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EPA/NARSTO PM MEASUREMENT RESEARCH WORKSHOP

"Breakout Group; Exposure Assessment"

July 22, 1998

MR. LIOY: All right. We have three hours this afternoon or less or more, less, I hope. I guess they came back from lunch and said, well, here's the breakout session worksheet and I looked at it and looked for some more guidance as to what we're supposed to do and basically it's the same questions that I had up there this morning, and we're supposed to fill out this little box. All right? This is our goal, to fill in the little boxes. The boxes say what are the science questions, hypotheses, basically this. All right? The key thing is and I think Petros was talking to the dance squares at lunch and saying that one of the ideas was to come up with things like places and measurements and see where the different groups come up with some correspondence and coordination, based upon the different focus from the individual workshops. I think Petros came up with an interesting question. He and I argue a lot, but it's all in good fun, but I think he comes up with some very good questions at times. One of his

questions was, and I think it's appropriate for you all to ask, and I don't want to dominate this, is do we need Supersites to answer questions on exposure and, if we do, what are the questions that we have to answer? If it's no, we can all leave. All right?

MS. SHELDON: But, we have to pay $1.00.

MR. LIOY: We have to pay $1.00, so you should stay here a little bit to get your money's worth. But, do we need Supersites to help us with assessing exposure and, in that regard, what are the major science questions that we have to deal with in respect to that and etc. So at first, I want to listen to your input. Who wants to start? I know it is after lunch and you are all tired, but, Paul?

MR. KOUTRAKIS: Did we have this with EPA, or API as most of the people here are interested in that, so keep that in mind.

MR. LIOY: Okay, if you want to do that. Does anyone want to hear that or do you feel that you want to get into talking.

SPEAKER: Do you want to start with philosophy or field work?

MR. LIOY: Yes. Do you want to get into the nuts and bolts or do we want to get into philosophy?

SPEAKER: I think you've got to

start with a big picture and what we've heard, what documents are in preparation for this workshop. It's all very good stuff, but it deals with the outside atmosphere. It deals with the outdoor atmosphere primarily and Dan's introductory, you know, leading question was, Dan Albritton's was to establish a model, set a goal, what overriding goal was to establish a model that relates indoor exposure to outdoor. When I asked you the question, you said the work between indoor and outdoor wanted to establish the fraction of the indoor exposure that comes from outdoors. Well, I feel there's enough work being done to show that, in most situations, there is very little relationship between indoor and outdoor. So one might almost say that from a health point of view, let me finish this through before we argue, the steps I'm going through here, that if you take that to it's ridiculous limit, then it almost seems that we wouldn't need to do any outdoor source receptor work, because if we're interested from a health point of view, we should just study the environment in which people spend most of their time. What's ridiculous about that, is that we could easily let the outdoor air quality go to hell and filter everything while in an indoor environment and that certainly wouldn't be acceptable either. So we do still have to understand the outdoor source receptor relationship to things like that. That's, of course, in any case. That's already a

given with all the regulatory efforts that are underway are dealing with and then that's, you know, the momentum is such that it never will change. So then the question is actually the outdoor environment is being characterized to an Nth degree, but the indoor environment is not and I think that what you really have to do is to initially focus on what people are getting from an exposure point of view without almost, separately, from whatever's being done in the outdoor air.

MR. LIOY: That is going to be done. Although I would disagree with you about something about characteristic that is known to the Nth degree. We know that outdoor has a very little influence on indoor. That's based upon a limited number of studies. There are a number of studies, in fact, that will be going on and that are going on that will start to look at the more critical aspects of PM2.5, being one foci of PM, and what the personal exposures are to individuals. So...

SPEAKER: There was a list that Mauderly gave us. There were a couple of lists.

MR. LIOY: Of chemicals.

SPEAKER: Of materials that have been implicated, hypothetically or realistically, as being causative agents, agents of concern.

MR. LIOY: Right.

SPEAKER: It seems to me, one needs to test or determine the extent to which those materials exist in the atmosphere where we, as individuals, at least urban dwellers, spend 80 to 95% of our time.

MR. LIOY: Well, do they exist just outdoors?

SPEAKER: No.

MR. LIOY: Outdoors and indoors?

SPEAKER: Just indoors.

MR. LIOY: Well, I think you have to match them up because you want to make sure there is some kind of, there could be some indoor sources.

SPEAKER: Obviously, there's exchange, yes, but if you have limited resources. I mean, if you have limited resources, let's focus on initially on what the most urgently need information are. Later on, you can make the connection because the outdoor people are going to help us make that connection.

MR. KOUTRAKIS: Are you suggesting here that we have indoor Supersites?

SPEAKER: Huh?

MR. KOUTRAKIS: Are you suggesting we have indoor Supersites?

SPEAKER: Yes, that's a good way to put it. That is a good idea. Indoor Supersites.

SPEAKER: I know nothing about either air pollution, but I assume it is different because there's probably lots of bad chemicals coming out of these plasticized walls and carpets and things that we have, that one knows... And, as you say, we spend 80% or more of our time inside. I guess the question you want to ask is, are there any studies correlations say things are worse outside than they are inside? That is, if the agents that cause health effects are 50 times more important outside than they are inside, even if you're on the only outside 10% of the time. That still would be worse.

MR. KOUTRAKIS: I think... But, on the average the three factors of the effect of air quality is the penetration factor, plus the percentage of particles making it through the cracks in the doors and usually, for a typical house, that penetration ratio is about 80 to 90%. The second is the amount of particles that is there. That is the position of that. About 50% of the particles come from others. It was indoors before the air goes out again. On the average, you could take a 24 hour measurement, 50% of the particles are other than the particles that penetrate indoors and about 50% of the particles indoors, they are generated indoors. Now, this is an average 24 hours. The second time is when we cook, this can go to 500 to 600 mg. So I think there is, and I saying this because there is this

position. I think both indoor and outdoor particles are very important in this.

SPEAKER: This is a highly variable number depending upon ventilation.

MR. KOUTRAKIS: Sure, sure. Yeah.

MR. LIOY: One, it's highly variable depending upon ventilation rate. It's highly variable dependent upon the source. The source is more important the ventilation. The ventilation rate, you know, will give you an exponentially decay pattern that modifies over time, but the biggest thing, the initial concentrations that we inject into the system.

MS. CHOW: I'd like to spend a couple moments talking about the forest, the span of trees and then the trees, in light of this workshop and, although I do not agree with much of what's been said, I think we have to go back to the context and I think the NRC expressed it well on that figure they had, when it went from source into the environment, into air quality, into exposure, into dose, into effects. So to think of it, so the whole of the issue, we want to understand PM and do something about it, we have to understand the whole of this chain, and there's all sorts of pieces to it, because that's where you get to the indoor, the outdoor, what particles are people exposed to. But the regulation is for outdoor particles. So what is the

exposure of people to outdoor particles, whether indoors or outdoors, whether they're exercising or not. So, we have to understand the whole of the picture. However, what we're here talking about in this particular workshop is the Supersites and the Supersites are a category of money from Congress and their intent is to look at the ambient air. So, in other words, if all you do is look at the ambient air, you can't go from source to effects. If all you look at is indoor, you can't go from left to right. So I think we have to say that how does the Supersite, set of sites, fit into that picture such that we would know more about exposure when all is said and done.

SPEAKER: So, your conclusion here is that it's actual personal exposures that...

MS. CHOW: Yes.

SPEAKER: How do you get from the source to the personal exposure?

MS. CHOW: Yes, yes. Because what's going to happen is, it's inevitable, I mean, the monitoring, the standards are going to be based on stationery monitors. I mean, how else could you set a standard, and so how representative is that outdoor monitor of actual exposure?

SPEAKER: So what you need from a monitor is what you need is input to get exposure models?

MS. CHOW: Yes.

SPEAKER: That's one aspect. Less than 10%.

MS. CHOW: 10% of your time is outdoors. There is more that comes in, but all of this needs to be understood and here, in this particular workshop, we're not talking about the whole of exposure. We're talking about how can Supersites make the science of exposure to particles stronger?

SPEAKER: Right.

SPEAKER: Now if your exposure models are based on human activity data.

MS. CHOW: Yes.

SPEAKER: The ones that you use to regulate are. Then you need time resolution in the Supersites which is equivalent to the model...

MS. CHOW: Yes, that's the kind of thing I think we need to be talking about.

SPEAKER: I think there's an important distinction when we talk about exposure assessment between exposures of an individual and exposures of a population. If you try to assess exposures of individuals, there's a lot of variation from person to person depending upon how much time they spend indoors, outdoors, what they're doing indoors, whether they smoke or have a smoker in the house, and whether they are cooking or vacuuming or what not. So,

outdoor stationery sources may not relate very well at all to an individual. But, if you look at a population which is an average of many individuals, then you start to see rather high correlations.

SPEAKER: But a population doesn't get sick and die.

MR. LIOY: Let him have his thought. Let Carl finish.

SPEAKER: There are two types of studies we're doing. We do studies of individuals like a panel type study where you recruit a group of people and you make serial measurements on them in terms of health outlooks, physiological, asthma, heart attack or infant mortality. When you do that, then you need to know about the individual's exposures, that particular individual. But, when you study populations, as have often been done in the acute mortality and morbidity studies, whether you look at hospital admissions of a city or mortality of a city on a day-to-day basis, you don't need individual exposure estimates. You need population exposure estimates.

SPEAKER: Isn't the population made up of individuals?

SPEAKER: That's true, but the average population exposure consists of individuals, some of whom are on the extreme of high exposure and some of whom are on the extreme of low exposure, but

as we go from day to day, all of those exposures start regressing towards a mean.

SPEAKER: You don't die of a mean exposure. You die of an acute...

SPEAKER: But what we're measuring is the mean mortality on a given day and we're comparing that with the mean population exposure either of that day or prior.

SPEAKER: It's like a layer of ozone on a national average.

SPEAKER: No, it isn't.

SPEAKER: But anyway, that's what you do, so what does it mean in terms of what we need to measure. What does this mean? Continue? What should be measured?

MR. LIOY: Well, let's go on to the next. Continuing on. Let's talk about number 1 first before measured.

SPEAKER: Number 1, meaning the questions or hypotheses?

MR. LIOY: Yes, right.

SPEAKER: The suggested hypotheses. Perhaps it's already known, but let’s run by it, since there seems to be a correlation between health effects and outdoor PM2.5 and PM10, the question is do indoor source strengths concentrations correlate with PM, and they might, because people burn

oil to heat their house. Some of that filtrates in. Perhaps there's reasons why that might be true in summer. Independently of whether or not the indoor sources are the same ones as the outdoor sources, okay? They might be correlated, they might not be. Because if they're not correlated, then that's evidence to assume that it is the outdoor concentration that's delivering the toxic stuff. So anyway we have to look at the hypotheses.

SPEAKER: That's true. That's very true.

MR. LIOY: That's a good point because one of the things that I found that we have ignored is the issue of indoor air chemistry and you may have an organic vapor that's released indoors from this and you have penetration of outdoor ozone indoors and/or free radicals like hydroxil radicals and you may actually produce particles indoors that are related to the outdoor air, but not necessarily being derived from the outdoor source. It may not be toxic. It may not be toxic when it was outside, but it could driving the association or...

SPEAKER: There are differences that meteorology say that will make the house concentrations go up, and that is the reason for the analysis.

MS. CHOW: We've done a lot of

measurements. We do single particle issues with real time information, so we measure outside the same time as we're measuring inside. It's all been a chemistry building, so we have lots of indoor sources of particles. But, you know, they're never the same at the same time, but we look at the time evolution of how long it takes to get in, what causes things to come in, but, as I said, there's a lot more particles that we see inside that we don't, obviously, you know, that we aren't seeing outside at the same time or ever. One of things that you mentioned is, you know, transformations, and there are no ECC salts in soil and different organics and they'll come inside and they're completely, we believe, based on their size distribution and everything that they're the same particles, but they look completely different inside because in our chemistry department we have all kinds of nice organic vapors. Just like you say, yeah, they're really, really transformed inside in a way we never see outside. So it's a combination of the two, and that's a really good point, I think.

SPEAKER: Have you ever done this at home?

MS. CHOW: Not yet. No, we don't have that kind of power at home.

SPEAKER: If you look in a pool in a heavily impacted neighborhood, meaning there's a lot of ambient particles. During events where ambient

particulate is maximum. Number 1, if you plot outdoors, you see a very strong diurnal variation because of both source strength and meteorological dispersion factors, which conspire to give you high levels at night and low levels during the day and if you, at the same time, look indoors, you'll see a beautifully correlated line, which shows 70% roughly infiltration of those particles and the contribution in the home from the outside source is dominant, not all the time, not everywhere, but in the worst places in the worst times, at least in the North West. That's an observation that's been verified many times. So if one of the critical questions here is if you reflect back on what's driving this whole thing it's the notion, number one, there's something about outdoor particles that relates to health that can be seen in a population. There's the belief that it's not everybody in a population, it's special people. It's neither the individual nor the population as a whole. It's something else, which is hard to get at, and it's related, some how or other, to an acute kind of time scale. Those three factors together, I think, are what makes exposure assessment in this kind of problem setting very difficult. The idea of what the Supersites can contribute to grapple with those problems, I think, is the key issue for today.

MR. LIOY: Well, I tried to derive a question, though, of does outdoor sources

concentration drive indoor personal exposure and we don't know.

SPEAKER: That's not a question. That's a known.

MR. LIOY: I'm sorry. If that was a known, we would have regulated, we would be regulating every industry today, but we're not. We have five years in which to come up with the appropriate strategies and select the appropriate sources. We don't know the answer to that question yet.

SPEAKER: Well, the gentleman here is from the integrated air cancer program, looked at 20 homes in three different cites and he found that it varied by this inside the home, outside the home was a central site. There was a correlation between all three locations of a major, of almost 60% of the mass. Inside the home, we get suffocated, and then from the outside the deposits are there, with the recent studies. Children running around. Chemical features and time fractions is highly correlated and I know of no other study that shows where there's an anti-correlation to that outdoor and with indoor concentrations.

MR. LIOY: That is for a particular location, namely wood-burning in a particular type of setting.

SPEAKER: Summertime, too.

MR. LIOY: If it's in a particular type

of setting, you can't make that kind of global pronouncement for everything. We don't know this. We don't know. We don't even have enough information on what 2 and 2.5 distribution outdoors is across the United States so we can't make that kind of pronouncement yet.

SPEAKER: I'd like to just throw in the following comment. Things might be a lot more sticky than you think. Just because 90% or 70% of the particles indoors came from outside, or whatever you want to say it is, doesn't mean that the worst ones aren't the ones that regenerated indoors. First of all. Second of all, it may be that there's a correlation between the health effects and the outside stuff, simply because we're in a nasty time span, when there's air pollution outside, it drives people inside, so they get in their air conditioners and then they're exposed to all toxins, perhaps. So we don't know. I think we have to be careful that assumptions and exposure response here may not be...

SPEAKER: I had that same concern. I think Peter's suggestion of a Supersite indoors would be very meaningful to see what the real characters of are these particles indoors compared to the outdoor particles. We have them near each other, we have to know. It could be that the particles actually exacerbate something that's going on indoors.

MS. CHOW: Paul, could we go back to something that, an issue you raised early in the game? Should we take five minutes to talk about studies that are being done because, frankly, what I hear people saying is that there are studies that are about ready to be funded by HEI and EPA and so I think that we're kind of like...unrelated.

MR. LIOY: But, I still would like to, well, the issue of what are the constituent species that lead to toxic effects, morbidity and mortality? I think that from the standpoint of the Supersite, we will be able, for the first time to have, I hope with this type of network, the ability to do measurements in a way we've never done before, not the prescribed set of measurements, not a limited set of measurements, but, in fact, if we learn more information from toxicology or we have better techniques for measuring organic fractions that we know are relatively toxic, we can include them in the Supersite measurement study. Beyond that which we have in the speciation study. Now we get back to question 1. Is it the outdoor air that's associated with these exposures that lead to effects and is it a constituent species or it's still just a mass? I mean, the Supersites are going to be set up. We're not going to get a super indoor site, I think, at this point. It would be nice to, but I don't think it's going to happen.

MS. CHOW: But you can't, with this particular pot of money, you can't do it, but you can do indoor measurements. I mean, we're funding cooperative agreements, there's grants, there's HIE, so there will be, I'll use the word loosely, indoor Supersites and so the issue...

SPEAKER: As part of other work.

MS. CHOW: As part of other work, but for this workshop, I think, like an issue probably that everybody would agree with, that we need enough measurements to be able to correlate to those things, so I mean that might be a recommendation.

MR. LIOY: Petros?

MR. KOUTRAKIS: I want to agree with what Judy just said. I think that there is that time of the year, I think there is a way here today, there is a lot of money to go into those Supersites and the question is, in terms of trying to fixate, how the selection of those cites and the selection of analyze and the frequency of the measurements can help us to know a little bit more than what we know right now about exposure assessment. We are not designing indoor studies and we don't design personal studies. We, there is significant issues about indoor quality, relationship that does not follow with the outdoors, and everything. But there is already four or five studies that will start in here and they will just continue. Now,

considering this study about emissions which are already out there, with the exposure assessment, how can we, what kind of correlation can we make with this group to the rest of the group so we can take advantage of that how the money that we would be spending, four, five, six years.

