Engine Manufacturers' Association, oil refiners, ARB and OEHHA staffs.

The study design designated the testing of one heavy duty diesel engine that represents the majority of the market share in California. They tested this on three fuels, the pre-1993 regulation fuel, low aromatic and an alternative formulation fuel.

The engine was tested using the US EPA's heavy-duty diesel transient federal test procedures. Multiple samples collected during multi-day testing for each

of three fuels was done.

To maximize the resources available and to address the overall goal and purpose of the study, CE-CERT met several objectives. They quantified a number of items, including the criteria pollutants as you can see; size fraction characteristics of the PM 2.5 and PM 10; carbonyl analysis; elemental and organic carbon analysis; particle and gas phase PAH and nitro-PAH, nitrosomorpholine analysis. They also determined the mutagenicity and an attempt to quantify the dioxins for methods development.

Testing was conducted from December 1996 to January 1997.

The final draft report was approved by the ARB's research screening committee on April 3rd, 1998.

The results showed that the emission reductions in both PM and NOx, oxides and nitrogen, from the use of new reformulated fuel meets ARB's predictions set forth in the 1988 diesel fuel regulation.

While the mass has been reduced, the chemical composition of the exhaust, per milligram per brake horsepower per hour, from the old and new diesel fuels are similar.

DR. FUCALORO: Excuse me. I read the CERT report and that doesn't seem to be the case. I would just look at some of the graphs, and they seem to be quite different in

certain compositions.

I can give you a page 67, for example. If you look at that, the weighted total between the pre '93, the low aromatic and the reformulated and --

DR. GLANTZ: What page?

DR. FUCALORO: Page 67. That's one. There's several others. But it seems to be some significant difference in some of the components, many of which are known to be toxins.

MR. AMES: Dr. Fucaloro, this is Don Ames, with the ARB staff.

Let me first take a shot at this.

And that is what we were attempting to do is look at the toxic air contaminants that Robert mentioned earlier. There are 40 known toxic air contaminants in diesel exhaust and one of the issues raised to us years ago by some industry representatives was the question if you would find these same toxic air contaminants in the old fuel exhaust and the new fuel exhaust or would many of them disappear?

So part of the objective of this study was to look at that fingerprint and see if the relative proportion when you account for the reduced mass from the exhaust of the new fuel, would you have the same relative proportion of those 40 toxic air contaminants.

And a general answer is, yes, although there are

some exceptions, but, yes, we largely found those toxic air contaminants to be present with the new fuel exhaust as well as the old fuel exhaust, and so that's the general answer.

But when you look at individual species you may find some slight differences, and we have some staff from our research division if you want to get into more details.

ACTING CHAIRMAN FROINES: I had a question about that, because when I looked at the data, there are some chemicals that I look at closely because I think they're so particularly dangerous, and one of them is 1,3-butadiene, which I think is the most toxic of everything, and it seems to me when I looked at it, it seems as though the 1,3-butadiene went up rather than going down, and that's an important issue.

DR. FUCALORO: It goes up from 1.8 to 2.46 milligrams per braking -- for, I don't know, BHP, what does the B stand for?

MR. KRIEGER: Brake horsepower.

DR. FUCALORO: It's units of energy, right? Power times time, right? So per joule. It goes up in that case.

Same with benzene as a matter of fact, even the low aromatic, which I don't know if that's correct, but the low aromatic fuel has a higher benzene emission than the higher aromatic fuel. Unless I'm reading this wrong.

MS. SHIROMA: I'd like to introduce Manjit Ahuja

and Ralph Propper from our Research Division, who were the contract monitors for the CE-CERT report.

MR. AHUJA: Yes. As your question is quite valid, the fuel, the low aromatic fuel is a combined fuel and it is not a commercial fuel. It is used for research purposes.

And, yes, we did find that the benzene went up and 1,3-butadiene did go up in fact quite significantly.

But if you were to go and take a basket of fuel-outs from commercial outlets, it may be different than what we have found here.

MR. AMES: One thing we'd like to point out is that when you do a toxic air contaminant weighted factor and you multiply potency times mass for each of those toxic air contaminants, we do see a benefit to the new fuel, a reduction in potential cancer risk from the exhaust relative to the brake horsepower and that's one important point for the average fuel that's out there.

DR. FUCALORO: Well, I was going to say, just look at page 74, Table 30, and in terms of a fingerprint just looking at the numbers, I think you can see that there is quite a difference in the composition of the organics that are listed in this table from the three fuels, the pre '93, I understand the low aromatic is not a fuel that's available to the public, and the reformulated blend, you can see rather significant differences.

And that's why I'm just wondering about the statement that the diesel chemical composition, and I guess you mean diesel exhaust chemical composition fingerprint is same in the old and the new. I was not clear what you mean by the new. Do you mean the low aromatic or the reformulated?

But in either case, I think that one could see that there's a difference and that can be somewhat misleading, that statement, in my view. Now, maybe I'm wrong and you can correct me if I am.

ACTING CHAIRMAN FROINES: I think that the other question that I have is on this list, some of the compounds go up and some go down. And what's missing here on this particular list are the nitro-PAHs, which I take as being some of the most important.

And also it doesn't -- isn't able to address the degree of nitrousation that could occur under conditions of atmospheric chemistry.

So I think we want to move on past the CERT thing so we may need to go back and not focus so much on detail. I think we're going to need to have some sort of the conclusory sense of what the implications are.

Clearly, I would conclude one thing and that is that a great deal of more research is needed to look at the composition of diesel fuels and their combustion products

over the next few years, and I think that that's something we probably would all agree on.

But I think what Tony and I are sort of getting at is the take-home lesson isn't entirely clear here.

DR. GLANTZ: I just wanted to clarify something.

My understanding, and I mean I'm not the chemist here, but my understanding is what you were saying and what the CERT study was saying is that the new fuels produce less total emissions, but that the distribution of different compounds within, per unit mass of emission was similar. I mean, is that -- is that what you meant?

MR. AMES: That's correct. Because we wanted --

DR. FUCALORO: I understood it that way. My statement is predicated on that understanding that the -- because this is per unit energy and the fact that distribution is dissimilar in some ways and of course it's how dissimilar is becomes perhaps their definition of what similar is different than mine.

I would think for example for 2,3,5-trimethylnaphthalene the pre '93 diesel fuel had 283 micrograms per unit energy that they do, and the low aromatic had 15. So 15 to 283 seems to be quite a different ratio, but maybe I'm reading it wrong and that's all.

I certainly don't want to hold us up.

ACTING CHAIRMAN FROINES: I have one question that

has to do with bioavailability. What's the relative particle size, aerodynamic diameters of these different fuels? Because clearly if the particles get smaller, then you have more bioavailability potentially and so you can have a greater risk rather than a lesser risk.

MR. PROPPER: We didn't find any significant difference in the particle size in these fuels.

However, when we planed the study it was before the great concern about the ultrafine particles arose. So that we only looked at larger size cuts like one micron, 2.5 micron.

I would like to add in response to Dr. Fucaloro, you're quite right, the major difference that we did see in the target analytes between the new and the old fuel was in the volatile PAHs, and this is consistent with the fact that the newer fuels contain much less volatile PAHs in the fuel.

And for the three fuels you find quite consistent correlation between the amount of PAH in the fuel and the amount of volatile PAH submitted.

I'd like to add, though, that the main toxic concern has been with the more particle phase PAHs like benzo(a)pyrene, although it still is good to see those numbers go down in the volatile PAHs.

MR. KRIEGER: One more to add about the size of the particle too, and the study showed that 98 percent of

the particle is less than 2.5 microns. The majority is confirmed with what we said in our report.

Back on the question on the exposure of the South Coast Air Basin, the upper end is 4.5 micrograms per cubic meter.

ACTING CHAIRMAN FROINES: I shouldn't ask this question.

When you have the 4.5 days, do you also have a lot of nitrogen oxides in the air on those days?

Let it go. It's not about --

DR. GLANTZ: Genevieve, the chair has withdrawn the question.

MS. SHIROMA: We'll go on with the presentation.

ACTING CHAIRMAN FROINES: Don't worry about it.

You know what I'm worried about. The higher the PAH stage, the higher the nitro-PAH days.

Let's go.

MR. KRIEGER: Bullet No. 4, the mutagenicity we found is lower in the new fuel. The results indicate that the most mutagenic fraction for the PM is an unidentified fraction from the fractions containing PAH and nitro-PAH. However, the differences are not statistically significant since the study was not robust enough. They tested one engine on three fuels.

DR. FUCALORO: It's 55 percent, mutagenicity is

now 55 percent. And it may not be significant, I certainly didn't do the statistics, but it is significantly lower, am I correct? I mean, I meant significantly not in a mathematical -- it is appreciably lower?

MR. KRIEGER: Yes.

MS. SHIROMA: For the data set for the study, and the data set of itself, but looking at making some sort of broad brush conclusion, okay, that's what Robert is referring to.

MR. KRIEGER: I think you're correct. Not on a mathematical sense, statistically, but from appearance, yes, yes, it is.

ACTING CHAIRMAN FROINES: I have done tens of thousands of Ames tests over the years, and so I know this one pretty well. And I think saying that it's lower is fine, but I think one has to be careful and we'd have to look -- were they doing direct mutagenicity or oro chloro induced S9 fractions?

DR. FUCALORO: Both. The S9, plus they did it both, with and without. Am I correct?

MR. PROPPER: Yes. They did both kinds, and there are somewhat different result, but not drastically different results between whether they did the plus S9, plus S9. They also used vapor phase and particle phase.

I'd like to point out that the bulk of the

mutagenicity was in fractions more polar than contained in the nitro or PAHs. We don't know what's in those.

ACTING CHAIRMAN FROINES: The bulk of the mutagenicity was, say that again?

MR. PROPPER: Was in fractions more polar than those that contain the nitro-PAHs and also obviously the PAHs.

DR. FUCALORO: The seventh fraction?

MR. PROPPER: Yes, that's correct.

ACTING CHAIRMAN FROINES: Well, I think it's important to say that the mutagenicity was low, but mutagenicity goes down by a factor of two is almost inconsequential and for the most part, so I think what it suggests is that we need to do more work to carry it further.

I think it's good findings and important findings, but I think it does suggest the need for further follow-up.

MR. KRIEGER: Fifth bullet on dioxins.

The study detected dioxins in both old and new fuels, but could not be quantified.

However, the method development for collecting these dioxins was improved and it goes back to the statement Dr. Froines made, overall the study points to a need for additional research on more engines and under various operating conditions and fuels.

In summary, diesel exhaust is a complex mixture of gases, vapors and fine particles, with the majority as fine particulate matter.

As the CE-CERT study indicates, it remains a complex mixture after reformulation with the same toxic substances.

Most of the emissions of diesel exhaust, PM 10, are from on-road motor vehicles.

ACTING CHAIRMAN FROINES: It also is important to realize what the atmospheric conditions you're operating in, because within that particular context we're concerned with different health effects. There's a clear evidence for acute health effects, respiratory effects associated with diesel exhaust and so that part of the question is is the relationship between the technology, the fuel and the emissions and the health effects that you're interested in learning about.

And I think we want to be careful to not always have everything be part of some sort of tyranny of cancer, so that we're not only looking at one kind of end point as we evaluate this data, and that's what tends to happen.

MR. KRIEGER: In summary and to conclude, the population-weighted average outdoor diesel exhaust concentrations decreased from three micrograms per cubic meter in 1990 to 1.7 microgram per cubic meter in 2010.

Near-freeway concentrations of diesel exhaust PM 10 were found to be up to three times that of ambient concentrations.

MS. SHIROMA: Sorry to interrupt, Robert.

Dr. Froines, just to note that when you were asking about the range of concentrations that didn't account for this near-source scenario where near the, in this particular case it was the Long Beach freeway, the concentrations were found to be up to three times higher than the ambient.

MR. KRIEGER: Finally, we have considered a person's daily activity and exposures to different environments to estimate for 1990 an average total air concentration of 2.1 micrograms per cubic meter.

We have done an additional analysis to estimate for 1995 the average total air concentration of 1.5 micrograms per cubic meter.

At this point --

DR. FRIEDMAN: I'm a little confused about the first item, which says that the concentration will be down to 1.7 in 2010, and that's already lower than that in '95. I'm not clear how those two fit together.

MR. KRIEGER: The 1995 estimate is a total air exposure estimate. That includes weighted concentration from indoor and outdoor exposures. So the estimate of 1.5

includes within that outdoor concentrations the exposure to indoor air as well. It's not a 24-hour outdoor exposure. It's an integrated time-weighted exposure.

MS. SHIROMA: The number --

DR. BLANC: The number you're referring to is for a target for outdoor, which is higher than indoor, and this number includes -- is something between the mean for outdoor and the mean for indoor, because it's an average 24-hour exposure.

DR. FRIEDMAN: I see.

How did you arrive at the 1.7 for 2010? Did you sort of do an extrapolation of the current trends?

MR. KRIEGER: Extrapolation of the current trends. That takes into account all the controlled measures and future control measures that have been adopted to date in our emissions inventory.

ACTING CHAIRMAN FROINES: Everybody is so comfortable in this room. We're going along at this kind of rolling pace. I think we ought to create a little more tension and move on in a more less rolling pace.

I want to ask, it seems to me if in fact you get threefold increases in measurements near freeways, or at least in the few freeways you've looked at, does that represent something we should look more into?

I mean, are people who live near freeways having

quite significant exposures to diesel in California? We live in a state of freeways, after all.

MS. SHIROMA: Should you approve the report, should the Board identify diesel exhaust as a toxic air contaminant, then during the risk management phase, we at the ARB will be looking further into refining that estimate and then also looking at whether something else can be done.

MR. KRIEGER: At this point I'd like to turn the presentation over to Dr. George Alexeeff, of the Office of Environmental Health Hazard Assessment, to give an overview of the Part B report.

ACTING CHAIRMAN FROINES: Welcome, George.

DR. ALEXEEFF: My name is George Alexeeff. I'm deputy director for Scientific Affairs of the Office of Environmental Health Hazard Assessment in the California EPA.

ACTING CHAIRMAN FROINES: Have we congratulated you on this promotion?

DR. ALEXEEFF: Well --

DR. FUCALORO: You received my card, haven't you?

DR. ALEXEEFF: Yes, thank you.

DR. GLANTZ: I guess the question is when you say can we congratulate him, does that mean is it proper or is he glad he was promoted?

DR. ALEXEEFF: Somehow I'm still on this hot seat,

so I don't know what has changed.

MS. SHIROMA: It's gotten hotter.

DR. ALEXEEFF: In any case, I'll be presenting a review summary of the key issues in the health risk assessment report for diesel exhaust called Part B.

And the last time I made a presentation before the panel was on October 16th, and on that day we came to the panel with five major issues that were being raised in the comments, and we seeked your advice on how to address some of those issues and we have --

DR. BLANC: Sought.

DR. ALEXEEFF: Sought, thank you.

So we have implemented your comments or suggestions in this version here. And I'll touch upon those as I go through the presentation.

Also as you see here these are the major topics I will be discussing. Some of these topics are more contentious than others. The ones of greatest interest, both in terms of the commentators, and I think in terms of the discussions we had last month, are the human occupational studies and the cancer quantitative risk assessment. So I'll go in greater depth for those, but I felt it's important to sort of give a complete picture.

Also, as you know, this document is very technical. There's a lot of information in here, and I have

the relevant experts on each of those topics here present, so as issues come up we can have them come up and answer those questions.

Okay. First, in terms of the human acute -- actually, I'm going to make one more comment before I start on this.

Now, we have reviewed the scientific literature and all the comments up until, essentially just about this point. As mentioned, Dr. Froines even presented us with some information from the Federal Register this month. In February of '98, couple months ago, US EPA came out with their health assessment of diesel exhaust, so this document we have here is very current.

First is the human acute non-cancer health effects. There are increased symptoms of eye, throat and bronchial irritation. There's increased physiological symptoms such as headache, nausea and vomiting. There have been reports of immunological activity based on elevated IgE, altered T-cell cytokine levels, hyperresponsive nasal eosinophils, and enhanced immunological reaction to common allergens.

Most of this information was obtained actually as a result of comments made by the panel in October, and a lot of these reports were published in 1996, '97, '98.

Also have been some occupational case reports

suggesting asthma.

Unfortunately, we can't really quantify the exposure concentrations that cause these results.

Next slide.

There's also been some corroborative animal studies done where we have either inhalation or direct application in the respiratory tract which induced airway changes, lung function changes, increased susceptibility to lung infection, and also a number of reports suggesting immunological activity based upon, again, elevated IgE, altered circulatory cytokines, eosinophilic infiltration and inflammation of the airways.

So that's the acute summary.

With regards to the chronic non-cancer summary, again this information has not been considered that controversial in terms of what we've reviewed and what we've proposed.

In terms of chronic non-cancer health effects for the humans, there are some occupational exposure studies that suggest some respiratory effects, but the data are insufficient to calculate a reference level.

Instead, we've taken the same route as US EPA and the World Health Organization using animal data, and in this case there's an inflammatory and histological changes in the lung reported above 460 micrograms per cubic meter in the

rat exposed for 30 months. That's the basis of our study.

And the next slide it just shows how we did our calculations. We used what's called benchmark dose approach, which is kind of a new approach that's used in non-cancer risk assessment where instead of simply taking the no-effect level, you extrapolate to some percent response. And in this case you can see under the column with analysis percent response was either 1, 5 or 10 percent response.

And we used two different models, a probit and a Weibull. You can see the benchmark concentration is then treated like a no-effect level in the rat.

And then an uncertainty factor is added and our uncertainty factor in this case would be 30, and then you come up with reference levels in the range of 3 to 21, or 2 to 21.

But that's the basis of our non-cancer risk assessment.

The next slide sort of compares with what we did with other agencies.

US EPA has had in their IRIS database and also they've reiterated it in their most recent 1998 February document, a reference concentration of five micrograms per cubic meter. It's based upon the same chronic histopathological changes in the female rat.

And the World Health Organization also conducted a series of analyses similar to the kind of thing I just showed you. They had a range of two to 14 micrograms per cubic meter.

I also wanted to point out that US EPA also has a PM 2.5 standard, a 15 micrograms per cubic meter, because there was some questions as to how the standard relates to these results.

And as I mentioned, our approaches come up with a range of two to 20.

So consequently we're recommending to agree or go along with what US EPA presented to come up with a reference level of five micrograms per cubic meter.

ACTING CHAIRMAN FROINES: That's assuming a threshold and a 30-fold safety factor?

DR. ALEXEEFF: Yes. It's a 30-fold safety factor, assuming a threshold.

DR. WITSCHI: How did you come to the 30?

DR. ALEXEEFF: The 30, okay, the 30 is broken down into two parts. Usually when we're extrapolating from animals we consider differences between the animal species and the humans. And sort of the first step is to consider a tenfold uncertainty factor.

Now, in this particular case there is also some data in the monkey suggesting that although it's not as

quantitative as this rat data, suggesting that maybe the species are not that different in terms of response.

So in this case we only used a threefold uncertainty factor to go from the rat to the humans.

And then the other part of the uncertainty factor is the interspecies differences or differences within the human population. And again the standard approach is to start with ten, and we stuck with ten, and so did US EPA. The reason for that is ten sort of represents kind of the average, healthy individual and -- I'm sorry. You start with the average healthy individual and then you want to also add a factor of ten to protect those that might be susceptible in terms of asthmatics or other chronic respiratory diseases. So we stuck with a factor of ten in this case. So that's the basis of the 30.

ACTING CHAIRMAN FROINES: George, have you found that all the sport utility vehicles that are produced after the year 2000 are diesel vehicles and if you found that near freeways that diesel levels are very high, so you were well above your five, how do you assess the range of risk? This is in a sense a threshold value. How do you define dose response? How would you determine the number of people who might be at risk at seven, 10, 20, 50 and a hundred?

DR. ALEXEEFF: Well, if the 30-fold factor ends up being a fairly large assumption in this case, and if we go

back one slide or -- one slide, John, you can see that the benchmark concentration you see one, five and ten percent response. So you can see that the one percent response is about three. This is in the rat, though. Okay. And so, you know, and then the five percent response would be a little bit higher.

So what one, you know, the best one could do with the data would be to make some sort of correlation with this information. But then the uncertainty ends up being this 30-fold uncertainty factor.

DR. GLANTZ: George, I don't see where when you said the one percent is three. I don't understand.

DR. ALEXEEFF: I'm sorry. One percent results in a number of .17, and then divide by 30.

ACTING CHAIRMAN FROINES: For people who don't know about the benchmark, they're essentially extrapolating from data points where you have information.

DR. GLANTZ: No, I understand that. It's just I don't understand when you have the one, five and ten percent, are those -- is the one percent, .175 percent is .59 and ten percent is --

DR. ALEXEEFF: Yes. I'm sorry. That column B and C in terms of simplifying the slide, that's actually milligrams per cubic meter, because we're kind of -- the concentration that we started with was much higher, so we're

kind of going down. It's actually there .17 milligrams per cubic meter or 170 micrograms per cubic meter.

There's a small time adjustment which actually results in the actual number change in terms of the conventions of the exposure in the rat.

ACTING CHAIRMAN FROINES: Why don't you go ahead.

I want to take a little time on this, because you're required to make estimates of risk and this does constitute your estimate of risk for non-cancer respiratory effects. And I want to make sure that everybody is aware that there are more numbers in this document than simply the numbers associated with lung cancer risk.

DR. ALEXEEFF: Now, in a practical matter, Dr. Froines, the way it would work or the way it does work when we have a reference concentration and there is some exposure and we're trying to compare it with that reference concentration, we use what's called kind of a hazard index approach. So if the concentration is below that five, we feel that there is no issue of concern at all. That's the basis of the approach.

Now, if it's above the five, we feel there's an increasing chance of some concern, so it's not -- it's simply sort of reflecting kind of in terms of our procedures where we would start, you know, having some concerns and depending on -- the concern that we have is in part based

upon how large the uncertainty factor is. So in this case the uncertainty factor is relatively large. So like a factor, like a value of six or something like that would not be of great concern in terms of the uncertainty, but a value of 50 would then of course be of concern.

ACTING CHAIRMAN FROINES: All right.

DR. ALEXEEFF: Now, I'd like to briefly review the genotoxicity. And the genotoxicity itself I don't consider that to be a very controversial issue in a sense, but there is this related issue of the bioavailability of this genotoxicity. And I'll be getting into that, but I thought I should just briefly go through the genotoxicity information.

I presented almost the same slides in October.

ACTING CHAIRMAN FROINES: Go quickly then.

DR. ALEXEEFF: Whole diesel exhaust and diesel extracts were reported mutagenic in bacterial assays. Particles and extracts of diesel exhaust were reported mutagenic in mammalian cell assays. We have diesel exhaust extracts reported to be mutagenic in cultured human lymphoblasts.

Mutagenicity per microgram was not significantly different between the new and the old fuels. We had some discussion about the information is basically preliminary.

Diesel exhaust extracts induced chromosomal

aberrations in mammalian cell assays, but most of the results were negative in vivo.

The particles in extracts induced sister chromatid exchanges in mammalian cell assays and the results in vivo are mixed.

Now, treatment of mammalian cells in vitro have resulted in an increase in the DNA adduct formation.

And rats and monkeys exposed to whole diesel exhaust demonstrated an increase in DNA adducts formation and their increased levels of DNA adducts have been found in some workers exposed to diesel exhaust.

Now, in terms of bioavailability, the DNA adduct work that I just mentioned is very difficult work and there are some uncertainties in that work and some differences of opinion.

But I'll briefly go through why we feel that there is evidence, and we our provide this in the report, why we think there is evidence that the genotoxicity in the particles is bioavailable, even from a mechanistic point of view, aside from the cancer impact.

The particles, when the particles are dispersed in simulated pulmonary surfactant, there exhibited similar genotoxic activity to regular diesel exhaust extracts in vitro.

The reported adduct formation in rats and monkeys

exposed to diesel exhaust are supportive, but there have been, as I mentioned, some questions of these results in literature, but we feel that it is supportive.

Rat tissue exposure to diesel exhaust induced unscheduled DNA synthesis, and so when I say diesel exhaust, I'm saying it's a difficult experiment to develop where you are actually exposing an in vitro study to diesel exhaust, and that's why I mentioned that.

DNA adducts associated with some occupational exposures to diesel exhaust, there are some urinary metabolites of polycyclic aromatic hydrocarbons found following exposure to rats to diesel exhaust. Also urinary metabolites of polycyclic aromatic hydrocarbons have been associated with some occupational exposures to diesel exhaust. Thus, the genotoxic components of diesel exhaust particles appear to be bioavailable, but more study in this area would be useful. We think this would be a great area to continue doing more research.

DR. BLANC: George, I have a question, just a process question for you.

And we have a printout of your slides.

I think because this goes over material that is available to us in the report, I think if you will simply highlight briefly any areas where you believe the data you're presenting this morning represents a significant

change or advancement on the February draft document, I think that would be a more useful approach, because I think the panel is familiar enough with much of what you're going over that it's really not productive, I think, to go into this level of detail.

DR. ALEXEEFF: Okay. I'd be happy to.

ACTING CHAIRMAN FROINES: George, I was going to say, remember, that we've seen it in October, we saw it in March, we've read the document, and I think we need to move so that we can be more active participants. So, for example, I would just leave out the animal cancer data.

DR. ALEXEEFF: Fine.

ACTING CHAIRMAN FROINES: And Melanie is going to have to be very short on the comments, I think.

DR. MARTY: I am very short.

ACTING CHAIRMAN FROINES: Because I think otherwise people are going to -- does everybody agree with that?

DR. FUCALORO: I agree.

I have a question on some of this, I'll certainly pipe up.

DR. ALEXEEFF: I think one thing that's worth noting in terms of animal cancer findings is the result in the US EPA report. So I just bring your attention to that quote in there. No sense reading me quotes, but I'll just

bring your attention to that.

DR. GLANTZ: What quote is that?

DR. ALEXEEFF: It's their findings about the issue of mice. The US EPA feels that the mice data is also an important consideration in the animal carcinogenicity.

Now we'll get to the cancer epidemiology slide.

As we mentioned before, we reviewed many studies. I just want to emphasize that there seems to be some confusion from time to time that we've looked at many studies, including those of not just railroad workers, but also truck drivers, dock workers, transport workers, equipment operators, to name some.

The next slide.

And we assess the quality of this information both qualitatively and quantitatively. We've gone through the what's considered the Bradford Hill criteria in terms of consistency, possibility for bias and chance, evidence of exposure response, temporality, biological plausibility.

The issue of causality has been one that remains in the comments, so it's important to take this into account.

So the key issue here is that there's a lot of consistency. We feel the explanation in terms of bias or chance is unlikely. Evidence of exposure response is sort of the weak point.

Getting back to the strength of the findings, it's a fairly weak association, about a 40 percent increase.

Temporality association is appropriate and the biological plausibility, we think, is definitely there.

And on the next slide this is from the document. Smoking-adjusted studies of diesel exhaust exposure in lung cancer, and in this list again there are in addition to railroad worker studies, there is also truck drivers, dock workers, equipment operators.

And you can see the consistency by looking at just the midpoint. Some of the studies are not statistically significant. The far -- the point on the far right is the result of the meta-analysis, the all smoking-adjusted value.

And then if we go to the next slide.

DR. FRIEDMAN: George, there was a point in the middle with very narrow confidence bounds. Was that a meta-analysis too or -- that is a very large study. I think it was Pfluger.

DR. ALEXEEFF: I can't recall.

DR. FUCALORO: It's almost identical to the meta-analysis.

DR. ALEXEEFF: Which, can you read that?

DR. FRIEDMAN: Pfluger, 1994.

DR. ALEXEEFF: The question, Dr. Lipsett, was from Dr. Friedman, was that an actual meta-analysis or was it

actually a study of workers?

And I think that was the question you were asking; right?

Dr. Michael Lipsett.

DR. LIPSETT: It is from one of the studies that was part of the meta-analysis. The summary estimate is over at the far right of the graph.

DR. FRIEDMAN: Was it a huge study, is that why the confidence levels are so narrow?

DR. LIPSETT: Okay. It was -- it wasn't a huge -- it wasn't necessarily a huge study. It was about 1300 people.

DR. FRIEDMAN: Well, I mean, this is not a real important point, but I just wonder if there's not mistake in putting -- because it just doesn't seem right that a study would have such narrow confidence limits.

DR. LIPSETT: I can certainly check it on the spreadsheet, but we did have an error-checking procedure in terms of data entry, and having a couple people look these things over. I don't think it's a mistake.

DR. FRIEDMAN: By the way, I appreciate, I think the previous version had this expressed as logs of relative risk, and I appreciate that you made that change to actual relative risk. I think it's much more understandable now.

I just have one minor suggestion that I don't

think should hold up our approval. I think that perhaps in the next version that although you now don't have it expressed in logs, you should still use a log scale, because it's -- you're talking about a multiplicative type of situation.

And then the confidence limits would be symmetrical. In other words, from .5 to 1 should be the same distance as from 1 to 2, and 2 to 4, and so on.

DR. LIPSETT: Okay.

ACTING CHAIRMAN FROINES: Go ahead, George.

DR. ALEXEEFF: And this slide just simply quantitates that the point on the far right side, it's 1.44 using a fixed effects model, and 1.43 using a random effects model. And this is again the smoking-adjusted values taken from the studies that took -- that adjusted for smoking.

The next slide.

And again in the human cancer findings, the early findings by IRAC had limited evidence. US EPA, in their most recent document, has moved further than that and is now saying that the human evidence is highly suggestive of an association, and it's just short of being labeled as a known human carcinogen.

And the next slide mentioned before about HEI and WHO's conclusions, that they do see a weak association, weak meaning about a 40 percent increase. And at the same time

HEI feels that their conclusions should be always couched by the fact that they feel the uncertainties and confounders prohibit the use of this information for quantitative risk assessment. And that is a difference of opinion, but I just like making that clear.

ACTING CHAIRMAN FROINES: Is that true in Aaron Cohen's chapter?

DR. ALEXEEFF: I don't think Aaron Cohen's chapter specifically addresses application of this to quantitative risk assessment, but it could very well be.

Okay. In terms of our conclusion, our conclusion and our document is that the epidemiologic studies provide evidence of a consistent and causal relationship.

The next slide.

Now, I'd like to -- this is pretty much the issue of greatest contention, concern, both in the comments and by people looking at our document, how we did the quantitative risk assessment, what we used, so I'm going to go through it and also try to put it in a little bit of perspective.

First of all, Kathy Hammond, Dr. Hammond, made a presentation last month to the panel discussing the exposures of different worker groups, all the way from heavy equipment operators, truck drivers, bus drivers, railroad workers.

And she presented to the panel this range, this

exposure range of 5 to 500 micrograms per cubic meter. She felt that that kind of covered the whole range. And that's in the slides that she provided.

At the same time in October the panel had asked us to think about using this meta-analysis information somehow in a risk assessment. And we felt that we -- that it could be used to give us a sense of the total bracket of risk, but not necessarily the range of risk that we would propose, primarily because the exposure range in all those different occupational groups is such a broad range.

You can see that it brackets the risk from about 1.3 in 10,000, to 1.3 in 100. So that's kind of like the conceptual approach that we were using that basically the meta-analysis and the total range of exposure that it's possible in the studies, what would the range of risks kind of be or the bracket of the risk.

We did an in-depth evaluation of two railroad worker studies. One is the Garshick case control and the other is the Garshick cohort data.

It's the Garshick cohort data that's had all this extensive discussion and re-evaluation.

And, again, the primary source of uncertainty that we feel exists is the exposure data in these worker studies.

In the next slide what we did is we considered various scenarios of exposure to try to bracket what's the

possible range of exposure of these workers, again to get a full breadth of what the range of risk could be, because our primary responsibility is to come up with a range of risk.

The first, I presented this slide in the October meeting, but I think it bears repeating, because it can get to be a little bit confusing.

The first slide is what's called, what we're referring to as a block exposure pattern. That's just assuming constant exposure from 1959, and that is how the Garshick studies are constructed, just assuming constant exposure.

Later on in 1991 it was suggested that the dieselization that occurred from the mid '40s to '59 be taken into account, and so a ramping kind of approach came into fruition.

And in the bottom, number C, that is what we are referring to as a roof pattern, and roof is just descriptive of a picture, and that takes into account the rate of dieselization, plus the improvements in engine design and engine efficiency that occurred after 1959.

We have both some anecdotal information in these railroad worker studies, as well as some information that we received from the Engine Manufacturers' Association and received it from the, I think, the Railroad Workers' Association, or some railroad association that was studying

engine design. So we know that there has been some improvement in the emissions.

DR. WITSCHI: I have a question with regard to this.

The way this looks superficially is if these people are in pristine air and then from '59 all of a sudden they are exposed to diesel, do we have -- that's probably not true. I mean, they were working in railroad yards and there must have been considerable other things around before diesel came along. Do we have any idea about what was around before diesel came along or still together with diesel?

DR. ALEXEEFF: Well, yes, there's two issues here.

One is dieselization that was occurring, so if we went with the top diagram, which we do not in our report, but if we went with the top diagram it would not take into account the diesel exposures that occurred before '59, so we actually support the bottom diagram, number C.

But what you're saying is other compounds in the air that would be contributing to risk and exposure, okay. And that is definitely would be a concern in any of these exposure studies, other confounders.

Part of it is taking into account not in terms of the response, but at least in the exposure in the way that Dr. Hammond and others subtracted out some of the other

things that they were in the air, and particular environmental tobacco smoke and other -- there's other background concentrations of particulate matter that are subtracted out in the calculations.

Now, in terms of whether there is some other substance or component in the air which is causing the disease, some of the studies try to take some issues into account. For example, I think one of the Garshick studies tried to take into account asbestos.

But, you're right, this is an issue of uncertainty.

DR. WITSCHI: What about steam engines? They were pretty dirty.

DR. ALEXEEFF: Yes, I agree.

So you do have that confounding.

In a sense you have other exposures which are not taken into account, but what you try to do, and I can have -- well, maybe I should have Dr. Lipsett explain how the study designs of these epi studies try to focus on the diesel exhaust component in terms of their structure.

Did you want to make any comment?

ACTING CHAIRMAN FROINES: I will say, George, just one comment, as a person who is an exposure assessor in occupational epi studies, that it seems clear to me that if, one, if you put together a group of industrial hygienists

who do this kind of work, like Bob Spear or Steve Rappaport and Tom Smith and others, I think the roof model makes the most sense. It makes the most sense for two reasons.

One of which was in 1970, when the OSHA act was passed, people's attention to chemical exposures became much more heightened and it's very clear that during that decade of the '70s to the '80s, as a uniform phenomenon, exposures went down.

So I think it's one could argue about the slope of the decline, but I think it's clear that there was a decline in exposure.

And so it seems to me that using the ramp with then a flat exposure is probably going to estimate what was one of the most health, occupational health conscious decades in the last hundred years, and so that I think the roof model tends to reflect what the industrial hygiene community would recognize during that decade more than you might otherwise realize.

DR. LIPSETT: I just wanted to add a couple things.

First, a correction to what I said before to Dr. Friedman. I haven't read this particular paper in many months and went back, I was looking at the wrong thing when I indicated there was that. There was actually well over a million person years of exposure involved in that one study

and that will explain why the confidence interval is so narrow.

So I hope that allays your concern about an error in that.

DR. FRIEDMAN: Thank you.

DR. LIPSETT: One of the other things, though, with respect to steam engines is apparently one of the main concerns that took place during the steam engine era was asbestos exposure when these things were overhauled and the number of the railroad studies did try to take that into account where they had information about exposure to asbestos during that period of time.

And then with respect to the emissions from the steam engine, in at least one of the railroad studies found the investigators did try and look at the effects of that separately by using certain brackets on the time of exposure and found that the relative risk from that was not -- I mean it wasn't substantially greater than what you would see from the diesel exposures occurring later.

That's not very helpful. The data are pretty sparse, basically.

ACTING CHAIRMAN FROINES: Is there any data within the studies on mesothelioma, which would be indicative of confounding by asbestos?

DR. LIPSETT: Yeah, I think there was in at least

one of the studies, but again it's been many months since I've read most of these studies and I --

ACTING CHAIRMAN FROINES: But it's not something that you feel was a major issue?

DR. LIPSETT: No.

DR. KENNEDY: That was not generally recognized before 1948, so it would be hard to come up with anything before that.

ACTING CHAIRMAN FROINES: He's looking at people who are dying later. The Selecoff stuff is in the early '60s, so there's from the '60s on there's a consciousness about mesothelioma. So I would guess that they would --

DR. KENNEDY: I thought the question relates to the awareness of mesothelioma and a time context. It was not described by Selecoff until around 1950.

ACTING CHAIRMAN FROINES: He's saying that for the pre-diesel period, that there was asbestos, people might not have recognized it.

DR. LIPSETT: There's one study, though, the one Finnish study, that seemed to have a lower risk for lung cancer and it did find a substantially increased risk for mesotheliom in the train engineers that they looked at. It was severalfold increase in mesothelioma.

ACTING CHAIRMAN FROINES: That in your study or your meta-analysis?

DR. LIPSETT: Is that paper? It is included in the meta-analysis, but the mesothelioma is not, just the lung cancer.

ACTING CHAIRMAN FROINES: But it becomes a clear confounder then.

Let's go, George.

DR. ALEXEEFF: We agree with you, Dr. Froines, that the roof pattern is the most appropriate.

Now, this table is taken from the document and you can see, I'd like to just explain what this table represents because this ends up being sort of the crux of a lot of the discussion or concern. And again I have Dr. Dawson here if we have any specific questions on the derivation of these numbers.

First of all, just to point out we have risk estimates that are derived both from the case control study as well as the cohort study, and it's the cohort study that has had a lot of additional concern and a lot of the discussion of the comments refers to results of the cohort study.

Now, you can see in that column of different scenarios. Now, scenario A refers to the ramp pattern. All the other scenarios refer to that roof or that peak shaped. So it's just something to point out.

The ramped pattern has the highest risk, because

it ends up being the lowest exposure. Okay. Because it doesn't come back down. So that's something to keep in mind as to whether or not the ramp pattern is appropriate to keep in the range of risk.

So the other scenario is B, C, D and F are all scenarios on the roof pattern, but the differences have to do with what Dr. Froines mentioned about the slope of that roof pattern.

No. E, which has the lowest risk, has the highest peak. It goes all the way up to 500 micrograms per cubic meter in 1959, and then it goes all the way down to 50 micrograms per cubic meter. It has the -- it presumes the highest exposure of the railroad workers, and therefore results in the lowest risk.

And then the others, B, C and D represent modifications of those peak levels.

And we think that from B through E we've pretty much captured the information that Dr. Hammond presented last month in terms of what are the possible -- what's the possible range of exposure that could have occurred in terms of these workers here.

And also Dr. Hammond suggested that this information could be applied to both the case control, as well as the cohort study, the exposure information, and that is what we have done here.

Now, the other thing is --

DR. BLANC: George, one of the modeling assumptions that's missing from this table, and may be confusing to other people, is that the block pattern is missing, which gives yet the highest estimated risk, and the risk value of 2.4 times 10 to the minus 3rd, which it doesn't appear here, is in fact based on the block assumption; is that correct?

DR. ALEXEEFF: Correct. Yes. If one chose to make a calculation based upon the block diagram, as Dr. Blanc indicated, there would be slightly higher risk. It would go above the A value or above the scenario A, be somewhere around 2 to 3. So it increases it.

DR. BLANC: In fact, isn't that the risk number that's cited later in the document?

DR. ALEXEEFF: Yes. There are other investigators, and I'll mention that on my next slide or so, sort of putting it into context, numbers that have come out of the study using the block diagram. That's basically the approach they use. They used a constant exposure from '59, so it makes for a slight higher risk.

DR. BLANC: What I guess I'm trying to say, wouldn't it be useful for this table, depending on how this table would be used, to at least have in the legend or underneath the table, the clarification that is not listed

here is the block scenario, which would yield for the case control a value of X and for the cohort a value of Y?

DR. ALEXEEFF: What we want this -- what we would like this table to show is the range of risks being proposed.

And Dr. Froines at the last meeting suggested that we have an additional table, which shows all the risk values calculated by various investigators. So I will mention that and I think that's one proposal is to add.

We have the information in the document, but because the text can be difficult to sort of wade through, it was suggested we put it in a table. So I think that might be where it could be clarified.

ACTING CHAIRMAN FROINES: Let me make my point here, and I feel extremely strongly about that.

And, Paul, I think what you're asking for is exactly what I want in the end, which is a full table that covers all the risk assessments that have been done, and put in some sort of orderly form so people can read it. I mean, putting things in a table is supposed to make things easier, not harder.

But for example, in a previous slide, you've already shown a risk assessment. You've shown Michael Lipsett's meta-analysis and Kathy Hammond's, and estimates of exposures that occur, and you've come up with numbers

from that.

And so that is a value that's already been done. That's separate from the Garshick data.

DR. ALEXEEFF: Correct.

ACTING CHAIRMAN FROINES: And I want everybody to see that in fact, and we're going to come to this when I get into the NIOSH data later, that we have some very strong risk assessments that have been conducted that are not only linked to the Garshick information. I want to show the breadth of the risk assessments so people have some sense of the complementarity between them and have a sense of how people approach them.

So these are railroad workers and NIOSH workers on truckers and so on and so forth.

DR. GLANTZ: My understanding, I agree that there are places that you just get bogged down in this report, and my understanding is that nobody thinks the block pattern is a realistic exposure pattern.

DR. BLANC: Well, that's what the EPA is using for their risk estimate.

DR. GLANTZ: Oh, really?

DR. BLANC: Of course, one question that is a really minor one, but I was just curious, maybe, Mike, you have the answer to this, if we have a number of 2.4 using the cohort -- using, I'm sorry, the case control data and

the block assumption, and EPA has a value of 2.0, I'm just wondering maybe Dr. Dawson can comment why there's that slight mathematical difference, since I assume that's a modeling using all the same assumptions.

ACTING CHAIRMAN FROINES: But also, Paul, we can have in the table the EPA estimates again to show the ranges.

DR. BLANC: I think they are in essentially that's what this Table 3 is, which I guess George is going to get to.

ACTING CHAIRMAN FROINES: Well, I don't think it has the EPA data in it. Maybe it does.

DR. GLANTZ: If I can just maybe finish a point I was trying to make, and maybe I should drop it, but I was going to suggest that the discussion of the block pattern be just dropped in the report, because I think it's confusing.

DR. BLANC: Well, I wouldn't, because I think you want to show that you've addressed and related to the other risk estimates that are out there.

ACTING CHAIRMAN FROINES: If EPA has it, we can put it in a table and have a footnote that says based on a block.

DR. GLANTZ: Okay.

ACTING CHAIRMAN FROINES: Now, the other thing is that there's one thing that George and I talked about and

the panel can discuss it later, I don't think we have to discuss it right now, but the EPA document used a unit risk value of 2 times 10 to the minus 3, and we have no values that have more than two places past the decimal. It might be useful to get rid of anything past the decimal and just go with the number.

DR. BLANC: Well, they --

ACTING CHAIRMAN FROINES: Like 7.0 to 7.6, how we want to deal with that. Do we want to just treat that as 7 and go with it?

But let's not take that up right now. We're thinking about it.

DR. WITSCHI: But I have problem with the Table 3 and with the next two slides that George is going to show, because if you -- it gives a so-called overview about the different risk estimates. There were only two sets of data those different estimates were derived from.

The one is the comparative mutagenesis studies, which is always the same set of data is looked at it another way, and the other one are the railroad workers, and they also looked at it in different ways.

The need, the important thing is the paucity of data, but there are numerous way to look at those data.

But this doesn't exactly confirm that the database is assumed. Just because you can manipulate it in very

different ways does not necessarily mean the different analyses confirm each other and strengthens the evidence.

ACTING CHAIRMAN FROINES: I think that's an important point, Peter.

Let's come back to it when we go around the panel and talk about that as a substantive issue, because one could make the opposite argument that there is consistency within the data and that's good, and that the approaches that have been taken are different approaches.

The meta-analysis is not based on the railroad worker study. The NIOSH data is not based on the railroad worker study. So we have more than -- we have at least three risk assessments based on different data sets.

So let's come back to that.

DR. WITSCHI: Wait a second here. This table says for this meta-analysis, says based on smoking-adjusted pooled railroads.

DR. BLANC: Well, relative risk, not railroads.

DR. WITSCHI: Relative risks.

DR. BLANC: Yes, that's fine.

Also, Hanspeter, it's important that you note that in fact these relative -- I'm sorry, these risk estimates are not based, even the ones that cite Garshick, are not based all on the same studies, they're based two different studies. One is a case control study and one is a cohort

study. So I would actually differ with your interpretation that it's a different analysis of the same data, because it's analyses of different data and data obtained with a fundamentally different methodological approach, and therefore coming up with similar estimate ranges using two different studies, albeit in the same general work population, using very different methods of obtaining the data are quite supportive, one of the other.

So, actually, I wouldn't agree with your comment in that regard.

ACTING CHAIRMAN FROINES: It's an important point, and let's come back to it.

DR. BLANC: I think that, Dr. Dawson, you were going to just clarify for me that 2.0 versus 2.4. I don't think this will take you very long.

DR. DAWSON: Well, I'll try to be precise.

I'm Stan Dawson.

First of all, the US EPA number is based on McClellan's analysis of the case control.

DR. BLANC: Right. Case control study.

DR. DAWSON: Right. And he's making two assumptions there about the level of concentration which he considers to be constant from 1959 to 1980. And the two assumptions are 125 micrograms per cubic meter and 500.

Now, the higher risk number, of course, comes from

the 125, so that's where that came from.

Now, we do not -- that's just -- and this report, in the previous report, we used that number, the previous draft last year.

But in this report we do not use that number at all. We simply go back to the Garshick case control slope result, and put in our -- an extended block scenario.

Now, it goes back from seven years prior to 1959, because we think that it's really more like a ramp than a simple block, but it has the same cumulative area under the curve, the same cumulative exposure as the area under the curve, as that particular block, and the block is more logical for a duration analysis, which is what Garshick's case control study, how that was analyzed.

So, anyway, we put that extended block in and then did the basic calculation up there in A, which gives you this same number that you get if you used the ramp, and then I did the ratioing process to get all those other numbers out, simply erasing the area under the curve of each scenario compared to that original block.

ACTING CHAIRMAN FROINES: The people doing the video want to take a break, but I'd like George to go through your next -- can you get through the risk assessments and we need to take a break.

DR. ALEXEEFF: Yeah. I'd be happy to. It's not

that much further in terms of just putting in perspective.

If you look at the next slide, and I put a handout -- I broke it down into two pieces so that it would show up on the overhead, but this is the handout in the back.

And also I think the panel members should have this handout, which just lists various reports that have reported unit risks, and also includes the numbers that constitute our range are listed in bold.

So you can see the top, and there's the method description.

The first three are this comparative potency analysis, where one is comparing the potency of diesel exhaust relative to some other carcinogens.

And then the other first epidemiologic analysis is the one that Dr. Smith presented and slightly refined, he presented it was last month.

And then it's -- then you can see ours in bold.

If you go to the next slide, John.

Now, I've added the information in red there from the -- just to let you see that this is information that probably could be added. It's in the -- came in the Federal Register this month. There's a survey of ranges from Dr. Stayner, and that goes from one in -- you know, right there you can see the range there.

And then there's a new study which is in press by Dr. Steenland, at NIOSH, on US truck drivers, and reports that range, or that value there.

And I put it, it's sort of in the middle -- those numbers are kind of overlapping our range somewhat.

And then you can see further down in the non-bold, other studies. There's the railroad workers, London transport workers, US EPA's slight modification use of the McClellan data, and then our bracketing approach that we used on the bottom.

So it gives you a sense as to where the calculations we did can kind of be placed with other calculations that will be done, just on the human data or some variation of the human data. This does not include the animal data.

ACTING CHAIRMAN FROINES: So it looks to me like at the widest range you're running 1.3 times 10 to the minus 2 up to what?

DR. ALEXEEFF: Roughly 2.6 times 10 to the minus 5. It's on the previous slide.

DR. FUCALORO: It's not on this one. It's on the previous one.

ACTING CHAIRMAN FROINES: So we're running, what?

DR. ALEXEEFF: About 2 in 100,000.

ACTING CHAIRMAN FROINES: 2 times 10 to the minus

3.

DR. ALEXEEFF: 2 times 10 to the minus -- no, the smallest number is roughly 2.6 times 10 to the minus 5. Okay. That's the smallest risk.

And then the largest risk is -- well, there's 2 to the minus 3, and then there's the bracketing which goes even further.

ACTING CHAIRMAN FROINES: Which is?

DR. ALEXEEFF: 1.3 times 10 to the minus 2.

DR. GLANTZ: Yeah, but you know if you limit yourself to the epidemiological studies, which I think this is the more cautious thing to do, then the range is even narrower. It's around 2 times 10 to the minus 4 to around 2 times 10 to the minus 3.