SPEAKER: That's question number 3. Where should they be made?

MR. KOUTRAKIS: I don't think we can do that much, to be honest. The way we are today. I mean, there are these Supersites can do the exposure assessment, but because 90% of the money is spent on indoor and personal measurements, I don't think they can do that much. So I think, I'll be honest. I think that these people know here, somebody informs them about what's going to happen and where it's going to happen, so it helps us in the site selection and the type of measurements we can do.

SPEAKER: Let me respond, Petros, in a really general way. Could you show the whole slide there, Paul? To my mind, one of the key features of this problem as it relates to exposure assessment is that these questions are not, they're very much interrelated. If you look at the question of what needs to be measured and you ask a related question, on what basis do we decide what needs to be measured, you quickly discover that we don't really know what needs to

be measured. What we do, is we have something that we can measure, we have some hypotheses of things that might be causative, but we really don't have anything very solid to direct the measurement, which is a terrible handicap for any exposure assessment planning activity to start with, not to know what to measure. Because of that, I think that, that drives the question of where should measurements be made and when should they be made, because if five years from now, we don't have any more specificity about what is it in PM2.5 that's of concern than we do today, we will not have succeeded in terms of exposure assessment. So one of the things, just to respond very generally to the question about where should measurements be made, is we should take advantage of the full range of natural variability in PM2.5 in the various parts of the country and we should look for maximal differences chemically because, if we don't, the chances of distinguishing any differences go down.

SPEAKER: Now from a social acceptance point of view. Glen Cass suggested what, seven?

SPEAKER: We're not sure. Seven to 12.

SPEAKER: Seven to 12, somewhere, but he showed a map of seven. But it should be to test out of the models, so that takes care of seven from that

point of view.

MR. LIOY: Right.

SPEAKER: So now the question is where in those areas, modeling areas, domains that you identified, should the Supersite be in order to be a benefit to the kind of thing that you're talking about.

SPEAKER: Another approach is to say, do your own overlay of the country, and say if you were going to pick sites or regions within which sites would be located, to represent maximal qualitative differences, in order to lead to a better definition of what is it in the PM we're looking for, would you pick those sites or some other ones?

MS. SHELDON: I think there's an issue here that, in fact, we do have a number of exposure studies. We have an exposure program. A well defined exposure program going on at EPA with HEI. I think the first question we want to ask is that are the Supersites going to be more useful to these first generation panel exposure studies or do we want to be building data that can help us in our next generation of exposure studies? Right now we are limited in what we can measure, what we know we can measure and, in fact, most of the studies are going to be restricted to geographical areas where the, you know, the grand cooperators are going to be conducted. So, you know, we are tied to those. Those studies are going to start

shortly, both EPA's and HEI's. So I guess, to me, the first question is which set are we looking at? We already have one set going on.

SPEAKER: What's your suggestion?

MS. SHELDON: I'm asking the question. I'm not sure. To me, probably with the timing, it might be more useful to look toward the second generation.

SPEAKER: Well, Congress gave us all this money to help...

MS. SHELDON: That's true.

SPEAKER: But suppose the models are going to be used in this. I don't see any research out of ORD dealing with anything having to do with.... I'm talking about an exposure model.

SPEAKER: That's not true.

MR. LIOY: One of the problems is that here, we're in a situation right now which is very unusual for all of us. We have a whole host of dollars that's just been thrown on the market, okay? The EPA and a bunch of organizations are responding in a variety of ways, some of which would relate to what the law says, some of which would relate to what the science had said previously and now, what the NRC documents says. Okay? This is all new. Everything is brand new.

SPEAKER: Yeah, but it's for a five

year period. That's not what you want to do here.

MR. LIOY: In the next five year period, with respect to personal monitoring, we are still in the infancy of personal monitoring for PM. We're going to be able to measure mass and a limited number of components. Do we want the Supersites to be measuring that? No. We're going to have that at the national monitoring sites and probably at the speciation sites. Wouldn't you want to see the Supersites being able to develop the kind of data base for the chemicals of concern so that the next generation of exposure studies, which will be the ones, I think, of more importance, because as we develop techniques, we don't have those techniques yet. We can't measure micro quantities of PAH on a personal monitor. I'm sorry, we can't do that. But, we can, in the future, but we want to know if we really do want to measure PAH or do we want to measure something else. Maybe PAH is in some communities. It may be oxidized hydrocarbons in another community, but the point is that we don't have those measurements and this is what the Supersites can help us get. The kind of information needed to determine whether we really do or don't want to do it. You can't do it now. I'm sorry. You can't do it. It's a fundamental problem. We can't get these Supersites up in six months. We can't get measurement techniques developed in a year and, for exposure

assessment, we're going to be just focusing on now a mass.

SPEAKER: So you should at least now do what you can to the best of your ability the models are going to be used in this one.

MR. LIOY: That's a different, the models are approved by another set of cooperative runs.

MS. SHELDON: Just a brief overview of what EPA is doing exposure research program is. There are four. It's only going to be about two minutes. There are four components. The overall goal is to develop models to predict human exposure and generate the data that serves as input and verification to those models. There are, talk to Dr. Fonyac, who is our lead modeler about that. Anyway, there are four components to the program. One is the series of longitudinal panel studies, looking at exposures to sensitive sub-populations and we will probably do four panel studies in different areas of the country from 15 to 40 individuals over two week periods over different seasons of the year. Okay, those will get mass. There are mass and some chemical measurements that can be conducted on those exposure studies using currently available technology. The second component is what we are calling physical factor analysis. It's to look at indoor chemistry, look at

penetration factors, look at the physical chemical interactions of the particles at the person or in the indoor environment. The third component is time activity pattern, activities of the most accessible sub-populations, which right now we do not have data on and to look at them over longitudinal periods of time as opposed to a single period of time. The fourth component is the integration of that information into models and then model allocation. So we do have a consistent program that we are trying to develop. Pardon me? We have awarded the cooperative agreements for the model development. We will be awarding the cooperative agreements for the measurement methods. Russ Weiner is directing the physical chemical work and not until next year will we start the activity pattern data.

SPEAKER: When will results be coming in?

MS. CHOW: It will be two to three years.

MS. SHELDON: It will be two to three years. As you know, with any measurement study, it will be two to three years. We are also participating on a number of other studies, including the one that Dr. Shye is working on up in Baltimore and there we do have one on indoor Supersites.

SPEAKER: You're not going to make

the year 2000?

SPEAKER: What about the Spokane study?

MS. SHELDON: That's not part of our human exposure program. I'm not talking about our entire PM program. I'm talking about what is the human exposure program. Anyway, that gives you a little bit of an overview of where we are going outside of this Supersite platform money. That's where EPA's money is being spent in the humane exposure research program. As Judy has said, this is a different pot of money that is used specifically to do ambient air measurements and our question is, and I think it's a legitimate question, can these sites be useful to our human exposure study and if they can, how can they?

SPEAKER: One quick question for information. When are the Supersites supposed to go in? 99?

MR. LIOY: 99.

SPEAKER: That could still be consistent if coordinated with the health studies in 1999.

SPEAKER: Another question on the health studies, have locations been determined yet, for the health studies?

MS. SHELDON: No, not that I know of for the health studies.

MR. LIOY: Well, that's not necessarily true. We go basically on what we know and therefore we limit our brains to where the problems are. If we did that, the study that was done on the air toxic that Bob Stevens talked about would never ben done, because we wouldn't be going to a small city. We would be going to a big population area. We should learn the things that we have to be careful of with PM, but you've got to be flexible, because PM2.5 has a whole bunch of different components and a whole bunch of different sources. So therefore you can't make an assumption of, well, where we did all the longitudinal studies before, we should, should be the only places we go and do it again. Carl, you were going to?

SPEAKER: I'd like to make a suggestion to see if we have a consensus on this about the utility of the Supersite for human exposure assessment. That is, that least in some of the Supersite locations like six, that we have to have ancillary monitoring of indoor and personal exposure going on simultaneously and we do have those simultaneous measurements, then we'll be collecting the data and that will allow us to answer a lot of questions about the relationship between the Supersite and personal exposure and indoor exposures. Let us say that Atlanta was a Supersite, for example, let us say that we would then select about 100, random sample

of 100 indoor sites and also within those indoor sites, draw a sample of individuals and put monitors on the individuals and on the stationery indoor sites as well. That will generate the kind of data we need in order to go, the relationship between variations in outdoor Supersite concentrations and variations in the populations exposure to whatever is being measured at the indoor personal sites.

SPEAKER: I'll go you one step further. Why not put it on the people that actually had hospital visits?

SPEAKER: Well, you could lead into that, but I think the issue is, is what is that outdoor Supersite telling us about the population's exposure to air pollutants.

MS. SHELDON: Yeah, when will they talk about downsizing like teaching.

SPEAKER: That's very similar to the design of the particle team study followed in Riverside, California.

SPEAKER: But not in a Supersite.

SPEAKER: Well, no, we had a simple site plus the car site, so it wasn't a Supersite in the sense of diversity of analysis, but 90% of what you said, I agree with you. There's one problem which Paul mentioned, is that when we do personal monitoring, we're not going to be able to analyze for all the species

and all of the particles, so we can at least look at the mass and maybe chemical or any of the correlations between personal and the simple sections. Let me just add one more frustration to what you said, which is going to be quite important is the micro-environmental monitoring. It is not just indoor at home and outdoor. Well, we have personal. So far we've mentioned that. We mentioned outdoor, Supersite or satellite stations, and we mentioned indoor residence. Indoor offices, communion markets, there are many other locations that we have the opportunity and also the need to have measurements in those locations in terms of micro-environmental sampling programs.

SPEAKER: But Paul didn't exclude those.

SPEAKER: I'm sorry?

SPEAKER: Paul's comments included all that.

SPEAKER: I wanted to make sure. I added to it, I thought. The thing is that the penetration of particles that we talked about to this point, 70% or 60% depending on the side fraction, we studied that a lot in residences. In office buildings, hospitals, schools, in cars, roadways, walking and exercising. We still don't know the ratios between outdoor fixed site concentrations and the concentrations in those different micro-environments. So we have the opportunity here

to make use of the Supersite designs to add an exposure component to it and preferably a health effects component to it.

MR. LIOY: John, you had...

SPEAKER: Well, I agree with what both Carl and he just said, but according to the mission here that Petros tasked us with this morning. What can the Supersites provide? Well, they can provide the opportunity to do the things you suggested, but that's not what the money is for.

MS. CHOW: That's okay. We need to keep this straight. If the outdoor research is legitimate and there's plenty of other studies to pick up the ...

SPEAKER: The point I'm trying to get at is, I think that the answer to the question that Petros tasked us with is a no-brainer. The Supersites are going to be state of the art, okay? Well, unless we can think of any state of the art thing that's been missed that we already haven't thought of, well, I don't know what that could be, then we can go to another meeting or something.

MR. LIOY: To think in terms of maybe what's to be measured. I mean, whatever is measured beyond what we know now and helps us to find the chemicals that are of the highest toxicity and the highest concentration or moderate concentration

and highest toxicity. That's something that we need to know. All right? Therefore, that measured outdoor component and then we can determine with better personal monitoring, whether or not it's available indoors. That's something that's beyond. Whatever needs to measure. Whatever you can get, we'll take. But in terms of where it should be measured, when they should be measured and the fact that I still think the major question is what is the amount of outdoor air that is actually breathed by an individual during a day. Not the one that's done with an exposure factor handbook that says you breathe 20 cubic meters of air a day and that 20 cubic meters of air a day has 100 mg per cubic meter of outdoor air. That's not the point. The point is, what percentage of the outdoor air and what fractions of the outdoor air are actually breathed by individuals? Is it 25% that are total exposure or dose? Is it 50%? Is it 75%? Within that, is it mostly crustal or is it mostly acids or is it mostly sulfate? Those are the critical questions that we can only derive from understanding what's outdoor first so we can measure indoor and personal properly. You were next.

SPEAKER: Just getting to actually what Bob had said. When you talked about, you know, these studies have been done and we know how much is inside and all that, we know what gets inside. The question is, if you're looking at total mass. You know,

you're looking at masses. They could look the same, but it's not necessarily the same particles from the same source. It's not necessarily the same chemicals in those size distributions or mass distributions. With state of the art measurements, you're able to easily tell the difference between them, so that's where the Supersites will, you know, from indoors to let you nail down what the sources...

SPEAKER: We certainly established connecting the outdoor situation with the indoor situation is a major question we need to be addressing all together. So, in answer to what you said, Linda, how to coordinate some of these things. I think that is one solution that we have, that obviously we should keep these programs together so each one learns as much as possible as time goes on, including the development of the new instrumentation, but to develop some new experiments. As Kim was saying, you know, mass distribution might be the same, but things might be different, so even knowing at this stage what will be getting measured from a chemical speciation that, you know, proves it might be in the indoor, could help guide, you know, what we need to measure here or correlate with and then go on.

SPEAKER: Well, to respond to your question a minute ago about how much outdoor air does a person breathe in a day. I already made the argument

why we should look...

SPEAKER: One of the criteria for selecting a site should be to get a mix of source types. A similar argument would be that if you look at what is the answer to your question on a regional basis and, more importantly, how do the predictor variables of the answer to that question differ from one place to another? In other words, in what areas of the country does it make a big difference if you move two blocks in terms of the impact of outdoor air on a person? In some parts of the country, it makes a tremendous difference. In some parts of the country, it doesn't. Especially during air pollution episodes. So, again, I think another criteria that comes out of this discussion is looking for variation in the relationship. Not just to say, what is the relationship, but to look at variation in the relationship by picking sites that are disparate in terms of meteorology, in terms of the poverty, in terms of...

SPEAKER: Local sources?

SPEAKER: Yeah, local sources. Coming back to local sources again.

SPEAKER: One or two meters above the ground and your monitors are floors above the ground and you may want to do some volitor radient as one of the Supersite grounds.

MR. LIOY: Maybe we want Supersites to be as close to the ground as possible.

SPEAKER: Speciation sites are floored. Speciation, the operation of speciation sites, looking at the technology that comes out of the Supersites, if for example what they were talking about, if it comes along, it's possible that some of that technology can be brought to the speciation. So, just because we don't have a Supersite, we may have a broad speciation site and that does, the expert panel wrestling with the thought of how many days can we made a small recommendation that at a minimum these speciation sites should be operating every third day in order to fall into that site. So, I wanted to make sure that you were all aware that in a lot of geographic areas, there will be some of these speciation sites. Just because health studies are done some place that there isn't a Supersite, you still will have some qualified data.

MR. LIOY: Answer?

SPEAKER: Going back to the comment you made earlier. I think it is important that we want to understand the stations ability, as well as the other ability. What was mentioned about time activity, fluids and people that are outside at different times of the day and then we can know the dynamics of the outdoor exposure, as well as indoor and personal exposure on an environmental basis. But, getting into the characterization of this station on an urban scale,

clearly just one Supersite is not going to do that. If you have one Supersite in the middle of New York City, you're not going to know what's the difference between the outdoor concentration on sixth avenue or the park or something like that. Yeah, that's what I was going to say. If you could put satellite stations or use the network or something like that, which you need to enhance. I think probably our role in this meeting is to suggest, you know, how the Supersite concept should be used, implemented in terms of what additional monitoring in these situations that need to be included in the Supersite concept. I wanted to address the exposure question.

SPEAKER: Yeah, I fully agree with that. Defining what some of the variables are is a key as well.

SPEAKER: I'm an outsider. I don't anything about a lot of stuff you're talking about.

SPEAKER: Good.

SPEAKER: I just wanted to show you something here. We've been making measurements in Miami or aerosols for many years. This is mineral dust concentration in Miami. These are daily, mostly daily, but over the weekends it's three to four days, so this is mineral dust in Miami, and this is coming from Africa and it impacts on the whole Gulf Coast and the southeast of the U.S. and it does it every year. I have

data. This is from '89 and I have data from 1974 and you can see large day to day variability, but every summer, July and August, it comes in. It's down in Miami now.

SPEAKER: There's huge concentrations.

SPEAKER: What?

SPEAKER: The beach has huge concentrations.

SPEAKER: Well, these are 24 to several day averages. About half of it is PM2.5. To show you the regional similarity in a completely independent measurement that was made in Ft. Myers with a standard PM, PM2.5 samplers, which...

SPEAKER: Where's Ft. Myers?

SPEAKER: Ft. Myers is on the west coast of Florida. It's about 200 miles away, and the blue is our measurements at Miami and the red are the Ft. Myers PM10 measurements and you can see that they just track one another dramatically. The other point is if you look at the Miami data, we only sample during on shore rinse, so you want to exclude local sources, although we know they're not important. But, I emphasize that if you look at Ft. Myers mineral dust data, the Ft. Myers data is based on the iron aluminum concentration, but you can see in Ft. Myers, in the winter months, the mineral dust concentrations are

quite small. So this whole, the mineral dust concentration, in a large part of the southern U.S., is driven by these large mineral dust events, but there are things other than mineral dust there. There are pollutants that are coming from Europe, over North Africa, coast of north Atlantic, so you're talking about regional variabilities and coherence and what this stuff looks like, and you have to look further than to the next county or the next state. I just want to make sure that things like this are not overlooked.

SPEAKER: Excellent point.

SPEAKER: We have some information on that. We've been sampling, we've been doing an FRM sampler in Pennsylvania, a suburb of Pittsburgh, and this is purely anecdotal for this, but when the forest fires were currently in Mexico, we were seeing some things in Pittsburgh. We were seeing higher than that of 2.5 and higher carbons.

SPEAKER: But, we're not talking about source receptor relationships and what we want to talk about is exposure.

MR. LIOY: No, no, no. First, if you take Joe's graph as an example, you're not talking about exposure. You're talking about what are the chemical characteristics of the ambient air in a particular locale. You can say Ft. Myers, Miami. What are the chemical characteristics of the outdoor air. Do

those chemical characteristics then relate to any kind of toxicity associated with those chemicals that one has to be concerned about or are you just worried about the mass? In those cases, you're dealing with getting specificity for a locale. I mean, I really, I'll make a point, not every location is the same. You may have, we have regional differences, we have sub regional differences, we have international differences, but the key thing is what is the composition and how does that composition relate to what the population is exposed to in a particular locale. The more variability we have, the more information we have, the better we can design what we're going to measure in our exposure study.

SPEAKER: In order to make headway here in this workshop, we don't want to have to re-thread what you all, Mauderly and other people have done here, you all have done here doing the preparatory work for this conference. That's the whole idea for doing this. So we don't have to reinvent all of the information here. So the point is that we're talking about metals, right? Two, in organic material, metals detected in organic material. He's talking about another element, combinations material, part of this element. So these are the kinds of things that should be included in a Supersite measurement because it will give you some information of what might be a source.

MR. LIOY: I mean, I agree.

SPEAKER: But just measuring an element is not necessarily sufficient to help you with health assessment. There's a hypotheses about what compound of an element is the crucial item.

MR. LIOY: Or, should a Supersite be measuring not just the elemental concentration that you get at a speciation site. It should be measuring...

SPEAKER: That's what I say.

MR. LIOY: That was a good summary of that. We should just be measuring metals as we measure with XRF, but if we're going to look at metals to go beyond speciation, why measure metals at a Supersite if, in fact, we're going to the same thing we do at a speciation site. We should be looking at metals that have, in a sense of looking at the chemical composition of those metals to determine, in fact, if we have the toxic compounds of concern or the balance stage of concern.

SPEAKER: Paul, I would argue that it would be an efficient way to approach this to try to develop local hypotheses and local sub measurements on a Supersite by Supersite basis, rather than trying to come up with every idea that anybody can put forward about the oxidation state of arsenic or the amount of content of X, Y or Z and impose that on every Supersite.

SPEAKER: Well, we can't afford

that.

SPEAKER: Can't afford that and it doesn't make sense because Supersites have different sources and the ability to link that to any kind of health study is going to vary with Supersite. So the two things that I would advocate in terms of what to do with the limited information we have now about chemicals of interest, other than the laundry list of things we can do, we're going to do because we can do them, thing #1 would be to have as part of the Supersite program, some kind of mechanism for local hypotheses to be developed on a Supersite basis and employed, so that you can have elaboration of the measurements in one particular area, where there's a good reason to do it in a particular Supersite. The second I would advocate, and I don't know why I haven't heard this before, maybe it's already been discussed, is there should be some kind of a sample archive. We should be archiving these samples, at least some of them, because we don't necessarily know what is this mixture of things.

SPEAKER: They are being archived. At every site there will be a conducted reference sample. By definition all settlements and samples there are the two things will be done with them, mass and to archive.

SPEAKER: That's great, but what I mean by archiving is stick them in a -80 degree freezer.

SPEAKER: Right, so you don't have transformation of the organic processes.

MR. LIOY: Well, that's a good point. Petros, we've talked a little bit about the exposure programs and I think one of the issues that we said, where should we do these measurements, may be associated with, but not exclusively associated with where we're doing exposure measurements now. But it will give you a feel for some of the types of situations that are going to be measured and, to be quite reasonable about this, is that this is not the be all and end all. This is what has been generated by a series of investigors, who've put in investigor initiated grants or cooperative agreements, that were funded. They may not be the best sites, but they're the ones that have selected for the time being. They are reasonable, but beyond that, there should be, I think, others, but anyway, Petros.

MR. KOUTRAKIS: Well, I think I will talk a little bit, I'm afraid that we're trying to develop these things, which is going to be many, many millions and I think with synergy have to be a factor here. Also, we don't have many groups. I mean, how many groups we can around the country? You know, do we want to have 20 Supersites or 50 Supersites? Probably we would not have the groups or the money, of course. Also, I think that if we asked people what cities that we

would have to use, we would come with hundred of things, because it depends where you are from and you're special preference. So I think a good way to approach this is to give a report here of what kind of studies are about to start in the future and based on the groups we have around the country and based on the research initiatives around the country, probably we can find some locations where there is exposure of activities, sources and the monitoring activities, topology methods development, and basically, and I liked what David said, we don't need to design five or seven the same size for the same qualities, with the same pollutants, because in order detection we might not need to do. So what you said, that having a Supersite, specific hypotheses, I think that would really help. We might not even need to measure carbon here. Maybe in the wood-burning, I just give an example, I might be wrong, in the wood-burning areas we just need to study the special variability of wood smoke and the standard meteorology and the standard of getting that. So I think it might be a good approach not to develop a lot of money for the network where we are only going to get two, but develop specific studies that will address specific issues. So, and here I wrote what I know, and probably that is not 100 percent but from what I know, in New York, for instance, EPA and HEI are funding two large exposure assessment studies. NYU is about to

start this. In Atlanta there is an exposure study by EPA, done by Emory University. EPRI and API are moving to do deep Supersite, actually that should be here, also the site is for API.

MS. CHOW: We have to say that these awards have not been made, since we're having recordings here, I must say that these awards have not been made. The Congressional delegation is the one that announces the awards, so these are hypothetical studies that may or may not happen.

MR. KOUTRAKIS: Okay, the checks in the mail. These locations are involved in this?

MS. CHOW: Well, talking about the land. Sure.

MR. LIOY: Well, the HEI study, you know Elizabeth, it is going, that is our study.

MS. CHOW: Has HEI actually awarded?

MR. LIOY: Yes. Elizabeth is being studied and Los Angeles is being studied and Houston is being studied in the HEI study.

MS. CHOW: Now, Baltimore, we're finishing this summer, so Baltimore is supposed to be past tense.

MR. KOUTRAKIS: So there is different things to deal with different populations here beginning with asthmatic children, elderly people and

you can see that there is a lot of studies for exposure assessment. Now, if you want to have exposure assessment, you have to have the Supersite where you can go and characterize out of the presentation is special variability in some weather sites, those speciation sites, distribution source. That's what the source apportionment, there is already two or three, I should say three, EPA NARSTO centers that deal with source receptor relationships. There is another study, Supersite to be put together by EPRI in Atlanta, I think. API is going to participate there. In terms of toxicological studies, HEI has awarded a study that's going to be used for some data particles in Los Angeles, that is Port Amigos. In Boston, we have a study from HEI that's was designed by us. We have another common project approaching from IHS. In Detroit, Hackamack, Jack Hackamack, got a grant from HEI to do animal studies. Probably there is Chuck here in North Carolina. EPA is doing some things, stuff for humans and animals both. Epidemiological studies. There are several ones in Atlanta. In Boston we have NIHS. This is at by Yale University. Baltimore is EPA with North Carolina, Chapel Hill. Philadelphia, EPA has involved the interest in those data because of the many years of data. Of course, there is some other methods, so we could, for instance, find areas that may have different mixtures so we can do method development.

We don't need to do methods development in all ten Supersites. We can do a few of them, one with wood-burning, the other with nitrate and carbon oxidate aerosols, another in northeastern United States and another in southeastern United States.

MS. CHOW: For the sake of your list, remember that there's the EPA Centers Program that's out on bid and I don't know even what the polls are due, but those are going to be major, major studies and so there will probably be some sort of value, whether it be for source apportionment of health, whatever, some sort of value of the Supersites in relationship to those. There's also right now, we're operating a Fresno site and since it's staying in this room, I'll use the word Fresno.

SPEAKER: This is useful to look at, but I think that would be most applicable coming out of this group would be a list of criteria, rather than site recommendations.

MR. LIOY: Where should we be doing Supersite measurements? What kind of places?

SPEAKER: What kind. Okay, I think...

MR. KOUTRAKIS: We should start with that. It may be one bullet, although it might not be the first one. I think...

SPEAKER: What would be criteria to

Supersite measurements?

MR. KOUTRAKIS: For exposure studies or for all of the studies.

SPEAKER: First in support of either current or future studies.

SPEAKER: Yeah, to me the exposure is the first goal. What are the criteria you would assign to Supersite selection? What are the criteria?

MR. KOUTRAKIS: I think, to me, the most important, if you have already 10 million dollars of 5 million dollars spent in personal and indoor exposure, you might want some of the sites, two or three sites, in different environments in that state, to go and do outside, outdoors to support that position. So I think it's current exposure assessment studies.

SPEAKER: All right, that could be what?

SPEAKER: Current and future.

MS. CHOW: Remember, this timing thing. Supersites is going to take a while.

SPEAKER: I don't think you want to have a lot of...

SPEAKER: Remember this is for Supersite measurements.

MS. CHOW: This is just a suggestion. I'm not the developing person. One of the

things that's helped us is to get started on a new technique or a state of the art technique, a lot of times it's really helpful to study air that someone knows something about, so I would suggest at least some percentage of them...

SPEAKER: Existing monitoring infrastructure?

MS. CHOW: Yeah, absolutely.

SPEAKER: Existing knowledge and/or infrastructure structures.

SPEAKER: So if you want to test out a new instrument that does metals real fine, for example, in one place or another.

SPEAKER: Information. All right.

SPEAKER: One of the criteria I think before us is that since we have such a limited number, they ought to be in diverse locations where the atmosphere chemistry and temperature is different.

MR. KOUTRAKIS: Okay, so a mixture, a composition of particles.

SPEAKER: Diversity with respect to sources. With respect to meteorology. With respect to chemistry. With respect to topography.

MR. KOUTRAKIS: Slow down, slow down, slow down, slow down.

SPEAKER: We would like those well characterized.

MR. KOUTRAKIS: I would say one which is not for particles, but different people, different areas, that have different types. So diversity...

SPEAKER: Doesn't that correlate with location?

MR. KOUTRAKIS: Yeah, but you can have, for instance, like Boston and Baltimore, they have more or less the same kind of northeastern aerosol, but people have different activities, you know, because of the weather.

MR. LIOY: Hold on, hold on. Too many people. Bob?

SPEAKER: We have to have some criteria. It's got the one out in California or maybe two in California and there's nothing in the Midwest, nothing in New Orleans and nothing in the southern part of the country. It seems to me we need to get diversity...

SPEAKER: Geographics. As there is the climatological diversity.

SPEAKER: You've got these regions. This one says western, hot and dry. Then you have cool and wet and you've got the prairie region. You've got to cover the regions of that because there's quite a difference and they seem to have their own brands of particulate matter.

SPEAKER: Not only geographic, but

climatological.

MR. KOUTRAKIS: Climatological. These areas actually differ between them because New York versus Houston, Los Angeles, Seattle. I mean, there is already, you have these kind of mix.

MR. LIOY: But they're in something like Arizona. There is nothing...

SPEAKER: Primary versus secondary aerosol. I mean, there are some areas that dominate it more with secondary PM and some areas might be more dominated with the primary.

MR. LIOY: Joe?

SPEAKER: Yeah, question. Sea salt. It's my understanding that sea salt is going to be counted or included in the species that contribute toward the standards?

MR. LIOY: Sure, well, it's part of the mass.

SPEAKER: It's part of the mass. Right. So the question, so there's a whole, specifically the coastline of the U.S., and in fact there is where the major populations are. Coastal versus interior and it's going to be a real problem for a lot of areas.

MR. LIOY: I think geographic location has both climatology and also coastal versus land lock locations. And altitude.

SPEAKER: Rate of change of health

effects?

MR. LIOY: Rate of change of health effects? No, I wouldn't think we have enough on that. If we did that, we'd be plotting the next EPI study tomorrow. We need a background Supersite.

SPEAKER: I would make a strong plea for background. Whatever you want...

MR. LIOY: That's a real question. What is background?

MS. CHOW: You may need it as a Supersite for some other need.

SPEAKER: Given the diversity in all these other locations, is there really a background site...

SPEAKER: We all know that the regions where there are particulate concentrations and many, many times what they are in other locations and, you know, you're talking about several orders of magnitude and I think it's fair to say, even though the low ones vary just as the high ones vary, that there's a group of sites that are in that context to be considered background studies relative to the others.

MR. LIOY: Do we want to use a Supersite for that or do we want to catch these chemical speciation sites?

SPEAKER: I think you use the Supersite.

MR. KOUTRAKIS: Can I make a definition in this document because it is important? The way that we define the document, a graph shows the concentration of particles in North America, if you switch off all the industrial sources in the United States, okay? That will be naturally from the United States or industry and natural in Canada, Mexico or wherever, Africa, so unless you define what the model is and where to find it, I think you're going to have to a hard time to define one size in the paper. But, I think that it is a very important issue. We don't know what the others are.

MR. LIOY: George.

SPEAKER: One way to deal with that is put the site on wheels and go to the axis of background and known background.

SPEAKER: Mobile Supersites.

SPEAKER: There are lots of other reasons to do such a thing other than background.

MR. LIOY: George?

SPEAKER: While I have the floor, I have another thing here, at the very least for both the Supersites and indoor and you can look at the hypothesis and even ones that depend on health effects, at the very least in the next five or 10 years, we ought to scratch out the ones that are not relevant and reinforce the ones that are, based on this list. If

we don't do that, we're going to be spinning our wheels on health effects forever and exposure. It's essential, then, that we make in some way that these Supersites measure these 10 items.

MR. LIOY: At least initially.

SPEAKER: Then I think we can address these hypotheses and you can do that indoors as well for many of these with a suitable experiment now.

MR. LIOY: If we're going to look at the metals or look any compounds, we try to look at something that's of the biologically active graphs, not necessarily just look at the sulfate. But look at sulphuric acid or ammonia bi-sulfate if, in fact, again there are hypotheses that may not be of any value, but looking at species that have some meaning beyond the fact that you have a sulfate molecule there.

MR. KOUTRAKIS: Maybe what we should do is look at the transition metals that we have there extension, one analyzes and, you know.

SPEAKER: One item you mentioned acucompost a minute ago, and one of the atoms on the list was biological, is that contemplated?

SPEAKER: It probably has to be to help components be looking for them.

MR. LIOY: Measuring the top 10 hypotheses for health effects, measuring the top 10

chemical classes.

SPEAKER: Petros, I would add another item to the strategy list. I think that one of the goals of having a Supersite is try to generalize what you observed there to a surrounding area. It's not clear how far you can push those generalizations, but at a minimum, I think it would be important to have good population information for the area closest to the actual physical site and/or satellite sites.

MR. KOUTRAKIS: Should we include that as part of the list?

SPEAKER: Well, this is more a matter of what information do you collect to go with the site once you've selected it and I would argue that there ought to be some thought given to characterizing the populations nearest the site because those are the ones for which the site data will be most directly applicable.

MR. KOUTRAKIS: But, if you're not going to use it. I'm trying to figure out how...

SPEAKER: If you are going to be designing an exposure study to be conducted at the same time or immediately after the implementation, the simple fact is going to add value, but if you're just using that Supersite to provide information on whether or not chemicals of concern of the top 10 that are listed for health effects are there, I don't see that, that

information is necessary.

SPEAKER: It's not essential in terms of operating the Supersites, but in terms of meeting the goal of having the Supersites be maximally beneficial to population studies, I think it would be useful. For example, if I want to do a COPD study and I want to know where are my opportunities to find people in locations where I can get good data from Supersites, that would be great. We have that.

MS. CHOW: But that's under criteria for selection. I don't think, in other words, the monitoring, this pot of money for monitoring is not going to be spent to identify COPD. However, if that's a criteria for selection, current and future exposure, we could even say in health studies. Your point is important. My only comment is what aide to go for.

MR. LIOY: Let's say you did a series of measurements at a Supersite for a year and we found that there was an organic constituent that could pop it out, high variability, something that has toxicity in the top 10 list of things of concern. Then I could see someone going home and saying, well, let's design the exposure health study and knowing then they have to characterize the population around that particular location to ensure that they are going to pick up individuals who may, in fact, respond to that organic signal. I can't see getting that data in a Supersite

measuring study. I don't think it's going to work.