ACTING CHAIRMAN FROINES: Which epidemiology study?

DR. GLANTZ: If you just look at all of them.

I'm looking at the table.

The comparative potency, I think the epidemiologic analysis is going to be more -- there's more or less uncertain than the comparative potency analyses and if you just look at the epidemiological studies, the range of unit risk is about an order of magnitude, and we're just eyeballing it from around 1 or 2 times 10 to the minus 4 to around 2 times 10 to the minus 3.

ACTING CHAIRMAN FROINES: George, I mean, Stan, I think that's a point to take up, which is whether or not to use the comparative potency, and I tend to agree with you that those are less solid than the other studies we have before us.

So let's hold that. We've got a couple of topics we want to hold.

So, George, is this -- but I think the important issue here is that we see a range of values, we see a range of approaches and we see a range of populations that have been under study. So this gives us in a sense the landscape on the quantitative risk assessment issue for us to then talk about as part of our deliberations. This gives us a, I think, a wider picture than what we had in the documents that only listed basically the Garshick report.

DR. BLANC: Can I ask a question about the Steenland data that have just -- are just coming out or in press, in the American Journal of Industrial Medicine? In addition to the quantitative risk estimate derived from that study, does that study have a relative risk estimate that is not previously been calculated on that cohort or did they go back to data that has already produced a relative risk for lung cancer that has already been incorporated into the meta-analysis?

Maybe Mike can answer that question, Mike Lipsett.

DR. ALEXEEFF: I think maybe during the break we can check.

DR. BLANC: Okay.

ACTING CHAIRMAN FROINES: George.

DR. ALEXEEFF: And this last slide just, I think it's on the key points with regards to the requirements in the statute. There is the reference concentration for non-cancer chronic exposure of five micrograms per cubic meter.

We're supposed to make a statement whether or not we were able to identify a threshold, and obviously we identify a threshold for the non-cancer effects. We're unable to identify a threshold for the carcinogenic effects. And then the bottom point simply is the range of risk based upon our epi studies in that table, Table 1-1.

DR. FUCALORO: Just a clarification.

DR. WITSCHI: I have a question.

DR. ALEXEEFF: This is the range. It's in the current document. Later on we're going to suggest we have some revisions that might modify that range slightly, but this is what's in the current February document that went out.

DR. BLANC: So can you just -- can you explain to me again the 1.3 times 10 to minus 4 conforms to the number that I had seen previously, the 1.5 times 10 to the minus 3

is slightly lower than the 2.4 times 10 to the minus 3. Can you just explain to me again, I think I've lost a step here, where we discarded some of the more potent estimates that were somewhat above 2.0.

DR. ALEXEEFF: That is simply a correction from, I think the 2.4 you're referring to is what the previous version -- oh, I'm sorry. Yeah. We're going to be making a proposed correction based upon actual comments submitted which adjusted the 2.4. And Dr. Marty will be explaining that.

DR. FUCALORO: So the Table 2 reports it as 1.3 times 10 to minus 4, to 2.4 times 10 to the minus 3, and that's the accurate --

DR. ALEXEEFF: I'm sorry. That is going to be a proposed correction. So this is the range that's actually in the document, and then you have a proposed correction on that range.

DR. WITSCHI: I have a question.

What are we doing with the McClellan study from '89, because that's he repeatedly retracted it.

DR. ALEXEEFF: Right. We are not using the McClellan study in our calculations at all. But US EPA is, so we simply included it in that table. US EPA is using it, we are not using it.

DR. WITSCHI: I'm wondering whether we even should

mention it, because clearly somebody said that was wrong. I don't know that we can use this.

DR. BLANC: Well, I disagree pretty strongly with saying that. I think it's important to recognize what the US EPA is going to be doing as long as it's put in the proper context, which is this document does.

DR. WITSCHI: I'm not talking about the US EPA.

DR. BLANC: But US EPA is actually basing their risk estimate on the McClellan analysis of the Garshick case control data, and therefore it would be silly of us to completely ignore what the EPA is doing. It should be given a nod, as it is in this document.

And maybe I misunderstood your comment, but your comment was let's just not even mention the McClellan analysis, but that, I think, would be inappropriately naive.

DR. GLANTZ: Would it be okay to just in the table, the fourth through the bottom line is the McClellan risk number, which if Hanspeter says it's been retracted, couldn't that just be deleted, because if you go down further, the second from the bottom line is the citation to US EPA.

ACTING CHAIRMAN FROINES: See --

DR. GLANTZ: I'm just reacting to the comment.

ACTING CHAIRMAN FROINES: We all know Roger, and if Roger has published a paper with findings in it and we

review the science within the paper, right? That's our job. Sometimes we don't like that science and sometimes we do. Sometimes we're critical. Sometimes we accept it.

But we always interpret every paper we read. That's our job as scientists. No paper is read as though it's God's truth. The way science works is to be critical.

We have every obligation to take a paper that Roger wrote and be critical of it. We may decide that it's irrelevant. We may decide that it's a great paper.

But we do have the option, and I would argue the responsibility, to look at Roger's paper and make a determination on the adequacy of the science.

And I think we have to do that as scientists, because we all do it to each other when we review papers all the time, and I think it's our obligation to do that.

And if we simply say that Roger withdraws his paper, he can withdraw his paper, but it doesn't mean we don't get to read it and judge it. We respect him, he's a great scientist, so it's not as though we're saying that what he's doing is incorrect.

But I think we still have the obligation to evaluate the data that's in that document.

DR. FRIEDMAN: George, the bottom, the epidemiologic analysis listed at the bottom of the table, that's the one that's based on the meta-analysis. Could you

explain why you didn't take -- put that in bold and include that as one of your primary risk estimates?

DR. ALEXEEFF: Yeah. There's probably a couple of reasons we did not include it.

One is we were simply using it to sort of get a sense as to what's the total possible ballpark landscape. So it's a fairly broad range of exposure of five to 500 applied to the various occupational cohorts.

I think if one wanted to really do it rigorously, you'd probably want to, you know, choose various exposures for the various subcohorts and apply them, which we did -- which we did not do. But it was just sort of set the landscape.

ACTING CHAIRMAN FROINES: George, but that's wrong at one level, isn't it? Because you have taken a wide range and you have looked at the data and you do have a range that runs over a factor of a hundred, which is quite consistent with everything else we've done.

Therefore, the fact that you're bringing in the meta-analysis, making an estimate of the range of exposures, if we want to after this is all over, we can go back and look at that range of exposures more carefully and tighten it down and give it some other numbers.

But this actually seems to me to be very useful. It's saying we're not -- we're going to look at what the

exposures were known to be and we're going to take a range of those exposures, and we're going to see how it turns out within the context of the meta-analysis.

And I frankly think that that -- I don't know if this was what Gary was saying -- but I think that that one meta-analysis risk assessment linkage is actually very valuable.

DR. FUCALORO: I'm not sure. You don't mean that this -- you're talking about the last entry here? I'm not sure that's the meta-analysis, if I understood what that means, but rather a range of analysis -- a range of values that you've seen. I think the meta-analysis you're talking about is in the slide you showed previously, the graph, and which had a rather narrow range of uncertainty.

DR. BLANC: No, no. Let me explain what they did, because then if I didn't understand it, then you'll know that other people didn't understand it.

They did a meta-analysis that gave a relative risk of 1.4, let's say, for the confidence intervals.

They know from epidemiologic data that the absolute range of exposures in the various occupational studies was a low of five micrograms per cubic meter and a high of 500 micrograms per cubic meter. And then they went through an algebraic calculation and said let's assume that everybody in all of those studies was exposed to only five

micrograms per cubic meter, and that gave a relative risk of 1.4, what would the cancer potency be.

And then they said, well, now let's assume that everybody was exposed to 500 micrograms per cubic meter, what would be the cancer potency. So if everybody was exposed to such a high level to get a relative risk of 1.4, then you would get that low level of 1.3 times 10 to minus 4 and if everybody was exposed to five, then you'd get -- and that's why the brackets are actually kind of absurd in a sense, because -- and that's why you were so cautious to use the word brackets, but I think there's an easy solution for this problem, which would make it more consistent with all the other confidence interval based data that you presented, which is to make an assumption that the mean exposure was 250 micrograms per cubic meter, come up with an estimate of what the standard deviation about that mean of 250 micrograms per meter is, and then give us 95 percent confidence intervals for what the upper and lower bounds would be of the cancer potency factor, assuming not the zero percentile, but the fifth percentile, the 95th percentile, and assume that the exposures were normally distributed, even though that's probably not true.

And at least then you would get something that would be somewhat less than 1.3 and up to the 10 to the minus 4 and -- it will be narrower on both sides and if you

want to model it with instead of normal distribution, Possan distribution or something, which might even be -- have a narrower peak and lower slopes, that might even be better.

What do you say, Stan?

DR. GLANTZ: I don't know if we want to have them do it, because I don't think it's going to change.

DR. BLANC: It's not going to change the bread and butter of this --

DR. GLANTZ: I think it's a good idea. And I think it will confirm -- I think what that will probably end up doing is giving you a range of risk very similar to what they got from the Garshick data, which would strengthen the case. I don't know that we'd want to hold the report up -- maybe they can do that at lunch.

ACTING CHAIRMAN FROINES: Stan --

DR. GLANTZ: They keep saying they're smart.

ACTING CHAIRMAN FROINES: Stan and Gary and Paul, I want to emphasize the value of that is that it is -- it's not entirely independent, but it is a different way of looking at the risk assessment and to the degree that there's concern about the reliance on Garshick, this is another piece of evidence that we can use as part of looking at this overall picture, and I think it's extremely valuable.

DR. GLANTZ: Maybe they can do it over lunch.

They have a laptop computer.

ACTING CHAIRMAN FROINES: We don't have to worry about getting the exact numbers out before we make determinations. We all understand what Paul is talking about. But it's the idea, I think.

DR. GLANTZ: Yeah. I think it's a good idea.

DR. BLANC: Because I do think that having a level of 1.3 times 10 to the minus 2, which is so low, or so high, depending on the language you want to use, it undermines the utility of it.

So rather than doing something -- because we all know that the exposure over all of those occupations was not as low as five micrograms.

ACTING CHAIRMAN FROINES: The five is a bad number. As we saw in Allan Smith's where he is up around 80, 60 to 80, that makes -- that's a more realistic number.

DR. FRIEDMAN: I think that, just to emphasize what was said, that all these studies are estimates that are listed in bold are all derived from the Garshick data, either cohort or case control, and there's so much contention about that, that it would be nice to have something else that you did in bold too as another good estimate.

ACTING CHAIRMAN FROINES: Well, that's also, Gary, why I wanted to -- and we spent the morning getting the two

papers from NIOSH where two new risk assessments studies, one on truckers has been done, so it gives us a new data set entirely to look at.

And, again, the numbers are all turning out to be pretty much the same, but it's nice to have different sources of information to help confirm.

DR. BLANC: As an occupational health physician, I do have to say that the video people have now gone beyond the time that you promised them.

ACTING CHAIRMAN FROINES: Well, I was actually trying to squeeze --

DR. FUCALORO: Don't talk squeeze.

ACTING CHAIRMAN FROINES: I was hoping to get through to 11:30 and breaking for lunch. You guys think you can make that?

DR. BLANC: Can you go to 11:30 and break for lunch?

ACTING CHAIRMAN FROINES: I knew what I was doing, but I knew I was on tender ground here.

DR. BYUS: I'll be glad to run the camera.

ACTING CHAIRMAN FROINES: George, you want to try to finish off in ten minutes?

DR. ALEXEEFF: I'm done with my presentation.

ACTING CHAIRMAN FROINES: Okay. I have a question then for the panel.

DR. ALEXEEFF: Unless you wanted -- we haven't discussed comments.

ACTING CHAIRMAN FROINES: No, I think that we're at a place now where we have to make a decision, and I would argue that after lunch we go to the findings, which is going to get us into the substance of the panel can take up a lot of these issues, and maybe we won't take up the comments or that we do take up the comments. My only concern about taking up the comments is that it goes on for a very long period of time, we're going to start having less time for the panel's discussion.

And so however you want to do it.

DR. GLANTZ: Why don't we give Melanie ten minutes to talk about the key comments, and then we go to 11:30 and the key -- because I mean there was a lot of important stuff in the comments.

ACTING CHAIRMAN FROINES: Can you do that?

Stan, let me act -- in the role of the chair, let me -- how much time do you think you need on the comments?

DR. MARTY: Well, if you'd ask me that last night, I would have said a half an hour, but I think I can buzz through this in ten minutes.

ACTING CHAIRMAN FROINES: If you can do that and then that means that we won't go to comments until later with Genevieve.

DR. GLANTZ: You're using up Melanie's time.

MS. SHIROMA: OEHHA will go first then and then ARB with summary of comments and response and our proposed revisions. For the ARB portion it's maybe five minutes' worth of -- everyone has been mailed --

ACTING CHAIRMAN FROINES: If we start at 1:00 o'clock we'll be finished with comments completely by 1:15, 1:20, 1:30? I really want to get us on to the substance of this.

DR. GLANTZ: Let her do the comments.

ACTING CHAIRMAN FROINES: I understand. But I'm not talking about Melanie. I'm talking about ARB right now.

MS. SHIROMA: Yes. Ours is very brief, short.

ACTING CHAIRMAN FROINES: So we will start at 1:00 on the dot, and we will be finished with comments at 1:15, and then we'll start going around the table.

DR. MARTY: I think that the fastest way is for me not be get up there with overheads and just to talk about it, so that's what I'm going to do.

Essentially, we have grouped the comments by underlying theme in order to talk about them today and to stress the major substantive issues.

And I'd like to report that none of the issues raised in the latest comment period are new. Some of the details might be a little different, but the underlying

issues are the same that we have responded to in the past Part C documents in May '97 and again in February '98, and also in the responses to comments that we sent to you folks last week.

There were comments concerning causality. The commentators questioned how OEHHA could come to the conclusion that epidemiological evidence supports a causal link between exposure to diesel exhaust and the lung cancer.

And I think George went over that briefly earlier.

HEI made the comment that because of uncertainties around whether there's a dose response can be estimated, the extent of bioavailability in the small size of relative risks, that they could not come -- that it made it difficult for them to come to that conclusion.

And OEHHA has assessed causal inference using standard criteria. The consistency of the findings is there. The great majority of the epi studies find an association.

The small magnitude of risks is offset by the number and the diversity of occupations for which those relative risks were found, and the consistency of the findings from study to study.

We did analyze whether the possibility that the findings could be due to bias or to chance, and our analyses found that it is not likely to account for the effect.

There is modest evidence of exposure response based on the duration of exposure.

The temporality of the associations is such that there's sufficient time elapsed between the start of exposure and lung cancer in most studies.

And lastly there is biological plausibility. There are mutagens and known human carcinogens and respiratory tract carcinogens in diesel exhaust and diesel exhaust does cause lung cancer in animal models.

And finally the HEI themselves report in their own diesel exhaust document that the studies they reviewed suggests an exposure to diesel exhaust in a variety of occupational circumstances is associated with small to moderate relative increases in lung cancer occurrence and/or mortality.

These elevations do not appear to be fully explicable by compounding due to cigarette smoking or other sources of bias. Therefore, at present, exposure to diesel exhaust provides the most reasonable explanation for these elevations.

We had comments on causality, but I don't think it's worth going over them at this point.

The other issue that was raised by several commentators again hits on the bioavailability of the genotoxins present on a particle phase.

And their main points were that only extracts of diesel exhaust particles are mutagenic, that the DNA adduct data are not conclusive and therefore do not support bioavailability, and that no enzyme induction was seen in the chronic studies, and no immunological responses were seen in animals, indicating a lack of bioavailability.

And our response to that is as was mentioned previously, that while it is true that many of the studies used diesel extract, diesel exhaust extract, and those were positive mutagenicity studies, whole diesel exhaust also induced mutation and four strains of salmonella and diesel exhaust particles suspended in simulated physiologic fluids were mutagenic in salmonella and also in mammalian cell assays.

And I'd like to point out that the bioavailability argument does not apply to the vapor phase genotoxins that are present, which include low molecular weight PAHs and nitro-PAHs, 1,3-butadiene, formaldehyde and a host of others.

We did talk briefly about the DNA adduct data. I don't think I need to go over that again, but we believe that although there is some noise in the data it does support bioavailability.

In terms of the lack of enzyme induction, they're referring to the cytochrome P4 50 monoxygenates drug

metabolizing enzyme system. It is true that it was not noted to be induced in the long-term bioassays. However, induction of AHH activity over baseline is not required for PAH metabolism.

The levels of PAH experienced by the lung cells may be insufficient to induce enzyme activity, but sufficient to produce genotoxicity.

There is evidence that macrophages can activate benzo(a)pyrene coated on diesel particles and release the metabolites to the surrounding medium.

And there are many recent studies showing immunological responses to diesel exhaust particles.

Issues were raised about the uncertainty in the occupational exposure estimates. I think we've really covered that. I think it's safe to say that we believe that bounding of our exposure reconstruction in the document is such that it's unlikely that any of the exposures were lower than our lower estimates or higher than our highest estimates. And I think we stand by that.

It also was brought up that the extrapolating downwards from occupational exposures to ambient levels, and that extrapolation really is not unduly large if you're familiar with risk assessment in general. It's on the order of 10 to hundredfold, depending on what measurements you're talking about.

And other identified TACs had extrapolations up to 10,000-fold. We don't think that's really an issue.

Commentators brought up the issue that we're assuming a linear nonthreshold model and we could have been using other models.

The reason we chose the linear nonthreshold model is the presence of the many genotoxic compounds in the theory that the linear nonthreshold model is appropriate for genotoxic mechanism of carcinogenicity.

There is not an evidence for a threshold effect in humans. And particle overload is not evident in the workers and we don't think it's an issue in terms of modeling the dose response from epidemiological data.

We got some comments that Dr. Crump keeps getting negative dose response curves.

There's a couple of reasons we think that is the case.

One is that Dr. Crump treats clerks and signalmen as if they were exposed to diesel exhaust, and we do not, per the report in the Garshick study, which indicated that those individuals were looked upon as unexposed to diesel exhaust.

So I think that that is a big reason why we get different analyses, different results of our analyses than Dr. Crump.

In addition, there is some collinearity problems using cumulative exposure and counter year variables in the same regression, doesn't provide reliable estimates of the slopes because cumulative exposure is nearly proportional to calendar year once you exclude the clerks and signalmen, which was done in Dr. Crump's analyses.

Dr. Crump also pointed out that in our latest attempts to account for exposure prior to 1959, which gets back to the ramp and roof models, assumes that all workers had that additional exposure prior to 1959.

And he also points out an error which resulted in gaps in exposure in our program.

It is true that we assume that all those individuals had exposure prior to 1959, but the correction we realize was not going to be a perfect correction. We just wanted to indicate that these exposures occurred and to adjust the slope estimates to account for those additional exposures.

We also corrected the error pointed out and reran the model and this resulted in a small increase in the unit risk estimate.

There's a few other issues raised on the modeling, but I don't think it's worth going over them right now.

I did want to note that Dr. Kyle Steenland from NIOSH forwarded as a comment an abstract of a manuscript

that he is publishing, and we just heard a little bit about that, and he has an estimate that is on the order of 8 times 10 to the minus 4, right into the 10 to the minus 3 range as a unit risk.

ACTING CHAIRMAN FROINES: Stayner is mining, and Steenland is truckers.

DR. MARTY: Right. Dr. Duncan Thomas also was communicating with Stan Dawson and sent a number of comments, and Dr. Thomas presented at the March 11th SRP meeting. He sent a number of comments supporting the conclusion that lung cancer effects of diesel exhaust -- or that lung cancer and diesel exhaust relationship is causal.

He gave us lots of positive comments, which I probably should go through, but calls our meta-analysis outstanding.

And he also was happy that we started -- we used the Garshick case control and welcomed the reanalysis of the Garshick cohort data.

He did express difficulty that the multistage model where the last stage is considered to be the active stage is biologically implausible, but when we run the model, the model itself suggests that the final stage is acted upon by diesel exhaust.

And in a preliminary analysis the fit of the model with first stages dependent on diesel exhaust exposure is

much more poorer than the fit of the model with the final stage being acted upon by diesel exhaust.

And then I should probably finally mention that the California Trucking Association commented that OEHHA missed an Australian study, which would disprove our association between within diesel exhaust exposure and lung cancer risk. That's pointed out in a number of studies in our document.

And OEHHA's reviewed that study now as a technical report from the Australian government.

The study is conventional cohort investigation intended to examine all causes of mortality. It is not specifically a study of lung cancer or of diesel exhaust.

And there were actually a number of problems, technical problems, with the study, which was designed to be a preliminary study anyhow.

There was not a minimum period of employment for the coal miners to be in the cohort. They mixed coal miners from underground mines and above-ground mines. They had difficulties tracking the miners' work experience.

Most importantly the average age of the cohort was between 40 and 50 years old, which is really not old enough to be examining these individuals for incidence of lung cancer.

And 30 percent of the cohort had been in the

industry less than ten years, so we didn't have enough exposure time lapsing.

And also the report included deaths in the first ten years of the cohort experience, which just adds noise to the cancer analysis.

And finally the SIR for lung cancer for the entire cohort, while appearing to be lower than the general population, was actually not statistically significant.

Does anyone want to discuss individual points or want me to touch on other things that you've read in our response to comments?

DR. BLANC: I just want to say in terms of the coal mining study, particularly such a hubbub was made about it, I found it verging on the absurd that you even had to respond to that. It was not germane and it was not appropriate for analysis of any kind of cancer risk, let alone diesel-related lung cancer risk.

So I think you're completely on safe ground by disposing of that in short order.

And in fact the summary document upon which that published paper was based, itself acknowledges that the study cannot be used to address cancer risk because the latency period is insufficient to evaluate cancer in that cohort.

ACTING CHAIRMAN FROINES: Gary.

DR. FRIEDMAN: I just want to add too that I was very disturbed by some of the comments that said that your group was biased, that you started out with a forgone conclusion and just tried to prove it.

And I think that that's not true at all, and I think those, that kind of comment is totally inappropriate.

I know your group has worked very hard to respond to all the comments to really do an objective analysis, and I think that people who make comments like that should realize that they're just not appropriate. They're ad homonym arguments which have no role in a scientific discussion.

DR. GLANTZ: I just also, I thought you guys did a very very fine job of responding to the comments. I mean, there's a huge volume of them. They were very all -- they were covering a wide variety of issues and I thought the responses were really strong.

I have a couple of things I want to suggest, based on the comments, but overall I think you just did an exceptionally good job on it.

DR. MARTY: Thank you.

ACTING CHAIRMAN FROINES: I think when you look at the US EPA document and you compare it to ours, it's really very impressive, given that we're operating as a state agency, in contrast to the federal government.

And I can say, having been the longest term member of the panel, that this is in fact the best document that I've ever seen from OEHHA and ARB. It's really quite an extraordinary document, I think.

And then with that, we'll break, because in the afternoon it gets -- we start to go at the document a little harder. Get the good news first.

We're going to start at 1:00, folks, because I want to get everybody's energy going so we can get through here today.

(Thereupon the lunch recess was taken.)

A F T E R N O O N S E S S I O N

ACTING CHAIRMAN FROINES: I'm calling the meeting to order.

The tension level in this room is much too low. We expected about 500 truckers here. That didn't materialize, and now everybody is so relaxed we can't move anything forward.

So for better or for worse, whatever way we're headed, let's move it along.

That requires Stan Glantz taking a seat.

And Genevieve and her people up here.

Tony is going to start with the findings.

Come on, Paul. We give you $100, we expect every minute of your time.

What we want to do is to integrate comments on Part A and Part B as we go through the findings. So you guys are going to have to be creative, nonlinear, of course.

We're about to pass around the most recent NIOSH information on risk assessment, which you won't have had a chance to read, but that is literally hot off the presses.

And it has the advantage of being miners and truck drivers, so it's not same old, same old.

DR. GLANTZ: We were discussing the origins of why Hanspeter thought RR meant railroad.

DR. BLANC: That's because Stan is often trying to

railroad people with his epidemiologic --

DR. GLANTZ: No, no.

ACTING CHAIRMAN FROINES: So we're ready to go.

Tony, could you take us through each section of the first half of this?

DR. GLANTZ: Wasn't Genevieve going to talk about their response to comments first?

ACTING CHAIRMAN FROINES: Who?

DR. GLANTZ: Genevieve.

ACTING CHAIRMAN FROINES: They will, but we're going to move this so we can finish this today.

DR. GLANTZ: I'm fine.

ACTING CHAIRMAN FROINES: And we have had the comments to read and Genevieve and Melanie know that as we move forward here, where there are comments that are germane to the findings, they will bring them in.

If there's new science, then somebody needs to tell us about that, but I've been listening to this stuff for nine years now, and I'm not hearing a lot of new science.

DR. GLANTZ: Okay.

ACTING CHAIRMAN FROINES: Lot of mathematicians, but that's about it.

DR. GLANTZ: Well, let's go.

DR. FUCALORO: Okay. I'm new to this, and was

called -- pressed into service because Jim Seiber had to be out of the country, legitimate reasons, as far as I know. And I have to report on Part 1 or Part A.

I'm just going to read something that Jim suggested, some suggested language to be added to our findings to see whether or not you agree with it.

After that I guess we can throw it open to the discussion to respond to this.

ACTING CHAIRMAN FROINES: Usually we go around the room and get comments.

We're now in the Part A findings, everybody, so we're going to go around the room and get comments on the Part A findings.

DR. FUCALORO: People can respond to this or make any other statements they wish to make regarding Part A.

Let me read what Jim has written.

He said, although there is evidence that diesel exhaust is carcinogenic, particulate matter concentrations in California's estimated total population, air exposure has decreased significantly from 2.1 plus or minus .8, he has grams here, but micrograms per meter cubed in 1990, to 1.5 in 1995, and estimated values of 1.2 for 2000 and 1.1 for 2010.

Also very recent ARB-sponsored studies by UC Riverside and UC Davis scientists show significant

reductions in concentrations of some carcinogenic components and a reduction of specific mutagenic activity in exhaust from modern diesel engine running on either reformulated or low aromatic fuels of the types introduced in California in 1993.

Thus the trend in reducing particulate matter and carcinogenic components in diesel exhaust emitted in California is positive.

SRP recognizes the improvements made to date and encourages further studies aimed at documenting and reducing the toxic potential of diesel exhaust as emitted to California's air environment.

I would say that that's not clear from what I heard today that the carcinogenic activity of diesel exhaust has been reduced, but it might have been reduced in these new fuel formulations, and so the last sentence still obtains, it seems to me, encouraging further studies aimed at documenting and reducing the toxic potential of diesel exhaust as emitted to California's air environment.

So with that, I would go around the table and see what people think.

ACTING CHAIRMAN FROINES: You've made a presentation. Do you want to respond to that?

MS. SHIROMA: Yes. Just to help direct the discussion, I think that we have touched on Dr. Seiber's

points in your number five, also number nine, and number 10.

Now, in light of his comments, you may wish to add more specificity, but I think the three topic areas are covered, the estimated ambient total exposure, the acknowledgement that the current regulations will reduce, are anticipated to reduce that total exposure, and then the CE-CERT analysis.

DR. FUCALORO: Right.

Of course in No. 10 I would argue, and you can tell me if you agree with this, with the removal of the sentence which says the results indicates that diesel exhaust from the new fuel tested contained at the same relative portions of toxic air contaminants as the old fuel.

I don't think that's quite accurate. I don't think it changes any of our conclusions regarding diesel exhaust as a toxic air contaminant.

I'm just not sure from the data, unless you can convince me otherwise, that that's true.

MS. SHIROMA: And we are focusing on the toxic air contaminant subset of the mix, but we could suggest that you consider that the exhaust for the new and the old contain the same constituents.

DR. FUCALORO: I think that's fair to say.

MS. SHIROMA: Okay.

DR. FUCALORO: I think that's fair to say, they

do.

MS. SHIROMA: Contain the same toxic air substances as the old fuel. Take out the phrase relative portions of?

DR. FUCALORO: Right.

MS. SHIROMA: So the sentence would read the results indicate that the diesel exhaust for the new fuel tested contain the same toxic air substances as the old fuel.

DR. FUCALORO: Yes.

And I think in some ways that's accurate, but in union with the next sentence, maybe you need some other sentence in there which says, or something added to that sentence, although, perhaps, perhaps at different concentrations. So then that makes sense at the next sentence which says further research will be helpful to quantify the amounts of specific compounds emitted for a variety of engine technologies, operating cycles and fuel, to better characterize any differences between old and new.

MS. SHIROMA: So then we will add in -- and I think that's --

DR. KENNEDY: I don't mean to talk out of turn, but are not the differences in new fuel more complex simply than their carbon components? We're talking particle size, which is really an unknown. We've got some balancing

forces.

I think that to make a summary statement that reflects only these components is really not doing justice to the changes, although I certainly would agree that we are all in favor of continued investigation into what these differences mean in terms of our safety.

DR. GLANTZ: I actually was going to suggest we just delete No. 10. I think especially with the changes that we're making now, I don't see what it really adds to the findings. Everyone is always in favor of more research and better fuel and all that. I mean --

DR. FUCALORO: Well, I think in this case the reason for putting it in, this is I'm speaking for Jim on this, I think I agree with this, is that the composition of diesel exhaust probably does change, not only the amount, but the composition does change. It's different than, say, benzene, which is one compound, but this is a mix of compounds, a heterogeneous mix in terms of phases, that we have to be very careful to note that the change may be good and may be bad, and we have to -- and continuing research would ensure that study continue.

DR. GLANTZ: Okay.

ACTING CHAIRMAN FROINES: You have a sentence that you two can agree that will be in there?

MS. SHIROMA: I think we're very close. I was

going to suggest that perhaps a sentence that we're suggesting on ES-11, the executive summary on page 11, to add in the CE-CERT. We have a sentence saying -- it's labeled as E-11 in the revisions to the February 23rd report, and Peter just handed that around.

DR. FUCALORO: Read it.

MS. SHIROMA: A comparison of the milligram to milligram per cubic meter emission profiles using the three different fuels showed the presence of the same toxic substances in a similar distribution of toxic substances, but with a few substances showing much different emission rates.

It then goes on to mention that in addition, higher mutagenic activity was observed in both the particle and vapor phase.

ACTING CHAIRMAN FROINES: That would be enough, I think. Let's not -- these are findings and we're going -- we're not going to take the executive summary and make it into findings. These have to be simpler. So I would accept a sentence, but --

DR. BLANC: Let me suggest a phrase reflecting what everyone has said.

The sentence would now read in point 10, the results indicate that diesel exhaust from the new fuel contains the same toxic air contaminants as the old fuel,

although there are concentrations and other components may differ. Period. Further research, blah-blah-blah.

ACTING CHAIRMAN FROINES: I want to have further research in there.

DR. FUCALORO: I do too.

DR. BLANC: Would that phrase be --

ACTING CHAIRMAN FROINES: That's fine.

DR. FUCALORO: We can't call Jim Seiber, but I think that reflects his --

ACTING CHAIRMAN FROINES: If he gets a trip to the Netherlands, he doesn't -- we don't have to check with him. He made the trip after this thing was scheduled.

Give it to somebody who can be more responsible than me.

That was good, Paul.

MS. SHIROMA: That will do it.

DR. FUCALORO: That works.

MS. SHIROMA: That works.

ACTING CHAIRMAN FROINES: I don't think -- I would oppose putting in this mutagenic activity in. One, it wasn't statistically significant and, two, it was change of a half, and if you're a mutagenesis person going for a change of a half doesn't really mean very much.

DR. GLANTZ: Could I just as a point of information, are the findings, the draft findings you handed

out today, the same as the ones that were faxed around yesterday?

MS. SHIROMA: Yes.

ACTING CHAIRMAN FROINES: This is just a working document.

DR. GLANTZ: I just want to make sure, because I read those and didn't read this.

DR. FUCALORO: I guess with that issue resolved, as near as I can tell, it seems to, we can go around the room now and gather the comments from various panel members on Part A.

So I would ask Craig to --

DR. BYUS: I have no comment. I agree with these changes. I think it's perfectly fine.

ACTING CHAIRMAN FROINES: You're on 1 through 10.

DR. FUCALORO: 1 through 10, which is Part A.

ACTING CHAIRMAN FROINES: Check your notes and see what you have.

DR. BYUS: I like the findings, virtually all of them.

DR. FUCALORO: 1 through 10.

DR. BLANC: I have a question.

Vis-a-vis comments that were made, why did somebody make a big deal about whether we said it was gases and fine particles, as opposed to saying gases and vapors

and fine particles? Maybe our lawyer would say why that -- that was lost on me as to what the -- it seemed to be a big deal to somebody, and I couldn't figure out exactly why.

Do you remember that comment?

ACTING CHAIRMAN FROINES: When I see comments like that I tend to go by them pretty fast, because I think they're --

DR. BLANC: I thought it had some legal implication as well.

DR. FUCALORO: There is a scientific distinction.

DR. BLANC: That I know.

MR. KRIEGER: Dr. Blanc, I'd like to try to address that.

Legal issue, I don't think that's the problem.

I think it was quoted in one part of our text as being gases, vapors, particles, and another part of our text it was quoted as gases and particles.

Diesel exhaust is a mixture of gases and particles. The particles there's phases, you have a solid phase and you have a vapor phase, so the confusion over the terminology is what spurred that comment.

DR. BLANC: I only brought that up in terms of the very first paragraph. It was a nonissue, it didn't matter to me.

DR. FUCALORO: Now, Craig, you're completed?

DR. BYUS: I'm fine.

DR. FUCALORO: Paul, do you have any other comments regarding the first ten conclusions?

DR. BLANC: Well, I wonder why John hasn't said anything here. I guess you say it later about the nitro-PAHs. So it's in the second -- it's in point 2, but it's not in point 1, except PAH derivatives includes the nitro-PAHs, I assume.

John, do you see what I'm talking about?

ACTING CHAIRMAN FROINES: Under 2?

DR. BLANC: Under 2 you specifically mention PAH derivatives such as nitro-PAHs, but in paragraph one you just say PAHs derivatives.

ACTING CHAIRMAN FROINES: No. Because paragraph one is intending to focus on gases.

Paragraph two is intended to focus on particle-bound chemicals.

There was a clear distinction made there.

You notice that in paragraph one we're talking about products of incomplete combustion, gases, fractions, includes all those, and the PAHs that we're talking about there are things like naphthalene that are basically vapors, in a vapor phase or gaseous phase.

Then you go down to two and you're talking about the particle bound organics.

MS. SHIROMA: Dr. Froines, maybe some of the confusion is maybe this is just a typo and you paste and click and so forth. Last sentence on No. 1 says some of the gaseous components are and it includes arsenic and nickel.

And perhaps that's where some of the confusion is. Perhaps that was meant to be moved.

ACTING CHAIRMAN FROINES: Well --

DR. BLANC: Yeah.

ACTING CHAIRMAN FROINES: I had wanted to put in the list of carcinogens identified, and that would have been under three, and that didn't get in. It was on a slide here today, but it never made the text, and I wanted it to be spelled out. So I would just as soon take out that last sentence of one, but I wanted it included under three.

MS. SHIROMA: And it would be more generic. Some of the components --

DR. BLANC: Get rid of the word gaseous then, is what she's saying. So then it should read some of the components of diesel exhaust, such as benzene, formaldehyde, 1,3-butadiene, arsenic and nickel are suspected or known to cause cancer in humans, and that entire phrase then should be moved to be the last sentence in point No. 3.

ACTING CHAIRMAN FROINES: Yeah. The only thing I didn't like about this was -- it's okay.

DR. BLANC: Would that be acceptable?

ACTING CHAIRMAN FROINES: I would add chromium in there. Add chromium in. But there are other --

DR. BLANC: Well, you said some.

ACTING CHAIRMAN FROINES: Here's my point. This is about the gaseous phase and some of the constituency --

DR. BLANC: But clearly arsenic is not in a gaseous form.

ACTING CHAIRMAN FROINES: Wait. Sure it is. If nickel and arsenic are in a gaseous form, then chromium is too.

DR. BLANC: Not as a fume?

ACTING CHAIRMAN FROINES: That's part of the problem with this.

My problem was that I wasn't so sure we should have the metals in here as gases.

DR. BLANC: Wouldn't that solve the problem if you get rid of the word gases, and just say some of the components?

ACTING CHAIRMAN FROINES: That's right. It saves that.

But the point is I would rather have a section under three where we actually list the carcinogens found in diesel exhaust. And that wasn't done when I asked for it to be changed.

So we list a few compounds here that in essence

referred to the gaseous aspect of it.

DR. BLANC: Well, let me ask you then, if you were going to add other things that you felt were nongaseous, so that we avoid the argument of arsenic and nickel, you would include there PAHs and nitro-PAHs, or what else, what would be missing?

ACTING CHAIRMAN FROINES: No. Because those aren't --

DR. BLANC: What would be missing from there, assuming that we added chromium?

ACTING CHAIRMAN FROINES: You see what you've got, we've created an apples and oranges problem here. We start out talking about gases.

DR. BLANC: Well, I think it's confusing to talk about those perhaps, then.

I mean is it that important to you that we talk about those detailed gases. Your real point is that they're carcinogens. So then doesn't it make more sense --

ACTING CHAIRMAN FROINES: I would take out -- I think we should just take out that sentence and have the carcinogens listed under three.

DR. BLANC: Yeah, that's fine.

ACTING CHAIRMAN FROINES: Then it's in its proper --

DR. BLANC: That's what I am suggesting,

essentially.

ACTING CHAIRMAN FROINES: So we take out the last sentence of one, and add a list of carcinogens that are under three.

DR. FUCALORO: And I'm given to understand that arsenic and nickel are probably organometallic type --

ACTING CHAIRMAN FROINES: No, no. There's --

DR. FUCALORO: I'm wrong about that? Nickel is in what form just --

ACTING CHAIRMAN FROINES: It's a fume. It's a fume. And that's why it was incorrect actually to list it as a gas, because you just have to decide what you think is the relationship between a gas and a fume.

DR. FUCALORO: I see.

DR. GLANTZ: Are you saying that what we would be doing then is like in No. 3 saying there are many carcinogens in diesel exhaust, and then list the ones that are listed in the report?

ACTING CHAIRMAN FROINES: Yeah. Irrespective of their gases or particle base.

DR. FRIEDMAN: I would suggest, though, that when you do that, since that statement in No. 3 says possible, probable, et cetera, that you distinguish, because someone might conclude that 16 of the 17 are just possible. So I think that you should set a definite, the probable and

possible each listed separately.

ACTING CHAIRMAN FROINES: Right.

DR. BLANC: One other thing that would make it clearer to the reader, because this was something that confused me, I understand it now, but you've explained your intent, would be actually since you want one section to be about gases and the next one to be about particulates, that's the intent, right? It would actually be clearer that that's what you were doing if that's what we were doing if point No. 1 was one sentence only, which was diesel exhaust as a complex mixture of gases and fine particulates emitted by diesel fuel internal combustion engine. And point two would start the gases fraction is composed of, and then everything else would be one number higher.

That would make it clearer, because the very first sentence is what confused me, since that was a lead-in sentence to talk about gases and fine particles. I never would have realized it --

ACTING CHAIRMAN FROINES: How about another suggestion, because I don't quite agree.

How about if we have 1 A, B?

DR. GLANTZ: I think you should have two.

ACTING CHAIRMAN FROINES: I think 1, 2 and what is now 2 will become 3?

DR. GLANTZ: Yes.

DR. BLANC: Yeah.

DR. FUCALORO: I think so. Because it lays out the -- one says they're both gaseous and particulate, and two and three and give you the gases and --

ACTING CHAIRMAN FROINES: That's fine. I don't like one-sentence paragraphs.

DR. BLANC: I don't like bullet intros to paragraphs that then don't talk about what the bullet intro says.

DR. FUCALORO: Now that we handled these comments on style, let's get back to the science.

DR. BLANC: John, I have one other, this is actually just a very very minor thing.

In the former paragraph six, the very last sentence, the sentence says it also excludes other routes of exposure to diesel exhaust, such as ingestion and dermal absorption, from deposition of diesel exhaust.

I almost wondered if there was a word missing there or was that -- I wasn't sure what that comma was supposed to make me --

DR. FUCALORO: As an extra comma.

DR. BLANC: Does that comma really need to be there?

The dermal -- well, my question is is both the dirt got the diesel from deposition and the dermal

absorption is from deposition, right? So the deposition refers to both of those things?

DR. KENNEDY: That sentence excludes other routes of exposure to diesel exhaust from deposition to diesel exhaust. That's the --

DR. GLANTZ: The deposition of diesel exhaust should be deleted.

DR. FRIEDMAN: Change it to exposure to deposited diesel exhaust, such as ingestion of dirt and dermal absorption.

DR. BLANC: Yes. That would be clearer.

DR. GLANTZ: Can I say one other thing about that one?

There were some stuff in the public comments about the problems of water, of compounds from diesel getting into water, and then being, you know, drank or drunk, or whatever.

And you can correct my grammar, Paul.

I think it would be just worth just mentioning that, that there's another of the things that we're excluding is diesel exhaust that gets in through the water supply.

There were two letters in the public comments, or more than two, there was a bunch, talking about that. One was from the Bay Area Water Control District, or something.

You're looking very blank, John.

ACTING CHAIRMAN FROINES: No. I'm waiting for you to make some recommendation.

DR. GLANTZ: I would just recommend, and you have a list here where you're saying it also includes other routes of exposure to diesel exhaust such as ingestion of dirt, water and dermal absorption.

DR. FUCALORO: And I'd like to take the lead here, because I think Gary had a sentence that I think can incorporate your suggestion. So if you can repeat --

DR. FRIEDMAN: I just suggested taking off from deposition of diesel exhaust and putting in the word deposited before diesel, before diesel exhaust. So I'm not sure how that would quite encompass Stan's concern.

DR. BLANC: All you have to do is insert the word water after dirt. Dirt, water, and dermal absorption.

DR. FUCALORO: Why can't you have deposition?

DR. KENNEDY: The really key question here is not necessarily the source, but the route of exposure, which is the sentence. So routes of exposure include ingestion and dermal absorption, and that's it. And you can eat it, you can drink it, you can roll in it, and sort of there. Beating the horse.

ACTING CHAIRMAN FROINES: Peter, where are you making --

DR. KENNEDY: The same sentence, that excludes other routes of exposure as -- meaning noninhalants, to diesel exhaust, such as ingestion and dermal absorption. Period. End of discussion, end of sentence. It implicitly includes any form of ingestion.

DR. BLANC: Dirt or water.

MS. SHIROMA: Gentlemen, along those lines, Melanie was reminding me that crop ingestion is also another key example. These were meant to be examples, but Dr. Kennedy --

DR. GLANTZ: I like what Genevieve is suggesting.

ACTING CHAIRMAN FROINES: I'm still trying to get it.

Such as ingestion of dirt?

DR. KENNEDY: Just ingestion.

DR. GLANTZ: Ingestion and dermal absorption, period.

ACTING CHAIRMAN FROINES: Got it.

DR. KENNEDY: Source of the contamination is not important. It's the route of it. It's the route of application.

ACTING CHAIRMAN FROINES: Got it, Genevieve?

MS. SHIROMA: Got it.

DR. GLANTZ: The sentence would read it also excludes other routes of exposure to diesel exhaust such as

ingestion and dermal absorption, period.

That's what you were suggesting; right?

ACTING CHAIRMAN FROINES: You done?

DR. GLANTZ: I think that's fine.

DR. FUCALORO: Is there any other comment on this issue?

If there isn't, we get back to Dr. Blanc who --

DR. BLANC: No. That's it.

DR. FUCALORO: You're finished with your comments?

MS. SHIROMA: Pardon me, Dr. Fucaloro. Sorry to interrupt.

Just a protocol comment. Kirk has indicated for members of the audience that there are extra copies of the material that you're looking at now on the table.

And then also Kirk is reminding that the other SRP members are now back from lunch and have been for some time, just for the record, since we reconvened.

DR. FRIEDMAN: I have nothing to add on this part.

DR. FUCALORO: Good.

We'll go around to Dr. Glantz.

DR. GLANTZ: I'm happy now.

DR. FUCALORO: I'm sorry. I didn't hear you.

DR. GLANTZ: I have nothing more.

DR. FUCALORO: Nothing to add.

DR. WITSCHI: I was wondering, the first sentence,

you describe the diesel engines --

DR. FUCALORO: I'm sorry. What you are looking at?

DR. WITSCHI: No. 2. The first sentence, does it still adequately describe new types of diesel engines?

DR. FUCALORO: That's a good question.

I guess, I certainly don't know the answer to that and would call upon members of the ARB.

DR. WITSCHI: I recently talked to Joe Mauderly and he told me, this isn't a quote, but when they did the first diesel studies with the '81 engine they had, they had to dilute the smoke to get about eight milligrams per cubic meter. And they repeated the studies in '86 or '88 and the new engine, and they just could use what came out of the tailpipe for getting the same particle loads they had in the previous study. And if he was going to use a modern today engine, he would have to concentrate what they were coming out of tailpipe.

So I'm really wondering with this statement that release of particles at the rate of about 20 times greater than from gasoline fueled vehicles if this is still true with modern technology.

DR. FUCALORO: Go ahead.

MR. KRIEGER: Dr. Witschi, the 20 times greater comes from at least the most recent study that we're aware

of which examines early 1990 engines, and that was from actually the World Health Organization report. That 20 times calculation came from that.

In our report we mentioned, and like you said, it's true, the older engines have greater amount of particles than the gasoline, they just didn't catch up in technology yet, but we mention it's a 50 to 80 times greater in the report, but generally it's 20 times a good number right now for the current technology.

DR. WITSCHI: But the greatest, they way this reads, this is a one-dimensional statement in a multidimensional world.

DR. FUCALORO: How would you suggest changing it or would you suggest eliminating it? I mean, you're obviously critical of the statement. Can we modify it?

DR. WITSCHI: Well, this is clearly something that has changed over times, and probably is going to change over times too.

And in this describing diesel exhaust, those changes that have been accomplished and those changes which are going to occur should be acknowledged. As I said, otherwise it becomes a one-dimensional statement, which does not reflect reality.

DR. BLANC: Well, I have a suggestion that I think that would address that.

Part of that is covered in the later points, but in terms of making it clearer, because later points are made about the changing technology and so forth, but I think the addition of the following phrase at the end of the first sentence would perhaps address your concern, such that it would read now at the very end of the sentence, on an equivalent fuel energy basis, based on technology currently in use, period.

DR. WITSCHI: I'm not so sure about current. He said 1992. We have 1998.

DR. BLANC: Based on technology in use, widely in use as of 1992.

DR. WITSCHI: Well --

DR. BLANC: I think --

DR. WITSCHI: There is an additional problem there, and this is not only the progress in engine technology, but the other problem of not as many changes in the fleet as we could expect from changing technology. Because many of these old clunkers, which are emitting more, are still around, actually too many of them.

DR. BLANC: You're saying for many, it's more than 20?

DR. WITSCHI: Yeah.

DR. BLANC: I think the number 20 reflects an average of old technology and new technology.

DR. WITSCHI: What it's bothering me is this first sentence simply doesn't describe the situation. It's much more complex, and which eventually is coming to judge health effects have to consider to some extent.

MS. SHIROMA: May we offer some suggested language? And then Dr. Witschi's comment.

Again, the suggestion is one of the main characteristics of diesel exhaust is the release of particles at a relative rate of 20 times or greater than from gas fuel vehicles, depending on -- dependent on the age and operating conditions of the vehicles, because that's essentially what the WHO report indicated, that it could be up to 80 times, depending on the age and operating conditions of the older --

DR. WITSCHI: I would agree with extrapolating back up to 80 or whatever it is, but I'm not quite so sure about the 20.

DR. FUCALORO: Do you want to avoid any specific quantitative term or we can put in a hedge word, many multiples of that from gasoline-powered vehicles. Would that be better for you?

DR. WITSCHI: It might. I'm still not --

DR. FUCALORO: In some ways it seems to me in reading the remainder of that paragraph, that first sentence isn't that important to mention gasoline-fueled vehicles. I

mean, except to mention that there's -- to indicate that there's a large fraction of the exhaust is particulate matter in diesel powered.

And then the second sentence the particles are mainly aggregates of, and that's specific to diesel fuel.

So maybe that's the approach once you take that it's recognized that a good portion of diesel exhaust is in the form of particulate matter.

Then the particles are mainly aggregates, and so on.

DR. FRIEDMAN: I think, though, that the comparison with gasoline is worthwhile because people are saying, there had been some comments, you know, why are you picking on diesel exhaust, why don't you pick on all exhaust.