SPEAKER: Petros, to the number four there, I think this is something we should probably talk more about. It's not the top 10 species. It's the top 10 hypotheses. If you read that, it actually may be the top 1,000 species.

SPEAKER: Like David Letterman's top 10 hypotheses?

SPEAKER: Yeah, I mean, there's a limit to how far we can go through here, but we are going to somehow need to bring this list to a cost reality. In other words, do you measure every single pH or do you measure pHs as a class? So there's things like that that, until we resolve, I mean that is the cost.

MR. KOUTRAKIS: The Halter monitoring group and the weights and measurement group is meeting right now and let's hear what they have to say.

SPEAKER: Yeah, but there has to be some...

SPEAKER: But they're also going to talk about measuring semi-volatile organic material and that will include photocyclase.

SPEAKER: But you can't afford, you can't do each and every one.

SPEAKER: You can't do all the species.

MR. KOUTRAKIS: Should we spend some time and analyze vapor and...

SPEAKER: I have a question about population. For example, you'll probably have one supersite in one city. Is that going to be a suburb or an urban site?

MR. LIOY: My understanding of where the site location, is it around high population density?

MR. KOUTRAKIS: I think it should be population based studies.

MR. LIOY: Population based site selection. Now that could be urban suburban, population based site selection.

MS. SHELDON: Now when you have that spatial variability. I'm told that means that, in fact, you have one supersite and in some locations satellite sites.

MR. KOUTRAKIS: Some you need more and some you need...

MS. SHELDON: Okay, so that's really part of the siting.

SPEAKER: That's really population driven. It's kind of one of the variants that we're trying to experiment with a little bit. When you start looking at where you see really high levels of PM frequently in not major urban centers frequently, but frequently in

mill towns. Where you see really, really high levels of PM2.5, associated with typical industrial types of activity. Steel mills, pulp and paper, you see the same things over and over again, so you're looking at trying to find some representativeness of that kind of thing.

MR. LIOY: That's a question that, in essence, has essential tension. Is the population driven by the number of people or the proximity of the people to concentrations and chemicals of concern? Hypotheses. There are two population issues. You know, the large milieu of people or those who may, in fact, be at highest risk.

MS. SHELDON: So selection, that's criteria for selection. Actually, I was...

MR. LIOY: So criteria would be population based upon the number of people versus and/or the people at highest risk. Meaning, with respect to sources, not necessarily with respect to disease.

SPEAKER: Yeah, because the truth is you may, individually there may be a source, but in aggregate there won't.

SPEAKER: But, at the same time, I don't think the supersite mission is, is not to locate the area of major refinery or cement mixer or something like that.

MR. LIOY: If we had a number of

refineries around the country, it would behoove us to at some point in time to have some supersite measurements near a population. I think it would be reasonable. We, for years, never did that for air toxics. We measured air toxics in the middle of the city and found nothing and then we finally said, well, gee whiz, maybe we should measure the air toxics next to the source, where they're being emitted. But, that's the point. That's the point. Nothing was there.

SPEAKER: I know asthma is so under-reported and death certificates are so poorly done and everything, but it seems like what you'd like to do is locate sites where the per capita incidence of whatever effect we're looking at is highest. I don't know if we can do that.

MR. LIOY: Not now.

SPEAKER: There's a fundamental problem, I think, when you get over in Baltimore, if you're in south Baltimore, the concentrations of many metals are often 10 times higher than they are at the current supersite or whatever it's called, at Lake Clinton. This is only like 5 kilometers away.

MR. LIOY: I agree.

SPEAKER: So, and there's a whole population that lives in south Baltimore, okay?

MR. LIOY: John, that's the point. People at highest risk for source categories because I

found that, in New Jersey, I had a site that was 4 kilometers apart. One in Elizabeth and one in Newark. The total area, itself, was basically characteristically the same. However, in this area in Newark, I had a high density of local sources and, gee whiz, wouldn't you know I had particulate matter concentrations in the winter time that went over 300 mg per cubic meter for 24 hours. If I measured in downtown Newark, I would never have seen it.

SPEAKER: Industry is often concentrated for a good reason. South Baltimore, the shear works, et cetera, et cetera.

MR. LIOY: You're next.

SPEAKER: This sounds like a good reason for having one mobile supersite. I think there's a strong recommendation for doing that, for taking one of each of the best instruments, I mean, if we're developing instruments like single particle things, real time stuff, put that on a van and drive around and look at some of these.

SPEAKER: Didn't I hear that you're into representing all seasons and get a trend established?

MR. KOUTRAKIS: We can get model for one year and go next year to another one. I think the important point... Do you want to say something, because I have a point about...

MR. MAUDERLY: It's stimulated by the mobile station and my naivete, but if you really want to understand processes and basically you're looking for effects in areas which, even though polluted, are relatively clean compared to a lot of places in the world. I was in New Delhi in January a year ago. You could see the reduced visibility down the length of the corridor in the hotel, which was an air conditioned hotel. I mean, you know, there you have huge amounts of aerosol. There's no problem with measuring stuff there and I'm sure that there are all kinds of health effects that are involved, which should be very, very apparent. Now, as I said, this is a little facetious, but the parallel question, though, is are there health effects studies being made or considered in remote areas outside the United States? I say that because I am a scientist...

SPEAKER: They've been done by a number of different groups.

MR. MAUDERLY: She knows.

SPEAKER: There's Mexico City, Russia, China, where you can't, I couldn't see you inside the house. I could not see you this close.

MR. MAUDERLY: What is coming out of that which might be relevant to this...

SPEAKER: That's a whole other discussion. It really doesn't have anything to do with

supersites.

MR. LIOY: Carl.

MR. SHY: Two issues of monitoring strategy questions. What is the frequency of sampling necessary for a site? Frequency.

MR. KOUTRAKIS: Every day, as short as we can do it.

SPEAKER: Before when you asked about the sampling at the sites. At some supersites... (Everyone talking.)

SPEAKER: Indoor and personal monitor.

MR. LIOY: Who was next? I've lost control.

SPEAKER: I just wanted to bring up one thing in relation to this question of location and possible mobile site. I think to me, one of the goals or the goal of personal exposure studies is to come up with some way to correlate outside measure with personal exposure so that we can ultimately set standards for protection of public health. I can see a mobile site coming up with a conclusion that you need a sampler on every block in some cities, and that's not going to do us any good because I don't think EPA is going to do that. I don’t think they’re going to be able to.

MR. LIOY: I think, maybe not that

issue, but at least what it states is that when you develop the SIPS, all right, your SIPS just don't immediately say it's the power plant, all right, that's what you have to control. If, in fact, you found that with the supersite measurements and then maybe with speciation measurements that there are a variety of different sources of concern, that makes the SIP process more complicated, but more realistic. I think, in the past, we've tended to look at the, you might say, deep pockets or the most logical or big sources and not looking at the ones that may, in fact, have the major influence.

SPEAKER: That's what I'm saying, is we've got to keep our goal in mind here.

MR. LIOY: Right.

SPEAKER: We understand it would be useful in a general sense.

MR. LIOY: But, I think the idea of having this mobile supersite is very good to keep people out of the, to keep people flexible in their thinking.

SPEAKER: But there's a basic qualification in a mobile site. You don't want to just drive them around in a van.

SPEAKER: What I was thinking about, well, you already had it up there with the mobile supersite, is one that you park at the supersite for a

while and then you move around to make sure that that supersite is really sampling something that is representative of what's going on, and it's not in some strange little valley where you're getting 50 or 100 times the metal concentration.

SPEAKER: Well, a mobile supersite would have to stay in one location for at least a month to be of any value, I think.

SPEAKER: In Los Angeles we moved the perimeter around about once every couple weeks...

SPEAKER: Two weeks?

SPEAKER: And that's not enough time.

MR. LIOY: So you need about a month and I think the strategy that I've had in the past is one month to six weeks at any one site, you can really get a picture of what the issue is.

SPEAKER: Don't forget that you have criteria, too, here which says that you're not starting in a vacuum. You may not know every chemical species in the area, but you should have some data, PM10, something which is descriptive of, if not the exact supersite location, some kind of a grid within which the supersite will go.

SPEAKER: In some locations the best you may have is TRI, and with that, I wouldn't bet

the farm on it.

SPEAKER: What you're trying to do is find the link between the air and the people, and so what you're really trying to do is where are the people and, you know, really how do you, with the small amount of equipment you've got, because you're only going to have a dozen different things... How do you best cover the population? So, you know, putting them all in big cities, if most of your population is in Pittsburgh, that would be the answer, but I suspect that that's not entirely true. So what you really want to do is look at the population and find out where they are in slices relative to exposures that you know about and are they, do they follow the pattern. Do a certain amount of people live in typical milltowns of this kind and maybe, and how to help, and do we systemically go down a list with maybe kind of mobile equipment, talking about, what we really need to do is go visit these kinds of milltowns and find some representative samples. You build up the overall picture of exposure for the overall population at risk, cheaply, because otherwise you're going to be measuring the same thing in a lot of different places.

MR. KOUTRAKIS: I think an important issue is the duration, how long you stay there? Do you stay one year, two years, three years, and I think for exposure studies, for instance, I would

rather go to three different sites in three years to get more data rather than just staying in the same area where the activity and problem of origin would be.

SPEAKER: That's if it's a fixed site.

MR. KOUTRAKIS: Yeah.

SPEAKER: If it's a mobile site we might have more flexibility.

MR. KOUTRAKIS: Let's say we're in New York, New York. In terms of exposure, I'd rather go to another city next year. Some other studies, for instance, if you do epidemiology and if you want to do trend analysis, you might want to have a couple sites that there are four, five, six years. I don't know for intercomparison studies in a year, you can do the intercomparison and leave. So I always hear something, but I won't bother to go into this. Duration might vary by site. We can have some of the supersites, they can move from one city to another and some others that can be there for trends. I wrote here one, three or more years and, of course, it's nice to have 100 years, but it's very expensive, so I think these, I would suggest that these be part of the hypothesis, specific site...

SPEAKER: Let me ask everyone. Would one to three years be for all sites, including mobile and fixed or just fixed? Does mobile have shorter durations in being done, deal with local type

problems. I think that's what David Smith said. One to three years? Is that what you want for everything or do you want to have the mobile or does this all sound flaky, well, I doubt it. I mean, one to three years for all types of sites? One to three years where it's fixed sites and will mobile have shorter duration?

SPEAKER: I got an idea. You know, in Baltimore what they call a fixed site is a bunch of big boxes that you can crawl in with the air conditioner running and stuff like that. There's no reason why these couldn't be on a big truck in the mobile sites. In fact, you know, unless you're going to be in somebody's building, which you probably don't want to be, you know, a fixed site, the concept of a fixed site in some of these, you're better off with something you can put on a flatbed trailer because you have to set up that site, put up a fence, do this, do that and everything else, you're better off with mobile sites.

SPEAKER: You still have to put a fence around it.

SPEAKER: Well, but it's a different type of fence.

(Everyone talking.)

SPEAKER: That's my problem with the mobile concept in a sense. You can put them on a flatbed, but by the time all the measurement people and all the exposure people and all the health effects

people are going to finish their list, you're going to be instrumented to death at the supersites. Setting them up and following them and arranging for security and maintenance and all that is not going to be easy, that kind of moving these mobile, quote, unquote, stations that readily.

MR. LIOY: But actually it might be easier doing that than trying to instrument. I look at just the reverse. It would be easier to have, let's say, 10 mobile trailers built by X,Y,Z company, which are outfitted with the standard fare of what we want to do initially for supersite measurements and then use that as something we could flexibly take things in and out based upon new techniques, rather than go to, well, I'm going to the city of Philadelphia today and I need from you, I need a building that's got 18,000 square feet, got electricity like this and security like that, but it has to be representative, where people are, and spend a year negotiating to get that site developed. Remember, supersites, you're going to be talking about lots of measurement techniques, lots of energy, computerization, the need to have consistency among different individuals, and that becomes a chore if you're going to do it in a fixed location within a city because coming up with the monitoring site is very, very difficult and you end up sometimes compromising away what I think is one of the more important criteria, which is

characterization of population by hypotheses for health. Those things you may, in fact, not have. In fact, you may end up with all the cities being the same in terms of characteristics because you had to make some severe compromises. That's my only point.

SPEAKER: I agree, but I'm saying that you can't easily move from one street to another. You're still going to have a lot of set up problems.

MR. LIOY: No, but you can move from one city to another.

(Everyone talking.)

SPEAKER: A couple of things along this. One is depending on how you put it together, you can infest, I mean there are airborne, there is airborne instrumentation and that moves from one site to another quite quickly, so if you properly set up the vans, you could do this kind of thing. But the second thing is that this doesn't have to be all the same. I think you should have one mobile supersite that maybe moves around as rapidly as is feasible to get enough data and then you leave another one parked for five years to get trends and some other data.

SPEAKER: I think there's at least five years at some of the sites. You have mobility for one, and five years would be...EPA has a really short attention span. That's really a sustained operation for a long enough period of time to follow a population along

with the chemistry.

SPEAKER: I think my reaction on this question about how long to park it and how mobile to make it is that I don't think there's a generic answer. I think it depends on the characteristics of the site and what of the local hypotheses are getting priority, and also depends on the multiplicity of purposes at these sites because it's sort of beyond just exposure assessment. But it almost makes me think we should start another list, which is additional needs, and one of the things that should be on that list should be an ongoing scientific commentary and guidance to the supersite program, so that there can be program management of questions like at site X, how long do you want to leave the stuff there and where do you want to go next.

MR. LIOY: I think that's a good point, and it's something we're going to put down, but I think one of the issues has to deal with how, we have to come up with a set of platforms and if the platforms are developed in a way that is not at consistency, it's going to take a long time to get anything out in the field and I guess one of the things about, maybe, even if it's not a totally, even if all the platforms are not mobile enough that they move around for less than one year, but they stay in a spot for one year or two to three years. If you can make them all developed in a modular way so that

it's all done right, that may make it a lot easier to implement than if we say, well, I'm going to, it could be, you could end up with a bunch of contractors that are told to, well, put in a bid for supersites and then you have nine different contractors come back and say, well, I want to develop a supersite here, here, here and here, and they may not be the same and that could be very hurtful.

SPEAKER: I agree, they should all be synchronized.

MR. LIOY: All right, we know what needs to be. The road map got obscured. All right, what needs to be measured? I think we've defined it, that we start out with a list of the 10 hypotheses and then come up with lists from the individual other groups, saying how do we pare that down. Where should the measurements be made? Well, I think we've come up with a set of criteria for siting.

MS. CHOW: Can we not do better than that? In other words, these same criteria we've been hearing for the past five meetings, I mean, is this group able to say, you know, like Boston and Fresno, I mean, or is that something that has to be a separate, you know, funded discussion?

MR. LIOY: I think we have to provide some criteria because the other groups are also going to address siting and so, in the end, the

synthesis group has to decide, all other things being equal, on some kind of a compromise.

SPEAKER: Well, Judy, this is pretty specific. Current and future studies of existing information, diversity of locations, geographic locations, background of supersites, population based, by number or by people, whichever, different source categories.

MS. CHOW: Can we add some possibilities and just name places? Come up with some names?

SPEAKER: I think so. I don't see why not.

MR. LIOY: Here we have the monitoring strategy. The monitoring strategy is when should it be made, well, that's part of the monitoring strategy. We start out supersite specific activities. Well, that means, when this should be made, is it different criteria than if you had all the supersites being the same? Ongoing research activities. Spatial variability. Chemical variability. As short as possible for sampling.

MS. CHOW: So that's, when should they be made, so that answers that question.

MR. LIOY: All right, characterize population near the site. Well, that comes back to a major kind of scientific question, which I started out

with. What is the amount of ambient air that is actually part of the person's exposure? That, I think, is the major criteria or major question we have to answer because if it's zero, then Peter's point is right. Maybe five years from now, we can go off and do something else. But if it's 100 percent or 80 percent, well, then, we have to be doing something else, but I think the major criteria for these supersites is how do they give us information to help us design exposure studies better, to understand what parts of those 10 criteria or 10 hypotheses do, in fact, in outdoor air lead to exposures that are indoor and personal, that are a significant amount of time in duration to cause an effect.

MS. CHOW: I guess what I'm getting to is, if we take that list and the similar list, these same questions are being done by the other groups and overlay them so that, in effect, the supersite maximizes the utility for all the different sub groups.

MR. LIOY: But it may not necessarily mean that we may not have locations.

MS. CHOW: Yeah, we don't want to go to the lowest possible denominator, but where might there be points of overlap and have we given enough specificity and there's a limit to what we can do, but have we given enough specificity. Like, for example, I think it's good that we, say, go to on time resolution, go

to the mass spec technology. Will we even want to recommend to the technology group that they hustle on one particular aspect.

MR. LIOY: But the down side, the down side to maximum resolution time, if you make that your major focus, you're going to lose detailed information on composition because it's coming up with samplers, they're going to give you time resolution down to an hour, is not necessarily going to be the type of measurement you're going to be able to achieve to understand particular fractions of the aerosol, so therefore there is a compromise between the hypotheses and reality.