So I find that some kind of comparison, whether it's 20 times or something indicating a much larger rate of particle formation --

DR. FUCALORO: But his point, of course, is that the absolute quantitative amount is such a difficult thing to nail down, because there are older vehicles, newer vehicles, changes since 1990 something, whenever you had the last measure. So one could then also say that it is a -- that the particulate matter is a large portion, much higher than in gasoline-powered vehicles.

ACTING CHAIRMAN FROINES: Why don't you just say -- excuse me. Why don't we just say which is the release of particles greater than from gasoline-fueled vehicles on an equivalent fuel basis?

DR. FRIEDMAN: Would it be fair to say considerably greater?

DR. BLANC: I would actually say at least in order of magnitude greater, because even -- you know, even if you're not happy with 20, I think that they --

DR. FUCALORO: At the minimum.

DR. BLANC: Ten is certainly giving you even more of a fudge factor downward. So I would say that if we said at least in order of magnitude it would put things in the range that we're talking at a minimum.

ACTING CHAIRMAN FROINES: Let's do that.

DR. WITSCHI: The other thing is that might be a bit off the wall, but the emphasis on particles puts everything we think is bad about diesel, the particles, and that's a fact I'm not convinced of.

DR. BLANC: I don't think that starting with paragraph one gives that impression.

DR. WITSCHI: Okay.

DR. FUCALORO: It talks about both particles and the vapor phase and this particular paragraph has to do with the particulate matter.

DR. BYUS: I think we do have to make some comparison with the gasoline engine. Everyone accuses us of picking on diesel. I mean, this is the reason. It's explained in detail.

I would be in favor of using the word markedly more, instead of just tenfold. I don't think you can put any number. But I would say markedly more, and then leave it at that.

I mean, you could say even that there has been a number of attempts to improve the emissions of diesel engines. Everybody knows this. If we want to put something in the findings, because they have, I mean, later on they mention it. But I would say just markedly more particles.

ACTING CHAIRMAN FROINES: I want to go back and --

DR. FUCALORO: Can I get closure on this?

Do you think do you have the wording that represents that?

MS. SHIROMA: Yes. One of the main characteristics of diesel exhaust is the release of particles at a markedly greater rate than from gasoline-fueled vehicles --

DR. FUCALORO: On an equivalent fuel basis.

MS. SHIROMA: On an equivalent fuel energy basis.

DR. FUCALORO: Does everyone find that acceptable?

ACTING CHAIRMAN FROINES: I thought it was -- is

the release or particles at least in order of magnitude greater than from gasoline-fueled vehicles?

DR. FUCALORO: That was the previous suggestion by Paul. But Craig has said -- wants to go to back to the less quantitative statement and used the word markedly greater.

My own preference, I don't have a preference. I think both are fine, as far as I can tell, but so I'm willing to accept either one, but if any of you --

DR. FRIEDMAN: Is there any concern that it could be less than tenfold greater?

Hanspeter, is it --

DR. WITSCHI: Yeah. According to what some people telling me is that today's 1998 diesel engines approximate internal combustion engines with regard to what's coming out of the tailpipe.

DR. FRIEDMAN: Then I guess I would stick to markedly.

DR. FUCALORO: Then I go with Craig.

DR. WITSCHI: It's something that really would have to be checked into.

ACTING CHAIRMAN FROINES: I think we should draw this to closure.

DR. FUCALORO: I think we have.

Do we all agree on Craig's wording, that is to say markedly greater? Okay.

ACTING CHAIRMAN FROINES: I want to go back to one for a second, where we say volatile hydrocarbons, aldehydes, et cetera.

I want to have it changed to be volatile organics such as aromatics, butadiene, benzene, formaldehyde as example, because volatile hydrocarbons is not a sufficient descriptor of the gaseous compounds.

You can say, you can include hydrocarbons, but I think we need to show that there are other volatile hydrocarbons, aromatics, alkenes, such as volatile hydrocarbons, alkenes, aromatics, aldehydes and low molecular weight polycyclic or aromatic compounds.

DR. FUCALORO: Any comments on that suggestion?

If it's -- if not, if it's been recorded, we'll move on.

ACTING CHAIRMAN FROINES: Peter, you done?

DR. WITSCHI: I'm done.

ACTING CHAIRMAN FROINES: Everything?

DR. FUCALORO: We have another Peter.

ACTING CHAIRMAN FROINES: One through ten.

DR. KENNEDY: I have one small change, since we're talking levels of comfort.

On the last line, become trapped into is grammatically incorrect. I would suggest trapped within the small airways and alveoli of the lungs. Anatomically, small

airways is a better term.

DR. FUCALORO: I'll defer to your knowledge on that.

ACTING CHAIRMAN FROINES: Go ahead.

DR. FUCALORO: Did you record that?

Any comment on that?

I come back to you, John, do you wish to make any comment?

This is your construct, so I guess maybe you're pleased with that.

Okay. Again, this is my first go-around at this sort of thing.

Are my duties completed or do I need to --

ACTING CHAIRMAN FROINES: You're done.

DR. FUCALORO: I'm done. Thank you.

ACTING CHAIRMAN FROINES: Thank you very much.

Okay. Now, we'll get down to the hopefully easiest part of the discussion. We want to go over now the health effects associated with diesel exhaust.

I am the lead, so I'll take the lead on going through it.

I just want to say that as far as I was concerned, the document dealt, as far as my reading, with both animal and human acute effects of diesel. The document deals with chronic, again animal and human effects of diesel. The

document deals with immunologic effects, animal and human. It has some discussion of mortality of non-cancer effects. It deals in animals and humans with respect to genotoxicity. It addresses bioavailability, which is a very important issue.

I should say that we're doing a lot of work now on chromium where we're finding in fact that particles are not bioavailable, and so in some cases with some substances you have real significance with respect to carcinogenicity.

And finally, the document deals with lung cancer.

Now, I've left out some other categories, like reproductive effects, developmental effects, bladder cancer, because those the document concluded there was not sufficient evidence, although it may have hints of evidence to focus health effects discussion on those.

So that the ones, the list I just went through, represent those effects, those health effects that the document addresses that they consider significant within the context of identifying diesel exhaust as a toxic air contaminant.

So we have the obligation now to determine whether, in terms of finding this as a toxic air contaminant, whether or not the State has met the burden of proof or the quality within the context of those subject areas.

So it seems to me that perhaps one of the first things we can address within the context of the health effects part of the findings is those areas where we -- there is evidence for health effects.

And I'll go around the room and I'll start with Craig Byus again and come back to finish with Tony.

DR. BYUS: Yeah. I have minimal comment on this as well. I find after the last meeting I had all the issues I had cleared up and I think it's written quite well in terms of the in vitro and in vivo data. I'm very pleased with it.

ACTING CHAIRMAN FROINES: We love those kinds of comments.

DR. FUCALORO: The author loves those type of comments.

DR. BLANC: One of the things that struck me throughout those discussions in the focus on the carcinogenic issues associated with diesel exhaust has been the relative back burner that non-cancer risk has had to take, and it's partly driven by the requirements for quantitative attempts and quantitative risk assessment, I realize, and how that kind of risk assessment gets even more complicated dealing with non-cancer outcomes.

I believe that even absent any evidence of carcinogenicity, which is overwhelmingly convincing for

this, that this would be a toxic air contaminant on the basis of its non-cancer health-related effects.

I don't think we need to say that explicitly, but what I would like to see, I think, in the current number, 14, which will I guess change to 15 as all the numbers get inflated by one, is a statement which might say something like it should be recognized that this reference exposure level may need to be lowered further as quantitative data emerge on the potential adverse non-cancer effects from diesel exhaust in the future.

ACTING CHAIRMAN FROINES: Paul, can you say that again slowly. It should be recognized that --

DR. BLANC: It should be recognized that this REL may need to be lowered further as quantitative data emerge on potential adverse non-cancer effects from diesel exhaust.

Because I think this is an area --

ACTING CHAIRMAN FROINES: To be lowered further?

DR. FUCALORO: I would get rid of the word further, wouldn't you, Paul.

DR. BLANC: Lowered, okay, as quantitative data emerge on potential adverse non-cancer effects from diesel exhaust.

ACTING CHAIRMAN FROINES: So that would be added to 14?

DR. BLANC: Yeah, the end of it.

ACTING CHAIRMAN FROINES: I don't see anybody standing up and protesting.

DR. BLANC: This is also just a question about are we discussing all the rest of the points?

ACTING CHAIRMAN FROINES: Yes.

DR. BLANC: Or just the points related to -- because there's some summary points at the end.

ACTING CHAIRMAN FROINES: Well, I think what we should do is we should be going through the points that you have in your head as things you want to address. As we get all around and there are points that are not yet addressed we should take that up then.

But you can only do what you can do, and others will presumably raise other points and then we'll have to go back and look at the document overall.

DR. FUCALORO: What Paul was just suggesting that items 20 through 22 are a summary.

ACTING CHAIRMAN FROINES: We'll have to go back to those.

DR. BLANC: Okay.

ACTING CHAIRMAN FROINES: So in a sense we're trying to deal with everything in a sense leading up to that.

DR. BLANC: Right.

ACTING CHAIRMAN FROINES: If everybody agrees with

everything that leads up to that, then that pretty much makes those last points they follow presumably, but we'll see.

DR. BLANC: Okay.

DR. FRIEDMAN: I thought that these were very well done, but I have one suggestion for the item that's currently numbered 16.

There's a sentence that seems to be trying to combine two ideas and it sounds like a non sequitur.

OEHHA analyzed the lung cancer findings for consistency and found that the association was unlikely to be due to chance.

I think that should be, if I understand it correctly, it should be restated that OEHHA found the lung cancer findings to be consistent and found that the association was unlikely to be due to chance.

There's two different things going on there.

ACTING CHAIRMAN FROINES: OEHHA found the lung cancer findings --

DR. FRIEDMAN: To be consistent.

ACTING CHAIRMAN FROINES: And found the association was unlikely due to chance?

DR. FRIEDMAN: Right.

DR. FUCALORO: Making it a compound sentence.

DR. FRIEDMAN: There's two things.

My only concern now with that change, and I don't have a better suggestion at this point, is there's the found, findings and findings. There's too many -- maybe you can say concluded, OEHHA concluded that the findings were consistent.

DR. FUCALORO: I find it to be fine.

DR. GLANTZ: Actually, though, these are really our findings, not OEHHA's findings, so I would suggest that we leave OEHHA out of it and just say the lung cancer findings are consistent and unlikely to be due to chance.

DR. FRIEDMAN: That will be fine.

ACTING CHAIRMAN FROINES: Lung cancer findings are consistent and the association --

DR. GLANTZ: Is unlikely to be due to chance.

ACTING CHAIRMAN FROINES: Is unlikely to be due to chance.

You have to remember that Stan is pretty good at this kind of thing, for those of you who don't remember the lead day.

DR. GLANTZ: Halloween.

DR. FRIEDMAN: That's all I have.

ACTING CHAIRMAN FROINES: Okay. Stan, we never assume that you will have quite the succinctness that Gary and Paul --

DR. GLANTZ: I just have a couple of things.

No. 16, I think the last sentence of No. 16 should be moved to No. 15.

And then in No. 18 -- well, let me, just before I comment on No. 18, I think that the --

ACTING CHAIRMAN FROINES: You're saying that the last sentence in 16 should --

DR. KENNEDY: Is not a epidemiologic study. It's animal information.

ACTING CHAIRMAN FROINES: Good.

DR. GLANTZ: Belongs with No. 15.

DR. KENNEDY: Can I expand on that just a moment?

Because I think there are a lot of conflicting animal data, even though this is clearly positive, and is there any responsibility to note that there are species-specific differences or that any issue of transference of mechanism needs to be considered?

It gets a little messy, but I think it is the responsible thing to do.

ACTING CHAIRMAN FROINES: Peter, were you going to say something about that?

DR. WITSCHI: No. Well, I really -- no, I don't think so.

First of all, we have only three animal species where this thing has really been tested, out of one -- which one, the hamster, never gets lung cancer from any

inhalation. So that's the one thing.

DR. KENNEDY: Mice where this doesn't really happen --

DR. WITSCHI: In mice it does happen, yes, in some, but the evidence is not all that good and all that consistent.

ACTING CHAIRMAN FROINES: It would be interesting, because I feel that the mouse issue is unresolved. I think there are definitely positive studies, and it's very dangerous to take a well-constructed animal study, specifically with mice, and find positive results and then draw a conclusion that there's no evidence in mice.

I think that if we went back and did similar studies with mice it would end up being positive. But I'm not arguing that.

So I think mice is one of the missing areas in this whole toxicologic investigation, but we're stuck with the data that we have, so we could say further animal research is relevant, but nobody is going to want to do it.

So one could say something about -- you could say although the mechanisms by which diesel exhaust induces lung cancers in the rat are not certain, but there may be some species specificity associated, but then we are making -- we as a panel are making a decision about a mechanism and this is a bit more neutral.

I'm not sure the panel wants to make that --

DR. WITSCHI: I'm not sure what you mean.

ACTING CHAIRMAN FROINES: What I'm saying is if we say something, if we hint anything about overload or Mikaylas Menton clearance processes or any of that, we're actually entering into the discussion of the mechanism, and it seems to me that we probably don't want to do that.

And if you're the person that's shaking your head no, then I'm happy, because you're the most knowledgeable in that respect.

DR. WITSCHI: Because if you're going down that route, you're going to find out that mice are unique too, the way they handle butadiene.

ACTING CHAIRMAN FROINES: I think Peter and I agree on one thing in the world, and that is butadiene is an important chemical.

DR. BLANC: Dr. Kennedy, I'm not sure where we are at this point. There's been some back and forth.

Are you satisfied with just moving the sentence as is?

DR. KENNEDY: I am --

DR. BLANC: Do you still want to say something additional?

DR. KENNEDY: I'm happiest with just moving it up.

And maybe the mechanism by which diesel exhaust

induces lung tumors is not certain. One could simply remove that clause.

DR. WITSCHI: Could we just add results of inhalation bioassays in the rat and with lesser certainty in mice have demonstrated the carcinogenicity.

ACTING CHAIRMAN FROINES: Say it again, Peter.

DR. WITSCHI: Results of inhalation bioassays in the rat and with lesser certainty in mice have demonstrated the carcinogenicity of diesel exhaust in test animals.

DR. KENNEDY: I'm happy with that.

DR. FUCALORO: If you put in the phrase with test animals.

ACTING CHAIRMAN FROINES: Read it to me again. I'm sorry.

DR. WITSCHI: Result of inhalation bioassays in the rat and with lesser certainty in mice have demonstrated carcinogenic potential of diesel exhaust in animals.

ACTING CHAIRMAN FROINES: You want to keep the sentence about mechanism in still?

DR. BLANC: No. He wanted to delete those.

DR. BYUS: Is everybody convinced then that diesel, all -- I mean that the diesel exhaust carcinogenicity in rats cannot be explained by the particles alone? That's the question.

ACTING CHAIRMAN FROINES: Wait. Let me just deal

with the factual.

Peter, are you taking out --

DR. WITSCHI: Take out the second sentence.

DR. BYUS: You see what I'm saying, I like the idea of the uncertain mechanism in a sense what we're saying, I mean my interpretation of that data was that much of the carcinogenicity, I would say much, not at all, but much of it in the animal data, the rat data, is explained by particle overload and the particles themselves, not necessarily. And so that eliminate diesel exhaust as being positive, simply the particles at very very high doses.

ACTING CHAIRMAN FROINES: I don't think the evidence --

DR. BYUS: That's what I'm asking everybody.

ACTING CHAIRMAN FROINES: I think what happens sometimes in science is that people want a hypothesis to work out to be the correct hypothesis, so the research that gets done gets emphasized in that area.

There's a lot of research on animals that hasn't been done. So in a sense what Joe Mauderly, who is a very fine scientist, has done, though, has focused his research, thereby leaving a bunch of questions unanswered.

So the role of more semantic cell mutation, the role of nitro-PAH carcinogenicity as is yet unresolved. It may not be important. It may be important.

I think it's important.

DR. BYUS: So do I.

ACTING CHAIRMAN FROINES: I think there are others that do.

So I think what we have now is we have a body of literature which is holding a place, but it doesn't mean it's holding the answer. It's just holding the place.

And so I'm not ready to say, yes, because you've got titanium dioxide and carbon and diesel and they all look about the same, that therefore the answer that follows is true. I don't agree with that.

And I think what we're going to see as we go forward is that both mechanisms are going to be playing a role.

DR. BYUS: I agree with you.

What I'm asking you is does the animal data in rats demonstrate that diesel exhaust is a carcinogen? That's what we're saying, does it demonstrate it?

And I'm not sure that it demonstrates it.

ACTING CHAIRMAN FROINES: I think two things.

One, I think there is one piece, one biological issue that's important, and that is that diesel produces cancers in mice, it appears, in rats and in humans.

Now, you can go through each one of those and find reasons why any one of them are not true, but I think that

you have to take seriously the fact that you have three species that have cancer from a similar exposure.

That, by itself, is important, I think, whatever the single species arguments and all that.

But that doesn't -- just one more point.

So but put that aside.

All I'm saying is with respect to the rat it appears that the mechanism of the carcinogenicity in the lung of the rat could change depending upon the dose that the rat receives. And that is the high dose may have a mechanism different than what you might find at a low dose.

DR. WITSCHI: Address your concern about has it been demonstrated, I mean if you look at carcinogenesis, and particularly inhalation assays in general, the diesel is really almost the only confounder. We have gotten almost identical results in at least three or four or five different labs. In all those labs they produced lumps and to me it has unequivocally --

DR. BYUS: But some of the particles, that's the point. And this is the point, clearly.

So you're then you have to say is it the particles or is it the diesel exhaust itself with the carcinogens.

You can't ignore that when you say demonstrate. That's what I'm getting at. That why I'm trying to say is I liked your attempt at qualifying that statement with the

mechanism. In a sense now we take that mechanism statement out, we're -- I mean, I'm less comfortable with it in a sense.

I agree with everything you say, but I just I think you can't get away from that point. It could be the particles themselves. The animal experiments, could it all be explained by particles, that's -- I'm not sure that it couldn't be, but certainly in rats it could be.

DR. WITSCHI: Well, you --

DR. BYUS: The other animals I'm less sure.

DR. WITSCHI: If you listen carefully to Joe, he never said that he doesn't believe diesel does the cancer, probably one of those mechanisms Joe alluded to.

All he said really was this particular mechanism or because it's a particular mechanisms which produced apparently those lumps in rat, we should not use this for the human situation. That's all he says. He never said that he didn't believe diesel was not carcinogenic.

ACTING CHAIRMAN FROINES: In fact he does. He was asked at a meeting I chaired and in fact he acknowledged that it was a carcinogen.

So that then we also have the issue going back to our favorite chemicals of things like benzene, formaldehyde, acetaldehyde, butadiene, that there are things besides particles that people breathe that do cause lung cancer, and

so it's entirely possible that when you're breathing all these gaseous compounds that are carcinogens, they may be a source of cancer that does not have anything to do with overload.

DR. BYUS: I have no doubt. I have no doubt about that, but I'm saying the data -- all I'm saying the data as it's done in the rats could all be explained by the particles.

ACTING CHAIRMAN FROINES: Well, let's go back to the action item, as opposed to a discussion item.

Would you prefer we left in that phrase because --

DR. BYUS: Yeah, I like -- but I'll --

ACTING CHAIRMAN FROINES: We can leave it in unless anybody strongly objects.

DR. FRIEDMAN: Could you point it out again. I've lost it.

ACTING CHAIRMAN FROINES: It says the sentence now reads --

DR. FRIEDMAN: What item is this?

ACTING CHAIRMAN FROINES: Item 16, page four.

Results of inhalation -- and it's been moved up to 15. Results of the inhalation bioassays in the rat and with lesser, something, certainty in the mice, have demonstrated the carcinogenicity of diesel exhaust in animals, although the mechanisms by which diesel exhaust induces lung tumors

in the rat are not certain.

DR. WITSCHI: Actually you should really just, to be honest in saying the mechanisms by which diesel exhaust induces lung tumors in animals.

ACTING CHAIRMAN FROINES: Okay.

DR. WITSCHI: Remains uncertain.

ACTING CHAIRMAN FROINES: That's better.

DR. FRIEDMAN: Doesn't that agree with you, Craig?

DR. BYUS: It does. That's why I liked it in there. I don't disagree with what everybody is saying, I just want to make sure that we don't -- it is important.

ACTING CHAIRMAN FROINES: Back to you, Stan.

DR. GLANTZ: In No. 18 -- before I comment on the change, I think we should make there, one change I think should be made to Part B of the report is that in Chapter 7 the quantitative risk assessment, I really think the assessment based on animal data gets in the way of the report.

Several of the commenters took exception to it.

And we don't use it in the end and I think it's very confusing.

And what one thing I would suggest is that the part that the sections in Chapter 7 that deal with the animal risk assessment be moved to an appendix to get them out of the way.

And that the animal risk assessment numbers that are in the figure, I think it's figure 7-10, be taken out of that figure.

I think if OEHHA wants to present the results of the calculations for people's information that's -- I don't have a problem with that, although -- but I really think it makes the report hard to follow.

And I think the criticisms of the use of the animal numbers that came in and the comments were well taken, especially since the human data, I think, is better.

So having made that suggestion, I would change No. 18 by deleting the first two sentences.

ACTING CHAIRMAN FROINES: Wait, wait, wait.

Are you suggesting, are you making a recommendation before you get to 18?

DR. GLANTZ: Yeah.

ACTING CHAIRMAN FROINES: That the animal stuff gets moved to an appendix.

DR. GLANTZ: The animal stuff in Chapter 7.

ACTING CHAIRMAN FROINES: George, what do you think?

DR. ALEXEEFF: It's okay.

DR. FUCALORO: It's my impression that the animal material was in that chapter historically because I think you were using those data for your risk assessment, then

when you decided not to, the material remained in that chapter. I think it should be set aside, perhaps in an appendix.

DR. GLANTZ: I wouldn't be that unhappy to see it disappear entirely.

ACTING CHAIRMAN FROINES: Anyone disagree with that move?

DR. KENNEDY: No. I think it's a good idea.

ACTING CHAIRMAN FROINES: Peter is a plus. Peter 2 is a plus. And then plus. And then there's clearly support from the non --

DR. BLANC: Well --

DR. GLANTZ: I'm not saying delete it.

DR. BLANC: No, no. I think that the appendix proposal is more useful.

And in the same vein, the last iteration of the draft document appeared before the EPA February '88 document, and I wonder -- '98 document -- I would wonder whether or not in that same appendix you could then comment on the EPA mouse-based risk guesstimation as a -- you can put that in there too, and then you would at least be alluding to that. I don't feel strongly about that.

ACTING CHAIRMAN FROINES: That's a good idea. I'd support that.

DR. BLANC: By the way, I think that's another

reason why it's good to get mice into that other phrase that we put them in, because after all, being used by the --

ACTING CHAIRMAN FROINES: George, you know what's being said?

DR. MARTY: EPA's lower end of the range.

DR. ALEXEEFF: There's just one clarification.

We don't believe there is a mouse-based risk estimate in the US EPA document. It is a rat-based --

DR. BLANC: Is that an error then in their text?

DR. FUCALORO: I thought they said rat-based, but I could be wrong.

ACTING CHAIRMAN FROINES: Well, Stan --

DR. GLANTZ: I'd like to say, because we want to approve the report today, and I don't want to get something -- open up a substantive thing which could then cause trouble, if it's an editorial change that the chair can approve on the panel to put a comment in on the EPA report, I don't care one way or the other.

But I think the important point is to move the stuff in Chapter 7 dealing with animal-based risk assessment into an appendix and make it clear, as several of the commenters suggested, that this is being presented for information and comparison purposes with other studies, but the risk assessment doesn't use the animal.

ACTING CHAIRMAN FROINES: George, listen. You and

Stan stop doing that. The action item is that you're moving the material on animals into Chapter 7.

DR. GLANTZ: No.

ACTING CHAIRMAN FROINES: Into the appendix.

DR. GLANTZ: The animal material in Chapter 7.

ACTING CHAIRMAN FROINES: Let me do this. I can do it fine.

The second thing we would like you to do is to look at the EPA risk assessment and look at the discussion of the mouse data and whether it's included in the risk assessment.

If there's particularly relevant information that you think is worth commenting on, then do so in that appendix.

And if you think there are major policy or science questions that need to come back to the panel, do so, but try and not do that.

DR. GLANTZ: No, no.

I would like to amend -- no, no. I would like to say if there are major policy or scientific issues, don't put them in the report. I don't want to have to go back and --

ACTING CHAIRMAN FROINES: Well, those of us who believe in mice are more oriented towards having it in there if we can. So, George and I will communicate on this and

we'll communicate and if we need a -- if it --

DR. GLANTZ: I would say if it has to come back -- if it can be done and it's simply an editorial thing, that I don't care.

But I think if it's something of sufficient magnitude that would have to come back to the panel, I would argue not to put it in.

ACTING CHAIRMAN FROINES: I think that if we find something that's significantly important it should come back to the panel, because we would rather not somebody on the outside sue us and force us to do the same thing.

Let's handle it appropriately. And I guarantee that 95 -- 99 percent of the chance is that you'll never see it again.

DR. GLANTZ: Okay.

DR. FRIEDMAN: If it has to come back to the panel will there have to be another public comment period?

ACTING CHAIRMAN FROINES: Yeah. You guys are escalating, aren't you?

DR. GLANTZ: I think that if you can --

ACTING CHAIRMAN FROINES: We can handle this. We'll make a recommendation.

DR. GLANTZ: I will accept what you're suggesting with the caveat that if it has to come back to the panel, you won't do it.

MS. SHIROMA: Could I get a clarification on this?

From listening to the discussion it sounds like you would like the information moved in Chapter 7 to the appendices, and then to add some clarification on what the US EPA did?

ACTING CHAIRMAN FROINES: No. To review what US EPA did and determine if there's any information that would be germane to that section.

DR. GLANTZ: Actually, I don't like that, because I want -- I think there's a point where you have to finish.

And what I'm -- and I think that's just a different point.

What I'm -- what I want to do -- and this is getting off the point talking about mice and rats. What I -- the reason I'm making the suggestion is because I want to make it very clear that the risk assessment is based on the human data. And I really think the animal-based risk adjustment just gets in the way. The human data are clearer, the human data are more germane to humans, the quantitative risk assessment is simpler.

ACTING CHAIRMAN FROINES: But wait. Let me speak to that. I think it's very --

DR. GLANTZ: I'm not saying delete it from the report.

ACTING CHAIRMAN FROINES: Come on, Stan, let me

finish.

I think you're right in every respect, except for the fact that major mechanistic issues, specifically around interspecies variability, has been raised.

There is some quite important scientific issues that diesel has raised around animal testing.

If there is something in the EPA document that helps illuminate that issue, then I think as a matter of science we have an obligation to incorporate that.

And it may be more troublesome, but I think this is not simply a regulatory process. This is a risk assessment where we try and look at all the data and we try and look at how the data and animals relates to humans.

And I think that by simply saying the human data is better is to misunderstand some of the complexities of the mechanistic issues around the animals.

So I would still argue that if there's something in there that's useful, it could be put in, and if it -- and I suspect it won't have to come back, because it can be done as a quote. It could be kind of done as a quote from the EPA document. It's not something that George is going to write some new creative thing from. So it shouldn't be a problem at all.

DR. GLANTZ: Okay. Then I will stop.

Getting back to No. 18, what I would do then is I

would delete the first three sentences of the paragraph and then so that the first sentence of the paragraph would read, there are data from human epidemiological studies of occupationally exposed population which are useful for quantitative risk assessment.

And then I would delete everything down to where it says based on a variety of exposure scenarios. The range of resulting estimates of cancer risk, and then I would insert in parentheses, upper 95 percent confidence interval, or whatever it was you had on the slide, which was clearer.

And then I would delete the last sentence, because I think that the Table 3 that you provided, which while very interesting, should be incorporated into the report, not the findings.

And I think you should incorporate that Table 3 into the report with the other additions that you showed us today, the Steenland study and other study.

And then I would add a reasonable point estimate of the unit risk is 4 times 10 to the minus 4.

So the paragraph would read --

ACTING CHAIRMAN FROINES: I'm sorry. Could you go over your changes.

DR. GLANTZ: First three sentences are out.

And then the next sentence stays.

And then beginning with --

DR. BLANC: Which is the next sentence?

DR. GLANTZ: The next sentence which says there are data. That stays.

And then from on balance down to where it says population due to diesel exhaust, I would delete. It's the third-from-the-bottom line.

DR. FUCALORO: Including population, including the sentence in which that --

DR. GLANTZ: Yeah. I would delete everything down to where it says based on a variety.

And then after cancer risk, in parentheses, I would put, 95 percent upper confidence interlevel, or however it was on the slide they showed.

And then I would delete the last sentence and add the sentence, a reasonable point estimate of the unit risk is 4 times 10 to the minus 4.

ACTING CHAIRMAN FROINES: Are you subtracting out a comparison of estimates of risk can be found in Table 3?

DR. GLANTZ: Yeah. I would take that out.

ACTING CHAIRMAN FROINES: No. I disagree strongly with that.

DR. GLANTZ: Table 3, I think that should go in the report. I mean --

ACTING CHAIRMAN FROINES: I see. You're saying --

DR. GLANTZ: I think Table 3 should be in the

report.

ACTING CHAIRMAN FROINES: No. I think it should be in the report and I think it should be in our findings. Because our findings show the range of risk assessments that have been conducted, and I think I'm going to present this to the Board and I want to have that table in front of me, because I want to show them the breadth of -- it doesn't do any harm to have a table that shows the breadth and the scope of the risk assessments.

DR. GLANTZ: All right. I just think -- all right.

I mean, but in any event it should be in the report.

ACTING CHAIRMAN FROINES: No doubt.

DR. GLANTZ: With those other two studies. I think it gets in the way here, but I'll defer to you.

ACTING CHAIRMAN FROINES: So you're at the crucial point.

DR. GLANTZ: No. 18 would read the following.

There are data from human epidemiological studies of occupationally-exposed populations which are useful for quantitative risk assessment. Based on a variety of exposure scenarios, the range of resulting cancer -- or resulting estimates of cancer risk, parentheses, 95 upper confidence interval, is 1.3 times 10 to the minus 4, to 2.4

times 10 to the minus 3, Table 2. A reasonable point estimate of the unit risk is 4 times 10 to the minus 4. A comparison of estimates of risk can be found in Table 3, if you really want it.

DR. BYUS: You better say lung cancer.

DR. GLANTZ: Yeah, lung cancer. I agree with that.

ACTING CHAIRMAN FROINES: George, before we get into the more difficult question, when we go through and have Kyle Steenland's and Stayner's document and Kathy Hammond's work with the meta-analysis and Allan Smith's work, those are four new pieces of information, does the range of risk stay to be to these values or will they include any of the -- will those all fall within this range or does the range change based on those four values?

DR. ALEXEEFF: They all fall within the range.

ACTING CHAIRMAN FROINES: They do.

DR. ALEXEEFF: Yes. Based on what was suggested earlier for in terms of the -- we did preliminary calculations following Dr. Blanc's suggestion, and that would stay within the range.

ACTING CHAIRMAN FROINES: So that with Allan Smith, Kyle Steenland, Les Stayner, Allan Smith, those four new values that are not based on Garshick, they're not based on Garshick, they would all stay within this range as you've

defined it. That's a yes or no question.

DR. ALEXEEFF: The answer is yes.

ACTING CHAIRMAN FROINES: The answer is yes?

DR. ALEXEEFF: Yes.

ACTING CHAIRMAN FROINES: You're comfortable with that?

And you understand what I'm now saying is that the range of risk in our Table 3, the range of risk that we list will include those values?

DR. ALEXEEFF: Right.

ACTING CHAIRMAN FROINES: And we will be -- we will see that they are similar? George?

DR. ALEXEEFF: Uh-huh.

ACTING CHAIRMAN FROINES: And that you can put a sentence in to say these four values taken with the Garshick data are essentially internally consistent.

I'm trying to get a weight of evidence here. Do you understand I'm trying to --

DR. ALEXEEFF: Yes.

ACTING CHAIRMAN FROINES: I'm trying to show it's not all Garshick.

DR. BLANC: Can you tell me, following up on John's comment, if you use the value of 250 micrograms in the algebraic calculation based on the pooled relative risk of 1.4, what that midpoint is?

DR. ALEXEEFF: Yeah. The new point would be 2.6 times 10 to the minus 4.

DR. BLANC: Would be that value.

ACTING CHAIRMAN FROINES: Okay. But I'm not -- wait. I'm coming to you. But I want to make sure that I'm clear.

DR. ALEXEEFF: Yes, you're clear. What you're saying is if we consider our range of risk, which is the range that we calculated using essentially -- well, first starting with the two railroad worker studies. Now if we also consider the work, the revised estimate from the meta-analysis, plus the Steenland study, plus the Stayner information, plus Allan Smith's calculation, are those numbers all falling with our estimated range of risk, and the answer is yes.

ACTING CHAIRMAN FROINES: Yes.

And then I want you to put a sentence in that draws attention to that, that you have railroad worker studies and coal miners and you have meta-analysis and you have railroad workers, you have a wide range of industries and occupations which have been done by different people and have come out with consistent, which appears to be consistent, results and that you take that as being meaningful.

DR. ALEXEEFF: Yes.

ACTING CHAIRMAN FROINES: Because I think that there has been a lot of concern expressed about the overemphasis on the Garshick study, and here you have a wonderful opportunity to show how whether it be coal miners or truck drivers or railroad workers or the meta-analysis covering all the studies, that you have reasonably consistent results based on solid methodology. And I think that's very worth drawing attention to.

Now I'm finished. I'm finished. And I'm now going to go to what -- to Stan's issue, which I take it is controversial.

DR. GLANTZ: No.

DR. ALEXEEFF: Before you do that, I'd like to discuss a couple other issues related to that.

ACTING CHAIRMAN FROINES: Okay. I think that that also means that you can consider dropping out or putting in an appendice or doing something with some of those risk assessments that are based, that are a little bit softer.

DR. GLANTZ: Wait. I had the floor.

DR. ALEXEEFF: I think -- let me just clarify one thing. We have this table. The table that we're calling Table 3. Okay.

And it sounds to me what you're suggesting is that we have a Table 3 with this information.

At the same time our range of risk table, which

would supplement that by adding this other study information, is that correct? Or is it simply we're talking about Table 3 and pointing to this Table 3? Let me just make sure we're talking about -- are we actually altering -- because the way we have explained our range of risk is look at this table, here's the calculations. So Table 7-10 as example or 1-1, if you're looking at the executive summary.

So one possibility would be to add this other information as part of the range of risk.

The other one is simply to use it as an adjunct table and point to it. And I guess that's the only distinction I'm not clear on.

DR. GLANTZ: If I could, what I think you should do is the former. That what I'd like is that in the table in the main text and in the figure, I think it's Figure 7-10, that you could take out the animal.

DR. MARTY: 7-4.

DR. GLANTZ: 7-4. You should take out the animal stuff and add in these other couple of estimates, the four estimates that John has talked about.

And the -- it won't change the summary statement here at all.

And I think now we're basing things on a much broader set of information. And so that's -- and I think the report and the executive summary needs to be revised is

appropriate to make that point.

I don't think it should be just be an adjunct of it. It should be viewed as consistent with all the other stuff that's in there.

DR. ALEXEEFF: So we would be revising Table 3, plus we would also be revising in our document our Table 7-10 or 1-1 where we actually have our risk range. Is that what the suggestion is? I just want to make sure I understand.

DR. GLANTZ: That's what I would suggest. But also there is that figure in there with the --

DR. ALEXEEFF: Plus the figure, right. Make the figure consistent with the table, I think is what you're suggesting.

ACTING CHAIRMAN FROINES: Peter is next.

DR. WITSCHI: I expressed earlier some concerns about that limited database. Some of them have been alleviated. But those two papers we just got by Steenland and by Stayner, have they to be appeared in the peer review literature, have to be published as such?

DR. BLANC: One is in the press in the American Journal.

DR. WITSCHI: One is in press? Both are. Okay.

ACTING CHAIRMAN FROINES: Both are press.

DR. WITSCHI: So they have undergone peer review?

DR. ALEXEEFF: No, actually let me -- I'm not hundred percent sure on the Stayner, maybe you can -- but the Steenland is in -- the Steenland article is in press. Okay.

And actually let me just clarify one other point regarding the Steenland.

So is Stayner too, right.

Regarding the Steenland paper, Dr. Blanc asked a question whether or not this was a new relative risk and if it was included in our meta-analysis.

So the answer is that the relative risk used in the Steenland paper is the one -- is in our meta-analysis already. It's the 1990 relative risk.

What is new in the Steenland paper is the exposure analysis of the truck drivers and coming up with a unit risk value. That is what's different and new. But the relative risk is the one that's published.

DR. BLANC: What was it, 1.3?

DR. ALEXEEFF: That I can't recall. I can't recall what that relative risk was. But it's in that --

ACTING CHAIRMAN FROINES: Can I say, these numbers are not to be used in the table until we -- I mean, we need to get clearance from the journal and from the authors to incorporate them into our document, so there could be a time gap. We can't take and we can't quote these. This is not

to go to the press. We can't -- these are -- one of them is in the Federal Register, but I think that these are documents that are about to emerge.

DR. GLANTZ: I think you should check with them, but it's not -- the fact is they provided them in press things and I mean --

ACTING CHAIRMAN FROINES: I'll work that out. Don't worry about it.

DR. GLANTZ: Well, anyway, so the other change I would make to Table 3 is first three lines about the comparative potency. I would take that out.

ACTING CHAIRMAN FROINES: Wait. I can't --

DR. FUCALORO: Excuse me. Where were you now?

DR. GLANTZ: I'm back at Table 3.

ACTING CHAIRMAN FROINES: Can we go back to your point, though. As much as you would like it to go by unnoticed, I think --

DR. GLANTZ: We can come back, but I'd like to just try and finish making the points. We can go discuss that.

Just to finish the point of focusing things on the human data, in the Table 3 I think the comparative potency lines of that should be removed.

I thought that argument was -- I mean, it's back to animals. I think it's not as strong and it just confuses

matters, so I would like that deleted from Table 3.

ACTING CHAIRMAN FROINES: I've lost it.

DR. GLANTZ: Table 3 has a bunch of different epidemiological -- the summary results of --

ACTING CHAIRMAN FROINES: You want to take out the three comparative potencies?

DR. GLANTZ: Yeah.

ACTING CHAIRMAN FROINES: Keep them in the text, George.

DR. GLANTZ: You can keep it in the report, but take it out of the table.

ACTING CHAIRMAN FROINES: I think the other thing I want to take out, I want to be responsive to Peter Witschi, and that is we have McClellan in here twice, one of which is a EPA quote, one of which is our quote of him. I would argue that I would support Peter and take out ours, and since we have this same thing as the EPA document quote.

Peter, you agree?

DR. WITSCHI: Yes.

DR. ALEXEEFF: Take out whose?

ACTING CHAIRMAN FROINES: There's no sense having the same risk assessment in twice.

DR. GLANTZ: The fourth from the bottom, the McClellan railroad workers, delete that from the table.

DR. ALEXEEFF: We didn't use it in our risk

assessment, so I think it should be deleted, because we took -- he wrote us a letter asking us not to use it, and we did not. So putting it in the table would suggest that we did, and it would be confusing.

DR. BLANC: Can we come back to your suggestion that the best point estimate is four? I'm sorry --

DR. GLANTZ: I didn't say best. I said a reasonable point estimate.

DR. BLANC: A reasonable point estimate. 4 times 10 to the minus 4?

DR. GLANTZ: Yes.

DR. BLANC: Could it -- it would be useful for me to hear you state to me why you think that's the most reasonable number.

DR. GLANTZ: Because when you look at -- the way I came up with that number was when if you look at figure 7-4, which is the results of all of the different analyses, and there are all kinds of different assessments or exposures assessments, that seemed about the middle of it.

And I was actually struck in reading this at how insensitive the unit risks were to the presumed exposures.

And it seemed to me that a reasonable number to use, because people are going to want to know what we would suggest and we've spent years looking at this is the middle, and four is in the middle, and I talked with George about

this, and he -- that was a number they came up with too.

DR. FRIEDMAN: These upper 95 percent confidence?

DR. GLANTZ: Yes.

DR. FRIEDMAN: Well, then I wouldn't use the term -- you can use the term, but not point estimate, because that will -- people get confused because they think of that as not as the confidence limit.

DR. GLANTZ: Well, then just say a reasonable estimate of the unit risk. Yeah. I'm happy with that. In fact, that's what I had originally written. Just say a reasonable estimate of the unit risk is. It's not even saying it's the best one, but it's a reasonable one.

ACTING CHAIRMAN FROINES: Paul, in seven minutes I want to take a break.

DR. BLANC: Well, I want to say two things in response to that.

One is I think that's an excellent idea that we say what we think a reasonable estimate is.

Secondly, I think that we should not have a reasonable estimate which is lower than the lower 95 percent confidence level of the various -- of any of the various models that we're suggesting are potentially viable.

There were in the series of roof models, I don't have the table in front of me, one of the roofs, you know that A, B, C, D thing, do you have that handy? Can you just

put that up?

DR. ALEXEEFF: The numbers?

DR. BLANC: The numbers.

DR. ALEXEEFF: Or the pictures?

DR. BLANC: The numbers.

DR. ALEXEEFF: Melanie will put that up.

DR. BLANC: First of all, the estimate that's going to -- that I've written -- that I wrote down earlier, that came out of Steenland is 7.7 times 10 to the minus 4th.

DR. ALEXEEFF: Correct. That's the number that we had.

DR. BLANC: Did I get that correct?

So we would be below their estimate for that.

And then some of these -- some of the lower 95 percent estimates of these models are also above 4 times 10 to the minus 4th.

So I think to be consistent, I'm not trying to split hairs, but I think we should go up slightly more than that in order not to be inconsistent with our own 95 percent modeling on the lower end. I think we're obliged to be above the lower end of 95 percent confidence intervals and some of these model assumptions, albeit not in -- so I think you're in the ballpark, but I think it needs to be up a bit higher.

DR. ALEXEEFF: Can I clarify a couple points on

this?

One is the four, I think that that's what Stan is, Dr. Glantz is referring to is the geometric mean of our previous upper 95 percent confidence limits. So it is a geometric mean of the upper bounds.

DR. FUCALORO: May I ask you a question? Is this a standard procedure to get the geometric mean?

DR. ALEXEEFF: We've often calculated a geometric mean, yes. But it's not --

DR. FUCALORO: Then if we use that number, somehow I think Stan has some point here he's trying to get is that we should have a number that we can quote rather than just a range. I think that's his motivation.

But then maybe instead of using the word reasonable, let's just say how we arrived at the number. It was the geometric mean between the limits of the range, or something like that.

DR. ALEXEEFF: Right. There's two points on that.

In the past what we have done, as we have often found a single study or a value that we felt was the most compelling and that is what we suggested in the range of risk.

In this case the view is more of an overall review of all the information.

In the past we've had a geometric mean. That is

not necessarily to say it's the best value. We tried to be clear in the document that we're saying it's not necessarily the best value. It just gives a sense of where the -- when you have a table of numbers like this, where the balance point is.

DR. FUCALORO: I understand that. And I'm saying by just stating exactly how you arrived at that number, I think that on the face of it explains it.

Now, whether or not someone says why did you do that, well, you can say ask Stan, or ask you.

But the question is that if there is a statistical methodology which comes to the best value, let's hear it and let's use it.

But if there is none, but some sort of policy or some sort of practice of using the geometric mean, let's state that we did and use that.

I would say that even in this case, there's probably less meaning to that number because it is a mixture as opposed to an individual compound, and a mixture that whose composition may change over time.

So this number probably has less impact or less importance.

However, if Stan thinks that that number somehow makes it convenient to people to state something, I'll go along with that, but let's just state what it is and not put

too much confidence in that number for the reasons I state.

DR. BLANC: Well, I want to correct something.

First of all, I had see the table briefly before and I now realize that it wasn't the two sides of the 95 percent. The one is the upper and other is the best estimate. So from that point of view, I'm sorry for bringing that up.

But I wonder how the 4 times 10 to the minus 4th changes when you plug in not just these numbers in your best, but you add the Steenland and all that. I just want to make sure that we're not -- because we are going to come out lower than Steenland's estimate that way. He's at 1.7. He's at -- I'm sorry. He's at 7.

DR. ALEXEEFF: Steenland's value is 7.7 times 10 to the minus 4.

DR. BLANC: We're proposing --

DR. FUCALORO: The geometric mean is not 4, it's 5.5.

DR. ALEXEEFF: Correct. Yeah. There's a point to make here and that is, as we indicated, there were some suggested changes in a couple of these calculations, particularly the numbers like in the scenario A. So if you look at scenario A, that number is different slightly from the value that's in the document, because of comments that came in. So it would end up being slightly higher, about

5.5, 5.6.

DR. FUCALORO: 5.58. But if you want one significant figure you get to 6, which is in very close agreement with --

DR. ALEXEEFF: On the other hand, if we included the Stayner information and the Steenland information as the table, do we have to recalculate the geometric mean again, is all I'm referring to.

ACTING CHAIRMAN FROINES: Why don't you leave them out.

DR. GLANTZ: Well --

ACTING CHAIRMAN FROINES: Leave them out.

DR. GLANTZ: Of what? You just said to put them in.

The only point, what I would suggest doing in light of this discussion is the following.

I don't think we need to talk about the geometric mean in the findings, but I think it should be explained in the report. Okay.

And I think what you should do is just correct these numbers, as you just said, add in these other four points, compute the geometric mean, round it to one or two digits, probably one, and then use that number, and then it will be around five, four or five, six.

DR. FUCALORO: Geometric mean from a set of

findings.

DR. GLANTZ: Make it clear how you did it.

DR. FUCALORO: I actually did it from the two extremes. That's how I came up with 5.6. But if there are more data you can --

DR. GLANTZ: As Tony said, the difference between six and seven and five isn't that much in this context. But I think what is important is to give people some guidance as to what we think a reasonable estimate of the unit risk is, because I don't think we should take the highest upper 95 percent number because that's, you know, I just think that's biased. And nor do I think we should take the lowest one. And this will give us a reasonable middle estimate.

And so you can explain, put a little section in the report or a paragraph at the right place explaining how you came up with it, and then put the appropriate number in.

DR. FUCALORO: Then you can worry about defending it.

DR. BLANC: Well, I just want to say again, I completely agree it's not that I objected to saying what we thought it was. I just thought it was obtuse to me how that number had been arrived at, and it didn't seem to be totally consistent with all the data.

DR. GLANTZ: Okay.

DR. BLANC: And I would say that when you go

through this exercise of generating this number, which is going to be in the ballpark of between 1.5 and -- I'm sorry, between 4 and 8 times 10 to the minus 4th, that what you take the -- if you do it on the basis of taking some kind of mean of these numbers, I don't think each of the various models should be weighted such that you have 15 different things going at the model. Take a mean of those four different roof models. Take a mean of the other roof and ramp models from these various data. Otherwise you're overweighting things from one data set and one approach.

So I think you can take the average of your various roof models, the average of your various ramp models, the average for the cohort for the case control. Do you follow what I'm saying?

DR. ALEXEEFF: Yes.

DR. BLANC: And then average those averages with your other sources, the one from the 1.4 meta-analysis relative risk based on a mean of 250 micrograms, the one from Steenland, et cetera.

DR. GLANTZ: It will probably come out the same as what Tony just did, but I think that's the correct procedure.

DR. FUCALORO: Whatever you do, be prepared to defend it, defend your method.

DR. ALEXEEFF: I think what we will do is we'll

combine -- we'll average the values based upon the studies, so we'll average the case control values, average the cohort study values. I think that's the most defendable. And just say this is our average from that and average from that and then we can average with the other values.

DR. GLANTZ: Geometric average.

DR. ALEXEEFF: Geometrically, yes.

DR. FUCALORO: Keep away from value-laden terms like reasonable and that sort of thing. That would be my suggestion. You can --

DR. ALEXEEFF: I think we would just leave it as -- we already have a discussion that it's a geometric mean and we'll just explain that.

DR. FUCALORO: Exactly.

DR. GLANTZ: The reason I picked reasonable was I was trying to avoid the word best.

DR. BLANC: I think for this kind of report, for this kind of document, the word reasonable is fine.

I think, Anthony, you were referring more to what they should say in the full-blown --

DR. GLANTZ: So anyway that's what I would suggest.

And that's -- and I have a few little odds and ends things in the report, which I think are more editorial that I can give them later.

DR. FUCALORO: I just want to pass by for your consideration changing the wording on the sentence which begins based on a variety of exposure scenarios, and I'm not exactly sure I know what that means, the range of resulting estimates.

Is this what is meant by that? Maybe I'm wrong.

The estimated range of the lung cancer unit risk factors determined from the epidemiological studies is?

DR. GLANTZ: That would be much better. I like that better.

DR. FUCALORO: Did you get it?