MS. CHOW: I agree, but see, that's what I call the level of specificity that should be in the report here. What needs to be measured where. So, in other words, we have to consider both elements, that you can't, you know, that one instrument will give you good characterization, whereas another instrument might give you poor characterization, but better time resolution. So these are the things. How would we weigh them in terms of exposure? What is more important to us? What is our 2 cents? The health people are going to say what's most important to them, others, source apportionment will say what's most important to them. What's most important to us?

SPEAKER: What kind of particles

are being measured continuously?

SPEAKER: And what's the time resolution?

SPEAKER: Ten minutes.

SPEAKER: It’s a particle thing. It’s one at a time.

SPEAKER: She just said she could measure it in one verse.

MS. CHOW: You can get about, people are getting about 10 minute time resolution on composition. To prove that it's quantitative is another...

SPEAKER: For what?

MS. CHOW: Total carbon, the typical moody type compounds that you're talking about. I mean, that's one of the places to start, with what's known, so.

MR. LIOY: But as I say, if you can do that. You can do a single particle at a time. You could also collect for, just for ten seconds, you don’t need to be....

MS. CHOW: You don't need to break it down in total carbon. You can also do total sea salt, total soil, total diesel exhaust, total car exhaust. I mean, you don't have to break it down.

MR. LIOY: Why don't we take a 10 minute break and come back.

SPEAKER: Give us a question to focus on when we come back.

MR. LIOY: The question of how do we get a more specific understanding that there's going to be a limit between time resolution and characterization, I think is one major question.

MS. CHOW: An additional level of detail. I don't know the answers, but just to get an additional level of detail.

SPEAKER: Can I make a suggestion on that?

MR. LIOY: Sure.

SPEAKER: I'm in the aircraft sampling business, where timed response is always a problem. Airlines, you need to make compromises. We use a technique which I think is very useful in this context. There are some things we can only measure very slowly. For example, aerosol composition. If you took an average sample over many, many months, there are things about aerosol that can be measured very rapidly. What we seek to do is try and find out the correlation between the fast measurement and the slow measurement. So when you accumulate enough data to get that correlation, you don't have to take all these measurements at that speed. You make the one at high speeds, and then you infer from the correlations what the effects are.

MS. CHOW: That's my pre-strategy, to get correlations. See?

MR. LIOY: George?

SPEAKER: There's another point I think for the exposure experts in the room here. What are you going to do with this high resolution data? Suppose you get data every second.

MR. KOUTRAKIS: We don't want that.

MR. LIOY: I don't think I want it.

SPEAKER: All right, pick a balance...

(Everyone talking.)

MR. LIOY: John first.

SPEAKER: I say we each hit the different categories. That would be not for health effects but for source distribution. Because when the wind shifts 10 degrees, we should be on that source, and any factor analysis and all that sort of stuff will work like a jewel.

MR. LIOY: Okay, well, why don't we take a 10 minute break and come back and figure out what is the resolution and what different levels of resolution we need to answer specific questions.

(**WHEREUPON**, a short break was taken.)

MR. LIOY: All right, maybe we should get started. We have one more topic to go over

and we'll sort of listen on tape. All right, we have one thing that we wanted to go over and that was the issue of time, all right? We had different types of measurement time that we were considering. Well, we have continuous, less than an hour, 12 hours, 24 hours duration of days, months...

MR. KOUTRAKIS: Species, mass...

MR. LIOY: Well, no, it's between chemical processes, physical processes, episodes, exposure. I did it the other way around.

MR. KOUTRAKIS: Where's the species?

MR. LIOY: All right, we can make that a sub category. Mass.

MR. KOUTRAKIS: Can't they go....

MR. LIOY: What are you talking about?

MR. KOUTRAKIS: Well, because it's going to be different groups within each, so....

MR. LIOY: Right, right. We can have chemical physical processes, continuous. Could that be for mass? Could be for a specific species?

MR. KOUTRAKIS: I think we should do them for hours, here. Why don't we, these are the people.

MR. LIOY: Hours? 12 hours. 24 hours. I don't see what your problem is.

MR. KOUTRAKIS: We are exposure people.

MR. LIOY: All right, but we need to know chemical and physical processes also in terms of understanding the chemistries and then we can design better exposure studies, correct?

MR. KOUTRAKIS: I don't understand this, but maybe people understand it, and that's quite all right.

MR. LIOY: What would you write?

MR. KOUTRAKIS: I don't know. What do you want to do here?

MR. LIOY: All right, let's start. If I'm looking at chemical, again, looking from the vantage point of exposure, what do we need to know about chemical and physical processes to understand how to design the next generation of exposure studies? Do we need continuous monitoring? Do we need less than an hour? Do we need 12 hour sampling, 24 hour? Do we want it all?

SPEAKER: By chemical processes, you mean particles themselves, or general air masses?

MR. LIOY: The particles I mean, in terms of what is formed and what are the size ranges and how persistent they are. I mean, for ultra-fine particles, do we really need to measure ultra-fine particles and if we do need to measure them, from the

standpoint of exposure studies, do we need to know it continuously? Do we need to know a one hour average, a 12 hour average or 24 hour average, to design the next generation of exposure studies?

SPEAKER: Okay, by continuous you mean 10 hertz or something like that?

MR. LIOY: Whatever.

(Everyone talking.)

SPEAKER: Obviously, continuous means different things to different people.

SPEAKER: With respect to current models likely to be used in the next rule making, the ambient monitoring is hourly. In fact, it's clock hour hourly range, so to the extent that you're going to relate human exposure behavioral patterns, which are usually on the hour or less, I mean, we need frequency of about an hour because that'll match with the EPA data base that's going to drive this.

MR. LIOY: So if we're actually doing exposure assessment, all right?

SPEAKER: You're going to drive an exposure assessment, Paul?

MR. LIOY: Exposure model.

SPEAKER: Based on the PM model, you need an hour time limit...

MR. LIOY: We need measurements of less than an hour for both mass.

SPEAKER: Well, mass certainly, because that's probably in the next standard.

MR. LIOY: What about chemical composition? Do we need less than an hour for chemical composition?

SPEAKER: We need another category, which is single particle measurement, that's different from...

MR. KOUTRAKIS: I think single particle is good in determining the future. I don't think single particle analysis is an orthodox method right now when used in terms of exposure models. We don't even know if you put that next to nitrate monitor or sulfate monitor or mass monitor, if it's going to give a good...

MS. CHOW: Yes, we do. We do know that. We've done it.

MR. KOUTRAKIS: You've put it next to...for what species?

MS. CHOW: Nitrate, with Susanne Hering at 10 minute resolution, they gave the same answer.

MR. KOUTRAKIS: How about sulfate?

MS. CHOW: That's what she's working on now. We assume that if we're doing single particles and nitrate matches... Pardon me?

MR. KOUTRAKIS: Metals?

MS. CHOW: Metals are pretty easy, actually.

SPEAKER: There's lots of stuff being done with metals that way.

MR. KOUTRAKIS: I'm sorry, I wasn't aware of that.

SPEAKER: Also, Linda had a point early on in this thing and that is should we just be using current instrumentation at the supersites or really be looking at the next generation stuff.

SPEAKER: Next generation.

SPEAKER: Okay, then single particle definitely should be a category here. To answer your question of about an hour, one thing we could worry about is that even though the health effects could be monitored in some way, on that basis or looked at that way, suppose you have some flu, some particular kind of thing that's coming in on a five minute basis and bringing you in a whole raft of different kinds of chemistry that you get for the other 55 minutes that you're measuring on some average basis and that could make all the difference.

MR. LIOY: That's when episodes become important. Do you measure in episodes? Do you measure less than an hour? Continuous? Do you have to measure hourly? Do you have to measure 12 hours, 24 hours? What is the need for exposure

studies? How do we define the criteria for timed duration of the measurement to be effective in designing an exposure study? Remember, the next level is to determine how we can implement that within either population models or actual population studies.

MS. CHOW: Basically, I mean, I guess we can scoot back to the issue of, my philosophy is, if you don't know the answer, which I don't think we know the answer. I think we would agree on that. Then you take what you can get at a cost effective way, and in a lot of these measurements. I mean, that's the balance, right? You take what the instrument will give you. If the instrument will give you second by second time resolution and it doesn't cost you anything, take it. You can always lump it into an hour again later, but you can never go back. If you only take an hour, collect every hour, you can never go back and get the minute information if you find out you need it for some reason. It doesn't cost you anything to take what you can get, based on the technology.

SPEAKER: It also is important the choice of instruments, that one instrument might be more reliable....

MS. CHOW: Yeah, yeah, it's all determined by you have the technology with you. Yeah...

MR. LIOY: Now our trailer has been

turned into five trailers.

SPEAKER: That's what I was explaining.

MR. LIOY: You're not giving me a picture yet. You're giving me everything you want. If it was up to you, you'd measure everything down to two seconds. But you can't do it.

SPEAKER: Let's try to look at this in a top down point of view. What is the health effects person going to use one second data for, or even an hour?

SPEAKER: Well, they use five minute SO2 data...

SPEAKER: Wait a minute, they don't use five minute SO2 data.

SPEAKER: They're trying to set a standard.

SPEAKER: What?

SPEAKER: They're trying to set a five minute standard for SO2.

SPEAKER: Ask a health effects person if he ever has used five minute data except in exposure chain and looking at an immediate response. And looking at populations, now, over a period of time. You're looking at chronic and acute effects, you're not going to get the big time, you know, time resolution. The second point in my top down point of view is, it's

going to be one heck of a long time before we have a personal exposure instrument that's going to measure either mass or chemistry on less than a several hour basis. Pardon?

SPEAKER: Wide scale spectrometry.

SPEAKER: That's right, but you can't carry either one around with you. So think in those terms for the near future, anyway, for the next five years, let's say, the personal instrumentation and the health effects community have to catch up with the short time response to be able to use the data. So why don't we think in terms of longer term averages, that is high quality data that we consider reliable, but current instrumentation for a period of time and then we can talk about short time resolution at some distant future.

MR. LIOY: All right, so, if you're saying under exposure models, eventually, right now we should be looking at these two categories.

SPEAKER: I'd say that's minimum now.

MR. LIOY: That's what we should be looking to now. That's what we want, is minimum for both physical and chemical characterizations, 12 and 24 hours.

SPEAKER: Minimum meaning, that's the longest time interval you want?

MR. LIOY: Right, right. The longest time interval we want.

(Everyone talking.)

MR. LIOY: Let George finish. Go ahead. Sorry.

SPEAKER: Luke says he needs one hour.

SPEAKER: I need one hour.

MR. LIOY: For mass?

SPEAKER: For mass.

MR. LIOY: How about if we do two parts to this? This could be mass and chemistry, mass and chemistry, but over here for one hour, you want at least mass right now. I'm saying minimum, mass, okay? That's what he's trying to... As I said, if we want everything, we don't even have that problem, we want continuous mass measurements of everything. But, for the time being, if we're going to develop these supersites, what can we get away with that will help the exposure assessor, for exposure models mass, for about an hour. For chemistry, at least the minimum we can expect is 12 hours and probably for some chemicals 24 hours, which will at least allow us to come into the ballpark of detectable concentrations that we may be able to develop the next generation of exposure monitors for, as well as exposure models. All right. Now, yes, what about episodes?

SPEAKER: I was just going to ask. This whole connection. Do we know anything from the health effects folks, whether, say, breathing something, particles with some composition of them, say, a loading of one for 100 minutes is different from breathing 100 times that much for one minute?

MS. CHOW: In all likelihood, for acute effects that's...

SPEAKER: Then you want to measure it as fast as the air mass changes.

SPEAKER: Well, that's for mass. For mass, we can do it. But, for chemistry, I say forget it. We're not going to be in that position right now. Not for quite a few years.

SPEAKER: We should strive to be in that position for that very same reason.

SPEAKER: Yes, but if you were designing this prospectively, what you'd want to do is, you'd want to know about the time scale, the biological response, one boundary condition, the time scale of the environmental or personal exposure changes as the other boundary condition and you'd set your sampling rate to capture that level of detail. Well, we're not going to know that. What we may know in the future is more, is a narrowing down of the kinds of health effects which might have implications for the time scale that's needed. We might know more in the future about what

we observe as the rate of change in various environments, which might suggest that we can lump data together because we're not, we're seeing the same measurement for several sequential intervals anyway. But I think that you're right. You're going to have to start with basically what's achievable and say we don't know enough now to say what's really required.

MR. LIOY: If I went to episodes from there, and using that as a jumping off point. Let's say I want to look at episodic conditions in a variety of locations, or mass, what is the minimum I would want to measure to help me design an exposure study for episodic locations, like down in a cement plant or a mill? Do you want continuous for mass or do you want an hour? What is the minimum you need to do?

(Everyone talking.)

MR. LIOY: Mass, for an hour, minimum? Mass is what at this particular point is what you'd think would be reasonable?

MS. CHOW: Is this mass by size?

MR. LIOY: Yes, size fraction...

(Everyone talking.)

SPEAKER: If you don't need the sensitivity, you can trade off the time.

SPEAKER: I still have the question, how are you going to use this data. There's no...

MR. LIOY: In terms of exposure

studies, the issue of utilizing this data, and just say, start with mass with one hour or less, that can help us characterize in exposure models how people move through various environments where they'll be coming into contact with ambient air and determining the mass exposure with less uncertainty.

SPEAKER: That part I understand.

MR. LIOY: All right. With chemical composition, in terms of exposure models, at least it will give us an idea of what chemicals we should be concerned about in various environments that people go through.

MR. DAUM: Is the question here, we have no corollary exposure study going on.

MS. CHOW: Yes, we do.

MR. DAUM: You do?

MS. CHOW: Yes, that's what...

MR. LIOY: These can help drive those.

MR. DAUM: Remember, you're measuring this at one location. If you want to look at a population and you don't know anything about the spatial variability of the study. We know that it varies all over the place...

MR. LIOY: That's not really true.

MR. KOUTRAKIS: Just to give you an idea. The errors, if you don't know the spatial

variability, you lose 20 percent accuracy. If you don't know the indoor concentrations, you lose 50 percent of accuracy. In personal, it can be 100 to 200 percent so I think the spatial variability, unless you are on the west coast, it's not as important as other issues of temporal variability, you know, when people are outside and when they spend the time indoors, and the micro environmental concentration. So I would think not knowing a lot about spatial variability, it's a big problem for exposure studies, which might be for other types.

SPEAKER: We just heard something very different from different places in Baltimore.

MR. LIOY: I keep driving the point home to you. The peak exposure studies that are ongoing now, these exposure studies are limited in scope because the only thing we can really effectively do is measure the mass, and we want the supersite, and some speciation, but it's limited. What we want to be able to gather from the supersite data and do it from the standpoint of what are the most logical things to measure and what is the smallest frequency of time that we want to measure it for to balance delectability versus variability, that may be necessary for generating the next level of exposure studies after we've learned a little bit about them from our current studies? We need this information to help us do the next step because,

without it, we can't design the next exposure studies. If we don't know what the variability is for, let's say in an episode, I would say try to get them to do, to get a one hour measurements of mass and certain chemical composition would be very important for an episode because, first of all, you will have higher concentrations and the mass would be higher, plus the frequency of the signal mass changes in an episode because of the fact that you have probably changes in source direction. But, also, it may be relatively consistent. But, clearly, knowing that information can allow us to determine, well, in certain locations, the next generation of exposure studies, if we're going to look at populations that do, in fact, live in areas that have frequently high episodes, this is what we have to focus on in terms of our next measurement techniques and also the populations we're going to look at. So I want the supersite measurements to be able to at least get me toward that target.

MR. PINAULT: Well, I think there is good circumstantial evidence. I mean, we've got cases where it appears that during periods of extreme peaks, that the composition of the peak is very much more nitrates than sulfates, than with the average, where we have...

MR. LIOY: In which city is this?

MR. PINAULT: Oh, gosh, I can't

remember which one it was. The monitoring people were saying, hey, the peaks look really highly anthropogenic, when you look at the average, you've got a lot of crustal material, growth, dust, and all this other stuff. But, when you get these peak episodes, they only involve just nitrates and sulfates. So the composition of those, that one hour, two or three hour or maybe 12 hour segment is different and more meaningfully different from an exposure perspective than the bulk of it that you're looking at. So it is relevant to look in small pyramids.

MR. LIOY: Now, in terms of chemical and physical process. Meaning the formation of chemical compounds that may be of concern and also physical characteristics of the aerosol concern, like particle size, do we want them to measure continuously or do we want to measure... Do we want to have good, you might say, atmospheric chemistry going on at these sites? Basically, that's the bottom line. That means, do we want to have continuous monitoring? Can we get away with less than an hour, or do we not care and just want to measure the bulk levels, the end point of these reactions?

SPEAKER: Are there any slow reactions, I guess, is the first question.

MR. LIOY: There are always slow reactions.

MS. CHOW: Formation reactions are pretty fast. It depends on what you're trying to, if you're to understand formation processes to try and control things, which, you know, is that what the supersites are trying... I mean, one way to sort of...

MR. LIOY: I'm looking at it from the standpoint of exposure right now. Okay?

MS. CHOW: Okay, you're still on exposure?

MR. LIOY: We're trying to understand physical and chemical processes to assist us in designing the next level of exposure studies to understand the composition. What portion of the outdoor air really does, is an individual exposed to in a day? Do I need to have these detailed measurements for exposure work or can I get it with something less?

MR. DAUM: I think that there ought to be some general measure, high frequency measure of some aerosol property that's mobile. For example, we usually measure with high frequency scattering coefficient for the number of concentration. I think that those quantities are frequently correlatable, most of them probably, correlatable with lots of other things that we measure, for example, sulfate, nitrate. I think that you'd have a high frequency signal if you could make a lot of inferences. From the correlation, you can say a lot of other things about it. It would be pretty

easy to do.

MR. LIOY: Take a look at one of the 10 hypotheses that the health effects people generated, that we want to understand the ultra fine aerosol, all right, and how the ultra-fine aerosol relates to these health outcomes. One of the things in exposure that one has to concern himself with is the duration of these ultra-fine aerosols and at least, if we're not having number concentration measured as frequently as possible, we may never know if the person is exposed to a single ultra-fine particle at all in the ambient air, because there may be many locations where this stuff just doesn't exist in high concentrations because it's been rapidly moved to the accumulation mode or, if you're near a source, you may find very high concentrations of these ultra-fine particles.

MS. CHOW: I'm sorry I have to ask. What are those X's? Does that mean?

MR. LIOY: Nothing. Forget it, forget it. That was something I did before in changing...

MS. CHOW: Okay.

MR. LIOY: I'm still trying to get up to here, but go ahead.

SPEAKER: Just to clarify. I can understand the less than an hour or an hour kind of time frame for the supersites, but for personal

monitoring, wouldn't you want much shorter than an hour?

MR. LIOY: Personal monitoring?

SPEAKER: For exposure studies.

MR. LIOY: No, I don't think, at this point we need. We can't.

SPEAKER: Not for the mass studies, but light scattering or something like that.

SPEAKER: It would be ideal.

SPEAKER: Yeah, maybe we should have categories of can and wish, I mean, on this.

MR. LIOY: Right now, I'm doing can.

SPEAKER: Sometimes you don't really need it on a fast basis and other times you really do, even though we don't have it down.

SPEAKER: One other thing, along the lines of continuous versus an hour or longer, do we know enough about some of the characteristics to say that the change, that there is a substantial change that has a less duration than an hour?

SPEAKER: That there absolutely are...

SPEAKER: Or two or three orders of magnitude every...

SPEAKER: Well, then the things that we can measure fairly easily. You already said number and concentration. There are a number of

counts like that that we can make fairly easily . **MR. LIOY:** Composition fades very fast, but from a standpoint of exposure, do I care? That's the question.

MS. CHOW: Paul, is your question, though, because I'm naive from an exposure side, so my question, I guess, which you're maybe trying to say and maybe make me understand a little bit more, is, you know, we know it changes fast. I mean, everybody does, I know. But, what I'm saying, though, is maybe what you're trying to say is that, so we're all talking on the same subject here, is that maybe you're saying that over the time scale, you average it over all the people or all space, those short temporal variations in any given location don't mean, they get averaged out to a person, just like they... I mean, one issue is like, whether, say, you're measuring something and there's a vanadium spike of particles in 30 seconds to one person, okay? If you measure it over an hour, you would never know there was any vanadium because it would get averaged out. But what you're saying is, to a population.

MR. LIOY: Do I care?

MS. CHOW: That's right, okay.

SPEAKER: I think Judy answered my question earlier. That's only true if the health effect response is linear in the toxic compound concentration.

MR. LIOY: We're not even close to trying that.

(Everyone talking.)

MR. LIOY: I guess in terms of chemical and physical processes, my feeling is, I just need to know what to produce to define an exposure study. If I'm going to look at defining an exposure study, one of the key features of it is that people say, well, here we have source X that emits, let's say, primary particles, but to define an exposure study properly and to have the secondary aerosol be part of it, I need to know at some point what's out there that's formed as a secondary chemical and is it okay for me to take a 12 hour measurement right now of that to be able to be certain that I have the minimum amount of information to know that I will have to include di-methane chickenwire as being a chemical to measure in my next exposure study? Or do I have to have one hour measurements to be clear about that?

MS. CHOW: Well, I would say an hour because you'd miss it if you average it out over 12 hours. You'd completely miss the chickenwire. It can only come out...

MS. CHOW: In the interest of time, let me suggest that chemical and physical processes are an extremely important issue and that the supersites are going to need to make scientific

contributions to that, but is this room the place to discuss it?

MR. LIOY: I'm not discussing, I'm asking what is the minimum I need to do an exposure study? What is the information output from the supersite that I need on chemical composition?

MS. CHOW: Well, see, I like to think in terms of the source to effects.

MR. LIOY: But, that's a different question.

MS. CHOW: And the chemical/physical processes is a contributor to that. It's in the pathway of exposure.

MR. LIOY: So you want to have it somewhere in the middle?

MS. CHOW: Well, I'd like a chemical physical processes person. I mean, in effect, that's going to be part of a model and I don't know whether those scientists would say 12 hours is the deal to separate night from day. I don't know the answer.

SPEAKER: It depends on also whether it's a mobile source or an incinerator or a power plant. You know, like you said, you know, it is an important particle source of dose modeling, so we need to really characterize these emissions and immediate concentration dynamics of it. But, it is going to be one hour to 12 hours, it is going to depend by the source

bite.

MR. LIOY: My feeling is, the point you're driving to me is the fact that we should have the chemistry as best as possible and probably a one hour average or less is what we need to adequately know what's going to be out there in a particular environment. That can help us design the next study. We may not do one hour measurements in an exposure study. That may not be the point. But the fact that we can generate it and it may, in fact, be sustained for more than one hour or multiple hours, may, in fact, define the duration of sampling and the size of the sample we collect di-
methane chickenwire. That's the point I think we're driving here. Yes, yes.

SPEAKER: Paul, there's an inherent problem in this thing.

MR. LIOY: Of course, there is.

SPEAKER: The chemical transformation you're trying to have, the unstable intermediates that are in the gap, which are probably going to be, or the end products like organic nitrates, for example, are going to be so hard to measure with technologies we have available to us here, we're more than likely going to have to be, for practical matters in the next five years or so, stuck with a 12 and 24 hours.

MR. LIOY: Is this for the chemistry?

SPEAKER: The chemical transformation with the exception of a few things in the sulfate and nitrate.

SPEAKER: For organic speciation is the big one, right? You need to collect for a long time there.

SPEAKER: Organic speciation and organic peroxide or oxide are intermediates and you have to collect for at least 12 or 24 hours to get anything. So, to push ideally for one hour resolution would be wonderful, but lots of luck.

MR. LIOY: I think that George has summarized exactly where we wanted to be because I wanted to say that we could do for one hour for certain parts, we could do for 12 hours for some, and we're going to have to go long for others. There's going to be no panacea, where we can say we can do everything at the same level. That will help us at least put ourselves in the ballpark of what we minimally have to do to concern ourselves with the next round of exposure studies. Because, if we want to measure peroxide, well, that means that Petros and I are going to have to come up with a very different sampler because we ain't got one now, or even in the horizon, that's going to be able to collect the mass necessary to do that measurement. Whether or not this is of any value to us will be based upon what the toxicologists find in the

laboratory eventually in terms of a hypothesis they're going to be testing, as to whether or not we care about that in five years. But, at least, at this point I want to know if it's out there.

SPEAKER: I think you can pump two organics in an hour, can't you?

MR. LIOY: Pardon me?

SPEAKER: You can pump two organics in an hour measurement.

SPEAKER: Not for most organic...

SPEAKER: Yeah, the shortest you can do organic speciation on particles in a polluted atmosphere is four hours. Four hours.

MS. CHOW: What do you mean by speciation? Do you mean polar and non-polar or do you mean a list of 100?

SPEAKER: Yes, yes, the polar, non-polar, quote, gases work, the shortest they can do is four hours.

MR. LIOY: In terms of source apportionment, do we need anything from source apportionment, from source apportionment, to help us design the next exposure studies and, if so, what is the degree of resolution in terms of the source characteristics that we have to have to help us design that study? Because, to me, this is a very important issue because it has to do with what the SIPS will

eventually mean. Is this going to be adequate in terms of doing the next round of exposure studies, to have source apportionment studies that are based upon daily samples? Is that going to be adequate or is it more important to have it based upon 12 hour samples or is it more important to have it as short a time resolution as possible. Because the supersites will be the only ones at which we're truly going to be able to do real source apportionment. The speciation sites, no matter what anybody tells you, it ain't going to work because we're not doing the type of measurements necessary to do source apportionment in modern day America. We could do it, probably, in Asia right now because they still use lead for gasoline and therefore you will have a lead signal that will let you know what's going on in the atmosphere for multi-focal sources. But, in the United States, we haven't got a signal in the inorganic fraction for mobile sources right now and we need organic measurements. What is it that this type of supersite measurements are going to have to do to help us understand the contribution of the mobile source so when we design our next studies for exposure, we are able to look at the mobile source contribution to exposure properly?

SPEAKER: Isn't motor oil...

MR. LIOY: Pardon me?

SPEAKER: Isn't motor oil...

MR. LIOY: No, I don't think so.

SPEAKER: I think it would be desirable to get 12 hour information because of the way people do their thing. Most people tend to be in a residence if you're asleep at night and most people are doing some activity pattern during the day. At least, if we can, say, separate it into 12 hour patterns, source behaviors. The same is true on source base. They change almost on a 12 hour basis. So that would be desirable, probably, if we could at least look into that.

MR. LIOY: Look into 12 hour?

SPEAKER: Yeah, 12 hour segregation patterns of PM.

MR. LIOY: So what you're looking at is 12 hour segregation patterns for PM and looking to specific traces that, at some point, we want to be able to pick up and transfer to be able to measure those traces in an exposure study because right now, we haven't got it.

MS. CHOW: I'd like to go back to something that Dave has mentioned a couple times, about site specific. Somehow in here, we have to have across all the sites a commonality that has a reasonable cost. If we say do everything known to God and man, we're going to be able to afford to have...

MR. LIOY: No, we can't.

MS. CHOW: But, in some cases,

there are going to be tracers. Dave was giving the example of maybe like wood smoke in the northwest, that there are some tracers for it. In other areas, let's say we might be looking at a mobile source rich area, in which case maybe we wouldn't want to even be able to get the pattern, the rush hour patterns, and so there's some of this that's going to be site....

MR. LIOY: It's going to be driven by the sites. But, if I was to say to the folks doing the supersite measurements, this is my target to begin with and then when we go for local hypotheses, we may change by virtue of what it is we're going to be looking at specifically. But I think George is right. If we can get tracers that can help us determine the diurnal differences associated with the sources in the local location, that can help us out in terms of designing the next round of exposure studies at a minimum.

MS. CHOW: Don't you always want to go, I'll call this, again, I don't want to be cost reasonable, so I'm just trying to challenge the group here. Do you not want to go a step further than what you know? A step further than what you can interpret today? So that you're predicting the future, as opposed to describing the past.

MR. LIOY: Well, I'll challenge you back by saying that I don't know if I can do what you say today. I mean, I have one study that's been done

that shows that you can differentiate the contributions from automobiles, and that's done, that was done by Glen Cass in L.A., in an area which had a high concentration of automobiles in a particular traffic situation. I can't say if I went out to Topeka, Kansas and used the same methodology, I could detect it because they may not have the concentrations that he had, so therefore, I've got to come up with something that's optimal at this particular point to ensure that I have a possibility of doing it.

SPEAKER: What are the implications, then, for the monitoring, then, to say that we can live with 12 hour averages for source apportionment. If you're already collecting the mass and chemical speciation 12 hour or one hour routine, then why not give that information for source apportionment because it's not exposure apportionment. We want to know, for example, during commuting time, if we measure the PM, TOM, or some other continuous monitor, giving a one or three hour window. We want to know where that PM2.5 is coming from. Is it 20 percent, 30 percent from automobiles? That's going to be important for regulatory purposes, as well as for exposure assessment as well. It's when you couple that with the timed activity information. So we do not necessarily want to limit ourselves to 12 hour averages when we talk about source apportionment.

MR. LIOY: I don't think we're limiting it. I think we're being limited by our ability to measure the organic fraction.

SPEAKER: Well, organics is not the only thing we include under source apportionment.

MR. LIOY: But that is the one. But the thing that's going to drive the ability to adequately define the automobile versus the diesel is going to be the organic fraction. It's not going to be CO. How are you going to partition CO without a unique tracer for the automobile and for the diesel? It's just not going to work.

SPEAKER: Paul, you got to monitor the SO2.

MR. LIOY: The SO2? For diesel?

SPEAKER: As far as the models go for source apportionment, the benz, Glen’s predicts one hour resolution on the models, if you care about that. That's what Glen’s model is.

MR. LIOY: Glen's model predicted one hour, if I remember, it did predict it, but I've forgotten what...

SPEAKER: Well, I'm saying that in general that's what his model was designed to do because he predicts what we see and I mean, it's an hour, that's what their temporal resolution.

MR. LIOY: But that's because of the

fact that he had source measurements in the tunnel that were...

SPEAKER: I'm not just talking about for cars and trucks, I'm talking about source apportionment in general and across the base and to try to understand that if you turn off a source, how do the particles change in a given time fashion at a given area. Their models predict that over the course, over the...

MR. LIOY: You'd have to have Glen in here to...

SPEAKER: I work with Glen every day. We don't need Glen in here.

(Everyone talking.)

MR. LIOY: What does this do for resolution measurements in particular areas, and can we translate the resolution to areas outside of the L.A. basin into areas where we would have much lower mass? It comes back to the question we may have had before. The time resolution measurements during versus detectability. Remember, the point of the matter is, is balancing those two, and if you ask supersites, all right, what it is for exposure study, I want to at least be able to say I can measure something in somewhere outside of L.A. or New York City, because there are people living there and they are all going to be suffering from the same problem. Are we going to be

controlling the right sources? As Bob Stevens said before, if you went up to the studies that he did in the air urban, with the air cancer, the cancer study, cancer exposure study, that was looking primarily at woodsmoke as being a dominant source in the location. From filtered samples.

SPEAKER: If that's what you have, you're right. If you have other measurements that nail the source even better, then I don't agree. I mean, it depends on what your measurement methods give you and based on standard techniques, you're absolutely right. But, if we're shooting for supersites, we supposedly are going to have new measurements and we don't need to be limited by what people have done in the past.

MR. LIOY: All right, in the next two years, are we limited by going after this or are we doing the best we can and then is 12 hours on time?

SPEAKER: I think 12 hours is harsh, personally.

MR. LIOY: Harsh?

SPEAKER: Yeah, I do. I can't speak from an exposure standpoint, but I can speak from a measurement standpoint and I think 12 hour...

MR. LIOY: We can go down to organics...

SPEAKER: No. I told you, four

hours. So, I mean, that's the best they can do.

MR. KOUTRAKIS: But, even if we do hold one hour, it's very expensive, I think the subject is of an issue...

SPEAKER: Analysis is expensive. No, I know.

SPEAKER: You don't have to do it every day, though, or every third day. You just do it at selected times.

SPEAKER: Well, four hours is in Los Angeles, too, I mean, there's lots of organics.

SPEAKER: That's exactly right.

SPEAKER: I think on this source receptor thing, we're probably talking about source apportionment. There's a little bit of semantics, here, you could get at that by a source based model.

SPEAKER: Yeah, the models.

SPEAKER: And calculate on an hourly basis using an air quality model and the distribution should be and I think you can compare that with the observation, and the other route to go is the receptor model, which is, theoretically anyway, independent of the source baseline and do your apportionment by that method. You look for sources you're not accounting for on the emission inventory. So, what I'm saying is that the 12 hour span is reasonable for quantitative data from supersites in the

near term for receptor models. Now, if you want to...

MR. LIOY: All right. Maybe we have to differentiate between models because I think what we're doing is mixing what you say is positive... The air quality model versus the receptor model. They're two different... So we have two different models, okay? We have the receptor model versus what we have as the air quality models. Because the air quality models you can get down to one hour resolutions, absolutely. I was mixing that with receptor models, so I apologize, because I wasn't sure where you were going with that. That's my fault.

SPEAKER: Sorry.

MR. LIOY: But, with receptor models, I can believe that the tracer is down to 12 hours is about as good as we can get. But, and that will allow us to look at...

SPEAKER: Glen would have a fit on that.

SPEAKER: He's on that panel.

SPEAKER: Yeah, he's over there. That's okay. It'll get covered. That's for sure. It'll get covered.

MR. LIOY: If you say we can push the system down to four hours, we can then be able to use air quality models. If we can do that, then we maybe can push the system in some locations for doing

receptor models down to four hours.

SPEAKER: Then there's probably certain tracers we can measure a lot faster than that, so we can get to the one hour air quality model.