MS. SHIROMA: Could you repeat that?

DR. FUCALORO: I'll just bring it over there.

DR. GLANTZ: Why don't you read it for everybody.

I think that's much better than the way it reads.

DR. FUCALORO: The estimated range of the lung cancer unit risk factors determined from the epidemiological studies is, then put in the value.

DR. ALEXEEFF: We would want to insert in there that upper 95 percent confidence intervals.

DR. FUCALORO: That's what Stan is suggesting. I think we all approved that.

ACTING CHAIRMAN FROINES: Okay. Stan, I want to take a break for the stenographer, and so if you have other points that are relatively minor you can just give them to

George or Melanie.

DR. GLANTZ: That's what I'll do. I'll just give them to them.

ACTING CHAIRMAN FROINES: And so we're then going to go next to Peter and Peter for -- and Tony, but he's getting all his shots in. He's not hiding over here. I was recognizing that.

So let's take a break. What we'd like to do is then go to Peter and Peter and back to me and Tony and then hopefully we can wrap up. I would like to try to wrap up by 4:00 o'clock if we think we can do it. Everything is going so smoothly, it would seem like we can.

(Thereupon a short recess was taken.)

ACTING CHAIRMAN FROINES: No yawning. Okay.

We've moved on from Dr. Glantz and we're now taking comments from Dr. Witschi.

George.

DR. ALEXEEFF: Just as a comment, we've looked through that EPA report again. We haven't found a mouse value, although they discuss mouse studies. So we don't suspect we're going to find one calculated on the mouse data.

ACTING CHAIRMAN FROINES: That makes everybody happy except me, because I still believe the mouse is positive.

Peter.

DR. WITSCHI: Okay. I have a substantial problem with assigning a unit risk diesel exhaust particles.

First of all, it's usually unit risk is associated with properties of specific compounds, and as far as this list is concerned, we have a mixture.

The second one, if you look at Table 2 the unit risk value for diesel exhaust is pretty close to the one of inorganic arsenic or benzo(a)pyrene or nickel or butadiene, out of which all those compounds are probably just present in traces of micrograms per cubic meter.

So having a unit risk of the mixture is the same as the defined compounds. Somehow I would like to know what it is in diesel then that makes it as potent as the other agents are.

The third problem I have is what we are doing, particularly if you look at point 19, the 200 to 3,600 additional cancer cases. We are taking something which probably happened in the 1950s and 1960s, and this is increased rates of lung cancer. We are multiplying this by measurements we took in the '80s and more often than not, those measurements are surrogates for diesel. Most of the time they are just separate particle without having been identified exactly as diesel.

And from this then we make projections for the

year 2000 and beyond. And this involves many many assumptions and many many uncertainties.

And frankly it's just too much for me. There are too many assumptions and there are too many uncertainties to come down and give a cancer potency to diesel.

Particularly if you look at this thing in a different way. This document has given us a hypothesis and the hypothesis is that diesel causes lung cancer in men, and that's a hypothesis that's testable, without having any numbers.

I know it's beyond the scope of this panel, but the way this happened, this could be test is by really substantially reducing exposure of the general public to diesel by dealing with all of those heavy polluters which are still around, and by really cutting down on reduction on emissions. And in other words to see whether diesel causes lung cancer is a testable hypothesis, and we should test it.

That's all I have to say.

ACTING CHAIRMAN FROINES: Well, break it in two pieces.

The first question derives from your concern about establishing a unit risk value, and the second concerns the actual cancer estimate of 200 to 3600, which is actually not based on a single unit risk estimate, it's based on a taking the two unit risk assessments and calculating them directly.

DR. WITSCHI: I understand this, but this does not change the principle. It does not change the principle.

ACTING CHAIRMAN FROINES: Okay. And so why don't we have a discussion about the unit risk issue first. And I don't know the best way to have it.

You've expressed two points of view.

DR. WITSCHI: Well, I also would like still to go by 36653 -- 9654 E, that while absolute and undisputed scientific evidence may not be available to determine the exact nature and extent of risk from toxic air contaminants, it is necessary to take action to protect public health.

In other words, to me it seems we can take action to protect public health in the absence of a unit risk, because a unit risk might not be scientifically as sound or defensible as it is for example for individual compounds.

And the other one in the particular case we do not need, because the evidence is just too good.

ACTING CHAIRMAN FROINES: Here's a legal matter. We meet our obligation as a panel by either adopting a unit risk or by accepting the range of risk. Our obligations are met in either case. We are under no requirement that says we must have a specific unit risk value.

Now, we have, with the exception of lead, we have always had a unit risk value.

So that the real issue is does the panel feel that

the data before it in their report justifies establishing a unit risk value. I think that's the question before us.

DR. GLANTZ: Well, I think since I suggested it, yes.

And I agree with you that we should do No. 18 and No. 19 and discuss those separately.

But the fact -- I don't agree with Hanspeter. I think the evidence in front of us that diesel exhaust is a lung carcinogen is very strong.

DR. WITSCHI: That's not what -- you heard me wrong.

DR. GLANTZ: Hang on. Let me just finish.

I think that the evidence that we have that it is a human carcinogen is exceptionally strong, and of all the reports I've been on, worked on, on this committee, this is one of the most thorough, more compelling, best cases, and I think that the -- so the fact that there is a risk is, to me, is certain as you can ever be in these things.

The reason that I suggested that we specify a reasonable estimate is because the fact is that that's going to happen as the discussion moves forward, and we've spent the last several years looking at this going to endless workshops, and I think that the idea of taking the geometric mean of these different estimates is a very reasonable way to come up with a suggested number.

The thing that has struck me in reading the report in terms of the human stuff is that how little scatter there is actually and how little variability there is in the estimates when you cut it many different way in the meta-analysis. And I'm glad that we have decided to give the meta-analysis more emphasis, because I actually think that's more compelling than just hanging everything on one of the Garshick or the two Garshick studies.

And I think that the thing that struck me is how relatively insensitive the unit risk, the sort of the unit risk estimate is, and I think that if -- that we are better positioned to come up with a recommended value than anybody else who has been in the process so far.

And every other report that we've done, we've come to that conclusion, often based on much much much less information and many more assumptions than are necessary here.

The only real assumptions that are made are, you know, which of these different exposure profiles is the reasonable one to assume. And what the staff have done is widely bracketed all possible things that would be reasonable. And we're taking something that's in the middle of that.

And so I think we're in fact making many fewer assumptions in doing this than we have, you know, everything

else we've looked at since I've been on the panel.

DR. WITSCHI: Well, I'm not -- that's okay. I mean, I never said it's not a carcinogen.

DR. GLANTZ: Yeah, I know.

DR. WITSCHI: I found actually among all the things, those estimates and whatever it was, actually I found Allan Smith's approach much more compelling than all those assumptions and certainties and guesstimates that came from developing the formal risk assessment, because that's somehow I personally can relate to. That makes sense.

DR. GLANTZ: Well, you're not going to get argument out of me.

But it comes out with about the same number, about 5 times 10 to the minus 4, 6 times 10 to the minus 4.

DR. WITSCHI: That's okay.

DR. GLANTZ: Okay.

DR. WITSCHI: I would be fine with. I just said the unit risk is for a mixture is something I have a problem with.

Take it only from Allan's standpoint, taking only that ratio of 1.4 without then bringing exposure into the game is, to me, much more convincing than starting to say going into all this particles, they make the carcinogens out there, so on and so, ramp, no ramp, proof and all these kinds of things. To me, this one here is much more simple.

ACTING CHAIRMAN FROINES: To you that would be acceptable?

DR. GLANTZ: You come up with the same number both ways, though, you know.

DR. FUCALORO: Well, I think as to be somewhat of a diplomat in this, I mean, one could also put another item in which points out Allan's approach and demonstrate that it comes out to about the same number.

I think, though, it points to something, you have another point here that I think is well taken, and when I tried to get in earlier, maybe I can be more explicit about it now, I admittedly will mix risk assessment and management and I know that there's a fire wall between the two by law, but allow me this for the moment.

Now, risk assessment and risk management use two factors that they're interested in. One is a risk factor and an exposure level. Normally for single compound toxins all -- once the risk factor has been established, the only thing one is concerned about is exposure level, trying to reduce that using the best available technology.

While in this case I would argue that one has to monitor also the risk factor, because the nature of diesel exhaust will change with time. And I think that perhaps wording that recognizes that, if it does not exceed our authority, and I'm not sure I know if it does, would be

something that might find its way in our recommendation, something saying that we recognize that not only does exposure level have to be monitored, but also risk factor, because that may be a changing number.

And what even confounds it more, and I think Peter, Hanspeter will agree with this, is the number of older diesel engines, you have newer ones, and so on, I mean, it's a pretty complicated number to get at, but maybe it can be arrived at with reasonable methodology.

ACTING CHAIRMAN FROINES: Well, I need help here.

DR. BLANC: Well, let me see if I can step in.

I think that Dr. Witschi's trepidations are understandable from a philosophical point of view, representing your philosophical approach to this, but I don't think they are consistent with the charge of the committee or of the process as it has gone forward over very many months and I don't think there is any linguistic way to satisfy your trepidation.

And I think that you're going to have, in the end, just beg to differ with the conclusions of the panel, because I don't think that taking out the risk estimation is a viable option.

And really my question to you is what form would you like your trepidations to be voiced?

DR. WITSCHI: Okay. Say that again, what form?

DR. BLANC: What form would you like your trepidations to be voiced in? Because they are too global to be addressed in the document, in our finding itself.

DR. WITSCHI: That's very simple.

The risk assessments saw the light of the day by the famous benzene decision, where something just could not be considered to be a carcinogen without demonstration of adequate risk, which happened in 1983.

The language and presumably the mandate of the committee, at least what it says here, also goes back to 1983.

Now we have 1998, and we have much more information. We know much more about carcinogenesis, we know much more about human carcinogenesis, and my contention is why going through all these difficult things and coming up with a number, which is fraught with so many uncertainties, when we are dealing with something we know it's a human carcinogen and can do something about it without even having creating a number which is based on many many assumptions. It's that simple.

DR. FUCALORO: In other words, you just don't think we need to report a risk factor?

DR. WITSCHI: Right.

DR. FUCALORO: I mean, that's what you're saying and you're using the language in the law which allows for

that to happen?

DR. WITSCHI: Yes.

DR. FUCALORO: I understand that.

DR. BLANC: I understood that that was your comment.

I'll come back and say again that is not going to be the prevailing view on this committee, I do not believe.

Then I am trying to find some way at the same time to take into account your trepidations while we move forward with our work.

DR. WITSCHI: We do not have to be unanimous.

DR. BLANC: What's that?

DR. WITSCHI: We do not have to be unanimous in adopting the findings.

The only thing I'm taking issue with is nothing else but point 18 and 19 in the findings. And it's going to be the prerogative of the chairman how he's going to phrase the question.

My disagreements to those two points would in no way preclude me voting for diesel exhaust being a toxic air contaminant. It clearly fills the criteria.

So I leave it up to the imagination of Dr. Froines eventually to come up having listened to me, to come up with an appropriate question.

DR. FUCALORO: In other words, I think you are

clear, he can phrase the motion such that you're given the freedom to vote that it is a toxic air contaminant, but not force you to vote for the number that's the item 18.

DR. WITSCHI: Yes.

ACTING CHAIRMAN FROINES: I would prefer if we could come to a unanimous agreement among the ourselves. I think it would be better for the panel.

DR. BLANC: Let me come at this a different way, then, or ask the question a different way.

If we at the end of the day take this memorandum as we've modified it through various comments, and we say we would now -- we would like the record to show that the panel has reached a consensus on this memorandum, and I turn to you and said I know that you're not thrilled with certain aspects of this because of deeper philosophical beliefs about how one goes about calculating risk, or whatever, however I say it, but can you live with this as a whole, despite whatever trepidations you have? Would your answer be yes, I can live with as a whole?

DR. WITSCHI: I really don't think that that's not so much philosophy, it's what I think is some criteria applied to science. I probably have -- I cannot live with that unit risk for diesel exhaust.

DR. BLANC: Well, then, John, I think at that particular difference on that particular point is, with all

due respect, probably irreconcilable and what the options are either simply to state that we've achieved consensus except on one point where there was one member of the panel who dissented from the view on this one point, or some other mechanism for noting that, but I don't believe that you're going to achieve consensus on point 18, or whatever.

ACTING CHAIRMAN FROINES: And we haven't taken a vote on this principle, so it's not clear what the consensus is.

But the other matter, let me go back to Stan, though, or to the other panel members. We have a range of cancer risk of 1.3 times 10 to the minus 4, to 2.4 times 10 to the minus 3. The 4 is already, but there's been no disagreement about. What do we benefit by coming out with a specific number?

DR. GLANTZ: Well, the reason that I think we should do is that we've always done it and I think --

ACTING CHAIRMAN FROINES: That's not true.

DR. GLANTZ: Well, except for lead, which was a report that was mired in political problems.

ACTING CHAIRMAN FROINES: But let me preface it by saying, at one point I wrote a document and I sent to all of you and said that we have an obligation under the law to define a range of risk.

DR. GLANTZ: Right.

ACTING CHAIRMAN FROINES: We have no obligation under the law to define a unit risk value.

DR. GLANTZ: Well, I understand.

ACTING CHAIRMAN FROINES: Let me finish. Let me finish, because I just want to make a point.

One of the things that we all agree on here is that further research is necessary, especially with respect to the relationship between the nature of the diesel particulate -- diesel exhaust with railroads and what people are currently driving down the street today.

DR. FUCALORO: In their Mercedes.

ACTING CHAIRMAN FROINES: In their Mercedes.

And we know that we need to look to see is the risk now similar to what we saw with coal miners or truckers or railroad workers sometime back.

So that I think that there is some benefit to not giving the South Coast Air Quality Management District a bright line. And that part of that is what concerns me.

And that is that are we prepared in here to say that we are sufficiently confident with what we are doing that the bright line is what we really want to come out.

DR. BLANC: Stan, maybe I'm confused.

Dr. Witschi, maybe I misunderstood your trepidation.

Is your trepidation only with giving a reasonable

best estimate, that you don't have any problem with saying what we think the range of risk is?

I took your comment, I think, maybe too globally.

DR. FUCALORO: I took it the same way he did. I thought you had a problem with the range also.

DR. WITSCHI: No. It's just this -- it's now a bit difficult.

As I said, Allan Smith did the same thing, which I think is much more plausible.

DR. BLANC: As a best estimate?

DR. WITSCHI: As a best estimate, because he does not go through all the assumption about ramps, plateaus, roofs and all those --

DR. BLANC: Well, then that I do have -- I'm sorry. I misunderstood you. I thought you had a much deeper philosophical scientific global difficulty.

Well, then what I would suggest is that we, instead of going through the exercise that we suggested before of taking the geometric mean of all the estimates, you just gives us the point estimate that would come from assuming midlevel, 250 microgram per cubic meter value of diesel and the 1.4 relative risk, and you're going to come up with a value that's going to be 5.2 times 10 to the minus 4th, and I can -- I'd be very happy with that if you would be happy with that.

DR. GLANTZ: Would you be happy with that?

DR. WITSCHI: Yes.

DR. GLANTZ: I'm happy with that.

DR. FUCALORO: I'm ecstatic.

DR. GLANTZ: Okay.

DR. BLANC: That's fine.

DR. GLANTZ: Let's stop.

DR. BLANC: Let's stop right there.

ACTING CHAIRMAN FROINES: Wait, wait. We're not done yet. We aren't done.

One, we haven't got to Dr. Kennedy yet. And he's sitting there with a bombshell.

DR. GLANTZ: Wait. One point I want to just make, at the risk of talking after we've reached consensus, I mean the reason that I'm --

ACTING CHAIRMAN FROINES: Stan, this is like you're asking those people last week --

DR. GLANTZ: Okay. I'll shut up.

ACTING CHAIRMAN FROINES: Can we go back to another --

DR. GLANTZ: Let the record record that the staff are giggling.

ACTING CHAIRMAN FROINES: Peter has raised a second substantive issue, which I think we now have to address, and that is that he's raising a question about No.

19, in which he's concerned about the -- why don't you restate it, because I may state in incorrectly.

DR. WITSCHI: Well, this is again one of those things which then can be looked at in different way. To some people this calculating numbers are going to look like real, to some people they're going to look like acceptable, to others they are not going to look acceptable -- not acceptable.

Whereas I think the evidence we have on diesel is that clearly exposure of people to diesel is not acceptable.

DR. FUCALORO: I'm sorry?

DR. WITSCHI: Is not acceptable. Not just for the cancer --

ACTING CHAIRMAN FROINES: What I hear you saying is that using this 200 to 3600 is based on a railroad worker study of some time ago and it may not reflect the actual risk in say Los Angeles today, so by putting these values in may overstate the risk. Does that --

DR. WITSCHI: Or understate the risk.

ACTING CHAIRMAN FROINES: Or understate.

The question is how can we best approach this issue?

DR. WITSCHI: Why do we need -- that's really my point, why do we need to convey to anybody that we have to -- we are going to count bodies. And we know about

something is here, it's bad and something against it can be done, regardless of how many bodies.

DR. FUCALORO: Your suggestion is to eliminate 19?

DR. WITSCHI: Yes.

ACTING CHAIRMAN FROINES: Stan.

DR. GLANTZ: Well --

ACTING CHAIRMAN FROINES: I have a feeling that Peter is agreeing with that. Or are you just acknowledging?

DR. KENNEDY: I'll say my piece. No, I agree.

DR. GLANTZ: I just consulted with the staff, and I need to slightly amend my agreement with the previous point, after prefacing it with I'm willing to throw away 19 to get 18 the way I want it, because I agree with Hanspeter, I don't think it's the point 19 is particularly necessary.

The problem I have with just basing it on Allan Smith's number, that gives us the absolute bottom of the range we've got from all the other studies. And I think that, while I agree with you, in fact I was talking to Melanie at the break, that after he does the back of the envelope calculation that comes out very close to what they did after years of analysis, I think that I would feel more comfortable with something that's closer to the middle of the plausible range, rather than at the bottom of it.

I was under the impression the Smith number came out closer to the middle.

ACTING CHAIRMAN FROINES: Oh, come on.

DR. FUCALORO: It comes out to 5 times 10 to the minus 4.

ACTING CHAIRMAN FROINES: These numbers --

DR. GLANTZ: 5 times 10 to the minus 4.

DR. FUCALORO: I better verify that.

DR. GLANTZ: If it comes out 5 times 10 to the minus 4, I'm happy. I just --

ACTING CHAIRMAN FROINES: None of it's correct anyway.

DR. GLANTZ: Well, don't say that.

ACTING CHAIRMAN FROINES: It's a risk assessment.

DR. GLANTZ: I know, but, thanks, you just got yourself sued.

ACTING CHAIRMAN FROINES: None of this is real.

DR. ALEXEEFF: Let me just make a --

MS. SHIROMA: None of it is precise.

DR. ALEXEEFF: If I can just make a comment.

If we rounded, if we used 250 micrograms per cubic meter as was suggested, all we have to do is in his -- in Dr. Smith's equation, is substitute 250 for 67, so you can see if you did that it's divisible by about four. So the number, if you round to one digit, would be 1 times 10 to the minus 4, just so you know what the number is, which is at the bottom of our range.

ACTING CHAIRMAN FROINES: Well, let's go with that.

DR. WITSCHI: Well, you know, that's we've gone through risk hazard identification, we have done some risk management, what about risk communication. I mean, the coming up with something rather than giving a risk -- let me finish. To like the calculation is the potency factor and so on, but Allan Smith essentially says look in people who are exposed to rather high amounts of diesel, so and so much was added to their, what they would had gotten anyway in lung cancer, and we should have learned a lesson from there, and if we do some very simple calculations, then if what people are exposed to on the street, so and so much is going to add to their burden. And that's much more easy to understand than any --

DR. GLANTZ: Right. But the difference is that I think that we have a lot -- we do have a lot more information than just that one calculation.

And I mean you have Kyle Steenland's work, which is -- he's very very meticulous. It came out around seven or eight.

And I just think we should pick something that's near the middle, and not at the bottom. I mean, at one level to me we're talking about 10 to the minus 3, to 10 to the minus 4, and that's a fairly narrow range.

But I just think based on having spent a lot of time studying this and working and trying to understand the differences between all these different competing analyses, and why different people got different numbers, and reading all of these studies, I think the bottom of the plausible range, which is lower than the real number is likely to be, and I think the top of the plausible range is higher than the real number is likely to be. And I think that if we just specify that range, then what's going to end up happening is that certain people are going to come in and argue for the low end and other people are going to argue for the upper end, based largely not on any grand philosophical or scientific reasoning, but their political positions.

What I'd like to see us say is that we're giving you a range, but we think the most reasonable number is something in the middle, because I think if you look at all the studies and if look at all the different --

ACTING CHAIRMAN FROINES: George --

DR. GLANTZ: Of the two Garshick studies under a wide variety of assumptions, they tend to cluster in the middle. And I think we want to draw attention to that.

And so I just think to say we're going to rely on one back-of-the-envelope calculation that gives you the bottom end of the risk, even though I'm very sympathetic

with the calculation, I think it really strengthens the whole rest of the argument, I just think we should be picking a number somewhere in the middle.

If you don't want to do a geometric mean, I mean the four number I came up with was from staring at the graph, that highly quantitative method, and George, it turned out, got the same thing.

DR. BLANC: Let me make -- I was taking an arithmetic mean between five and 500, which is probably also too primitive, so if you take the mean value that Allan Smith took, which was 67, so it's not the arithmetic mean between this low of the bracket of five and the top of 500, then I think the value that was arrived at was 3 times 10 to the minus 4th, which is very close to your four times --

DR. GLANTZ: I would be satisfied with that.

DR. FRIEDMAN: How about, would you be satisfied with not giving a number, but just saying we think that the true risk is probably somewhere in the middle?

DR. GLANTZ: No. I think we need to give them a number that we think is reasonable.

DR. BLANC: I think 3 times 10 to the minus 4th, which is the number --

DR. GLANTZ: I'm happy with that.

DR. BLANC: -- based on I guess 67 micrograms per meter. Do I have that number right, people from --

DR. MARTY: Allan Smith's was 5 times 10 to the minus 4, based on 67 micrograms per --

DR. FUCALORO: Microgram per meter cubed, right.

DR. BLANC: And he arrived at 67 as a kind of mean value based on -- where did 67 come from?

DR. ALEXEEFF: The 67 actually is basing it on the railroad worker information, using the Woskie data where you have a background level of -- well, approximately 80 something, 83, it's subtracting out the other -- the non-diesel background and you come to 67.

DR. BLANC: Does that seem like a reasonable mean for all of the pooled various occupations that we looked at, some of which were clearly much higher than that and some of which were lower than that, in your --

DR. FUCALORO: It only has to apply -- it needs to apply to the finding that there's a 40 percent increase in background lung cancers. So to use other data you'd have to look at what that increases. So he's using .4 over 20, assuming that that's increase from 1 over 20, which is the incidence of lung cancer in the general population; right?

So that's an extra .4, and that .4 over 20 is equal to the risk factor times the exposure, and if the exposure is 67, .4 out of 20 increase, then you come up with this number that you find acceptable.

DR. GLANTZ: Is 3 -- that's fine with me.

ACTING CHAIRMAN FROINES: I want to stop everybody's discussion, and I want -- I want one of the four of you, or whoever, to express to me the justification and the basis for the number that you're now proposing.

And it has to be said very clearly, because what you're saying to every citizen of California is that through a rigorous scientific process we have established what we consider to be the best value for diesel exhaust risk with respect to lung cancer.

DR. GLANTZ: Okay. Let me, as the first --

ACTING CHAIRMAN FROINES: Go on the record --

DR. GLANTZ: I'll try to express it on the record. Okay.

The way that I would prefer to -- I think that we, having spent years working at this, going to multiple workshops and spending more time than I care to add up reading all of this stuff, are the best-positioned people to make a recommendation of what a reasonable number would be.

I did not say it's the best number, although I actually think it is. I'm happy to use the word reasonable.

The range of risk estimates that have come out of this entire exercise, whether you look at the Garshick data, the two Garshick data sets, under a variety of assumptions of exposure patterns, which are reasonable, if you look at the Allan Smith back-of-the-envelope calculation, if you

look at the Steenland studies and the other new studies, the results to me are remarkably consistent, yielding risk estimates in the range of 10 to the minus 4, to 10 to the minus 3.

I think, however, that it is unlikely that we are in either of the upper or lower end of that range, and that if you look at figure -- at the figure in the report, which shows the effects of the different exposure models that are used, you'll see that most of them cluster around the middle of that range.