SPEAKER: I have to confess, I'm a little bewildered by this whole discussion. I mean, if we're talking about designing an exposure assessment study, what would be the time scale you'd want to resolve to for characterizing personal exposure?

SPEAKER: I'm not sure yet because...

SPEAKER: It could be in an hour. It could be four hours, it could be 12 hours. We can go down to one hour beautifully, but it's not going to happen in the next round because we still can't measure the tracers.

SPEAKER: Follow-up question is what is the time scale on which you want to be able to discern or anticipate a change in source contributions to a person?

SPEAKER: That'll come with your exposure assessment. It depends upon what the ultimate goal of the exposure study is.

SPEAKER: Well, that's what I'm trying to get at.

MR. LIOY: There are two types of exposure studies. The first go round would just be

characterization and exposure. I can get away with anywhere from 4 to 12 hours, all right? If I was doing it from the standpoint of somebody having the occurrence of some kind of event, then I might want to go down to as short as possible because if we're looking at acute effects, we're looking at a heart attack, or we're looking at a significant rise in blood pressure, if we're looking at a lot of different, asthmatic attacks, we want to get down to exposure studies that can measure as quickly as possible.

SPEAKER: How does your knowledge of sources play in that?

MR. LIOY: The knowledge of sources allows me again to go back to the biologically active agents. If I can say these are all, going back to Judy's diagram way, way back in the beginning. Our ultimate goal is to look at the source, concentration, human receptor and effects, right? If we can understand the sources of the concentrations that will lead to the exposure, that will lead to the effect, wow, that's pretty neat. Source apportionment allows me to pick up the tracers. But, if I can do this, if I can look at a variability of a tracer of X,Y,Z source that I know has a toxic compound of concern and that source causes a person to have a heart attack on day X, and another person on day Y, and there's a consistency on that, isn't that an important piece of information? That

is an extremely important use of source apportionment.

SPEAKER: So what you would want to know is something that would relate to the time scale in which you can observe biological response?

MR. LIOY: That's exactly right.

SPEAKER: On that time scale, I would say that 12 hours is probably as much as we can take advantage of now.

MS. CHOW: But, that's again, do we want to go further and have more information? In other words, today we might only be able to regress, you know, health effects against 12 hours, but if we had more good monitoring data, maybe we could regress it against one second. I mean, there's a silliness there.

SPEAKER: You probably want to get down to 10 to 15 minutes if you can.

SPEAKER: I think there's a natural process that's going to take you there anyway because aside from the question of just quantifying exposures is the idea of trying to understand exposure dynamics. What causes them to go up, what causes them to go down, what are the mechanisms, and that's going to lead people doing exposure assessment to want shorter time intervals and that's going to be limited by our ability to measure chemical species on different time scales. So once progress is made there, if we can make good chemical species measurements on 15 minute

intervals, the source apportionment will fall out.

MS. CHOW: And maybe some of this even comes down to activity patterns in terms of how much time do you spend in your typical activity. So if a typical activity, okay, we're in this room for three hours, if our typical activity is three hours here, we don't need minute by minute measurement here. But, if our typical activity outside is, well, you're going to run and play tennis for 30 minutes or something, then you want more size resolution. Now, some of this is an added level of sophistication, but if you want to build a model based upon accurate data to have the measurements match the activity time, would probably be the ultimate.

SPEAKER: Yeah, I mean typical diaries provide information on the level of 15 minutes or so.

MR. LIOY: I think time is up, so we can all go home. 12 hours is good now, 4 hours would be better, but as time moves on and then whatever comes beyond that is wonderful.

SPEAKER: There are some things that you can do faster now, and we might as well take the fastest things we can get.

SPEAKER: Tracers for this latter part, and...

MR. LIOY: But you don't know what

you're measuring and then, boy, that's as bad as anything else we can do.

MS. CHOW: We'll measure it anyway.

MR. LIOY: We'll measure it anyway, right. But, in terms of designing this exposure study, I don't want to touch it until I know better what it does. I think we've had enough. Thank you very much.

MS. CHOW: I think one point we might mention here is the importance of connectivity, not only to exposures, which we have discussed extensively and to health effects, but also the importance of connection to source apportionment, that, you know, we need to get...to see the site. Because when all is said and done, at this meeting are we going to have to like overlay each of the groups and that which creates the chain is what we should put in place.

MR. LIOY: I think it goes back to your initial comment, Judy. If we can source to the concentration to the receptor to any health end points, no matter where the source was, we've done a very good job in solving some very interesting problems and in reducing some major uncertainties. So, I have two left. George?

SPEAKER: The point I want to make here is first we're concentrating really on, as much as anything, on acute exposures in short term

spots. The thing we didn't touch on, which maybe is not appropriate for the supersites, is the chronic exposure and the chronic response. Now, the question I have is are the regular sites going to be sufficient to deal with that chronic exposure problem?

MR. LIOY: I think if you asked a epidemiologist right now, he would shudder when he heard Petros say that we're only going to measure speciation every third day. He would literally just shudder because he would be saying, my goodness, we are almost in the same position we were with PM, TSB, which was measured every six days, when I have to start looking at daily mortality and looking at the time series relationships there. So the question, Petros, to you is, is, from the standpoint of looking at exposure and health effects in terms of long term studies, is the speciation measured at three days adequate?

SPEAKER: But isn't that one of those questions that lacks a formal answer?

SPEAKER: It's a frightening world.

SPEAKER: I'm on the way to that, but, you know, we haven't really discussed that. I think it's very important to talk about the satellite stations. You know, what criteria is going to be used to select the location and number of these satellite stations and that satellite station definition might also help the epidemiologist problems. They may even want

to patch up the missing base by satellite station monitoring. So that the supersite might be monitoring every three days or every third day, but then you may have a satellite station making sure that there's coverage on a continuous basis and also the issue of covering different urban locations, rural, background, suburban areas, we need to sort of think very hard about how this supersite concept has to formally include the satellite monitoring stations.

MR. LIOY: Is the satellite monitoring station a defined entity in the mind of the people who are going to be funding the supersites? I haven't heard that point be made.

SPEAKER: Glen Cass showed it on the map, with all the little dots that run across there.

MR. LIOY: Glen has made a wonderful case for it, but I haven't heard John Bachmann or Rich say that.

SPEAKER: Yeah, but these kinds of meetings are what can bring that to the fore, and so I think your recommendations in that area, I mean, whatever the science...

MR. LIOY: Kimberly, what is your feeling? You and Glen, I assume, you and he worked that out. I apologize. The satellite studies that you described, is that something you feel is ...

MS. PRATHER: I don't know. I don't

know everything.

MR. LIOY: All right, I'll open it up to everyone. Time out again, time out again. In terms of satellite sites. Is this something you really feel is important to the supersite program?

SPEAKER: It is important, but you need to know that you're talking to a different cast of characters. Those are going to the states. And they will be under state jurisdiction. And so, states don't know anything about supersites or anything about aerosols or...

MR. LIOY: I know that.

SPEAKER: ...so it's a big communication gap.

MR. LIOY: So therefore if, in fact, some of these dollars are going to go to satellite monitoring, those states that become educated as to what they're supposed to mean and inter-digitate with whatever supersite measurements are going to be made there. All right.

SPEAKER: Are the speciation sites being driven at all by the science?

MR. LIOY: No, no, they're not. They're just being picked at random at this particular point.

SPEAKER: Well, not at random, but they're being picked...

SPEAKER: But some of them might be in Boston, or Seattle, or L.A., I mean, you know, and it's...

MR. LIOY: Well, one state that has nine, decided on nine speciation sites, and I asked them why, and they said, well, we figured we had nine open locations, that's where we're going to place those. For each city. All right, I'm sorry, Judy.

MS. CHOW: I'd be surprised if the states didn't put some of them in the major cities that they listed there and that allows for a potential cross walk and there's also, some of the states are quite sophisticated in terms of how they deal with air issues and so that might be an opportunity. I mean, you're quite right, you need coordination with the capital letters, not just the capital first letter. But I think we need to seek these opportunities because we need to know the representativeness of this supersite and there's no way to know the representativeness other than to have some sort of comparison.

MR. LIOY: It's an excellent point. It's something that hasn't been brought up too much today, except in the context of, you know, doing source apportionment, having satellite sites and a supersite, but that, I think is a very important issue because it's the only way I think we'll get to these time resolution issues in an adequate way.

SPEAKER: Those are particularly important for exposure assessment. It's really exposure assessment emphasis.

SPEAKER: Glen even indicated it's important for source apportionment itself, so you have two major components actually seem to me, that if it's done in an effective way and a coordinated way.

MR. LIOY: All right. Any other questions? George, you have the last word.

SPEAKER: No, I have the next to last word.

MR. LIOY: Does anyone else want to have a word? Otherwise, thank you very much. I appreciate your help.

(**WHEREUPON,** the Breakout Group Session was concluded.)

C A P T I O N

The Breakout Group Session in the matter, on the date, and at the time and place set out on the title page hereof.

It was requested that the Session be taken by the reporter and that same be reduced to typewritten form.

EPA/NARSTO PM MEASUREMENT RESEARCH WORKSHOP

"Breakout Group; Exposure Assessment"

July 23, 1998

MR. LIOY: Well, what I did last night, I just said...I figured out we needed a hypothesis just for them...

SPEAKER: A fuzzy hypothesis.

MR. LIOY: Fuzzy, fuzzy logic.

SPEAKER: Unfocused, as usual.

SPEAKER: That is right.

MR. LIOY: All right. I just said supersite measurements can be used to establish confidence and indicate the mass factor PM that must be measured and exposure to determine the portion of the ambient PM and its chemical constituents that contribute to total PM exposure, individual and population, saying that supersites are valuable to us to begin to understand this process.

And I think the goals of the supersite measurements, from our vantage point...and, again, this is a synthesis from yesterday...is provide information on the range of variability of pollutants necessary to develop health hypotheses. This will establish the presence of pollutants in the ambient air and define the level of concern, meaning that if we find that these

ambient pollutants there, the ten hypotheses exists in a very, very low concentrations, well, then, maybe it is a no-brainer. We don't have to worry about it and we have to go indoors and worry about the indoor particles being of concern.

Identify key variables in future health/ exposure studies. This could be exposure studies of themselves or exposure/epi studies. All right? Again, it all relates back to this do you really have to find them in the air to use them, because if you don't find them, it is not worth it. That is just one...yes?

MR. KOUTRAKIS: Where is...

MR. LIOY: It's coming, it's coming.

MR. KOUTRAKIS: He needs that information to ...

MR. LIOY: What?

MR. KOUTRAKIS: He needs that information, because he is...

MR. LIOY: Okay, can I...just let me finish, and I'll...this is going to be quick. It is right here. All right.

Another goal is to provide information that should design the next generation of exposure and microenvironmental monitors, the focus to be on personal and microenvironmental monitors and measurements that are made on pollutants that are related to the ten health hypotheses. Again, if, in fact,

we find the levels outside are significant or of any value in terms of concentration patterns and variability, well, then, we have to develop personal monitors that, in a sense, can determine whether or not it has reached the people. You know, it may reach the ambient air, but do they get indoors and, again, to people also?

We need to determine personal and microenvironmental exposure derived from ambient air. Again, if you are going to look at indoor/outdoor ratios of personal to outdoor ratios, you need to measure the same pollutants in the outdoor air as you measure in the personal indoor monitors, or else you don't get a ratio; you are getting, again, a suggestion or a hypothesis which is not really useful at that point.

Another goal, provide information needed apply the next generation of exposure models for estimation of population exposure to PM. Will reduce uncertainties currently associated with estimates of ambient exposures and subsequent dose received for the ten health hypotheses. Provide more realistic information on exposure patterns for compound and size fractions of concern for ambient air.

MR. OLLISON: I would add as well there.

MR. LIOY: Pardon me?

MR. OLLISON: You have got to service your current models now, because they are the

ones that are going to be using this current...

MR. LIOY: Next...okay.

MR. MUELLER: How do you define exposure in this context?

MR. LIOY: First, let me add this, and then we'll design it.

MR. OLLISON: To gather useful information during this new as well as the next.

MR. LIOY: As well as the current generation of models?

MR. OLLISON: Yeah, the current and future generations.

MR. LIOY: As well as current. We can always rephrase it later. As well...I am sorry, Peter. You wanted to know what we were defining exposure as for this, in this context? Was that your point?

MR. MUELLER: Yes, yes.

MR. LIOY: Exposure is, basically, not levels of the concentrations in ambient air but exposure means integrating levels with activity patterns and time duration of context. So, that is what I am envisioning as an exposure model, not what...

MR. MUELLER: Not concentration of.. .

MR. LIOY: No, it is exposure. Right. All right, selection criteria...yes?

MS. SHELDON: I was listening to Dan Greenbaum out in the lobby where he was saying, you know, he thought that the supersites could generate a lot of information to provide information to the sites and other monitors around in terms of what is really going on in species, time, et cetera. And, actually, I think this also applies to personal exposure, that it helps us understand those time integrated personal exposure measurements, and I was looking at what you were saying, and I was trying to decide if that was sort of said there or just task was shown...

MR. LIOY: It is said in goal 1 and goal 3.

MS. SHELDON: Okay.

MR. LIOY: It is in both, and the goal 1 that provides that allows us to understand whether these ten hypotheses really are important for outdoor air because of the fact that the material is there, both in terms of variability and in ranges, so, therefore, concentration, time, and in terms of application to exposure models, determine if, in fact, there is any reality to this in terms of significance in terms of the public health outcome. So, it relates to both, because these are the kinds of measurements you don't get in the regular ambient monitoring sites.

MS. SHELDON: That is right, nor can we get them on personal...

MR. LIOY: At this point, no, but we can use...

MS. SHELDON: At this point, and I think that, you know, maybe it might be useful to put it in that context, that you have got the supersite, and it provides that additional resolution both in species and time compared to all of the other monitoring you can do, including personal exposure monitoring. So, it can sort of broaden the picture.

MR. LIOY: You are right on target. We are talking the same language.

Okay, selection criteria. This is based upon yesterday. I don't think I have changed anything from yesterday's discussion. Current and future exposure studies or study data into existing infrastructure, diverse conditions, geographical location. Also, how geographical location affects activities, background, mobile supersites, to go everywhere in the world. You know, I think, Petros, you wanted to take that everywhere into Montana and the Pacific Northwest.

MR. KOUTRAKIS: That was part of the cross fires in the CASAC when we were trying to define what is background and what is the ambient condition. It was numbers 2 ug to 12 ug, and the standard is 15 ug, so...

MR. LIOY: Population considerations and density and/or people at high end

exposure due to source categories. Again, we get back to the issue of yesterday that we may want to do some measurements around locations where maybe high concentrations, either because of episodic conditions or because of the fact that a general site in an urban area may not hit what we call the more highly exposed individuals who are in the under-served areas of the city or near industrial sources.

Did you want to add something?

SPEAKER: Yeah, I would add one more little concept which is that a site that represents a large segment of the population, even if there is not high density...or a strong source relationship might be another criterion. What we want to do is to be able to address all the major cells of population types.

MR. LIOY: Okay.

SPEAKER: I mean, that would be one of the goals.

MR. LIOY: How...I am not sure I get...

SPEAKER: So, what we would like to do is to, to the extent that it is feasible, is we would like to represent, for example, take agricultural communities or people who live in agricultural settings. You may never find a high density of those people, and you may not necessarily be able to assign them to a high source category, but in the aggregate across the

country, they represent a lot of people, and you would like to know something about their exposure.

MR. LIOY: So, locations that represent large segments of the population or diverse segments of the population? I don't know. Linda?

MS. SHELDON: Well, actually, I do understand what you are saying, and I am not sure that you can do that, because, say, if you are talking about an agricultural population as a whole across the U.S., I think they make up 15 percent of the population which is important. Probably, what is driving their exposure conditions has to do with their location in the country, including their housing stock, their activities, the kind of farming they do. I think that may be more important than the...

MR. LIOY: You run up against the problem of how representative is representative for any category here.

MS. SHELDON: Okay.

MR. LIOY: My point is that if this sounds two exclusive, you have got two criteria. Either you have to be a highly dense population or a source dominated population.

SPEAKER: That strikes me as too restrictive.

MR. LIOY: So, give me your words. I agree with you, but I need words to that effect.

SPEAKER: So, something that would increase the ability to represent the U.S. population in other ways would be another criterion, an alternative criterion.

SPEAKER: They set standards on high end exposure groups.

MR. LIOY: I know, but...

SPEAKER: We are not just looking at standards; we are looking at understanding exposures.

MS. SHELDON: Right.

MR. LIOY: So...

SPEAKER: You basically want the distribution of...a representative distribution of exposures in the U.S.....

SPEAKER: As an alternative goal.

SPEAKER: That is right.

SPEAKER: And then, after you get that, you focus in on those high end exposure groups who you want to further identify.

SPEAKER: You also get the health end points...

SPEAKER: We are not sure.

SPEAKER: The dose response, the...

SPEAKER: How about just saying distinctive population, distinctive populations with

respect to exposure?

SPEAKER: Distinctive population? What do you mean by distinctive?

MS. SHELDON: Say a representative population?

MR. LIOY: Cross sections of the general population?

SPEAKER: That would be fine.

MR. LIOY: All right.

MS. SHELDON: I mean, right now, we are doing people in nursing homes, you know.

SPEAKER: You are not going to be able to cover the waterfront. All I am saying is in terms of...

MR. LIOY: I get where you are going now.

SPEAKER: ...the features of the supersite, there may be some which have other reasons for being located where they are, and, in addition, instead of looking at high density or at a source...

MR. LIOY: Now, I understand.

SPEAKER: ...we may be looking at some particular part of the population that is not present anywhere else.

MR. LIOY: No, I get it now. Okay, now, however, there is one thing about this, and I think this was at the end of the day where a lot of people

were talking about this or tired, which I think is a very important part, how. How are you going to do this? I mean, I thought about this last night. I looked at just the selection criteria for exposure issues, and I said, who is going to do this? Who is going to put this together and make this happen?

Because I think that to have this accomplished ...and I think this runs across all the different groups...you are going to need a management team and advisory panel for initial site selection and subsequent relocations. This cannot be done with, I think, the current management. I don't know if they have a management system yet for this supersite program.

SPEAKER: I don't know...

MR. LIOY: You don't know, either? She is a biologist, and she doesn't know. It is a practical problem that has to be addressed.

SPEAKER: Just as a practical matter when you are deciding where to put these things...

MR. KOUTRAKIS: The monitoring structure is provided to the, you know, to the...

MR. LIOY: Well, I am just saying how, and I think they should consider a management team and...

MR. KOUTRAKIS: We are not...

SPEAKER: Just say you are in the

cross-cutting...

MR. LIOY: I am just going to say we recommend. In fact, that is why it is going to be down here.

SPEAKER: Within EPA, you have culturally separated communities. They don't want projects.

MR. LIOY: Right, and that worries me.

SPEAKER: You have to establish sort of a...you have to establish a culture that whereby these various interests can work together to govern the supersite operation.

MR. LIOY: I think that is absolutely right.

SPEAKER: That is what you have in mind. Is that correct?

MR. LIOY: Yes, absolutely.

MS. SHELDON: Actually, let me...there is no specific management structure now. There are plans for a management structure. Since about March, there have been a group of people meeting on this and this workshop.

This is going to be a very big program to manage, and they have not identified an individual who will take the lead on it and put people together, but people from the exposure groups, from OAQPS, from the

health labs have been working on this and sort of coming together.

I think my job, for the first four months, was every time they talked about health and chemistry is I had to add exposure, because nobody had heard of exposure.

SPEAKER: I think one thing you might want to do...

MS. SHELDON: Yeah, I think you might want to put the definition of exposure in there.

MR. LIOY: No, no, no, I am not going to do that.

SPEAKER: Can you go back to that how list we had up on the board, put that on the screen?

MR. LIOY: Sure.

SPEAKER: The management thing is very...

SPEAKER: What I would like to say is that I retired from EPA from the same laboratory that Linda Sheldon is working in, and unless you have a peer review committee made of the Lioys and the Koutrakis and what not that would meet frequently and advise, you are not going to get an influx of outside thinking.

MR. LIOY: That is why I was thinking of having the...

SPEAKER: And I wouldn't say how I would recommend there may be something...

SPEAKER: We have already started, this workshop. They are all here.

SPEAKER: Yes, but I am saying you could have a continuation of that.

MR. KOUTRAKIS: We are already here by the time the subcommittee of the CASAC to oversee...

MR. LIOY: That is not going to be the same thing.

MR. KOUTRAKIS: Yeah, but let EPA...we can't say that we want you to provide, you know...

SPEAKER: Just recommend it.

MR. LIOY: All I am doing is that after reviewing this, I sat down and said to myself, with all these criteria, who is going to do it and make sure it is effective even from the minimal standpoint of our group? And I think you are absolutely right.

SPEAKER: You don't have within NERAL somebody to manage this.

MR. LIOY: That is not my issue.

SPEAKER: That group that manages it or that person needs advice.

SPEAKER: That is right.

SPEAKER: More than that...

SPEAKER: If there is going to be an ongoing collaboration between EPA and the scientific community over the operation of the supersites, what are further decisions down the road, then it is not enough to have one-way communication with advice from the scientific community to EPA. The decision making process has to be transparent so that we can see how the advice is used.

SPEAKER: Can I say you have consensus on this and let's get the ball going?

SPEAKER: Yeah, I will give you one last comment.

SPEAKER: I think about 20 years of experience in managing diverse...

SPEAKER: I know and great stuff, too..

SPEAKER: ...a great deal, and I can tell you right now that if you use that word management, you are going to, you know, get this kind of emotional reaction you are getting in this room, and you are not going to accomplish what you have in mind doing which is very important. So, the way the groups that I have worked with over this time period have solved this problem is using the word management coordinator, not somebody where the concept of management is not one of authority but one of facilitation.

MR. LIOY: Well, that is why I was going to say the management team.

SPEAKER: Yes.

MR. LIOY: In a sense, it is the same concept. I don't want to have it manager...

SPEAKER: But be careful what words you use.

MR. LIOY: I agree.

SPEAKER: You can even drop the word management and just say you need a panel to advise.

MR. LIOY: Well, but you also need EPA to have some kind of superstructure so that they can...

SPEAKER: Advice is not enough.

MS. SHELDON: That is right. Somebody has to make the decisions.

SPEAKER: I think Linda had a good suggestion. The one change in the red statement I would make is after EPA in that statement, put the parentheses ORD/OAQPS, because those are the two cultures that are not talking...

MR. LIOY: Well, ORD is part of...I will cut that off and I will redo that as a separate slide so it doesn't get...I can put that all the way at the end, cut off the bottom and make it...but I just wanted to throw in...when I thought about it, I wanted to make

sure that...

MS. SHELDON: You wanted something for people to react to.

MR. LIOY: Yes.

MR. KOUTRAKIS: Not only management. I think also it has to be people at a high level involved with this. Somebody we need to talk about this very group, and I don't know how we, from EPA that this is not going to be somebody, you know, who has no power and authority over lots of people within EPA to...

MR. LIOY: I am going to let them deal with that. I don't want to get into that.

All right, supersite monitoring strategy. We can get back to things that we can agree on right now or, actually, we have some control over. The other one we have no control over.

Site-specific hypotheses, link with ongoing research and air quality exposure, spatial and temporal variability...

SPEAKER: Are you going to get more specific about what you mean by that?

MR. LIOY: About what? Spatial?

SPEAKER: Spatial and temporal variability.

MR. LIOY: I think we did, but... duration of supersites, fixed, 1 to 3 years, mobile, 1

month. Collect particles for storage for future characterization. Coordination of satellite site monitoring with supersite measurements, and balance detailed characterization with time resolution on samples, because these are all things we don't have good information on, but these are things that are part of the monitoring strategy that we have to see established.

MR. KOUTRAKIS: One modification there, I wrote...include just...we might want to do toxicological or in vivo studies or in vitro studies. So, say in future characterization and health effects studies, number 7.

MR. LIOY: Does it have to be...I left characterization being...

MR. KOUTRAKIS: But characterization people, again...

SPEAKER: I really thought you were going to get more specific about temporal, you know, like intra-day.

MR. LIOY: Well, we have that as another slide.

SPEAKER: Oh, I am sorry.

MR. LIOY: You move too fast. You are getting ahead of me.

SPEAKER: Just one general comment. Under exposure, I would feel more

comfortable if it was more explicit in stating that there was an equal indoor component as well as the ambient so that...because I sort of feel as if it is rather explicitly pointed toward the ambient.

MR. LIOY: I say linkage with ongoing...link air quality or exposure studies?

MR. KOUTRAKIS: I will do it. For all the particulates Bill is saying, because that is what it really does.

MR. LIOY: No, he said just the opposite.

MS. SHELDON: Well, the indoor that we are dealing with here...

MR. LIOY: The indoor.

MS. SHELDON: ...the supersites and the ambient monitoring network, and these supersites will be coordinate with ongoing studies, but the supersite program per se will not provide funding for either indoor monitoring or personal monitoring. So, it is a...

SPEAKER: Is it possible to point out the need for that?

MR. LIOY: Yes.

SPEAKER: Oh, yeah.

SPEAKER: Because I think unless you explicitly cast...

MR. LIOY: I am going to say...I am

adding it right now.

SPEAKER: If you don't have a link, it is never going to be used...

MR. LIOY: Yeah, well, if you think about the goals in the beginning, I say that that is one of the reasons to get into that, but I think it is a very good point in terms of monitoring to say or exposure, parentheses, personal indoor studies. Okay? I think it doesn't hurt to repeat because of the culture that we have had to come from. All right.

Now, current needs. Now, it is current needs on time resolution of supersite measurement. Again, this is only current. We want to go as far as we can go in the future, but based upon what we discussed yesterday, this is how we felt we could...what we could survive with at this particular point. In terms of number concentration, continuous ionic species and mass, we want to get down to 1 hour. Organic, two different types of organic species, the best we can do is 4 hour. 12 hour peroxide, 24 hour. Episodes, we would like to get down to mass and chemical species to continuous. Exposure models, mass continuous. 12 hour for organic or inorganic for developing exposure models for source apportionment. Tracers for receptor models, the best we feel we can do for a lot of things now is 12 hours. If they can come with that and better...that is the minimum we want, and for air quality models, indicators...

SPEAKER: Tracers of what?

MR. LIOY: Tracers of sources. I mean, you know, we used to use lead as a tracer for automobiles.

SPEAKER: You are getting into source apportionment.

MR. LIOY: Yes, yes, we are saying whatever source apportionment can provide us.

SPEAKER: You are not trusting what the other people come up with.

SPEAKER: And I think you missed the boat on the hourly resolution of exposure model.

SPEAKER: You don't have real distinct...

MR. LIOY: Mass. We are doing mass.

SPEAKER: That is all?

MR. LIOY: That is the best we can do at this point.

SPEAKER: So, all health effects related to total mass?

MR. LIOY: No, no, no, you weren't here yesterday. We tried to say what can we expect as the best now with the idea that we want to go as far as we can go in the future, what can we expect from these sites that we can do the next generation of exposure studies better and, hopefully, along the way, these

supersites will get better and better monitors so that we can do continuous monitoring of organics, continuous monitoring of other species.

We are looking...we say what can we start with now, because within two years, I want to be able to do better on what I am measuring indoors and measuring exposure studies, so I want to know at least what is out there in the ambient air in the 12-hour measurement.

SPEAKER: The measurement group will come up with quite a menu of things that can be measured continuously.

MS. SHELDON: Yeah, why don't you just put species where available, continuous, you know, under the exposure models?

MR. LIOY: Species where available?

MS. SHELDON: Yeah, if available.

SPEAKER: The definition of chemical. Can you expand that to biological? Chemical and biological as well as physical properties? These are the supersites that should be...

SPEAKER: Should have the better monitors.

MR. LIOY: So, what are we going to be measuring for bio?

SPEAKER: Could be endotoxins.

MR. LIOY: One hour? You really want to do this one hour?

SPEAKER: I think maybe you need to do another iteration after meeting with the measurement group one.

MR. LIOY: Oh, I think we will.

SPEAKER: Because they have got a huge shopping list of things along the line of...

MR. LIOY: One hour, guys? We only want to do one hour.

SPEAKER: Just because you can do it with that frequency doesn't mean it is going to be useful to you.

SPEAKER: That is right.

MR. LIOY: Well, is that what you think we need to design our exposure studies better? Okay, fine. Well, just put it down and we'll go from there.

SPEAKER: You can collect the samples, but you don't have to analyze all of them.

MR. LIOY: Okay.

SPEAKER: Yeah, right, you collect them and go back and analyze the final time...

MR. LIOY: Okay, I'll leave it at that.

MR. KOUTRAKIS: Well, I'll tell you what the next charge is, it's a serious issue, and as Peter said, there is going to be a laundry list of methods, and everybody has a method these days, unfortunately or fortunately, and some of these

methods, they are continuously evaluating, and I think it is important that we don't start all the supersites at the same time and after a year, we realize there were screw ups, so I would say...

MR. LIOY: How about if we put a little asterisk and say with validated methods?

MS. SHELDON: Yeah.

MR. KOUTRAKIS: I think we should have a final...a supersite that starts before everybody for six months or a year. I don't know how long it would take to evaluate the methods and from there, we select the methods. There is a lot of snake oil around the...

MR. LIOY: Okay, linked with this, we hope that...or we need a pilot, pilot studies.

SPEAKER: Predicated upon pilot study outcomes.

MR. KOUTRAKIS: I would say one or two, because, you know...

SPEAKER: Yeah, that's cool.

SPEAKER: I had a similar concern. I mean, you have one of your five points, you know, one hypothesis, where to measure, what to measure. The question I have is what not to measure.

SPEAKER: I think the idea is now that people are thinking that we are going to put every Goddamn instrument...

SPEAKER: That is exactly my point.

SPEAKER: We need priorities.

SPEAKER: And then if you want to make it mobile, it will be like the circus comes to town.

MS. SHELDON: They know how to do that.

SPEAKER: I mean, where do you cut this thing?

SPEAKER: So, what not to measure is the question, not what to measure.

MS. SHELDON: Well, I think the better question is you need a core set of measurements that provide a set of data and then for different hypotheses, depending upon where you are doing it, then other...you know, then you could do 1-hour biologicals someplace.

SPEAKER: Is it where we have needs that are not currently meetable and where we really would like to do something experimental?

SPEAKER: You know what is going to happen. The next two groups over there, the methods group is going to talk about everything they can do. Now, the health effects group is going to say give us everything you can, and we are just going to put them into a big regression model and see what comes out. We are the ones who are going to be responsible for...

MR. LIOY: I agree. So, to put

it...my statement here is predicated on pilot study outcomes to select what to measure in the core set.

SPEAKER: That is good.

SPEAKER: I think you can generalize this slide. It is much too specific. You just need a kind of a general statement.

MR. LIOY: I think I'll just leave it here.

SPEAKER: That is cool.

MR. LIOY: If I leave it here, I don't have to write another slide.

MR. KOUTRAKIS: I think the most dangerous thing that can happen we are about to make here to go out and randomly just measure 10 million things that is going to be...

MR. LIOY: Agreed. That is why I am leaving that as an important point. That is going to be the final point. We only want to measure what we think we can measure reliably to help us develop...to do all this study, and then, as time goes on, some things should go away and some things should be added but based upon certain criteria.

SPEAKER: And, in your strategy, decide on what not to measure.

MR. LIOY: Yeah.

SPEAKER: Going back to the pilot idea, it is actually very difficult in practice, as was

said, to change things at a particular site unless, you know, you have a laboratory willing to just...So, probably, the pilot work will have to be done in one of the centers separately from the supersite network itself.

MR. LIOY: Well, maybe that can be the first task of the supersite network is to do pilot studies to establish what would be the basic core assessment of the supersites, and rather than to out and develop five centers all at once, five supersites all at once, knowing...and then getting to a point to say well, gee whiz, there are so many measurements that we may not have enough money to analyze any of the data, and, sure, we would love to see that happen.

MS. SHELDON: Believe it or not, I believe in EPA's own discussions, they talked about pilot sites.

MR. LIOY: Good. You had influence. All right. Well, that is it.

SPEAKER: Somebody said we should know how to measure now and time is of the essence.

MR. LIOY: Well, let me show that transparency, or else Petros is going to shoot me. The last slide was, basically, research...

MS. SHELDON: Didn't Judy say...actually, we just need to take out the names of...

MR. LIOY: No, near future.

MR. KOUTRAKIS: No, no, no, Judy said in some EPA studies with a star saying pending Congressional approval.

MR. LIOY: All of them?

MR. KOUTRAKIS: No, no, we'll do that. Almost all of them except the Baltimore EPA study.

MR. LIOY: You just tell me which ones.

MS. SHELDON: That one.

MR. LIOY: So, I have to put a star here.

MR. KOUTRAKIS: And the next one.

SPEAKER: What is the star going to do?

MS. SHELDON: Pending...

SPEAKER: Congressional mandate.

MR. KOUTRAKIS: No, no, no, no, but...

MR. LIOY: L.A.?

MS. SHELDON: L.A., yeah, pending, because all the others are ongoing.

MR. LIOY: Pending what?

MR. KOUTRAKIS: Congressional approval.

SPEAKER: Selected but not awarded? Is that what the story is?

MS. SHELDON: That is the story.

MR. LIOY: This is what she wants me to say.

SPEAKER: You know what is going to happen when you show this is that everybody is going to stand up and say well, you forgot this and you forgot that.

MR. LIOY: I am just going to say this is an example. Thank you. That is it. That is all I have got.

(**WHEREUPON,** the Breakout Group Session was concluded at 5:17 p.m.)

C A P T I O N

The Breakout Group Session in the matter, on the date, and at the time and place set out on the title page hereof.

It was requested that the Breakout be taken by the reporter and that same be reduced to typewritten form.