And so to me the procedure which I think is the best one to use is the one that got suggested of computing the geometric mean of these different estimates, because I think that's the one which is most likely to come out near what the actual number really is.

Now, if all the mathematical gyrations which are involved in doing that bother Hanspeter sufficiently that he wants to stay with a simpler thing, if those come out about the same, I'm not going to make an issue of it because I don't think the difference between three and four or four and five isn't that much to me.

My concern is that we not come in with a number that's at the bottom of the range, because I think that's unlikely to be the correct number.

ACTING CHAIRMAN FROINES: Let me stop. You

make -- you're talking to The Los Angeles Times, The San Francisco Chronicle, you're explaining why you have selected this value, and in two paragraphs why this is the best value.

DR. GLANTZ: Want me to try it again?

ACTING CHAIRMAN FROINES: If you can't do it, somebody else should, but it has to be clear.

DR. GLANTZ: Let me try one more time, John.

And that is that there is -- there is a certain amount of uncertainty associated with these different risk estimates, due to all the stuff we've been discussing obsessively.

And when you look at the range of risk estimates that you get, some of that uncertainty is going to bias the estimate up and some of it's going to bias the estimate down.

And I think the most reasonable estimate is in the middle. And that's why I'm suggesting we say that, not that it's at the bottom or the top. And to me the middle is around 4 times 10 to the minus 4.

That's where I came up with that number.

ACTING CHAIRMAN FROINES: Peter.

DR. GLANTZ: So that's how I would explain it to The LA Times, who is sitting back there.

ACTING CHAIRMAN FROINES: Can you speak to that?

DR. WITSCHI: The way I see it, I might be naive with that one, but what you're looking at for coming in the ranges four or five data set bases, the two Garshick studies, the Steenland studies --

ACTING CHAIRMAN FROINES: Meta-analysis.

DR. GLANTZ: The meta-analysis.

DR. WITSCHI: Well, yes, and those --

DR. GLANTZ: I don't think that's what we just -- I'm sorry.

DR. WITSCHI: Well, the way I see the other one, Allan Smith's estimate, is based on very broad data sets, 30 or so studies, so the database is much broader than yours, the 30 to 40, and fewer assumptions. That's how I would justify it, we came to this number. It's a broader database and fewer assumptions.

ACTING CHAIRMAN FROINES: George, what are the two numbers?

DR. ALEXEEFF: Okay. The number varies depending upon --

ACTING CHAIRMAN FROINES: No, I didn't ask you for the number varies -- I asked you for --

DR. ALEXEEFF: Five or one.

ACTING CHAIRMAN FROINES: What?

DR. ALEXEEFF: You asked what the two numbers were.

ACTING CHAIRMAN FROINES: His number is what?

DR. ALEXEEFF: Five.

ACTING CHAIRMAN FROINES: 5 times 10 to the minus 4.

DR. ALEXEEFF: Yeah. I'm sorry. Are you talking about the geometric mean number?

ACTING CHAIRMAN FROINES: I'm talking about the number that he just said is the best number that --

DR. ALEXEEFF: We chose the geometric mean, we haven't done the calculation yet, but it would be about five.

ACTING CHAIRMAN FROINES: 5 times 10 to the minus 4.

What is Peter's number?

DR. ALEXEEFF: Hanspeter would be 5.

ACTING CHAIRMAN FROINES: Unless I'm mistaken --

DR. ALEXEEFF: If we use Allan Smith's exact calculations, it would be five. If we use 250, it would end up being one. Okay. That's --

DR. WITSCHI: I could live with two things. One is with Allan Smith's estimate, and the other one by some addendum that a point estimate is not good enough, you really have to consider ranges.

DR. GLANTZ: We have given them the range, too. I'm not saying -- wait, so you're saying if we did Allan

Smith's just the way he did it, it would also be five?

DR. ALEXEEFF: Yes.

DR. GLANTZ: Then there's nothing to disagree about. Then we agree, it should be five. Because whether you do it the simple-minded way or the unsimple-minded way, you get the same answer, which means it's probably right.

ACTING CHAIRMAN FROINES: Here's what we're going to do.

You two are going to work -- you two -- excuse me. You two are going to work with Hans and Stan and the four of you are going to come up with a number, and the two of them are going to write the specific language that will go in here to go with that language.

DR. GLANTZ: No.

ACTING CHAIRMAN FROINES: No, no, no. We're going to try and get this done.

DR. GLANTZ: You mean right now? Okay.

ACTING CHAIRMAN FROINES: We're not going to necessarily do it right now. We can agree that the number is going to be in the middle and we'll have to agree that the language will get --

DR. GLANTZ: You're making this too complicated. I think we just agreed.

ACTING CHAIRMAN FROINES: No, no. But you don't understand is I'm trying to get this process through, one.

Secondly, I'm trying to get a justification that will go to the Air Resources Board that when it's written down they will understand it and say, yes, that makes sense to me.

DR. GLANTZ: But let me try and tell --

ACTING CHAIRMAN FROINES: I don't want you to try to say it anymore.

DR. GLANTZ: John, you're making it --

ACTING CHAIRMAN FROINES: I want you to sit down and write it.

DR. GLANTZ: Well, no. I think that we've said it. There's two different ways you can do this.

One way is to take the Allan Smith simple approach, which with his numbers which leads you to an estimate of 5 times 10 to minus 4, right?

ACTING CHAIRMAN FROINES: Right.

DR. GLANTZ: Just listen to me.

ACTING CHAIRMAN FROINES: Stan, I've heard this twice. You're missing the point.

DR. GLANTZ: No, I'm not missing the point. You're missing the point.

The other thing is that you can go through this other process that was described, which is more involved, and gives you the same answer. So it doesn't matter.

MS. SHIROMA: Dr. Glantz, I think that what the

chair is referring to is at times as we've dealt with substances, the chair directs a subcommittee to come up with the exact language over the next few days type of thing, that is then passed around to the panel members before the chair signs it. I think that's all he's --

DR. GLANTZ: I don't think we should put this in the findings. It's too technical. I think if we want to add something to the report explaining this that would be okay.

ACTING CHAIRMAN FROINES: Excuse me, but the issue of the quantitative risk assessment has been the most debated element of this entire process. If you're going to put in a range of risk and a unit risk value, you're going to say as part of that, what the justification of it was.

Otherwise, I'm not going to send it forward, because it has to be stated clearly to the Air Resources Board the basis of our decision.

DR. GLANTZ: But, you see, I think --

ACTING CHAIRMAN FROINES: Stan, don't argue with me. That's the way it's going to be. It's got to be written in a coherent, clear way, so that it is effectively justified for the body politic and for the Air Resources Board in particular.

I'm sorry. That's the way it has to be.

Now, you can go sit out in the hall now and the

two of you can write it, but we're going to get it written before this thing goes forward.

DR. GLANTZ: We'll do that now, because I think we need to do that before we leave. We'll go write it.

ACTING CHAIRMAN FROINES: George has the numbers, I think.

I want everybody to understand why I sound a little bit dogmatic.

DR. BLANC: No, I think --

DR. BYUS: You're absolutely correct.

DR. FRIEDMAN: We understand.

DR. BLANC: You don't have to convince us.

DR. KENNEDY: Say no more.

DR. BLANC: I think that we're trying to preserve consensus in a difficult situation where people hold different points of view, and it's challenging because some of those points of view are so fundamentally different than the process mandates that it does provide an inherent conflict.

ACTING CHAIRMAN FROINES: Well, I just -- the other thing is I would hate to see the ARB sued because an inadequate justification for a selection of a value was made.

DR. BLANC: No, I think you're right. You don't have to justify yourself to us.

ACTING CHAIRMAN FROINES: You have to tell people why you do things.

DR. BLANC: While they're out of the room, Dr. Kennedy, I think you had supported the view, and Stan before he left and Hanspeter had both seemed to be saying that they could live with point 19 coming out. Is that -- did anybody object to point 19 coming out?

ACTING CHAIRMAN FROINES: I think given the changes in diesel exhaust that are occurring, that makes perfect sense.

DR. BLANC: So I think we should move forward and just hear from Dr. Kennedy if there are other issues he wants to bring up.

DR. KENNEDY: I have very few. They've essentially all been discussed.

I am on this board representing probably a position closer to every man than any of the rest of you. I'm a clinician.

I don't deal with the sorts of calculations and perspectives that you do, and I frankly found a lot of the mental gymnastics that were involved in model development and manipulation to be somewhat baffling.

And whether it be a function of perspective or simply knowledge based, I am more comfortable in this simpler method of arriving at this information.

Because of it, I think also that section 19 is window dressing. It is not really essential to the information that you're trying to convey and I think it just has no value.

With a bit of background in biology, I had some concerns about the mixing of animal and human epidemiologic data, and that's been taken care of, I think, with good compulsive concern for detail.

On all other fronts, my only other question relates specifically to section 15 in the middle of the second sentence, sister chromatid exchange in rodents and human cells in vitro. Are the rodent data in vitro as well?

ACTING CHAIRMAN FROINES: George?

DR. BUDROE: John Budroe, OEHHA.

Yes. Both.

DR. KENNEDY: Both, yes. Okay. Then I'm happy.

DR. BLANC: If you're happy, I'm happy.

DR. FUCALORO: Well, go ahead.

DR. BLANC: Are you sitting in for John?

DR. FUCALORO: Yes.

DR. BLANC: Why don't you suggest we take a ten-minute break.

DR. FUCALORO: I'm suggesting we take a ten-minute break.

(Thereupon a short recess was taken.)

ACTING CHAIRMAN FROINES: Do we have everybody in the room? I want Peter to finish.

Peter, I appreciate your comments.

All right. I want to wait for Friedman if he's here.

DR. KENNEDY: For the record, can I add one additional small statement and that was I am grateful that we have the addition of two additional two studies to expand the database. I think that -- again, as someone who is sitting on the periphery of all this, I'm much more comfortable in our deliberations with the ability to see different perspectives coming up with the same answer.

And I think great credit goes to the folk at OEHHA for laboring so long and hard with the work, the information they had.

ACTING CHAIRMAN FROINES: Actually I labored to get those two, but that's okay.

DR. GLANTZ: Here's what he wrote.

And this sort of actually gets --

ACTING CHAIRMAN FROINES: Just read it.

DR. GLANTZ: The point that Peter just made that you get -- the fact that you get to the same place by such different pathways is, I think, important.

Okay. Here is what we wrote.

After considering the results of the meta-analysis

of all -- I should say all human studies probably -- as well as the detailed analysis of the studies of railroad workers, the SRP believes that 3 times 10 to the minus 4 is a reasonable estimate of the unit risk expressed in terms of micrograms per cubic meter of diesel exhaust particulates or their surrogates.

DR. FUCALORO: To the minus 1?

DR. GLANTZ: 3 times 10 --

DR. FUCALORO: Micrograms to cubic meter, quantity to the minus 1.

DR. GLANTZ: Right.

DR. WITSCHI: We can even say instead of believe, came to the conclusion.

DR. GLANTZ: Concludes. All right.

ACTING CHAIRMAN FROINES: Now, what was the basis for that conclusion?

DR. GLANTZ: The basis for the conclusion was what Peter Kennedy said, that when you come at this through two totally disparate approaches you end up with almost identically the same number.

ACTING CHAIRMAN FROINES: Write that down, because you can come to a conclusion, but then you tell the audience how you came to the conclusion.

DR. GLANTZ: We did. We considered the results of the meta-analysis of all the studies, which is one approach,

and the other approach was the detailed analysis of the railroad workers, which is the second approach.

ACTING CHAIRMAN FROINES: And then add Peter's sentence then.

DR. BLANC: How about this as that sentence. Thus, this unit risk value reflects two separate approaches yielding similar values.

DR. GLANTZ: That's fine.

DR. FRIEDMAN: I thought that you said before that it was five. How did you get three?

DR. ALEXEEFF: It's actually Dr. Fucaloro explained why it's three and not five. Five would be the risk for the background level of 1.5 micrograms per cubic meter.

DR. FUCALORO: No, no, no, no. Five is the five additional cancer cases per -- four and a half -- per 10,000.

DR. ALEXEEFF: Five is the cancer burden. That is to say when you take into account the background level, but the unit risk value he calculates is three.

DR. FUCALORO: Three micrograms per cubic meter to the minus one power.

ACTING CHAIRMAN FROINES: Thank you, George.

Let me say that we now have a -- how are we describing it? As a reasonable unit risk value, which is

justified on the basis of the evaluation of the data, understanding that there are different data sources and yet when looking at all those data sources this summation represents the best value.

Is that --

DR. GLANTZ: We're happy with that.

ACTING CHAIRMAN FROINES: I'm trying to make sure the record indicates that this is a best value which we have scientific -- what's the word -- scientific confidence in.

DR. GLANTZ: Yes.

ACTING CHAIRMAN FROINES: And it's meaningful in that regard.

DR. GLANTZ: Yes.

ACTING CHAIRMAN FROINES: Everybody agrees with that?

So around the room, there's no dissent on that point of view?

And George or Genevieve are going to take all that's been said today and produce a new draft findings, which will be circulated to the panel for final final agreement; correct?

MS. SHIROMA: Yes, that's correct. Before you sign the final.

ACTING CHAIRMAN FROINES: Right. I'm trying to be very clear, because simply because we make offhand comments

about risk assessment values, I want to make sure that we all believe in what has been done here.

And I think the record that our lawyer friends will now feel confident that we haven't created uncertainty in the findings of the panel.

DR. GLANTZ: Paul, why don't you read me the sentence, just to be sure, why don't you read me your sentence, let me write it down and let me reread the whole thing one more time.

DR. BLANC: Thus, this unit risk value reflects two separate approaches.

DR. GLANTZ: Just a second. This unit risk value --

DR. BLANC: Reflects two separate approaches yielding similar values.

DR. GLANTZ: Let me just for the record read this one last time, make sure everyone agrees with it.

After controlling -- or after considering the results of the meta-analysis of all human studies, as well as the detailed analysis of the railroad workers, the SRP concludes that 3 times 10 to the minus 4 per microgram per cubic meter is -- should I say the best estimate? Because that's what people are now saying.

DR. BLANC: No. Reasonable.

DR. GLANTZ: Is a reasonable estimate of the unit

risk expressed in terms of diesel particulates or their surrogates. Thus, this unit risk -- or this unit risk -- thus, this unit risk value reflects two separate approaches, which yields similar values.

ACTING CHAIRMAN FROINES: Great. That's great.

DR. GLANTZ: Who should I give that to?

ACTING CHAIRMAN FROINES: Give that to Genevieve.

That's really good work, gang. That's really good work.

And we sent the two people who I would never have predicted would have come back that fast to do it.

Friedman and Blanc be back in ten seconds, but you guys.

Now, George keeps trying to get in here.

DR. ALEXEEFF: Yes. If I could make one proposed modification or clarification.

The meta-analysis did not include all of the human studies. There were exclusion criteria for selecting those studies which --

ACTING CHAIRMAN FROINES: Can't we put that as a footnote?

DR. ALEXEEFF: We can just take out the word all, because it's the meta-analysis of all humans studies, but it's a meta-analysis of human studies.

DR. FUCALORO: What you're referring to is a

specific meta-analysis that was done in the report so it's not a vague term.

ACTING CHAIRMAN FROINES: Okay. Now, gentlemen --

DR. GLANTZ: What about No. 19?

DR. BLANC: We got rid of that.

DR. GLANTZ: Okay.

ACTING CHAIRMAN FROINES: Now, the following is a proposed addition to our findings, and I'm not sure the exact number, but it will be towards the end, maybe 22.

It reads as follows.

The panel has reviewed the report, "Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant Report," as well as the scientific procedures and methods used to support the data, the data itself and the conclusions and assessments on which the report is based. The panel finds that the report is based on sound scientific knowledge, methods and practices.

That's simply is a requirement that says that the panel is acknowledging the State has met the obligation under the law.

DR. GLANTZ: So moved.

ACTING CHAIRMAN FROINES: So moved.

DR. WITSCHI: Second.

ACTING CHAIRMAN FROINES: Okay. Secondly, No. 20, we have based on the available scientific information a

level of diesel exhaust exposure below which no carcinogenic effects are anticipated cannot be identified.

DR. WITSCHI: I know we have used the sentence before, but strictly speaking the scientific method never can show the evidence that something is not going to happen.

DR. FUCALORO: Had not been identified, is that better?

ACTING CHAIRMAN FROINES: Shall we say has not been identified?

DR. FUCALORO: I don't know if it's plural. It has not been identified.

ACTING CHAIRMAN FROINES: Has not. And we reserve the right to --

DR. FUCALORO: To find it.

ACTING CHAIRMAN FROINES: To find it.

Based on available scientific evidence as well as the results of the risk assessment, we conclude that diesel exhaust be identified as a toxic air contaminant.

Any no votes at this point we throw that person out.

DR. GLANTZ: Actually --

DR. BLANC: Oh, please.

ACTING CHAIRMAN FROINES: And that's it.

DR. GLANTZ: I move we accept the findings.

DR. FUCALORO: Before we do that, I really need to

mention something that Jim Seiber wrote, and just be a consideration. I actually think we've covered much of this, so let's see. I haven't read it since we've had this discussion.

He writes although the accumulated evidence indicates that diesel exhaust is carcinogenic, there is much uncertainty over the unit risk or potency factor for cancer in humans due to exposure to diesel exhaust.

In part this is due to species differences and effects in experimental animals, and in part due to the lack of measured exposure data in diesel locomotive work in epidemiological study.

SRP does not support selection of either a single unit -- he does not support a selection of either single unit risk factor or definitive range based upon available data. SRP rather supports a continuing search for scientific basis for developing a single factor with definitive range. A search should focus on diesel exhaust as emitted from diesel engines in current use using diesel fuels in current use.

I think the last thing we are going to do, but we've grappled with those other issues.

ACTING CHAIRMAN FROINES: I don't think we should take up most of that, because we've already dealt with it.

But I would agree that we could put a sentence in

that says that given the difficult issues associated with diesel exhaust that we support and --

DR. FUCALORO: Encourage.

ACTING CHAIRMAN FROINES: Encourage additional research.

DR. GLANTZ: We've already said that. It's in there already.

ACTING CHAIRMAN FROINES: Where?

DR. FUCALORO: We did it.

DR. GLANTZ: It's in there somewhere.

It's in No. 7.

ACTING CHAIRMAN FROINES: Not in my No. 7.

DR. FUCALORO: No. 8.

ACTING CHAIRMAN FROINES: It's now become No. 8.

But I still don't think that's enough. I think we should have a concluding statement that says further research on diesel exhaust exposure issues and health effects and risk assessment would be -- should be encouraged.

DR. BLANC: I would just -- I would not do that, actually.

DR. GLANTZ: I agree.

DR. BLANC: I would not do that because I think that placing that statement at the end unnecessarily weakens the conclusion, which could come back to be negatively

exploited in ways that you would not intend from such a statement. So I would simply leave well enough alone.

I don't think you have any reason to doubt that there's going to be a lot of interest in further research.

ACTING CHAIRMAN FROINES: I think -- I disagree on this one with you guys. I think that further research is required and it's important.

DR. BLANC: I don't disagree with that. I'm just purely arguing on a tactical, strategic basis, not because I disagree with that.

DR. GLANTZ: Our job is not to outline the research agenda. Further research is always required on everything.

And I agree. I think that for -- I think that of all the reports that we have looked at on this committee, this is the strongest, except, of course, maybe the one on secondhand smoke, and I think the evidence -- I had to get that in.

And I think the statement that he's proposed, that Seiber proposed, really makes it sound like it's weaker than it is. And I mean there's lot of issues that have been brought up in the discussion today that need further research and I think that that speaks for itself.

But I don't think that -- I think to put that in as a formal finding at the end like that will make it sound

like there's a lot more uncertainty here than there is.

DR. FUCALORO: In fact we have put it in, and you put in No. 7, but look at the last sentence in the old No. 10, what is that, No. 11 now. And it says further research would be helpful to quantify the amounts of specific compounds emitted from a variety of engine technologies, operating cycles and fuel to better characterize any differences between old and new fuels and technologies. And I assume old and new refers to both fuels.

DR. BLANC: We also said in the non-cancer health that we added a statement that said as new data emerge that this should be --

ACTING CHAIRMAN FROINES: I don't have that, because I don't have --

DR. BLANC: It's now item 15, the old item 14, that we added the sentence that should be recognized that this REL may need to be lowered further as quantitative --

ACTING CHAIRMAN FROINES: I think that there are -- I believe that there are significant research around the mechanism of carcinogenicity, how one addresses interactive effects and complex mixtures. We have never said a word about dermal absorption in this particular document. We do not know the role of nitro-PAHs.

And I can give you a list of hundred things that are important.

I think that research is important --

DR. BLANC: I'll compromise this far. I don't object to putting in such a sentence. I don't think it should be the last sentence of the document, so if you can figure out a place --

ACTING CHAIRMAN FROINES: George and Genevieve, George and Melanie, as you guys are working to finalize this to come back to us, find a place to put a sentence in about the need for additional health effects related to research. And we won't try and do it right this minute.

And we'll circulate it.

But I frankly think that this -- that there are so many very deep scientific issues, some of which have to do with the fact, for example, I think Mauderly is not entirely correct in the way he's interpreting his animal data, and there are a number of issues that are -- that may show diesel's less of a carcinogen and some may show it more, but I think those issues need to be resolved, because there are immense industrial significance to this use of diesel in the country, and I think we have to take that seriously.

So I really believe that a call to recognize that research has to go on is an important and I think this panel should be able to say that without feeling as though we were undercutting ourselves, or causing more insecurity about our findings, because I think this is quite -- this is one of

the best discussions of the science I've ever had in the 15 years I've been on this committee.

So I think it's a great effort, but I think we do need to recommend that further actions go forward.

DR. BLANC: One other small question.

The very end of the finding, are you still acting chair? When do you just become chair?

ACTING CHAIRMAN FROINES: I don't have anything to do with that.

DR. BLANC: That has to come from the ARB?

ACTING CHAIRMAN FROINES: Yeah. Maybe I've been here long enough and I can retire.

DR. GLANTZ: I'd like to move that we accept the findings as amended.

DR. BLANC: I second that.

ACTING CHAIRMAN FROINES: I want to congratulate the staff of the two agencies.

DR. BLANC: I think, can the record just reflect that we've reached consensus?

DR. GLANTZ: Let's vote.

ACTING CHAIRMAN FROINES: We'll take a vote. Sorry, I thought I took that as being a given almost.

So that the accepting of the findings vote, all those in favor raise their hand for aye.

(Showing of hands.)

DR. GLANTZ: It's unanimous.

Could I also move that we accept the reports as amended.

DR. BLANC: Second.

ACTING CHAIRMAN FROINES: All those in favor, say aye.

(Ayes.)

ACTING CHAIRMAN FROINES: Now can I say thank you?

DR. BYUS: Say nice things.

ACTING CHAIRMAN FROINES: I think this has been the most extraordinary effort that I've ever viewed in federal or state or local government. I think that the intellectual effort, the perseverance, the tenaciousness is unparalleled. And I think we owe a debt of gratitude, and I think the public of this state owes a debt of gratitude to the people in this room, because I think this has been a real difficult effort, and I think we've come through it and I think we've come through it very very well.

And I'm really pleased at the consensus of this committee. I think this committee worked very hard and very well today and at the last meetings, and I think we owe a pat on the back for ourselves, as well as the pat on the back to the staff who have been working with us.

So thank you very much. We've made a big step today, I think. And we should all take credit for it.

Good luck at the next stage.

MR. OLIVER: Thank you, Chairman Froines.

Please let the record reflect that the second motion to adopt the report was carried by unanimous vote of the panel.

DR. BLANC: So does you saying Chairman Froines, instead of Acting Chairman Froines, reflect any kind of change in status?

MR. OLIVER: Don't worry, it's not correct. It's only a statement from a lawyer.

DR. GLANTZ: Are we done?

ACTING CHAIRMAN FROINES: We're done. We did it.

(Thereupon the meeting was adjourned at 4:25 p.m.)

CERTIFICATE OF SHORTHAND REPORTER

I, JANET H. NICOL, a Certified Shorthand Reporter of the State of California, do hereby certify that I am a disinterested person herein; that I reported the foregoing meeting in shorthand writing; that I thereafter caused my shorthand writing to be transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said meeting, or in any way interested in the outcome of said meeting.

IN WITNESS WHEREOF, I have hereunto set my hand this 29th day of April 1998.

Janet H. Nicol
Certified Shorthand Reporter
License Number 9764